



Slurry Conductivity Sensor

Rugged inline real-time slurry conductivity sensor

AL-DCIK





INTRODUCTION

AL-DCIK is a ruggedized in line connectivity sensor that provides continuous real-time conductivity data. AL-DCIK is an erosion/wear resistant toroidal conductivity sensor specifically designed for the alumina industry to provide alumina to caustic ratio measurements (A/C ratio or R/P).

FEATURES AND BENEFITS

- Accurate, stable and repeatable real time in-line measurement of conductivity in any process line size with almost any velocity.
- Rugged sensor designed specifically for harsh slurry environments
- Flexible communications and repeatable calibration procedure
- Enables process automatization of alumina to caustic ratio control
- Allows the user to install the sensor directly in the main process pipe eliminating the need for costly high maintenance side streams and sample lines
- Uses proven technology extensively utilized in minerals processing
- Reliance on manual sampling is reduced and control lag is eliminated.

DESIGN PHILOSOPHY

Erosion Resistance

The AL-DCIK is made using a stainless-steel sensor body with a PSZ ceramic core. The stainless-steel body can erode without any effects on the measurement. The ceramic core does not erode at all maintaining the correct internal sensing area dimensions to eliminate drift.



SENSOR STEEL BODY WITH PSZ CERAMIC CORE

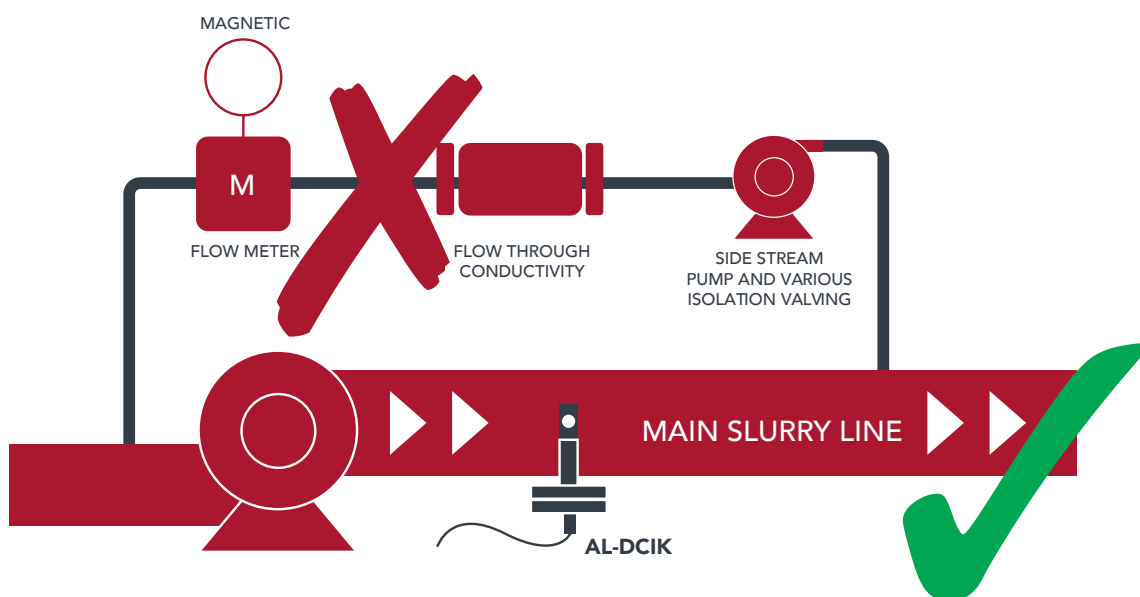


PROBE AFTER 6 YEARS OF SERVICE

APPLICATIONS

The AL-DCIK from Precision Light and Air has been specifically designed for alumina process slurries and the like, where PEEK, Teflon and epoxy bodies suffer from erosion and subsequently frequent, expensive replacements.

The AL-DCIK is directly installed in the main process pipe eliminating the need for costly high maintenance side streams and sample lines. For some time, small bore ceramic conductivity sensors known as "flow-through", have been used in side-streams. Now, with the AL-DCIK, you can get an accurate, stable and repeatable measurement of conductivity in any process line size, with almost any velocity.



IN LINE INSTRUMENT VS SIDE STREAM-MOUNTED INSTRUMENT

The AL-DCIK in-line measurement allows the Process Engineer to see process changes in between lab samples so they can react faster. This, in turn, allows the plant to push the A/C target higher allowing more bauxite charge into digestion as your certainty is higher. As we all know, one A/C point is around one million US dollars per train for a standard sized one million tonne alumina refinery. The instrument therefore pays for itself in weeks.



SENSOR

The AL-DCIK use a standard toroidal conductivity element that has been used in the chemical, mining and food industries for decades.

With inductive conductivity, the sensing element (electrode coils) does not come in direct contact with the process. These matched coils are encapsulated in a the steel/ceramic casing protecting them from the adverse effects of erosion.

TRANSMITTER

Much like the sensor, the indicating transmitter has been modified from a standard conductivity transmitter. The electronics are mounted in a 316ss enclosure with a viewing window. The configuration of the transmitter is through the front key pad. The large LCD display provides local indication of conductivity and temperature together with alarm status and a bar graph indication of output %.

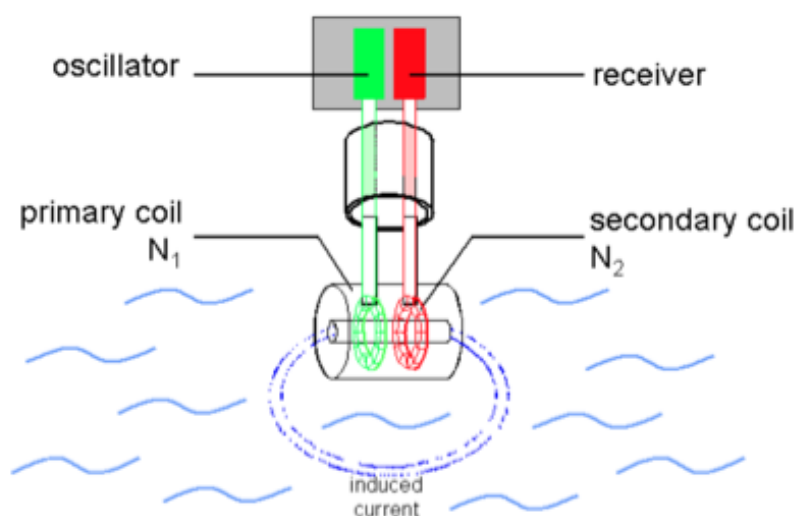
Additional Features:

- Continuous transmitter and sensor diagnostics
- RFI and EMI protection
- Custom temperature and conductivity curves
- Loop powered standard. 24V dc 4wire and mains powered available and includes outputs for alarm.



AL-DCIK FIELD INSTALLATION

MEASUREMENT METHOD



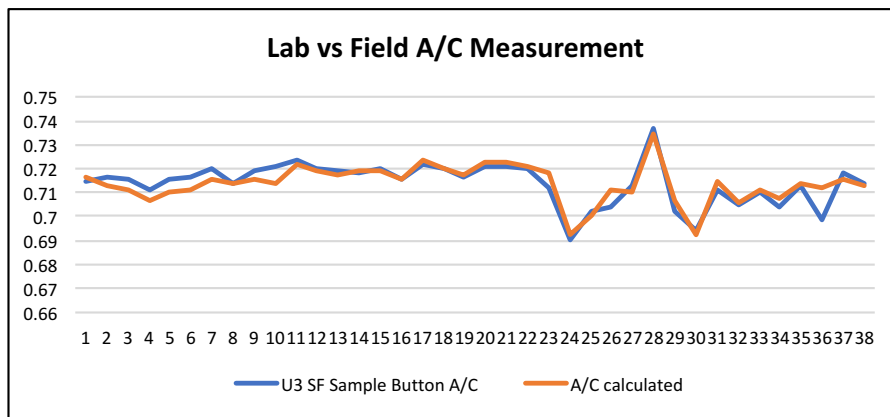
AL-DCIK PRINCIPLE OF MEASUREMENT

In the figure above, the AL-DCIK sends an induced current through one toroid that is immersed into the liquor/slurry (behind the steel/ceramic body). A second toroid receives that induced current. The amount of current it receives is directly proportional to the liquid conductivity. In alumina, the conductivity has an inverse relationship to A/C ratio. Thus, an increase in conductivity is a reduction in A/C ratio. The relationship is linear. Essentially alumina is an insulator and caustic is a conductor. So as the ratio changes, for a fixed caustic concentration, the alumina concentration must have changed.

In plants where the caustic concentration is relatively stable, the conductivity meter can provide A/C ratio on its own. However, if caustic concentration is unstable, a refractive index instrument (AL-CARK) is used to compensate the A/C ratio for changes in caustic. In this way, the exact A/C ratio, alumina concentration and caustic concentration can be calculated. All measurements referred above are also temperature dependent (as most analytical measurements are) and require the installation of a temperature sensor in line to provide this compensation.

LAB VS FIELD A/C MEASUREMENT

The below trend compares the conductivity measurement from the lab to the measurement from the AL-DCIK for a one week period. The R2 is extremely good. The P value of the conductivity is extremely significant.



SUMMARY OUTPUT				
<i>Regression Statistics</i>				
Multiple R		0.894049206		
R Square		0.799323983		
Adjusted R Square		0.787856782		
Standard Error		0.004086589		
Observations		38		
<i>ANOVA</i>				
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>
Regression	2	0.002328184	0.001164092	69.70523905
Residual	35	0.000584507	1.67002E-05	
Total	37	0.002912691		
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.389739325	0.278716934	1.398333855	0.170811139
Conductivity	-0.001242299	0.000105958	-11.72446245	1.12753E-13
Temperature	0.007543661	0.002639372	2.85812727	0.00713078

LAB A/C VS CALCULATED INLINE MEASUREMENT FROM AL-DCIK



SPECIFICATIONS

Sensor

- Maximum process pressure: ANSI Class 600
- Standard process pressure: ANSI Class 150
- Maximum process temperature: 205°C
- Flange size: 6" ANSI
- Temperature compensation: remote, by customer.
- Ceramic core bore size: 45mm
- Cable length: 6 meters (maximum 30 meters)
- Body material: 316l standard. SAF2205 optional.

Transmitter

- Accuracy: +/-0.3% Full Scale (includes linearity)
- Accuracy - temp measurement: +/-0.1 deg C
- Repeatability: same performance as accuracy
- Drift: Less than +/-0.2% full scale per 6 months
- Measurement range: Selectable .05 through 2000 mS/cm
- Output signal: 4-20mA loop powered, 24V dc 4-wire or mains powered.
- Display type: Multi-line LCD
- Enclosure IP rating: IP67 / NEMA 4X



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