



IR-Linescanner



The Total Solution For Kiln Shell
Temperature Monitoring

LSC-Series

Application

Since the first installation of an infrared line scanner in a cement plant in 1977, the kiln shell temperature monitoring has become an important tool to monitor the kiln temperature distribution and to optimise and control the production process. Even if the technology is primarily used for hot spot detection, the LSC infrared line scanners provide much more essential information to control the clinker production, to increase the refractory life-time, and to lower the energy consumption.

The Product

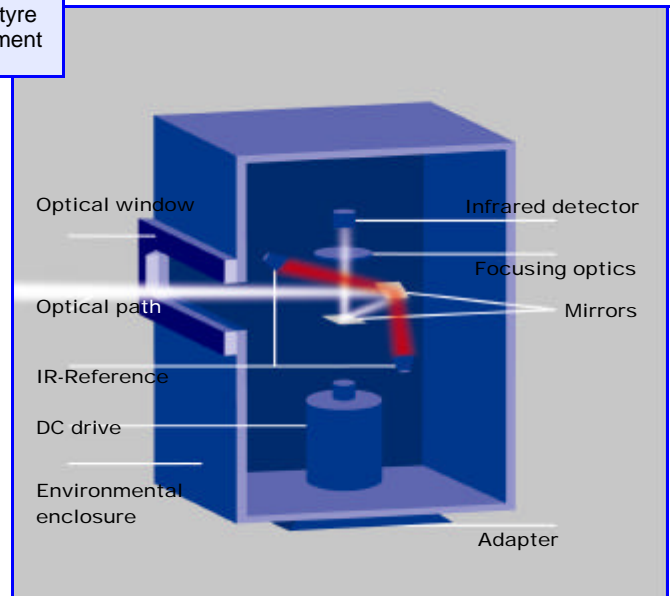
Whilst the technology is similar to a pyrometer, LSC scanners provide not only a single point measurement, but a real time temperature distribution over the kiln surface. For kiln shell temperature monitoring purposes, **GORATEC** offers complete series of infrared line scanners. The choice depends on the kiln parameters and on the scanner location. The large field of view of the line scanners (90° standard, and up to 120° as an option), and the very high geometrical resolution allows for up to 2048 temperature measurement points along each horizontal scan line. Based on a sophisticated rotating mirror concept, the opto-mechanical scan unit allows for continuous fast operation at 20 Hz (8 Hz). The dynamically balanced optical mirror is directly mounted on a heavy duty DC drive which ensures unrivalled reliability and line stability. Synchronised with the kiln rotation, the thermal image of the kiln shell temperature distribution is displayed in real time .

GORATEC offers a complete solution for any particular kiln and scanner location, consisting of:

- turn-key infrared line scanners LSC Series
- Fibre optics data transmission and digital interfaces (16 bit)
- Environmental protection
- LSC 4.0 kiln shell temperature monitoring software under Windows™
- Add-on sensors for tyre slip and axial movement

Scanner Head

The infrared radiation from the kiln scanned over a 90° field of view (up to 120° as option) is detected by a thermoelectrically cooled infrared detector and converted into digital temperature data. The wide dynamic range of the LSC series infrared line scanners guarantees the best measurement accuracy in the required 70°C to 600°C temperature range.



Scanner head

Fibre Optics Data Transmission and Digital Interfaces

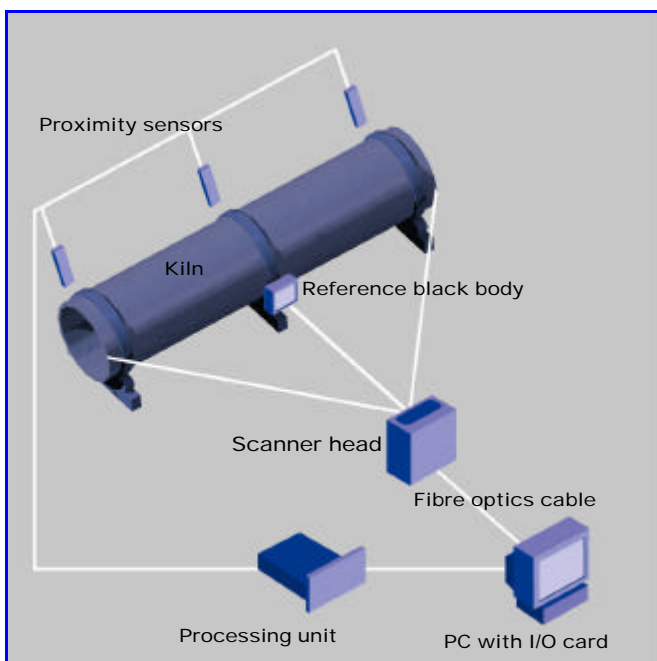
A 16-bit digital communication between the scanner head and the host PC is provided via fibre optic cables. This guarantees a reliable and undisturbed data transmission up to 2000 m. The fibre optics transmitter is integrated in the scanner head and the fibre optic receiver with digital interface is installed inside the PC.

Environmental Protection enclosures

LSC Series infrared line scanners are delivered with environmental enclosures which protect them against dust and ambient temperature variations. Duly protected, LSC infrared line scanners are designed for continuous operation in any position.

The major benefits are:

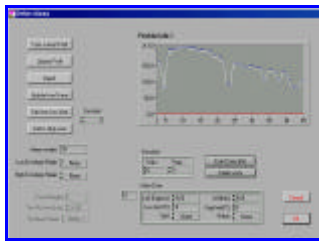
- surveillance of kiln shell temperature
- fast detection of hot spots
- evaluation of refractory status, coating buildups and trends
- evaluation of burning conditions
- simultaneous measurement of tyre slip and axial movement
- production cost reduction



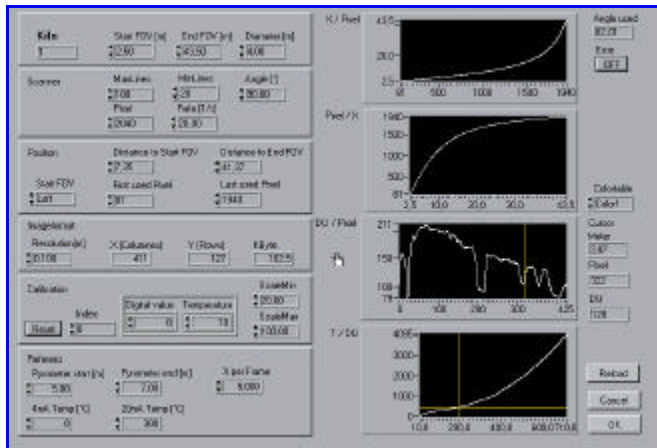
LSC system overview

LSC 2000 - DAM (Data Acquisition Module)

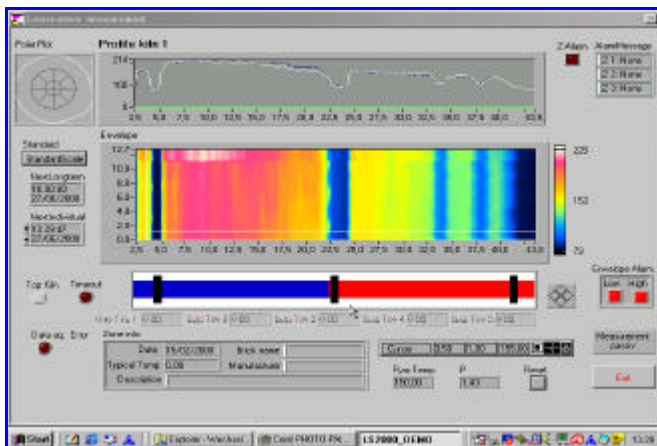
LSC 2000 - DAM software is a complete and powerful software package including all necessary modules as required by the cement industry. Its modules include: scanner head control, complete set of hardware tests, real time temperature data acquisition, kiln construction data display, refractory status description, kiln operation data acquisition, thermal image processing and archivation. The architecture of the software ensures maximum flexibility and functionality, as well as hardware and software compatibility and easy communication. All software functions are self-explanatory and will be activated by mouse or function keys in comfort menu. Selectable outputs and alarms can be used for control systems of the cement plant.



Alarm definition



Kiln parameter definition module



Measurement module

Software features for LSC 2000 - DAM

Surveillance mode

Thermal image acquisition

- image display synchronised with kiln rotation
- complete view of kiln (2D)
- selectable colour palettes
- selectable kiln area
- trend display

Kiln

- display of kiln construction, including position of gear and tyres
- display brick lining

Envelope curves

- display of envelope curves (instantaneous and accumulating)
- storage of actual envelope curve (automatic or manual)
- up to 20 alarm thresholds
- 10 selectable cursor lines
- storage of a reference envelope curve
- alarm recording

Temperature range

- selectable range

Kiln operation data

- kiln speed monitoring
- tyre slip monitoring
- axial movement



Main menu

PC Requirements

Operating system
Win NT 4.0,
Processor
Pentium II, 500 MHZ
64 MB RAM
2 ISA slots for the fibre optic and the digital interface
1 PC slot



Zone definition module

The major benefits of LSC 2000-software are:

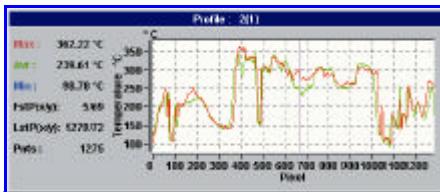
- analysis of operation parameters in real time
- fast detection of hot spots
- quality improvement by optimisation of process conditions
- longer production campaign due to continuous monitoring and refractory evaluation
- user friendly menu and functions
- realisation of kiln history
- centralised acquisition of measurement data
- interfaces to optional add-on measurement systems
- increased understanding of the clinker production process

LSC 2000 – DAM (Data Analysis Module)

LSC 2000 – DAM software is a complete and powerful software package including all necessary modules. A complete set of tools for off-line analysis of thermal images is available for the user. Designed for Windows 98/NT 4.0/2000 it is taking advantage of the worlds most popular Windows environment and ensures easy and fast manipulation of data by simply point and click with the cursor. Selected ICON and BUTTONS as well as usual pull-down menus guarantee an easy to use operation, for every level of operator. It allows data analysis from any place in the plant, within a standard network configuration.

- Geometrical scaling of the objects

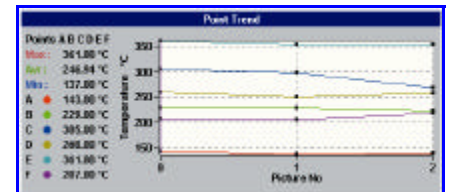
LSC2000 – DAM contains a lot of important analysis-, and data-conversation- tools, as well as export-filters, allowing the user to review the historical development of the kiln and to produce reports or spread sheets by a mouse click. Point – Temperature measurement on up to 16 individual cursor positions are possible and they can also be used for Point- Temperature-Trend display, when a sequence of images is selected. Temperature-Profiles can be produced by



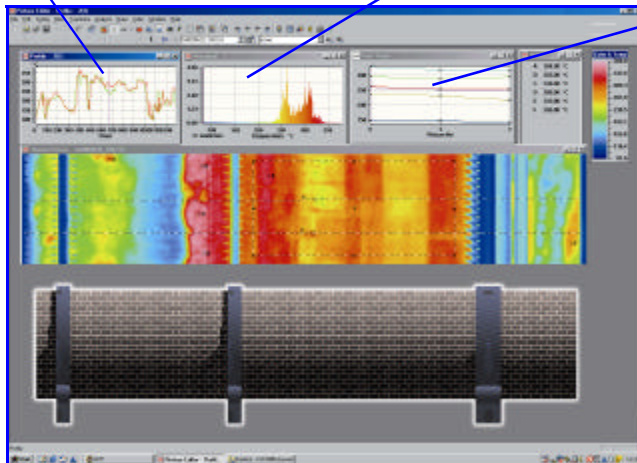
Profile Display (Two Profiles in 1 Window)



Histogram Display



Point - Temperature - Trend



LSC 2000 - DAN (Example of Analysis –Screen)

Key Features:

- Fully 32-bit
- Extended File Names
- Point – Temperature Measurement
- Point – Temperature Trend (up to 16 individual points)
- Temperature – Profile Trend (horizontal, vertical or free definable)
- Histogram Display (calculating MIN-, MAX- and average values for free definable areas)
- Background Temperature Compensation
- Correction of Emissivity of total image
- Partial emissivity correction
- Temperature addition
- Image Subtraction
- 3 different colour palettes
- Black & White / White & Black display of the images
- Isotherm Display
- Free definable ZOOM
- Relief – Display (3D – display)
- Text- and Draw function

using horizontal / vertical or free definable cursor lines. They can be used for Profile-Trend analysis as soon as a sequence of images is selected. The Histogram – Display is showing the temperature distribution within a pre-selected area of interest. This AOI can be defined using rectangular, circular or polygon (free definable) boxes. The MIN-, MAX-, and average value within the box will be displayed. They can be displayed as a trend or box-line-trend, when a sequence of images is selected. All individual "windows" can easily be converted into BMP or ASCII for further analysis or for documentation.

Summary

The **GORATEC's** LSC2000 program has been designed to meet the needs of the Cement industry, based on more than 10 years of infrared experience in this particular market segment. **GORATEC's** LSC2000 technology with its powerful Windows software, is providing a cost effective and easy to use solution for:

- Kiln Control and Kiln Condition Management
- Hot Spot Detection and observation
- Observation of Internal Rings and Coating
- Start up Control
- Alarm Monitoring
- Refractory management and optimisation

Your Benefits are:

- Utilizing longer production campaigns
- Improved refractory performance
- Increased refractory life
- Optimised Energy efficiency
- Preventive and Predictive Maintenance Management
- Data exchange to external systems

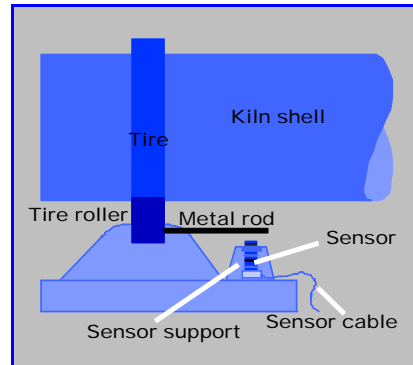
Technical Specifications:

Detector	
• Type, size	MCT, 75 x 75 μm
• Spectral response	3.4 - 4.2 μm
• Cooling	TE cooled
Scanning rate	8 or 20 Hz, switchable, (40 Hz optional)
Scanning sector (FOV)	90° or 120°, optional
Focusing	0.4m -8 , adjustable
Spatial resolution	
• Spot detection (50%)	1.0 mrad
• Temp. measurement (90%)	2.5 mrad
• Spectral filtering	3.4 - 4.17 μm standard
Temperature range	
• With Atmospheric Filter (ATM)	100-600° C
Thermal sensitivity NETD	
<i>NOF (Standard for LT, HT)</i>	
<i>ATM (BP 3.4 - 4.17 μm)</i>	
• 8 Hz	1.0° C @ 0° C
• 20 Hz	1.4° C @ 0° C
Accuracy	$\pm 2.5^\circ\text{C}$ @ 75-250° C $\pm 1\%$ @ 250-1200° C
Repeatability	
• Short term	$\pm 1^\circ\text{C}$
• Long term	$\pm 5^\circ\text{C}$
Stability of scanline level	± 1 mrad
Momentary scan position accuracy	
	± 0.6 mrad
System response time	20 μs at 8 Hz
Built-in temperature reference sources	
• Reference # 1	75° C $\pm 0.2^\circ\text{C}$
• Reference # 2	200° C $\pm 0.5^\circ\text{C}$
Operating ambient temperature range	
	-15 to +55° C
Operating ambient humidity	93% RH @ 40° C
Vibration (IEC 68-2-6)	
• Operating	5 - 150 Hz, 0.5 g, 3 directions
• Non-operating	5 - 150 Hz, 2 g, 3 directions
Shock (IEC 68-2-29)	
• Operating	5 g, 1000 bumps
• Non operating	25 g, 1000 bumps
Enclosure classification	
	IP65 acc. to IEC 529
Size	250 x 200 x 130 mm (W x H x D)
Weight	7 kg
Power Requirements	+5V, 1.5 Amp. (max), +15V, 1.2 Amp. (max), -15V, 1.2 Amp. (max)
Power consumption	20 W
Output Signals	DC coupled video signal incl. two temp. ref. levels Sync and clock pulses
Options	Visor (FOV 90°) for air purging the entrance window. Aiming Telescope for sector control. Air Cooler for extended ambient operation up to 80° C. Various spectral filters for optimized system performance.



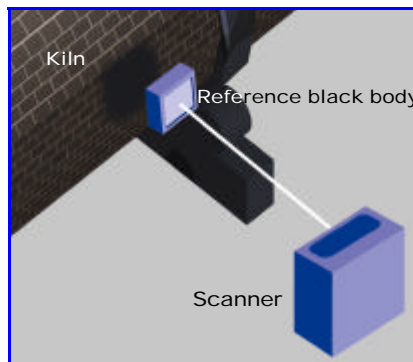
Optional features:

- ? Tyre slip monitoring
- ? Atmosphere correction



Proximity sensor for Tyre slip monitoring

The proximity sensors are used to detect the ring migration of each individual tyre. It is also used to detect the axial movement of the kiln. This is providing a permanent comparison of kiln, kiln-position and tyre. The operator is immediately informed when the slit is changing or any alarm conditions are met.



Reference black body

The Reference Black Body is used to perform an automatic or semi-automatic compensation of environmental conditions. The difference between "known BB-TEMP" and the "measured BB-TEMP" is used to calculate how much of the radiation is „absorbed“ by the atmosphere. By using this information, the „real“ kiln temperature is calculated and displayed.



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