

Design and Implementation of an SO₂ Detection and Alarm Monitoring System

Project Overview

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5

SO₂ Detectors
Installed

2

Kiln Areas
Monitored

0–10 ppm
Detection
Range

24/7

Monitoring

1 ppm

AL1 Local
Alarm

2 ppm

AL2 Evacuation
Alarm

4–20 mA

IS Loop Signal
Transmission

5/5

IS Loops
All PASS

£10k

CAPEX
Budget

1. Project Aim

- Design & Install five intrinsically safe 4-20mA SO₂ Detection loops circuits with verification certification.
- Integrate the detection system into the sites existing Foxboro I/A DCS. Implementing a two-tier alarm logic.
- Develop An HMI Graphic suite in Foxview and deliver operator training.
- Commission the Complete system and conduct a formal DSEAR detailed Inspections.

2. Introduction

Vale Clydach Nickel Refinery operates the Mond carbonyl process to refine nickel to 99.9% purity. During the activation-kiln stage, sulphur dioxide (SO₂) is introduced to enhance nickel surface reactivity, creating a hazardous working environment requiring continuous gas monitoring and alarm protection.

3. Problem Statement

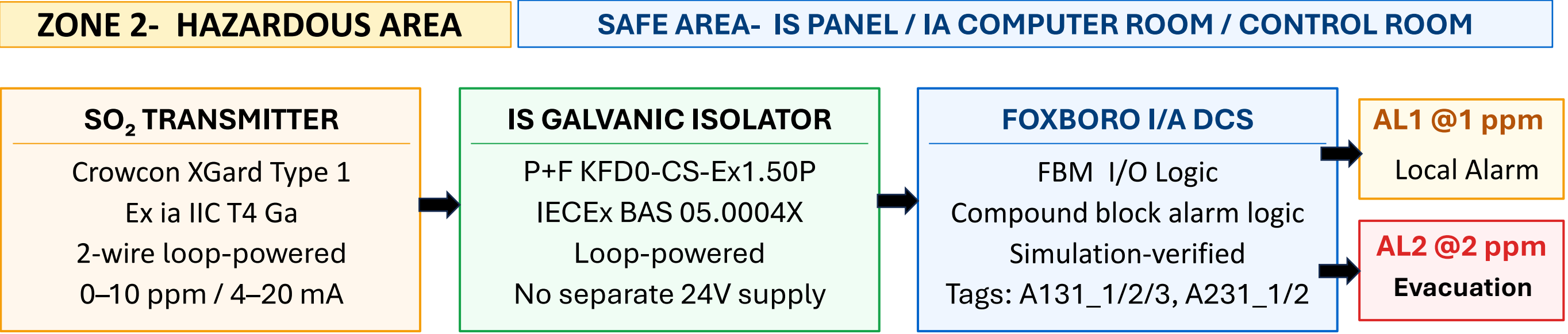
- No fixed SO₂ detection in activation-kiln area
- Gas releases undetected until personnel entered zone
- Detection by smell in several recorded cases
- No automated evacuation trigger
- No continuous monitoring data record
- COSHH Regulation 10 compliance gap

4. Field Installation



Figure.1: Crowcon Xgard Type 1 SO₂ detector installed within Kiln 1 activation area using low-level Unistrut mounting arrangement.

5. System Architecture



6. HMI Development and Integration

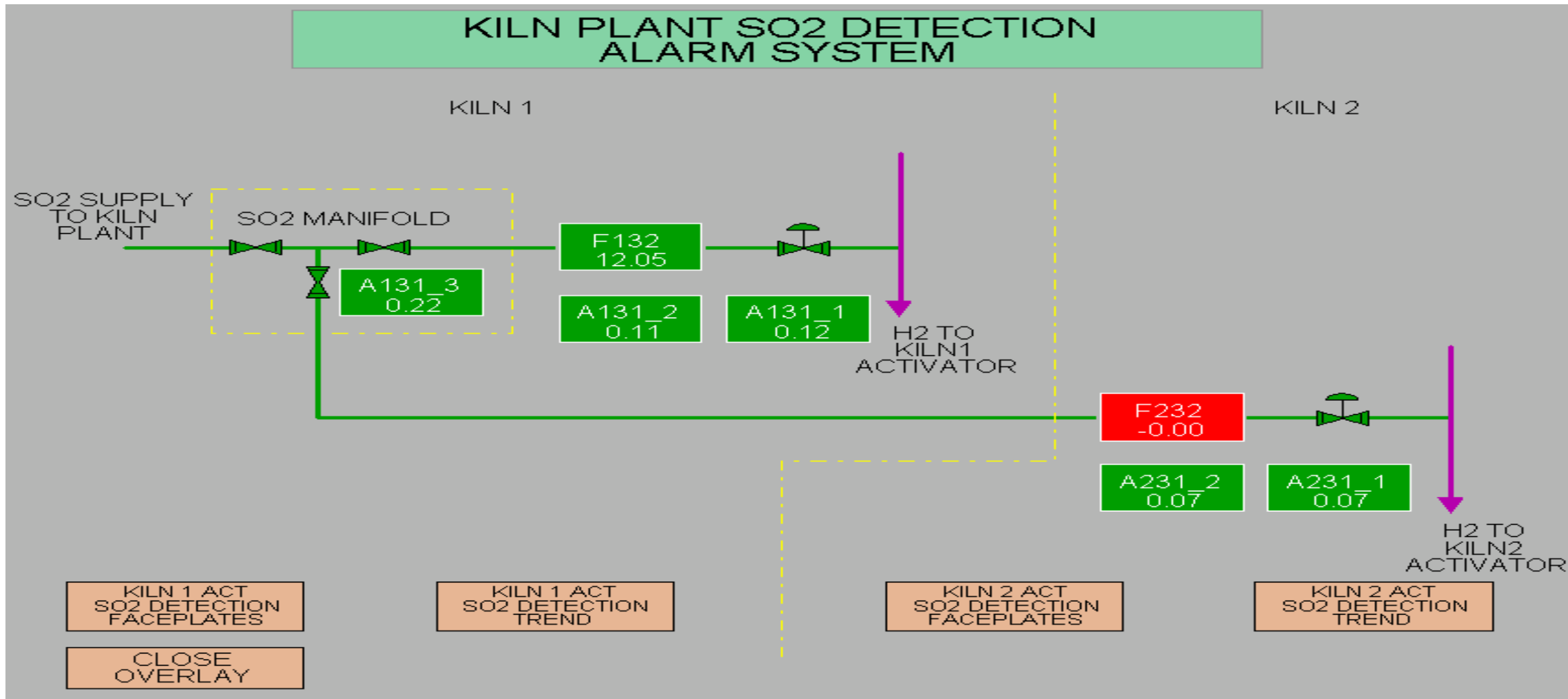


Figure.2: Fox View HMI developed for live SO₂ monitoring and alarm annunciation.

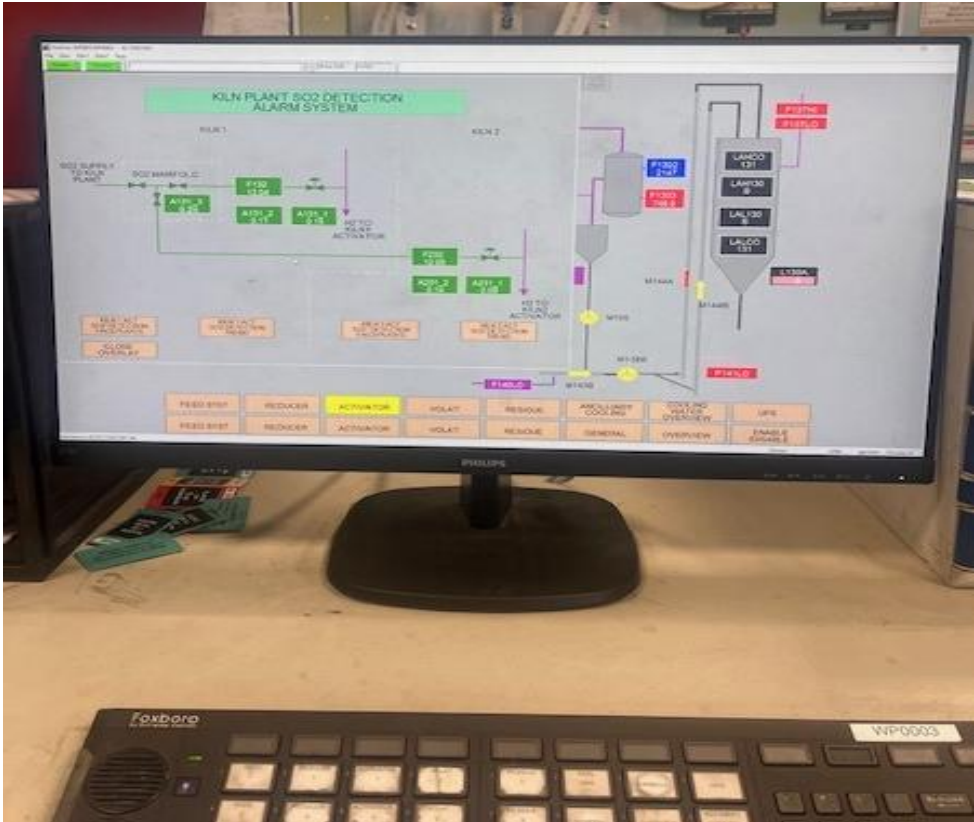


Figure.3: Foxboro I/A workstation displaying the live SO₂ detection and alarm monitoring HMI within the control room.



Figure.4: Individual Foxboro detector faceplate showing live ppm indication, alarm status, trend scaling, and operator navigation functionality.

7. Commissioning & Verification

- ✓ IS loop continuity and point-to-point
- ✓ DSD entity parameter verification calculations
- ✓ DSEAR detailed inspections completed in accordance with BS EN 60079-17
- ✓ 4–20 mA signal injection testing verified DCS scaling & Alarm operation
- ✓ Alarm logic confirmed
- ✓ Crowcon bump-gas commissioning completed
- ✓ System commissioned and handed over for live plant operation

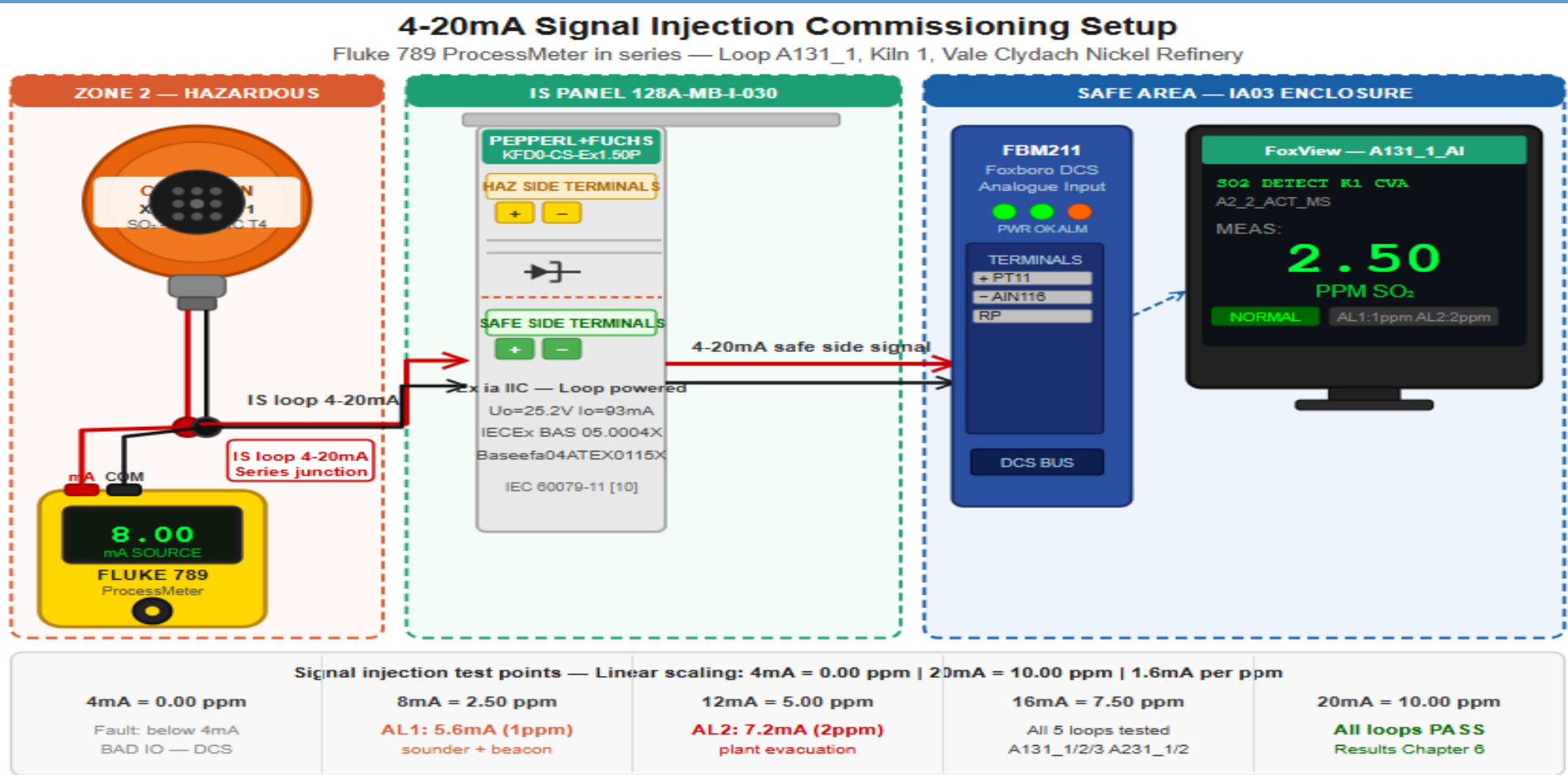


Figure.5: 4–20 mA signal injection commissioning test using calibrated Fluke process meter to verify DCS scaling and alarm operation.

SO ₂ (ppm)	Loop Current (mA)	Signal Status
0	4.00	Live zero: Normal operation
1	5.60	AL1 threshold: Local alarm
2	7.20	AL2 threshold: Evacuation
5	12.00	Mid-scale linear reference
10	20.00	Full scale: Max range
< 0 (fault)	< 4.00	FAULT: open circuit / Power loss

8. Conclusion

The project successfully delivered a fixed SO₂ detection and alarm monitoring system integrated into the existing Foxboro I/A DCS. The system provides continuous monitoring, alarm escalation, and evacuation functionality across both kiln activation areas, significantly improving personnel protection compared to the previous portable-monitoring-only approach.