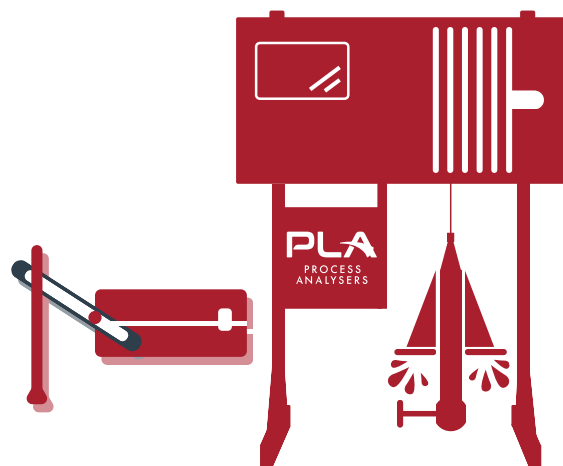


SmartDiver[®]

MUD DIVER[®]

PLIS393 RAKE INTEGRATION GUIDE

The strategically placed Tags and a Rake Switch, are integrated with the SmartDiver[®]'s control system. This helps to calculate dive timings, preventing the SmartDiver[®]'s Sensor from interfering with rake operations.



Rake Tag



Rake Switch

BASIC GUIDE ON RAKE TAG & SWITCH INSTALLATION

- The tag(s) is(are) installed in relation to the rake arms on the rake drive.
- The rake switch is installed in relation to the SmartDiver[®] sensor dive position.
- This allows us to calculate dive timings so the sensor does not get caught up in the rake arms.
- The SmartDiver[®] sends 24VDC output and looks for this to be returned as Digital Input 7 (I7).
- The contact from the rake switch is dry, voltage free. (NO, PNP)
- You can use any Limit Switch or 24VDC Proximity Sensor.
- If a proximity sensor is used, use a two wire or three wire PNP.
- **Complete the Rake Integration Process:** Integrate the Calculations & Data from the Rake in to the SmartDiver[®] control system.

IMPORTANCE OF RAKE TAG & SWITCH

THE RAKE SWITCH IS CRUCIAL FOR SMARTDIVER[®] SAFETY WHEN OPERATING IN THE RAKE INTERFERENCE ZONE:

- **Safety:** Protects the sensor from potential damage by the rake's speed changes and stops.
- **Direction:** Multiple tags allow the SmartDiver to understand the direction of the rake.
- **Automation:** Eliminates the need for manual shutdown during rake maintenance or stoppages.
- **Reliability:** Ensures consistent operation without relying on timely human intervention.
- **Measurement accuracy:** Allows diving to full tank depth, providing complete mud and interface level data.
- **Applicability:** Essential for most tanks, except deep cone settlers.

Note: PLA only supplies the rake switch upon request due to variations in rake pick-up points and installation requirements across different systems.

SAFETY MEASURES IMPLEMENTED BY THE SMARTDIVER[®]

- **UPS backup:** Raises sensor on power loss.
- **Rake switch monitoring:** Prevents diving if signal is too long or short.
- **If rake alarms are activated** the current dive will stop immediately and retract the sensor.
- **No-dive condition:** Activated if rake switch fails to engage.
- **Tolerance checks:** Halts diving if rake cycle time is outside set parameters.
- **Signal verification:** Dives only occur with legitimate, in-tolerance signals.

BACK UP FOR WORST-CASE SCENARIO (SENSOR HOOKING ONTO RAKE)

- Rake overpowers SmartDiver[®] motor (limited to 3A)
- Motor forced into reverse
- Cable unwinds from drum
- Cable detaches from SmartDiver[®] gland
- Sensor and cable wrap around center well or motor shaft
- Cable designed to break before damaging rake or drive

RAKE INTEGRATION PROCESS

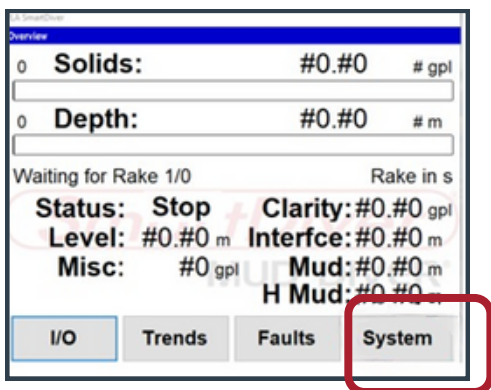
Rake Integration Calculations (RIC):

Calculates the Dive Start Delay – the delay required to ensure the rake arms will not catch the sensor when it is at the bottom of its dive.

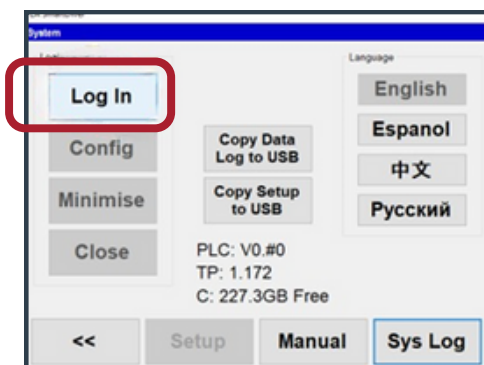
1. **Fill out the RIC Table with Data:** It can be either measured, or found in the SmartDiver[®] Control Panel's settings page.
2. **Note the last Rake Time:** This is the time between rake switch triggers. If there are two tags on the rake drive, these will trigger every half revolution.
3. **Measurement:** Time how long from when the rake switch triggers to when the rake is at the dive position.

RIC TABLE

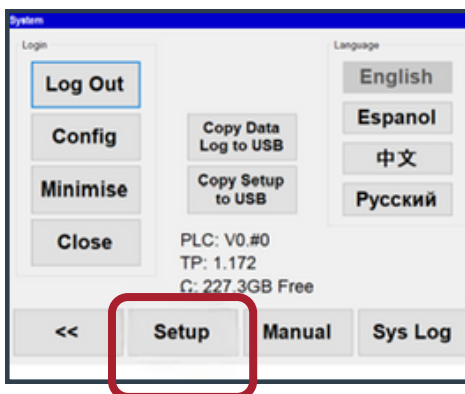
Item	Found in	Example value	Commissioning value
A: Last Rake Time	Settings	220	
B: Rake tags attached	Counted	2	
C: Rake arms considered	Counted	2	
D: Rake window	Settings	20	
E: Time Between – Rake Switch ON until Rake at Dive Position	Measured	142	
F: Clarity Hold Time	Settings	20	
G: Wash Time	Settings	20	
H: Distance to Liquid	Settings	1.5	
I: Liquid Height	Settings	2.8	
J: Rake Interference height	Measured / Drawings	1.0	
K: Last Rake On Time #	Settings	18.2	
L: Sensor Raise Speed	Settings	100	
M: Sensor Lower Speed	Settings	40	
N: Dive Start Delay	Settings	173	

A: LAST RAKE TIME**HOW TO INPUT DATA IN THE SMARTDIVER® CONTROL PANEL****1.**

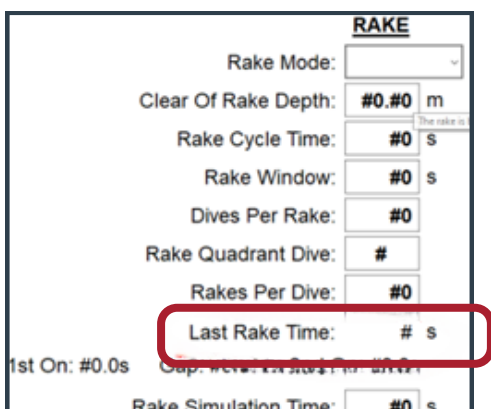
From the main OVERVIEW page, press

System**2.**

Press

Log In**3.**Enter Password: **9786**, then press**Ok****4.**

Press

Setup**5.**Scroll down to the RAKE section to find:
Last Rake Time

B: RAKE TAGS ATTACHED

Rake Tag Information to Consider:

- How many Rake Tags have been installed on the rake drive to trigger the rake switch.
- Are these aligned with the rake arms, or are they offset.

C: RAKE ARMS CONSIDERED

Rake Arm Information to Consider:

- How many Rake Arms in the Thickener - Especially the larger primary Rake Arms.

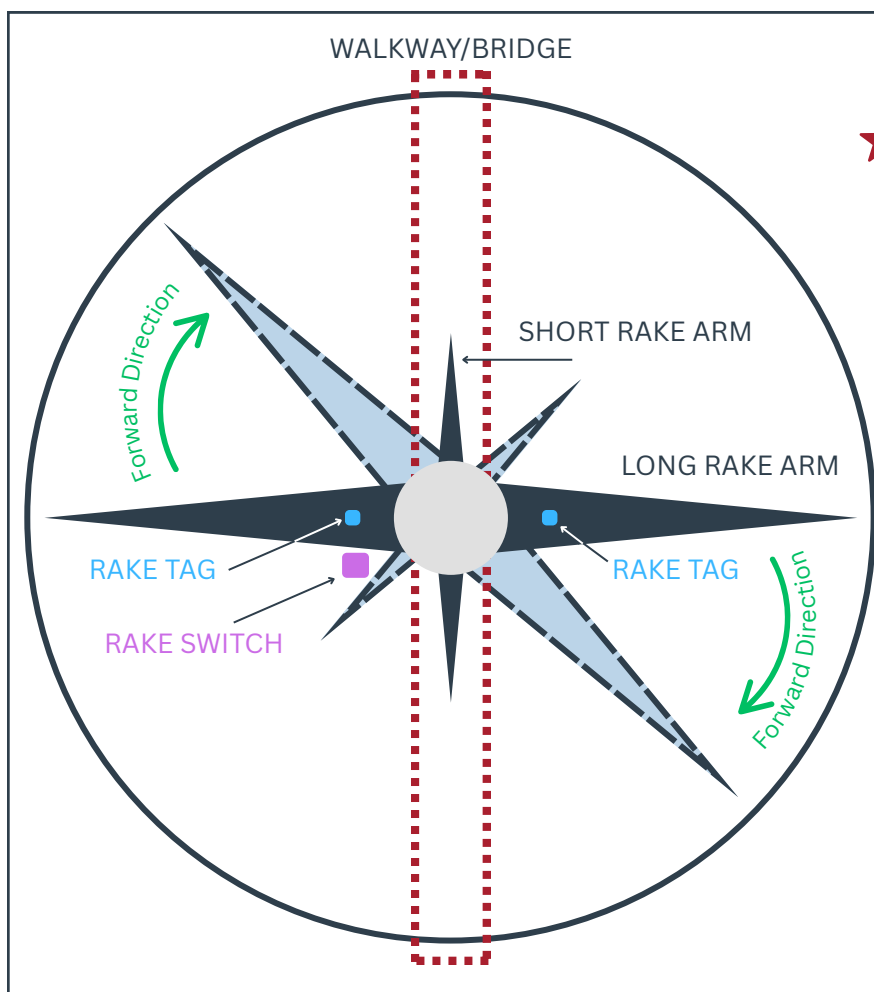
D: RAKE WINDOW

- In this context, a Rake Window refers to the designated time period or positional gap during which the rake arms are not in a position to interfere with the Sensor of the SmartDiver®.

E: TIME BETWEEN – RAKE SWITCH ON UNTIL RAKE AT DIVE POSITION

Measure the time between when the rake switch is triggered and when the rake reaches the dive position.

- Rake arm orientation can be determined by:
 - 1.If the tank is empty this can be observed
 - 2.Rake flags
 - 3.Markings on the rake drive showing the orientation of the rake arms
 - 4.Feeling for the rake with a long piece of conduit
- Start the timer when the rake switch triggers
- Stop the timer when the long rake arm is pointing to or is under the dive position



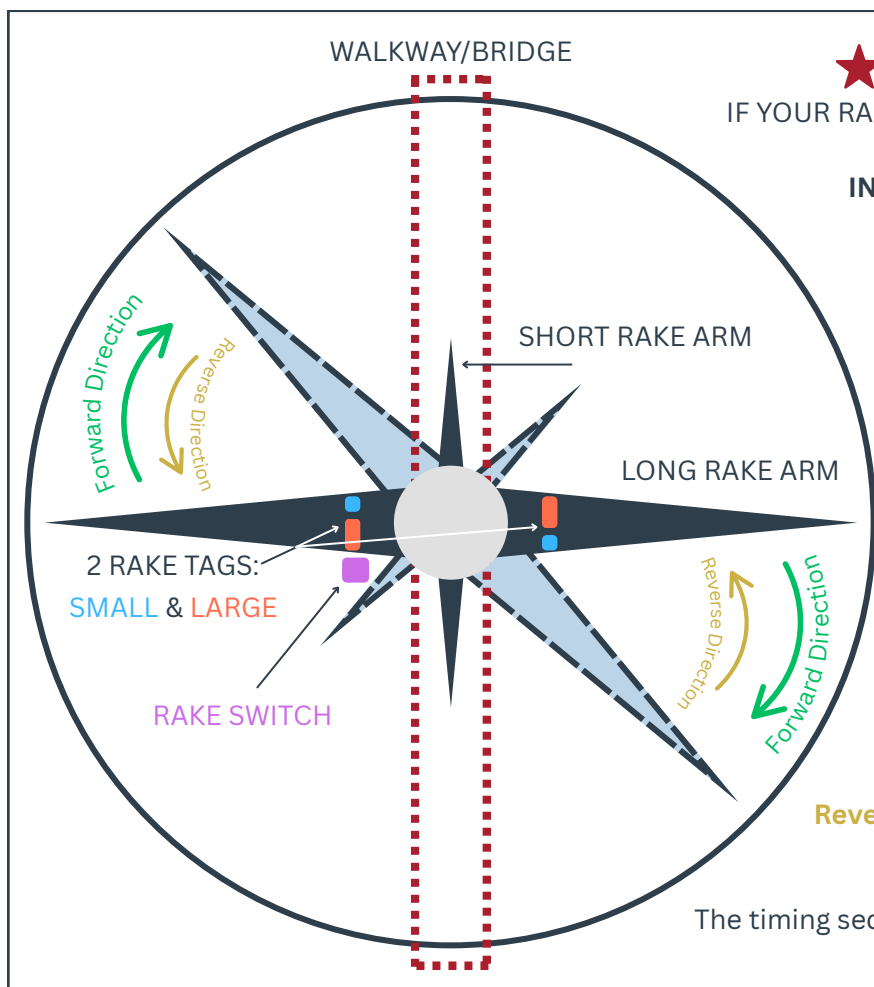
★ **FOR SINGLE-DIRECTION RAKE ARMS:**
IF YOUR RAKE ARMS MOVE IN ONLY ONE DIRECTION:

INSTALL ONE RAKE TAG ON EACH OF THE LONG RAKE ARMS, 180° APART.

The Rake Switch detects a pulse each time the Tagged Rake passes by it.

Why a Tag on both Rake Arms?

Reduces waiting time - you get a signal every 180 degrees instead of waiting for a full revolution.



★ **FOR BI- DIRECTIONAL ARMS:**
IF YOUR RAKE ARMS CAN MOVE IN BOTH DIRECTIONS:

INSTALL TWO RAKE TAGS ON EACH OF THE LONG RAKE ARMS

USE ONE SMALL TAG & ONE LARGE TAG PER RAKE ARM

SPACE THE TAGS 3-5 INCHES APART

Why two Tags per Rake Arm?

The larger tag creates a wider pulse than the smaller tag. The system reads which tag triggers first:

Forward direction: Smaller tag's pulse
→ Gap → Larger tag's pulse

Reverse direction: Large tag's pulse → Gap → Small tag's pulse

The timing sequence tells the system which way the Rake is moving.

F: CLARITY HOLD TIME

- This is the time needed for the sensor to stabilize as it enters the liquid and reaches the clarity hold point.
- In tanks with thick foam or scum, you may need a longer hold (around 20 seconds) for clearing or temperature stabilization before taking the clarity reading. For normal installations, 20 seconds is sufficient.

G: WASH TIME

- Enter the time you want the Sensor to be washed for after it parks in the wash bay. This is typically 20 to 30 seconds.

H: DISTANCE TO LIQUID

- Measure the distance from the tip of the sensor when the sensor is docked in the wash bay to the liquid surface.

I: LIQUID HEIGHT

- Enter the distance from the bottom of the tank (or the lowest point in the tank that your site wants to measure from) to the top of the liquid surface

J: RAKE INTERFERENCE HEIGHT

- **Rake Interference Zone:** The area where the Sensor could potentially collide with the Rake.
- **Rake Interference Height:** Distance between the bottom of the tank to the top of the Rake.
- Account for the Rake lift, if any.

K: LAST RAKE ON TIME

- This entry cannot be adjusted. The data is derived from the Proximity Sensor and it is a display of the time between the falling edges of the last 2 rake signals.

L: SENSOR RAISE SPEED

- Normally set to 99% (full speed).

M: SENSOR LOWER SPEED

- Set it as slow as possible to improve measurement accuracy.
- Be vary of the "maximum dive time" in rake times settings.
- Ensure speed allows full tank depth dive and return within time window.

N: DIVE START DELAY

- The rake switch is usually installed for easy access, not necessarily where the SmartDiver[®] should dive.
- You need to time the delay from when the rake switch triggers to when you want to dive.
- You can start the dive a few seconds before the rake passes under the SmartDiver[®], as the sensor takes time to descend.
- Always allow enough time to avoid the sensor being caught by the advancing rake.

RAKE TAG & SWITCH INSTALLATION EXAMPLES



Limit Switch

Extended Arm to Rake Tag
(through Grid Mesh)

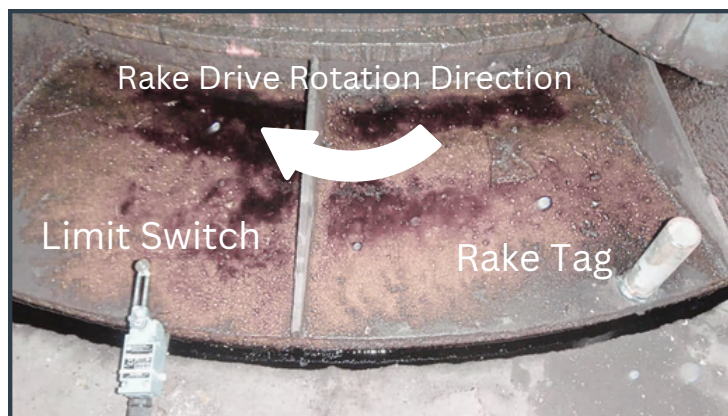


A Tag rotates on the Rake Drive, which triggers the Switch Arm.



Rake Tag

Limit Switch

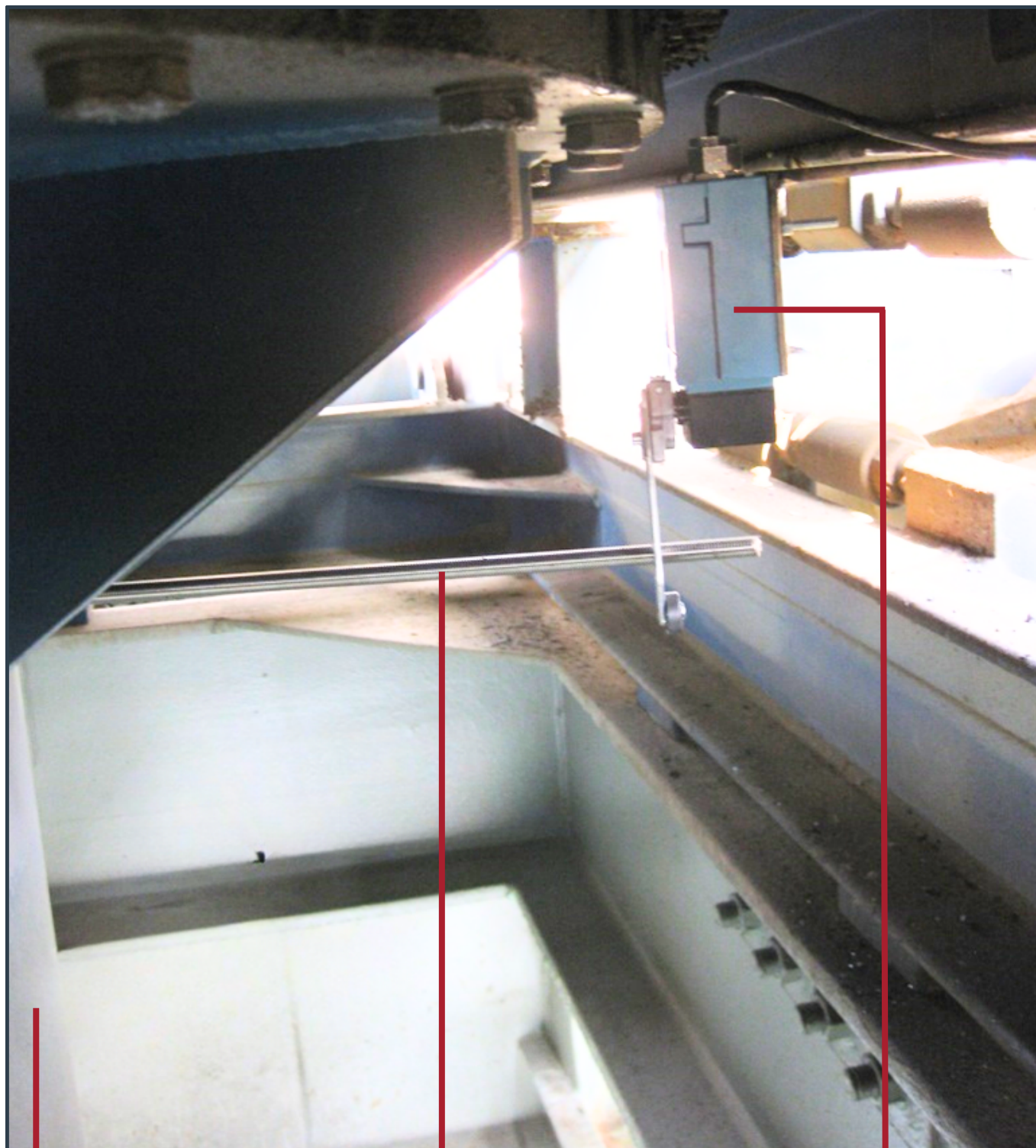


Rake Drive Rotation Direction

Limit Switch

Rake Tag

RAKE TAG & SWITCH INSTALLATION EXAMPLES

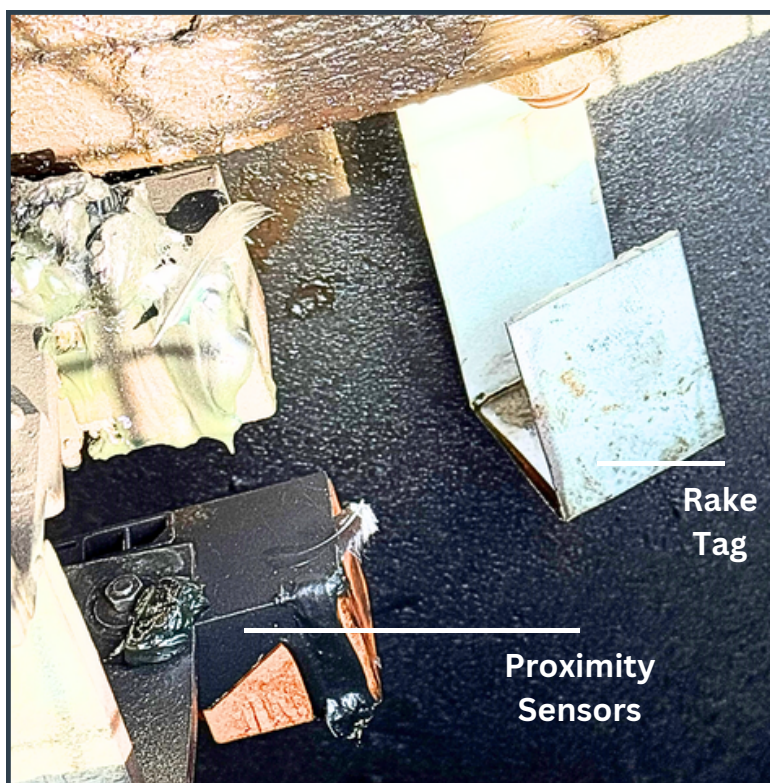
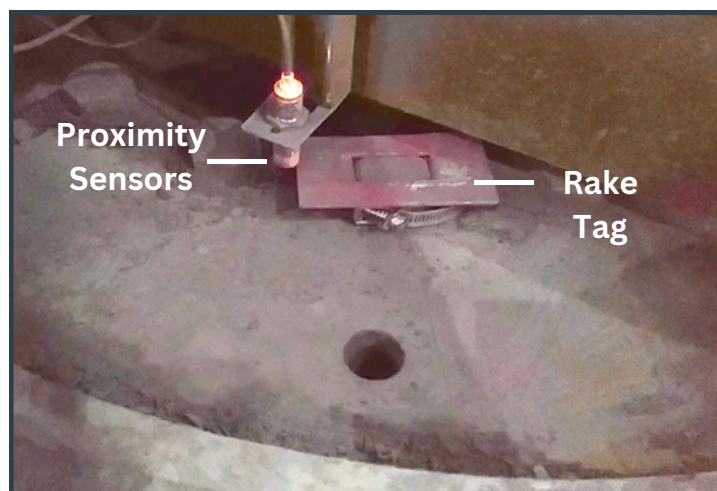
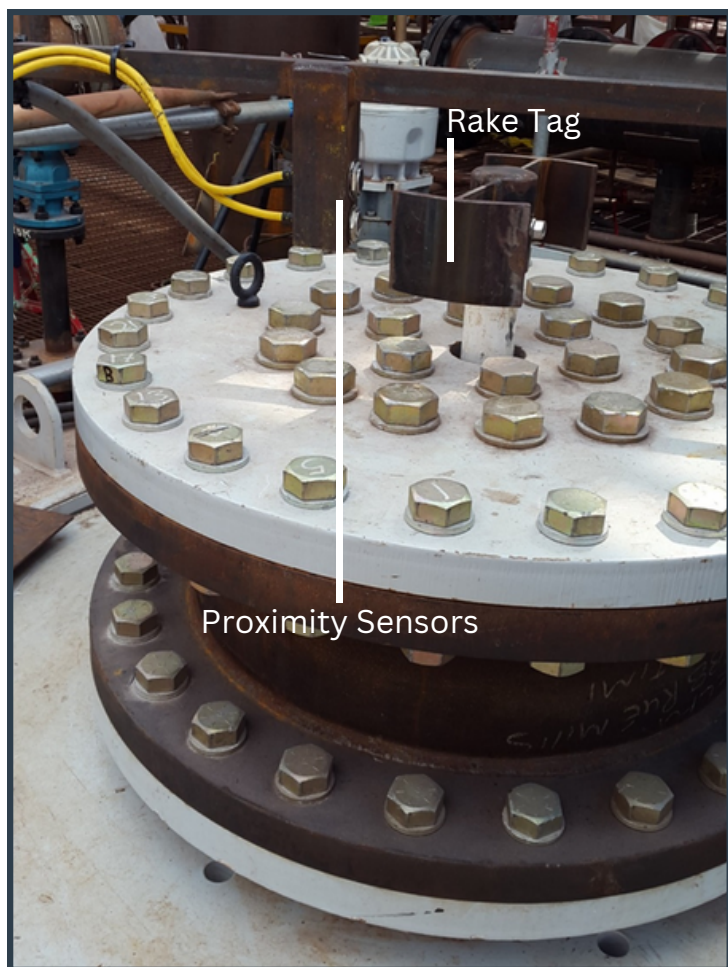


Thickener's Main Shaft

**Proximity Switch at the Drive Frame -
Connect to SmartDiver® Control Panel**

**Stud attached to Mainshaft at the
same orientation with Long Rake Arms
- Two Studs are 180° apart**

RAKE TAG & SWITCH INSTALLATION EXAMPLES



ELECTRICAL DRAWINGS

