PLA
PROCESS
ANALYSERS

Mud Diver

Suspended solids level measurement and tank profile station for Clarifier, Thickener, CCD and Washer Control Optimisation

SmartDiver®
MUD DIVER®

PRECISION LIGHT & AIR PTY LTD • 17 Sir Laurence Drive, Seaford, Vic 3198 Australia • www.plapl.com.au

INTRODUCTION

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SmartDiver is a ruggedized automatic mud diver that provides continuous real time data of operational parameters in thickeners, clarifiers, washers, decanters and CCDs in the mineral processing industry. Information delivered by the system includes:

- Mud levels
- Settling zones
- Overflow clarity
- Tank profiling (suspended solids vs depth)
- Specific gravity profiling
- Bed level measurement
- Mother liquor concentration measurement

Engineers and Operators, armed with this kind of data, can attack process optimisation of flocculation and underflow density control head-on. The reliance on manual "dipping" of the tanks is reduced and Operators can get detailed analysis of what is flowing in and out of their tankage.

SMARTDIVER SYSTEM ASSEMBLY

FEATURES & BENEFITS

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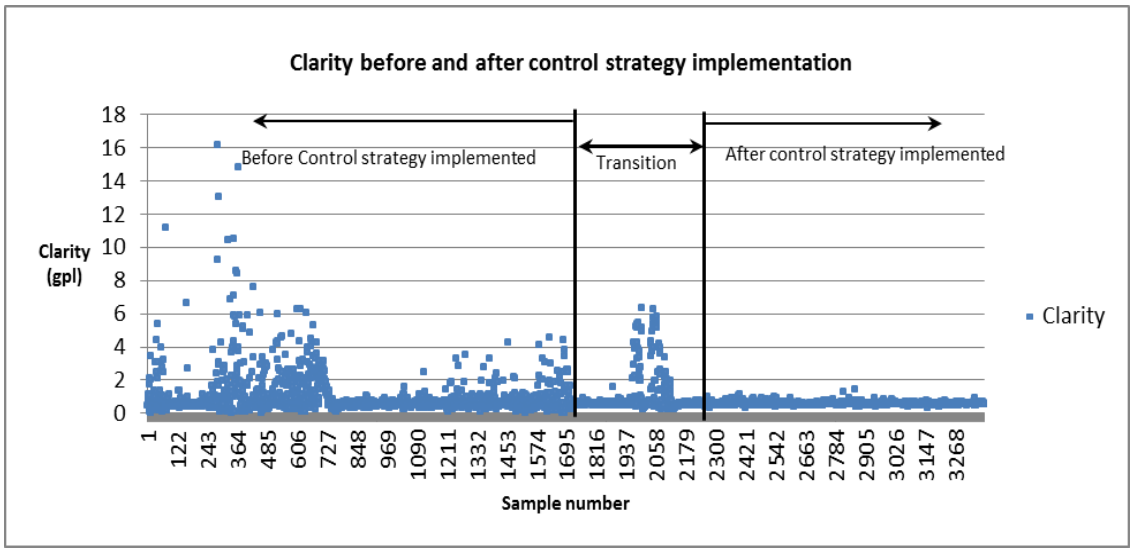
- Accurate and repeatable measurements provide historical data of the behaviour of the interfaces in the thickener and allow the user to visualise the operations performance through trends and graphical representations of the tank solids.
- The device provides the operator with more operational parameters to control the thickener performance (clarity, interface, mud bed heights).
- The system allows the operator to identify changes in the conditions in the thickener through integrated DCS alarms, trends of the various solid levels and tank profiles. Control can then be established using existing variables and the new measurements provided by the SmartDiver.

The SmartDiver is a low capital & maintenance option to:

- Enhance overflow clarity
- Increase underflow density
- Obtain superior rake torque control
- Optimise flocculant & reagents consumption
- Enhance preventative & predictive maintenance (PM/PDM) capabilities through correct control of the tanks, reducing tank maintenance intervals.
- Increase availability of the thickener through proper control.



IMPROVED CLARITY AFTER CONTROL STRATEGY USING THE SMARTDIVER WAS IMPLEMENTED

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DESIGN PHILOSOPHY

SmartDiver has been designed around easy to access non-proprietary components to ensure long term maintainability even in the most remote locations. Remote 3G/4G modem using "team viewer" is supplied standard with almost everything in the PLA range to make monitoring and troubleshooting operations easier.

Special attention has been given to the traditional high maintenance mechanical systems associated with retracting level measurement systems. As an example, the cabling connecting the SmartDiver sensors is specifically designed for continuous winding operations and is more commonly found in heavy duty applications in elevator control and offshore winching. A 40mm stainless steel shaft on stainless steel bearings indicate the strength and quality of the system. We have divers installed for 15 years that are still working with little to no maintenance.

The on-board PLC ensures that the SmartDiver can functionally do almost anything you want. PLA can modify the code for your specific application requirements quickly and securely. Later down the track, your own Electrical/Instrumentation Technicians can add functionality without PLA involvement. If the sensors or communications technology change over the years, the open platform allows you to change solid sensors or communications for something that better suits your application. The diver can evolve or devolve as your needs change.

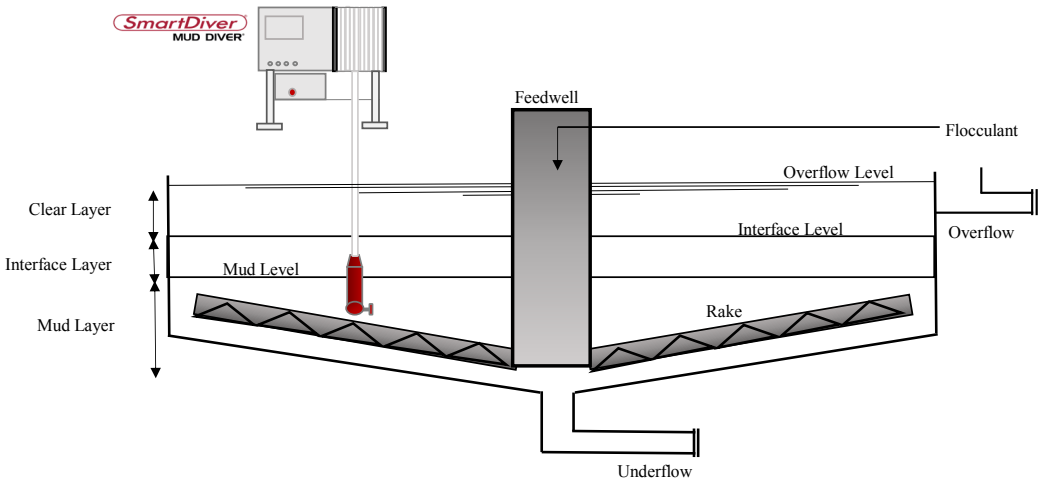
SMARTDIVER CONTROL PANEL - OPEN PLATFORM DESIGN

APPLICATIONS

A SERIOUSLY RUGGED MEASUREMENT SYSTEM FOR A SERIOUSLY RUGGED INDUSTRY

PLA's SmartDivers have been engineered to withstand the rigors and operational environments of the mineral processing sector. SmartDivers are being used in alumina, nickel, copper, uranium, mineral sands, and gold processing facilities in over 17 countries. The diver is just as well suited to other industries. The system can be used anywhere where there is a need to monitor settling in solids/liquid separation vessels (thickeners). We now boast more than 200 successful installations worldwide.

SMARTDIVER - COPPER THICKENER VESSELS APPLICATION



CROSS SECTION OF A TYPICAL GRAVITY THICKENER AND POSITION OF SMARTDIVER

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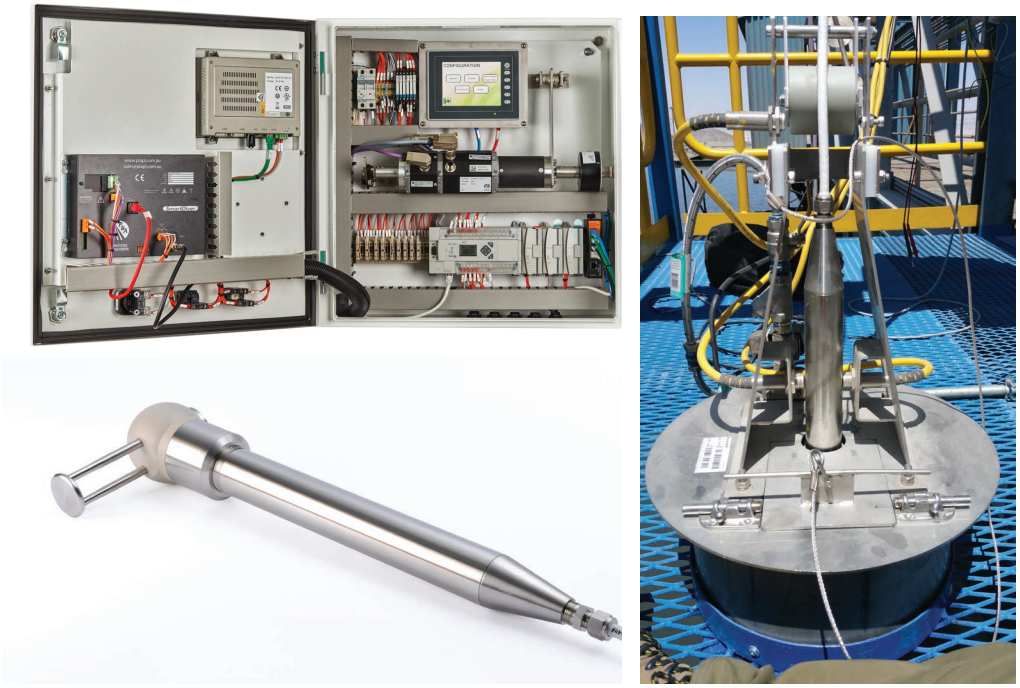
SYSTEM COMPONENTS

SMARTDIVER SYSTEM COMPONENTS

- **Power Supply**
  The SmartDiver power supply box includes a 24V DC and a UPS to allow for continuity of operations in case of a power outage.
- **Control Panel**
  Composed of a suspended solid transmitter, color HMI screen, PLC, motor, relays and manual switches.
- **Drum**
  The SmartDiver rotation system uses stainless steel bearings and support structure, and winching cable designed for continuous winding operations in temperatures up to 150°C.
- **Wash Bay**
  The SmartDiver wash bay controls water flow to wash the retracting cable and the sensor as it enters the bay.
- **Suspended Solids Sensor**
  The sensor has no moving parts and uses a patented sound attenuation sensing technique to provide accurate clarity, interface, and mud level readings. The sensor measures specific gravity concurrently with suspended solids.



SMARTDIVER SYSTEM COMPONENTS

MEASUREMENT METHOD

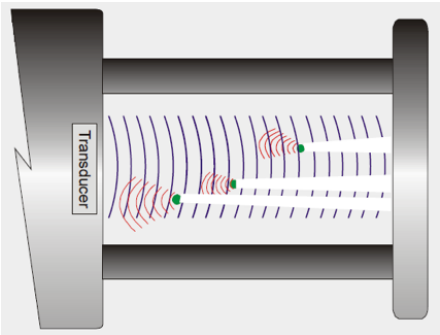
SMARTDIVER MEASUREMENT METHOD

1. Suspended Solids Measurement Method

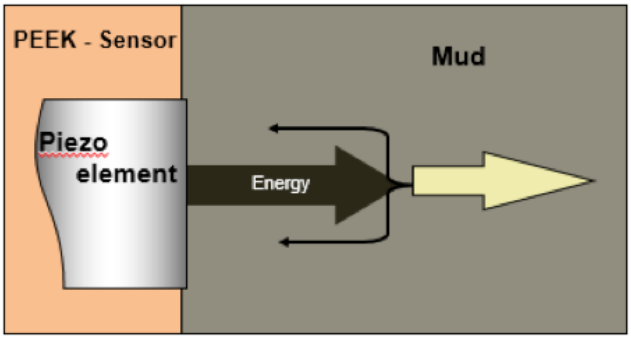
A transducer is charged sending a pulse from the sensor face to a reflector and back. As suspended solids increase, less energy is received back at the transducer. This is attenuation of sound and is directly proportional to suspended solids. Less energy received back, greater suspended solids.

2. SG/Density Measurement Method

Acoustic impedance measurement is used to sense the density of the slurry that the sensor is immersed in. This measurement happens concurrently with the attenuation measurement. Essentially we are measuring how easily the pulse we are sending comes off the face of the sensor. In air, no energy transfers off the face of the sensor. In water most energy is transferred off the face of the sensor and in dense slurry, almost all of the energy is transferred. Acoustic impedance is directly proportional to density.



SUSPENDED SOLIDS MEASUREMENT METHOD
– SOUND ATTENUATION



SG/DENSITY MEASUREMENT METHOD
THE ACOUSTIC IMPEDANCE (Z) = SPEED OF SOUND (C) x DENSITY (ρ)

PERFORMANCE OF INTERFACE MEASUREMENT TECHNIQUES

	Heavy Mud	Specific Gravity (SG)	Clarity	Profile	Reliability	Accuracy
SmartDiver (Suspended Solids and SG)	√	√	√	√	√	√
Fixed Ultrasound	X	X	O	O	√	X
Ball Float	√	X	X	X	X	X
Radiation	√	√	X	X	√	X
Bed Pressure	√	√	X	X	√	X

√ = Good Performance X = Poor Performance O = Average Performance

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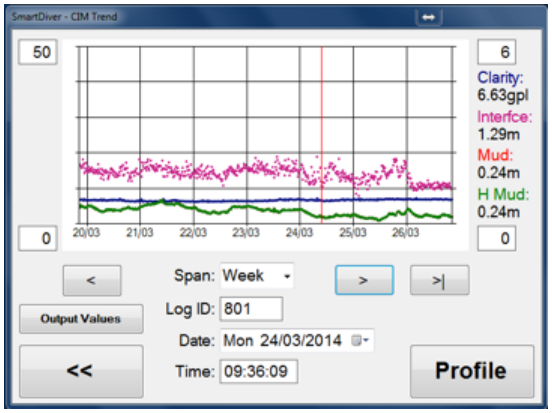
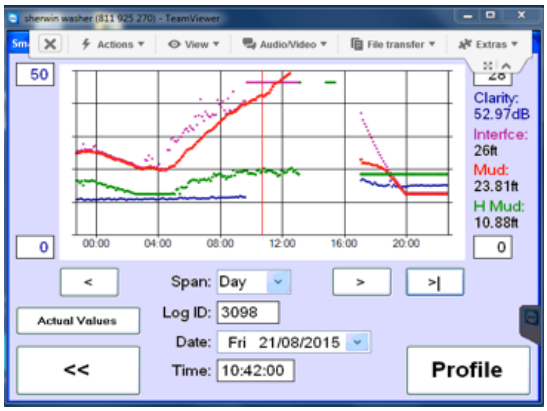
DATA ACQUISITION EXAMPLES

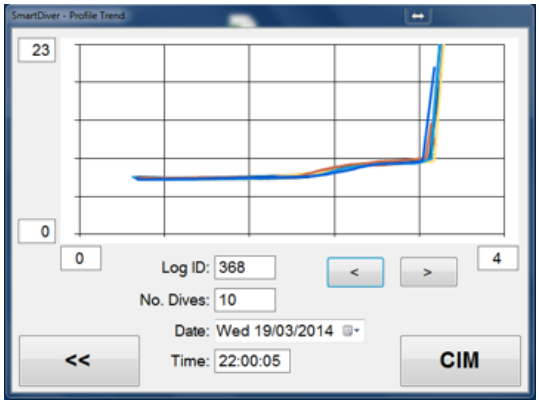
SMARTDIVER DATA ACQUISITION EXAMPLES



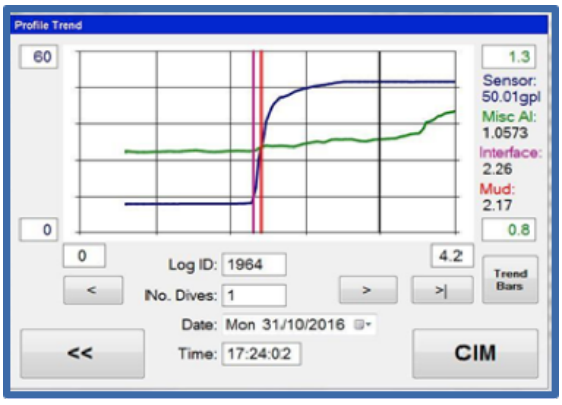
INTERFACE AND MUD LEVELS TREND IN A STABLE TANK WITH ADEQUATE CONTROL.



INTERFACE AND MUD LEVELS TREND IN A TANK WHERE THE OPERATOR LOST CONTROL. THE INTERFACE GOES OVER THE TOP OF THE TANK AND INTO THE OVERFLOW. CONTROL IS RE-ESTABLISHED LATER ON.



TANK PROFILE OF SOLIDS VS DEPTH. THIS IS A SET OF 10 DIVES SHOWING REPEATABILITY OF THE MEASUREMENT



TANK PROFILE OF SOLIDS VS DEPTH. INTERFACE AND MUD ARE VIRTUALLY THE SAME. MUD LAYER NOT DENSE OR COMPACTED

SPECIFICATIONS

GENERAL SPECIFICATIONS

Maximum Process Temperature:
- 150°C

OUTPUTS:
- Analog: 7X 4-20mA
- Contact output for fault.
- Digital: Modbus over Ethernet TCP / IP.
- Wireless Ethernet and wireless analog (optional)

ACCURACY
- Accuracy: +/- 2% of reading
- Repeatability: +/- 1% of reading
- Level: +/- 5-10mm

POWER SUPPLY:
240/110 Vac or 24 Vdc

MODEL CODING
- AL-6410

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SPECIALISTS IN PROCESS ANALYSERS FOR THE MINERALS PROCESSING SECTOR

Mud Divers • Slurry Liquor Phase Density Analysers • Clarity Probes
Slurry Conductivity Analysers • Slurry Caustic Concentration Analysers

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