Gas Hold Up (GHU) Datasheet

The **GHU (**Gas Hold Up Transmitter) is designed to provide continuous measurement in the difficult flotation process environment. With declining head grades in base metal recovery production, it has necessitated higher volumes of ore processing, to produce year on year base metal volumes. Due to the constant demand for battery production demanding more copper, lithium, nickel and cobalt, the automation of sulphide ores through the flotation process has developed a greater priority.

Mass pull control of the flotation process has been difficult to achieve because of a lack of repeatable and reliable process measurements. Most important in these measurements is the effect of **Ore Variations** (head grade, solids concentration feed, clay and gangue makeup)**.** With generally more than 95% of the ore being processed being gangue, there is a great chance of affecting the bubble creation chemistry, which is at the heart of the process.

FloLevel developed the **Gas Hold Up** technology that can provide the first **self-cleaning** insitu capability (pulp zone). This can provide feed forward measurement of the changes in bubble concentration caused by the variations in ore to the DCS on a continuous basis.

Currently, the instruments determining Gas Hold Up issues are to some extent unreliable because of the process environment. Level float units measure froth depth, which would indicate a Gas Hold Up issue when the depth of the froth column diminished, because low Gas Hold Up produces less bubbles. The froth camera can detect a Gas Hold Up problem as the bubble velocity decreases. Water ingress increases in the bubbles with low Gas Hold Up, causing the bubble density to increase. The problem with both technologies is that they only detect a low Gas Hold Up problem when the condition occurs.

There is a threshold level in Gas Hold Up in the pulp zone where the bubbles start to change characteristics. Not only does the bubble take on more water but they also recover less base mineral and float more gangue on the bubble. The GHU transmitter would be used to provide the DCS with constant measurements of the Gas Hold Up percentage. This allows the APC to compensate for the changes by adjusting the frother dosing rate, solids concentration feed percentage or by aeration flow rate changes. The control philosophy would be to keep the Gas Hold Up percentage above the volumetric fraction threshold at all times, guaranteeing base metal recovery under all ore variation blending conditions.
The use of a froth camera to measure bubble size (specifically oversize bubbles) will prevent overdriving the flotation cell.

FloLevel Technologies™

Features

- Self-Cleaning capability
- Not affected by density change in the Pulp/Slurry
- Not affected by conductivity variation in the Pulp/Slurry
- Color display on controller, showing the two process outputs with trends
- Simple installation from the top of the Flotation Cell without taking the Cell out of production
- Remote monitoring and commissioning capability
- Adjustable 31SS bracket with adjustable flange and options

Primary Application Uses

Ore Variation affects all Froth Flotation Cells and Columns, for example: head grade variation, solids concentration % variation, aeration flow rate variation, frother dosage variation, flotation processes that include “blended” ore variations, etc. The FloLevel Array is suitable for all flotation mineral recovery, this includes: copper, gold, silver, molybdenum, lead, talc, potash, zinc, etc.

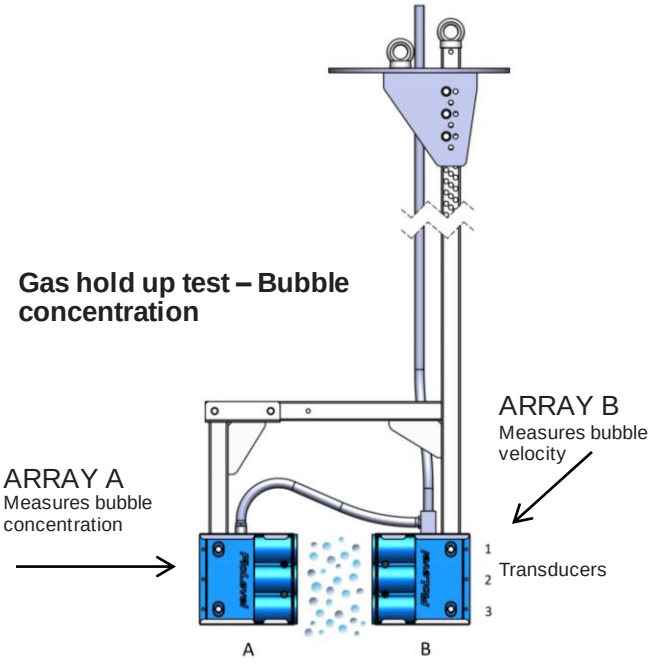
The FloLevel **Gas Hold Up** Array will provide continuous feedback to the DCS to enhance the use of an automatic process feed forward control. This compensates for process variations that affect the **Bubble Concentration** in the pulp slurry zone of the cell. Control of the bubble concentration is important for optimised base metal recovery **(Mass Pull)** and reduced contamination of the base metal concentrate in the froth.

1. The Arrays will provide a 0 – 100% measurement, being the ratio of “bubble concentration to liquid”.

2. The Arrays will also measure the bubble velocity, which will determine when the Gas Hold Up Level has dropped below the **Volumetric Fraction threshold.** When the Bubble Concentration drops below the volumetric fraction threshold, the bubbles take on more water and increase their density, slowing the bubble velocity. The changes to the Base Metal recovery are as follows:
   Reduced base metal recovery per bubble and increased **Gangue** contamination in the **Froth Zone.**

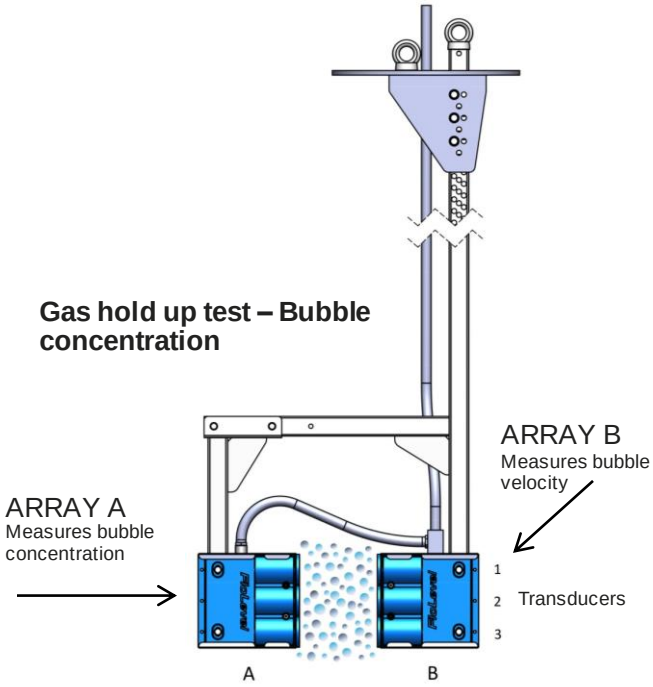
3. **Sample Update time to the DCS:** The GHU Transmitter will provide an update of the bubble concentration and bubble velocity every six seconds, to enhance mass pull recovery. During the measurement of the two process conditions, the transducer also carries out self-cleaning of the measuring diaphragm.

Gas hold up test – Bubble concentration



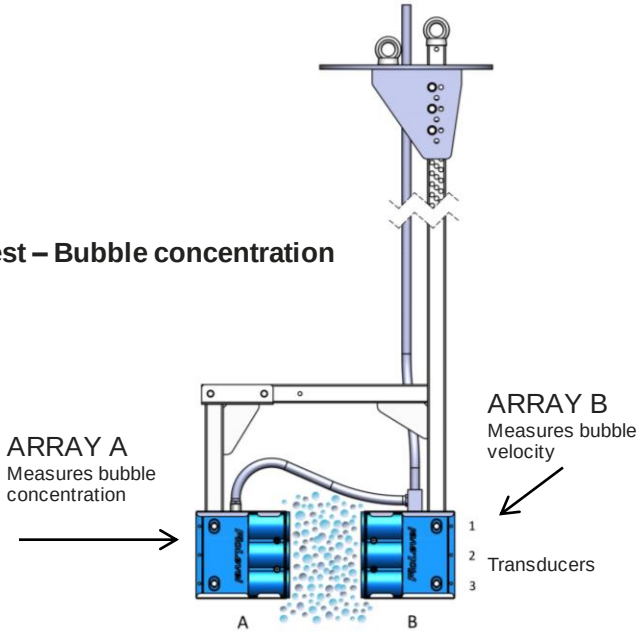
Process problem: Bubbles density high, reduced recovery. GHU Array measures: Low bubble concentration, bubble velocity low. DCS detects GHU threshold low, adjusts frother, solids% feed, aeration flow rate.

Gas hold up test – Bubble concentration



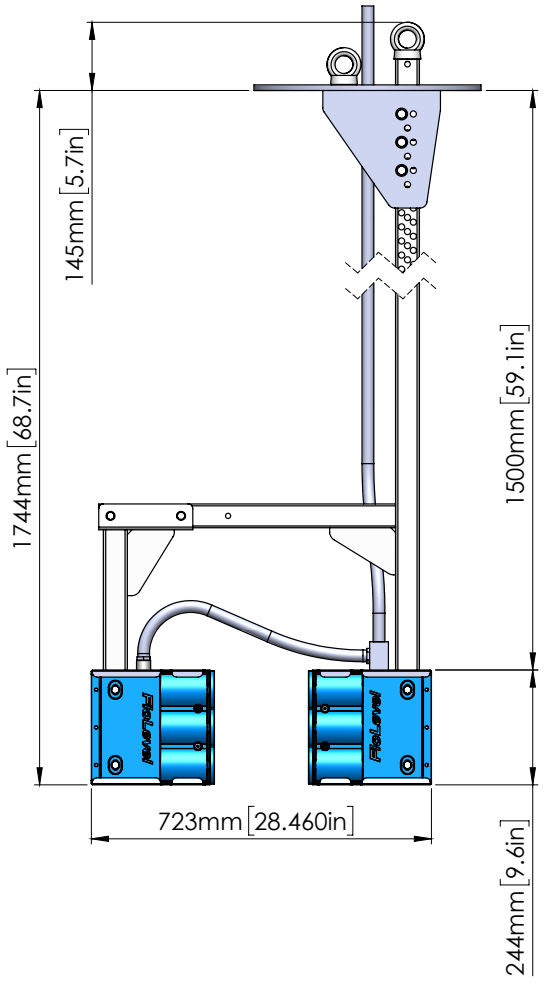
Process problem: Bubbles density in range, recovery ok. GHU Array measures: Bubble concentration and bubble velocity just above threshold (volumetric fraction threshold.) DCS adjusts frother, solids% feed, aeration flow rate to increase GHU level above threshold.

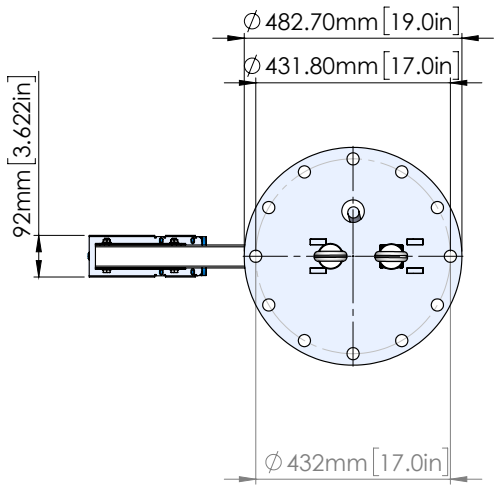
Gas hold up test – Bubble concentration



Process problem: Bubbles size increases, process stability reducing. GHU Array measures: Bubble concentration too high, bubble velocity trending high. DCS adjusts frother, solids% feed, aeration flow rate to reduce GHU level to stabilise bubble size and recovery.

Drawings





Specifications

Operating Supply Voltage
80 – 265 VAC, 50/60HZ

Current consumption
500mA @ 115VAC
350mA @ 240VAC

Outputs
2 x 4-20mA isol analog outputs 500 ohm max. @
Relays x 6 SPDT 5A@ 24VDC/240VAC

Sample Time
Bubble concentration and bubble velocity updates = 6 seconds (600/hour updates – 14,400/day)

Communication Protocols
Modbus TCP
Ethernet

Maximum Depth of Gas Hold Up Array
6000mm (240”)

Alarm Status:
Out of water alarm

Accuracy
+ - 0.5% of range

Operating Temperature
-20 deg C to 80 deg C. (-4 deg F to 176 deg F)

Separation Cable Distance Array/Controller
500m (1640 feet)

Cable required for Array/Controller connection
4 conductors shielded twisted pair
Belden 3084A
Dekoren IED183AA002 (MAX 350m - 900 feet)
Cables are supplied with plugs (power & communications)

Controller Display
3.5” colour display
Outputs and trends/diagnostics

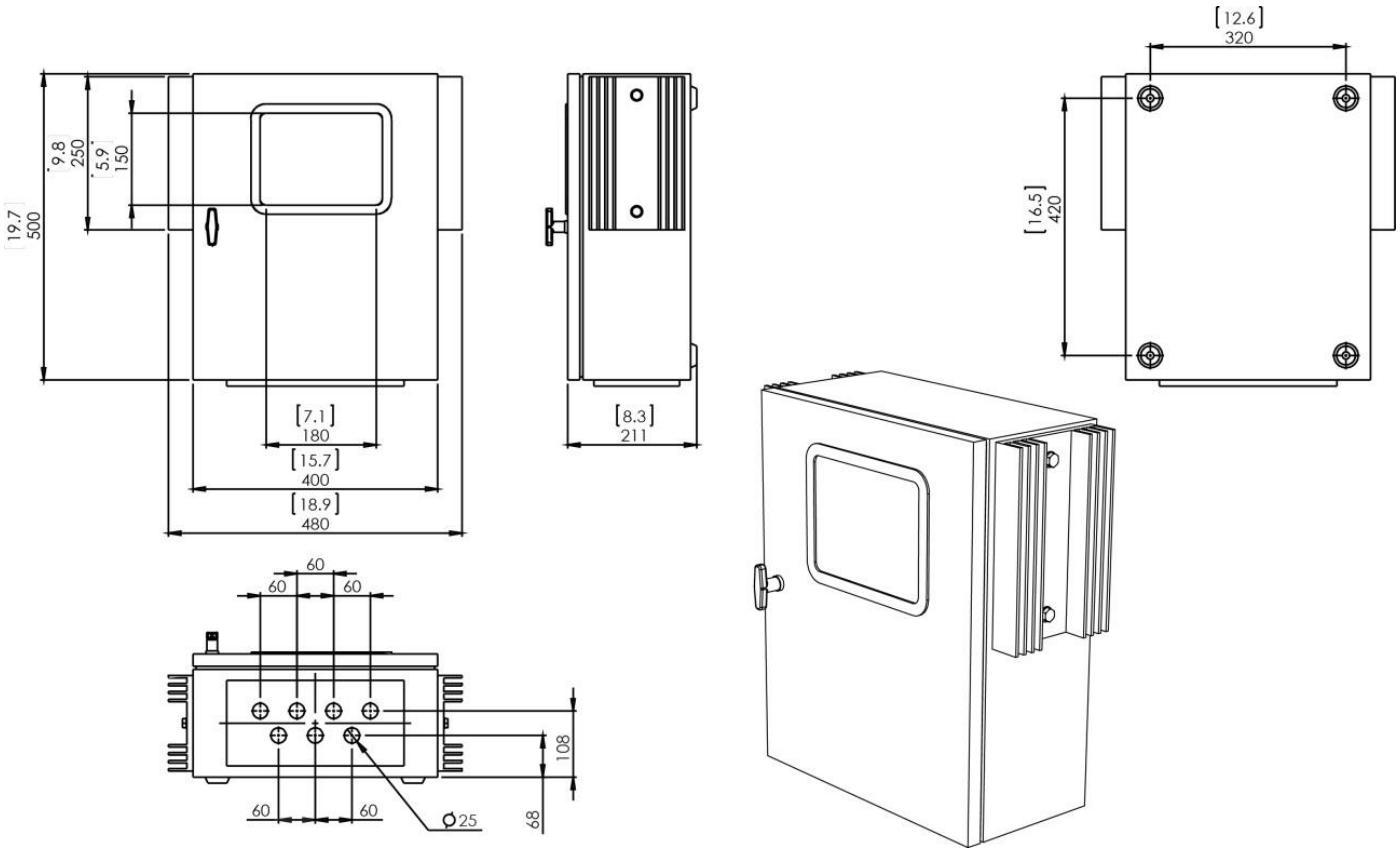
Controller Enclosure
316 Stainless Steel 700x520x200mm

Controller Sealing
IP65 (Nema 4X)

Controller Enclosure Entries
6 x 20mm (6 x 0.75”)

Typical Weight for system including bracket
30 kg (66 lbs.)

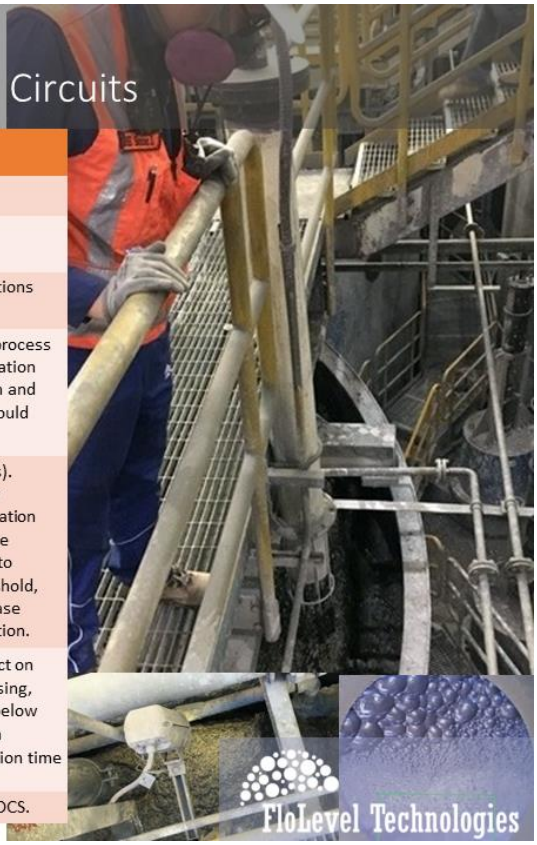
GHU Controller Enclosure



PRODUCT APPLICATIONS

Application F: Rougher, Scavenger, Cleaner Flotation Circuits

Rougher Flotation Cell Circuits	
FloLevel Products	GHU – Gas Hold Up (Volumetric Fraction of Gas Disbursed) in Liquid
Parameters Measured	The concentration of bubbles and velocity of the bubbles in the pulp/slurry when influenced by ore variation process changes.
Processes	Continuously monitor variations in bubble concentration % caused by ore process variations to allow DCS to compensate automatically to improve base metal recovery efficiency.
Alternative Instrumentation and limitations	Currently no alternative technology capable of operating continuously in the flotation process environment, that can provide the DCS control system process data to allow full automation control for optimized recovery. Currently Froth cameras that detect higher density froth and displacement floats are the only way that DCS control system has any idea that there could be Gas Hold Up issues, but currently still requires process operators to investigate.
Specific problems	Ore process variations cause changes to the production of bubbles (froth depth reduces). This is referred to as **Gas Hold Up** and it will have a major effect on base metal recovery efficiency in the Flotation cell. Ore variations like, Head Grade changes, Solids Concentration % changes, clay, gangue variation etc. To continuously monitor the **GHU** and make online compensation changes when the Volumetric Fraction Threshold (bubble concentration to liquid ration) starts to trend down. When the Volumetric Fraction drops below the threshold, less bubbles are produced, the bubbles contain more water, the bubbles recover less base metal and tend to contain higher proportion of gangue, reducing base metal concentration.
Corrective action	Trending the **GHU** continuously will allow the DCS to compensate the ore variation effect on bubble production by adjusting, solids concentration feedrate, Frother and Reagent dosing, Aeration flow rate etc. The concept would be to correct the **GHU level** before it drops below the Volumetric Threshold Fraction, thereby preventing the possibility of the Froth Depth changes that drop below the Launder Lip and a loss of base metal recovery in the retention time of the circuit.
Unique Benefits	Self cleaning transducers sampling every 6 seconds, 600 samples updates/hour to the DCS.



FLOTATION CELL CONTROL

Problem 6: "Air (Gas) Hold Up measurement" flotation process

Typical Flotation Process Problem

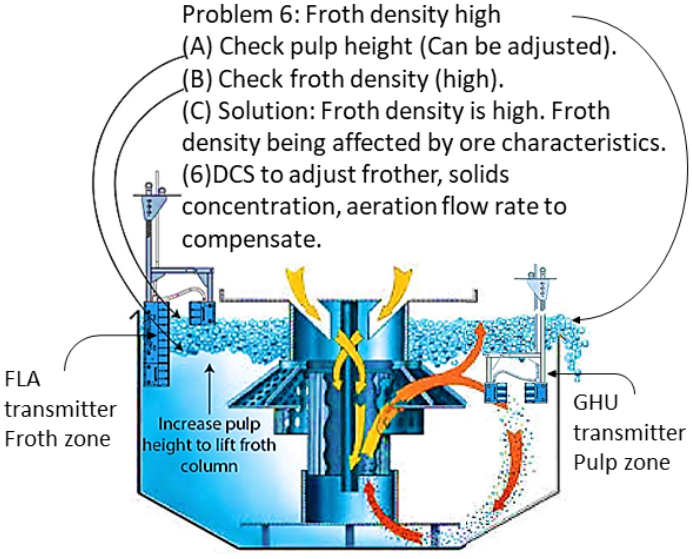
Froth Overflowing Launder Lip, High density froth, froth velocity decreasing.

FLA Level & Density/Gas Hold Up Transmitter Auto control for DCS Solution

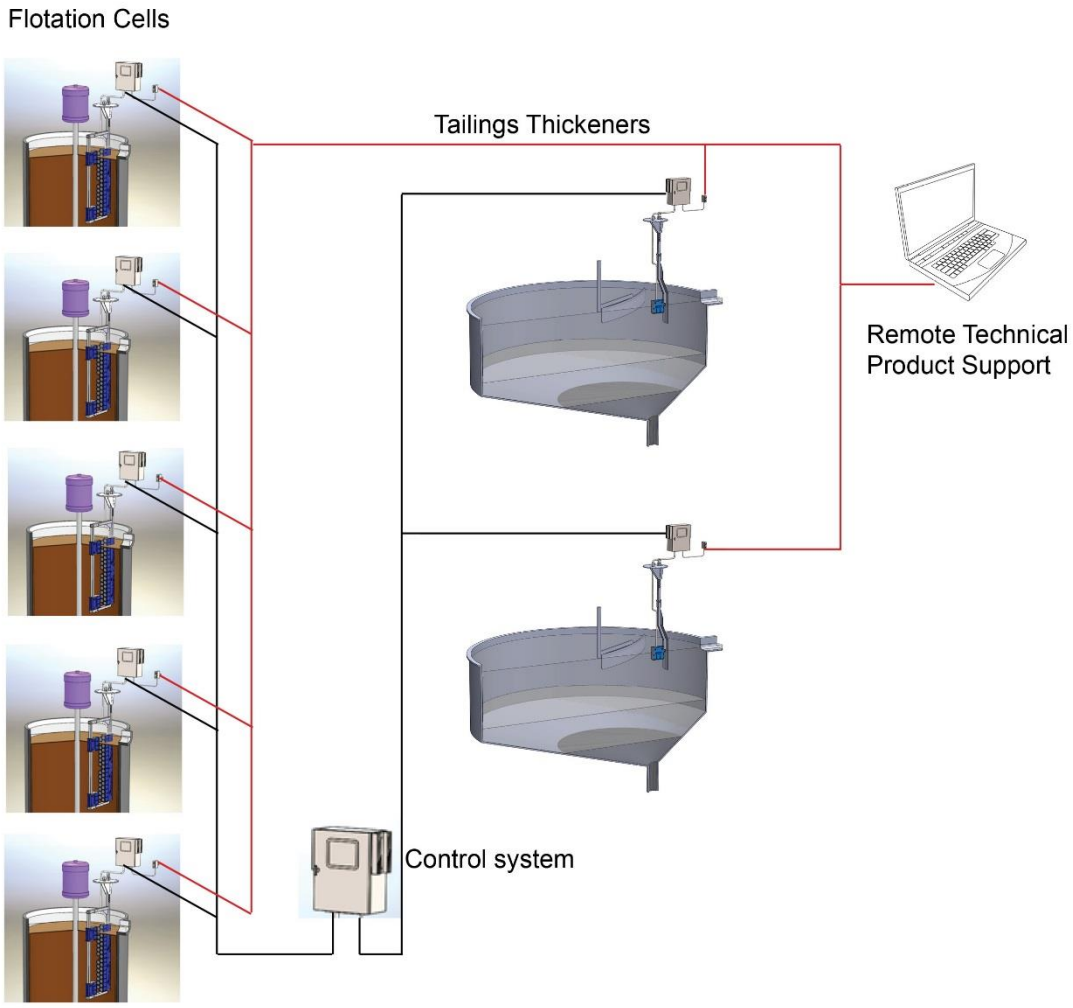
- The FLA monitors multiple process variables simultaneously, froth zone, etc.
- The GHU (gas hold up) monitors bubbles concentration/ bubble velocity, pulp zone.
  1. Is the Froth Density within limits? Froth density high
     a. FLA Checks Froth Density/ Froth velocity (froth zone).
     b. GHU checks bubble concentration and bubble velocity (pulp zone). Bubble concentration low, bubble velocity decreasing.
  2. Can the pulp slurry height be adjusted?
     a. FLA checks current Froth Depth/ Pulp Height. Pulp height can be raised.

Solution

- The Froth Density has increased, because the Gas Hold Up percentage has dropped below the threshold (low bubble concentration), bubble density was increased because of additional water content.
- DCS checks frother concentration dosing, solids concentration %, aeration flow rate, and observes the FLA process feedback on Froth Density, Froth velocity and Froth camera if installed.



Remote Diagnostics

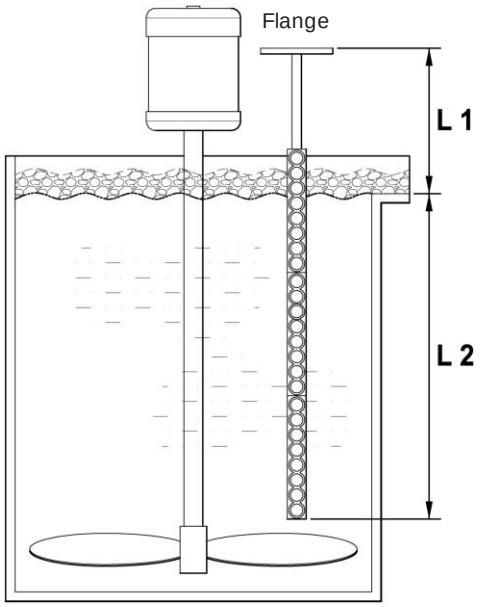


All FloLevel acoustic systems come with a remote diagnostics support module, which provide remote technical support anywhere in the world from factory trained specialists.

Applications that include flotation cells, reagent dosing tanks, mining thickeners that operate 24/7 can be supported remotely through all time zones.

Part Numbers for FloLevel™ Gas Hold Up System:

	Mineral	Level Depth below "L2"	Flange Position above "L1"	Resolution	Housing Material Array	Power Supply	Outputs	Cable Length	Flange Type for Mounting Bracket
GHU		Level below launder	Height above launder					Array to Controller	
GHU	Coal = 1	0.5m = 1	1.0m = 1	1mm = 1	ABS = 1	80-265VAC	2X4-20Ma =1	15m = 1	
	Copper = 2	1.0m = 2	1.5m = 2			50/60HZ	Modbus TCP = 2	Xm = 2 (X = customer specified)	
	Molybdenum = 3	1.5m = 3	2.0m = 3		Urethane = 2		Ethernet = 3		12" ANSI = 1
	Gold = 4	2.0m = 4	2.5m = 4						Other = 4
	Nickel = 5	2.5m = 5	3.0m = 5						
	Zinc = 6	3.0m = 6							
	Potash = 7	X.0m = 7							
	Iron Ore = 8	X2							
	Gypsum = 9	Customer							
	Talc =10	Advise							
	Silver =11	Length							
	Lead =12	Required							
		Inches	Inches	Inches				Feet	
		20.0" = 1	40.0" = 1	1.00" = 1				50ft = 1	
		40.0" = 2	60.0" = 2						
		60.0" = 3	80.0" = 3						
		80.0" = 4	100.0"= 4						
		100.0" = 5	120.0"= 5						
		120.0" = 6							



FloLevel Technologies Pty Ltd
Factory 50, 41-49 Norcal Road
Nunawading 3131 VIC
Australia
Phone: +61 (0)3 9872 3096
info@flo-level.com.au www.flo-level.com

FloLevel Technologies