CALEX
ELECTRONICS LIMITED

Multi-Channel Kiln Shell Hot Spot Detection Systems

Represented by :

RS485 Modbus RTU communications

PyroMiniBus infrared temperature sensor
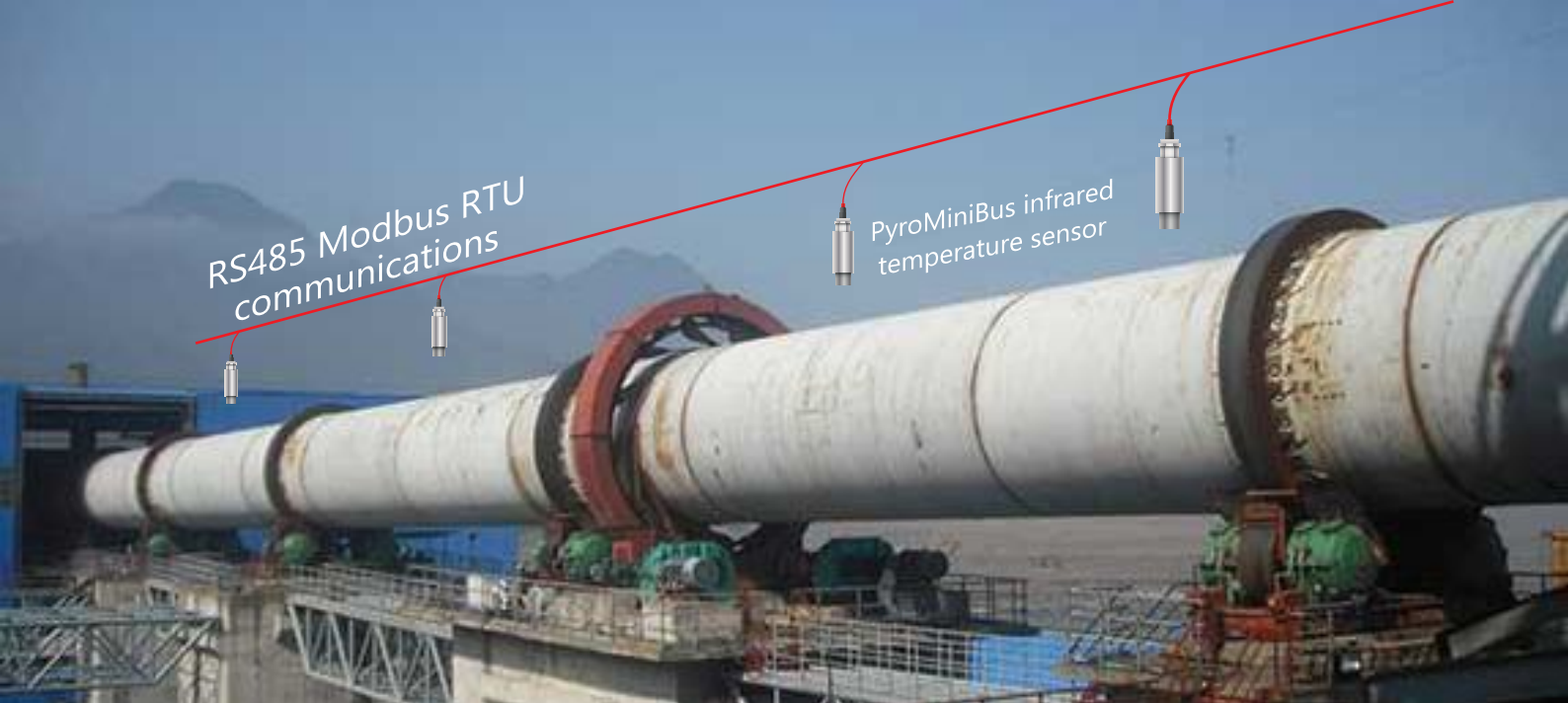
Overview:

Kilns, especially rotary kilns used in cement, lime, and mineral processing industries, operate at extremely high temperatures. Monitoring the temperature of the kiln shell is critical for maintaining operational efficiency and ensuring the kiln's longevity. Temperature fluctuations or hot spots can result in structural damage to the kiln, higher energy consumption, or unsafe working conditions. The Calex multi-channel IR sensor provides a reliable and effective solution for continuous, non-contact temperature monitoring of the kiln shell.

Challenges

1. **High-Temperature Environment:** Kiln shells reach temperatures as high as $400^{\circ}C$ - $500^{\circ}C$, making contact-based temperature measurement systems impractical.

2. **Rotating Kiln Structure:** The continuous rotation of the kiln adds complexity to the measurement process. It is essential to have a fast-responding system that can monitor temperature changes in real-time as the kiln rotates.

3. **Hot Spots:** Hot spots on the kiln shell can indicate issues such as refractory failure, leading to premature wear, reduced efficiency, and potential safety hazards.

4. **Dust and Smoke Interference:** In industrial environments, dust, smoke, and other particulates can obstruct the line of sight for temperature measurement systems.

5. **Energy Efficiency:** Uneven heating or over-heating leads to energy wastage, making precise temperature control essential for optimizing fuel consumption.

Solution Provided by Calex Multi-Channel IR Sensor

1. **Non-Contact Infrared (IR) Technology:** The Calex multi-channel IR sensor offers non-contact temperature measurement, capable of detecting infrared radiation emitted by the kiln shell without making physical contact. This makes it ideal for measuring the temperature of rotating kilns in harsh environments.

2. **Multi-Channel Capability:** The system is designed with multiple sensing channels, allowing it to monitor various points along the kiln shell simultaneously. This enables comprehensive temperature mapping across the entire kiln circumference and length, helping to detect hot spots and temperature gradients in real-time.

3. **Real-Time Monitoring and Alerts:** The Calex IR sensor system provides real-time temperature data, which can be integrated into the plant's process control systems. If the system detects any hot spots or abnormal temperature variations, it sends immediate alerts, allowing operators to take corrective action and avoid potential damage

4. **High Temperature Range:** The sensor can accurately measure temperatures up to 1000°C, making it suitable for extreme industrial environments. The sensor is also equipped with advanced optics to ensure precise measurement, even in challenging conditions.

5. **Dust and Smoke Compensation:** The Calex system is designed to withstand industrial conditions with dust and smoke. The sensor includes features such as air-purged windows or shields to keep the optical path clear, ensuring accurate readings over long periods without maintenance interruptions.

6. **Durability:** Built to operate in harsh environments, the Calex multi-channel IR sensor is rugged and reliable, with minimal need for maintenance. It can function effectively in high heat, dust, and vibration-prone areas.

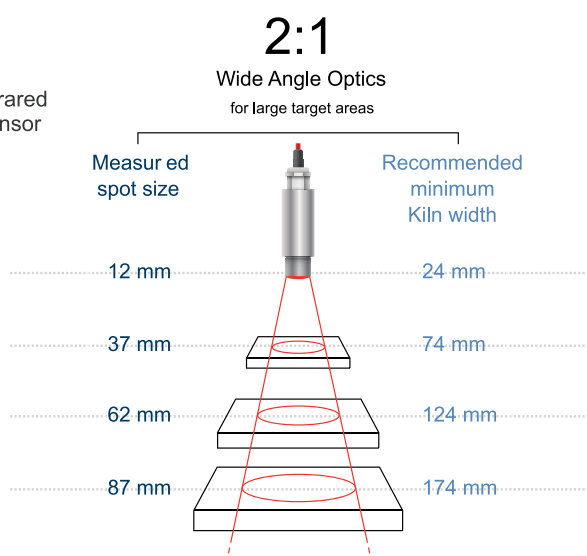## Benefits After Using Calex System

1. **Improved Kiln Efficiency:** By closely monitoring the kiln's shell temperature, operators can optimize the kiln's firing process. Precise temperature control ensures efficient fuel consumption, reducing energy costs by preventing overheating or inefficient operation.

2. **Early Detection of Hot Spots:** The system's ability to continuously monitor the shell temperature allows for early detection of hot spots or refractory issues. Addressing these problems early can prevent costly repairs and downtime, extending the life of the kiln.

3. **Enhanced Safety:** Continuous temperature monitoring enhances safety by ensuring that temperature fluctuations do not reach dangerous levels. Operators can intervene before any significant issues occur, minimizing the risk of accidents.

4. **Reduced Maintenance Costs:** By providing real-time data on kiln shell conditions, the Calex IR system enables predictive maintenance, reducing the likelihood of sudden failures and the need for emergency repairs. Regular monitoring can help schedule maintenance more effectively, reducing unplanned downtime.

5. **Reliable Performance in Harsh Conditions:** The Calex sensor's durability and ability to compensate for dust, smoke, and other environmental factors ensure consistent, reliable performance, even in the most demanding industrial settings.

6. **Easy Integration with Existing Systems:** The Calex multi-channel IR sensor can be easily integrated with existing plant control systems, providing operators with seamless access to critical temperature data and alarms.

Conclusion

The Calex multi-channel IR sensor system is an essential tool for kiln shell temperature measurement, providing a robust, non-contact solution that improves kiln efficiency, enhances safety, reduces maintenance costs, and prolongs kiln life. Its advanced multi-point monitoring capabilities and ability to withstand harsh environments make it the ideal choice for industrial kiln operations.

PyroMiniBus infrared temperature sensor

2:1
Wide Angle Optics
for large target areas

Measured spot size		Recommended minimum Kiln width
12 mm		24 mm
37 mm		74 mm
62 mm		124 mm
87 mm		174 mm

The PyroMiniBus System

The Calex PyroMiniBus system provides an ideal integrated monitoring, alarm and data logging package for Kiln under tyre hotspot detection.

Sensors
PyroMiniBus sensors have RS485 Modbus RTU communications, and can be connected directly to a Modbus Master, or optional local displays. The sensor body is made of 316 stainless steel to maximise shielding from electromagnetic interference.

Local displays
With optional PM180 6-channel touch screen terminals positioned close to the sensors, maintenance engineers can quickly and easily locate the high temperature reading.
The PM180 provides local temperature display, sensor configuration, data logging to MicroSD Card, and alarm outputs via a connected module. It may in turn be networked with PM180.
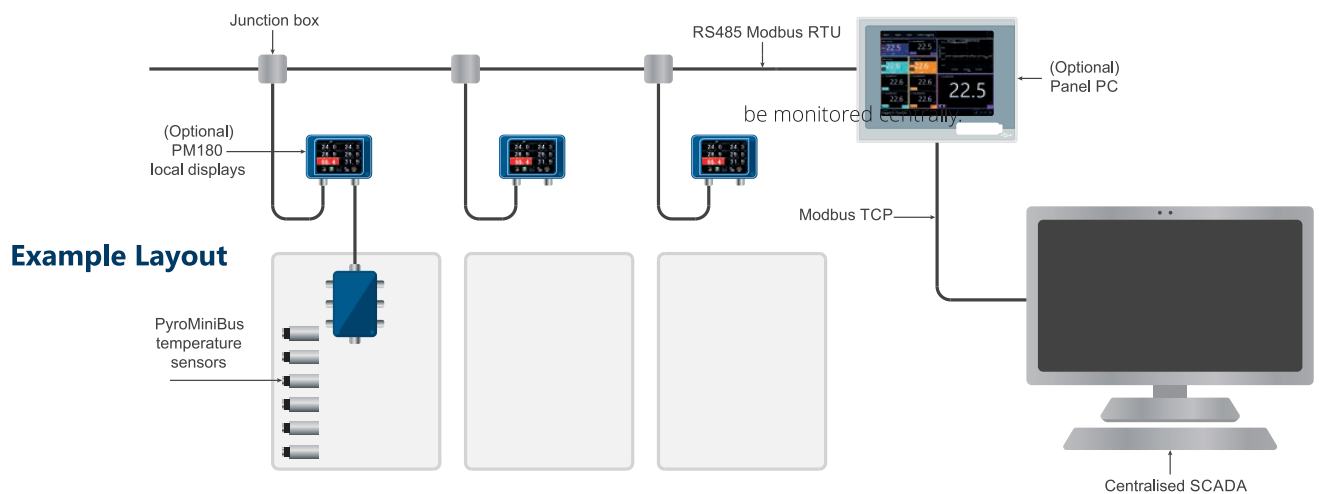
Local SCADA
Optional Panel PCs can display temperature data from multiple PM180 sub-networks, or from groups of sensors connected directly. One panel PC can monitor all the sensors in kiln shell, and the data may be accessed in real time via Ethernet using the software's Modbus TCP functionality.

Centralised SCADA
Sensors, PM180 units and Panel PCs can be connected to an external Supervisory Control and Data Acquisition (SCADA) system, or a Building Management System (BMS). The entire power distribution network can be monitored centrally.

Example Layout

Junction box

RS485 Modbus RTU

(Optional) Panel PC

(Optional) PM180 local displays

PyroMiniBus temperature sensors

Modbus TCP

Centralised SCADA

Measurement Angle

When measuring painted surfaces, the angle of the sensor relative to the surface does not usually affect the measurement accuracy. This is because non-reflective surfaces emit infrared radiation evenly at a wide range of angles. Please note: when measuring at a 90-degree angle, the measured spot is circular, and at lower angles it is elliptical.