SECURITON

Textile Mills

SecuriHeat ADW, SecuriHeat d-LIST

Case study | SecuriHeat ADW, SecuriHeat d-LIST | Textile Mills

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1 Introduction

The textile industry is one of the largest industries in the world with an estimated global market value at USD 1.11 trillion in 2024. It is projected to reach USD 1.61 trillion by 2033, growing at a CAGR of 4.2% from 2025 to 2033. Along with the growth of textile industry output, the textile machinery market is projected to grow from $49.70 bn in 2023 to $73.42 bn by 2030. More than 300 million people are employed along the global value chain.

Asia Pacific dominates the textile market, accounting for almost half of global revenues in 2024. Textile is a very significant industry for emerging economies and developing countries in these regions. While the whole industry is working towards becoming sustainable and safety-driven, the current manufacturing processes remain highly resource-intensive, contributing significantly to environmental challenges in terms of greenhouse gas emissions, water consumption and use of several hundred potentially hazardous chemicals in the various textile processing steps. Within this context, fast-paced and high-powered manufacturing, less rigid safety regimes and human interactive processes all present potential risks and hazards.

Typical textile mills involve manufacturing processes in a large open space, with fast-moving machinery, electric motors and high current electrical controls creating a unique hazardous environment filled with combustible dust and fibres. Additionally, storage and processing areas harbour large fuel loads and high hazard materials. Nearly all materials used in textile mills are flammable to some degree, and loose materials like fabric off-cuts or open layers of wadding can ignite a fire quickly. Deposits of fluff and dust as well as flying fibres on hot surfaces can also be a particular risk. Oily fibres, such as wool or cotton contaminated with oil from the spinning process, can result in deep-seated smouldering in bales which are almost impossible to put out from the outside.

The complex layout of textile production and storage warehousing facilities can impact the effectiveness of general fire detection. In buildings that rely on natural ventilation or use mechanical ceiling fans to disperse heat, smoke stratification can form during the initial stage of a fire development. This will prevent hot smoke reaching fire detectors installed at ceiling level. Alternatively, factories that use forced ventilation will see smoke rapidly dissipated. Therefore, to achieve the earliest possible alarm and response to a fire around business-critical machinery in the production area, it is advisable to consider a supplementary detection system offering risk-based object protection. Such a system is installed specifically to automatically detect fires originating from or around a milling machine. Working in tandem with general area fire protection, the object protection system will be designed to detect fires in and around the machinery before hot smoke or heat from these fires reaches general detection systems at ceiling height. It can therefore sound the alarm and power-down, also potentially actuate suppression systems, earlier.

When choosing the fire equipment for such a detection system, consideration is required regarding false alarms, expected working lifespan and service and maintenance intervals. All of these can be affected by environments surrounding these machineries that are hazardous, harsh and challenging. In addition, factories often operate on a 24 hour basis and unnecessary operation interruptions for servicing and maintenance are highly undesirable.

Securiton’s linear heat detectors, SecuriHeat ADW and SecuriHeat d-LIST, both offer a robust, reliable and quick acting fire detection system well suited to textile mills. While SecuriHeat d-LIST is designed as a fully addressable heat detection solution equivalent to spot-type heat detectors offering precise localisation, SecuriHeat ADW is better suited to smaller mills or self-contained production lines where it offers a low-cost reliable fire detection solution, covering up to 2 times 400 m (1,312 ft) sensing tube length per control unit.

The purpose of this Case Study is to provide fire safety and protection consultants, qualified fire system specifiers, design engineers or technicians, with recommendations for the application and use of SecuriHeat LTHD to protect textile production lines with large machines. The scope of this Case Study covers detailed recommendations, design considerations and practices for SecuriHeat line-type heat detectors (LTHD).

The Case Study also provides key requirements on Inspection, Testing and Maintenance (ITM) of SecuriHeat LTHD, and world-class technical and application support offered by Securiton through its headquarters teams in Europe and its vast global network of regional offices and distribution partners.

2 Aspects of fire safety and prevention

The reliable operation of large industrial machinery and equipment [1] in textile mills is critical to general fire safety and hazard risk management inside and around these manufacturing facilities. Complex production systems must also be in optimal operational condition 24/7 without interruption. These manufacturing processes have inherent hazards. Not just for building and life safety, but also from business continuity and asset protection perspectives, the consequences of a fire in a textile mill can be significant.

2.1 Textile mills

Textile is one of the world's oldest mechanised industries, but the machines have evolved as modern technologies become available throughout the production processes, from spinning, dyeing, ending and printing to weaving mills. However, it is common to find the latest technology operating alongside machinery a century old, especially in economies with lower labour costs.

Apart from the machines needed for the actual textile processes, other areas of production support and environmental management requirements also require various types of machineries and electrical and electronic systems, for example the handling of bulk raw materials and finished products.

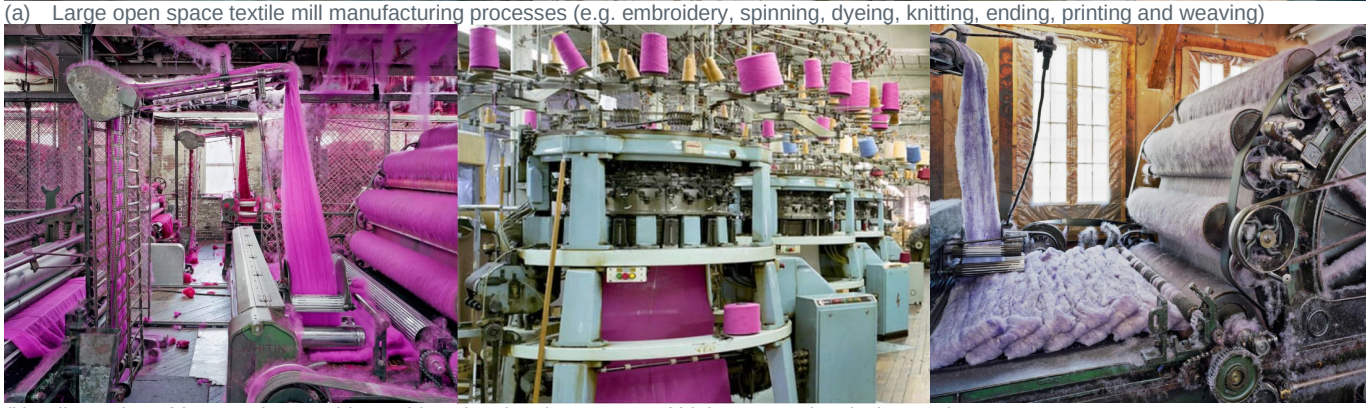
The use of chemicals is integral to the textile production operation. These chemicals are inherently dangerous, toxic and flammable from fire safety perspectives. Hence, chemical management and reduction systems, such as these used to implement Zero Discharge of Hazardous Chemicals (ZDHC) guidelines, help the optimal use of hazardous chemicals and controlling techniques reduces waste in textile manufacturing processes [2].

Many textile mills are now adopting sustainable production techniques to minimise environmental impact. These involve advanced technologies to reduce water and energy consumption, optimised production processes to minimise waste, and improve efficiency. Sustainable manufacturing practices that can incorporate an onsite renewable power station and sewage treatment plants, are all part of minimizing environmental impact in the long run for the global textile industry.

For the purpose of this Case Study, the examples in the following Figure 1 are used to illustrate typical textile mills.

(a) Large open space textile manufacturing processes: These house large machinery used in embroidery, spinning, dyeing, knitting, ending, printing and weaving, for high-volume, high-intensity manufacturing that involves processes starting with raw cotton, synthetic or re-cycled materials through to consumer garments and technical finished textile products.
(b) Examples of fast-moving machinery with electric motors and high current electrical controls: Mechanical systems are generally driven continuously 24/7 for uninterrupted processing involving high electrical current, fast moving mechanical parts with lubricants, solvents and other potentially flammable chemicals. The materials used throughout the production lines themselves are flammable as well.
(c) Storage and warehousing: There is extensive storage and warehousing required for cotton yarn, raw cotton sorting, production materials to final products. Proper storages are also mandatory to safekeep all flammables such as chemicals and lubricants. These warehouses and storage spaces can be highly hazardous and with challenging ambient environments such as dust, flying fibre and humidity.
(d) Hazardous environments: Textile manufacturing areas can fill with combustible dust and fibres resulting from operation processes. It is common to incorporate filtration system, such as these for the spinning mill, to collect dusts. All these potentially combustible dusts and flying fibres, whether on fully loaded dust filters or suspended in the atmosphere, and in close proximity of complex production lines with fast moving mechanical parts, electrical and electronic equipment, can be extremely hazardous if not manage properly.

(a) Large open space textile mill manufacturing processes (e.g. embroidery, spinning, dyeing, knitting, ending, printing and weaving)



(b) Illustration of fast-moving machinery driven by electric motors and high current electrical controls

(c) Storage (e.g. cotton yarn, raw cotton sorting, production materials and final products)

(d) Hazardous environments with combustible dust and fibres in dusty operation environment (left) and spinning mill dust filters (right)

Figure 1 Examples of textile mills

2.2 Fire risk, consequence and safety

Textile mills often consist of storage, production and processing areas with large fuel loads and high hazard materials. In the textile industry, all materials used are flammable to some degree. Unique characteristics of textile production processes create high fire risks in a challenging hazardous operational environment [3], such as:

- Loose materials like fabric off-cuts or open layers of wadding can be a source of quick-fire ignition.
- Deposits of fluff and dust as well as flying fibres on hot surfaces, such as dust on light fittings, can be a particular risk. Cotton flying is very hazardous when it is on fire, and difficult to put out because it is light and gets blown about by even light jets of water.
- Oily fibres, such as wool or cotton contaminated with oil from the spinning process in contact with mechanical hot surfaces.
- Rough, raw edges on rolls or bales. Deep-seated smouldering in bales is almost impossible to put out from the outside.
- High piles of stock and large fuel loads can increase the speed of a fire growth and spread.
- Older textiles mills may be constructed using timber materials. With the presence of airborne dust, a fire can spread rapidly to endanger the integrity of building structure.
- In a flammable dusty environment, flammable liquids can ignite easily, and oxidising agents may make an existing fire more intense by fuelling it with oxygen.

Manufacturing dust such as wool dust can cause a dust explosion [4] [5] if dust density exceeds explosive limits. Dust from cotton, acrylic and nylon fibres, presents even higher risk of explosion if dispersed into the atmosphere, e.g. when cleaning down, it can cause an explosion and/or fire when turning on any hot equipment. Therefore, government regulations keep evolving to address emerging fire risks in the industry. Many codes and standards (such as UK DSEAR [6]) mandate employers to control the risks to safety from fire, explosions and substances corrosive to metals, enforce essential good housekeeping and LEV[1] to control dust.

In the USA, after the Malden Mills accident where a major fire destroyed the company's textile plant in 1995 [7], OSHA[2] published a Hazard Information Bulletin in which the hazards of certain textile processes were described. The bulletin defined "*flocking as the operation in which finely cut fibers are applied, through an electric field, to various substrates for decorative and functional purposes*". Flocking units are considered critical when appropriate protection measures are not implemented. The hazard is due to the unlikely occurrence of dislodging and dispersion of the fine fibres in the atmosphere. An ignition source is intrinsic to the operations, such as arcs from a corona associated with the electrical grid, or arcs from the high voltage equipment used in the production process.

Other fire risks in textile mills can be identical to the characteristics of a general manufacturing environment. This consists of production and processing areas with large fuel loads and high-hazard materials. Factory building structures are large open spaces with electrical and mechanical equipment and a challenging ambient environment. The primary concerns of fire safety for industrial manufacturing sites include the potential rapid spread of fire and smoke from the time of ignition; and the danger of explosion when explosive limits are exceeded. Normally unoccupied or areas can lead to a much-delayed response to a potential fire incident.

The leading causes of industrial fires include flammable gasses and liquids, electrical malfunctions, combustible dusts, hot work, equipment and machine malfunctions. Textile mills rely on larger machines or complex equipment clusters for efficient, large-scale production. This machinery is a key asset requiring object protection, but in many cases, it is also a major potential origin point for a fire. Fire safety risks associated with using large industrial machinery include large moving elements of electrical and/or mechanical equipment, and various risks associated with the difficult environment in which they are located and to which they contribute.

Fires originating from or around major pieces of industrial equipment endanger the survival of the business, because they may cause the loss of key production assets and consequential interruption to business operation leading to failure to fulfil contracts and reputational damage.

In addition to an overall higher degree of fire protection, a reliable supplementary fire detection system designed for specific large machines, production lines or other valuable and risky equipment, ensures fire incidents can be managed to avoid or minimise operation interruption and damages. Widespread evacuation and power-shutdowns will also be avoided. Even as the fire situation progresses, fire services can be notified automatically and arrive at the scene much earlier before the fire spreads.

Minimising business interruption and damage to plant and buildings is likely to be the prime advantage of targeted, reliable supplementary fire detection for object protection, although ample time for worker evacuation is also important.

[1] LEV: Local Exhaust Ventilation
[2] OSHA: Occupational Safety and Health Administration, the USA, 1998

3 Challenges to reliable fire detection

The complex layout of textile mill production areas and their storage facilities can impact the effectiveness of general fire detection. Many textile mills have warehouse-like building structures with a typical ceiling height of 11.5-12 m (38-40 ft). Even for smaller scale production areas, the ceiling height is often 7-8 m (23-26 ft). For buildings that rely on natural ventilation or use mechanical ceiling fans to disperse heat, smoke stratification can form during the initial stage of a fire development. This will prevent hot smoke reaching fire detectors installed at ceiling level. Alternatively, factories that use forced ventilation will see smoke rapidly dissipated. Therefore, to achieve the earliest possible alarm and response to a fire around many business-critical piece of machineries in the production areas, it is advisable to consider a supplementary detection system offering risk-based object protection.

Such a system is installed specifically to automatically detect fires originating from, or within the proximity of, large textile machinery. Working in tandem with general area fire protection, the object protection system will be designed to detect fires in and around the machinery before hot smoke or heat from these fires reaches general detection systems which are typically located at ceiling height. It can therefore sound the alarm and power-down, also potentially actuate suppression systems, earlier.

When choosing the fire equipment for such a detection system, consideration is required regarding false alarms, expected working lifespan of the detection system, and service and maintenance intervals. All of these can be affected by environments where these machineries are installed. These environments can be hazardous, harsh and challenging. Sometimes equipment is installed in natural ventilated areas subject to ambient conditions, and will face seasonal temperature fluctuations, direct sunlight or reflection, and weather elements such as sea salt corrosion. In addition, because textile machinery is important for continuous 24/7 business operation, unnecessary operation interruptions are highly undesirable and must be avoided.

The frequency of the maintenance regime and need to access a fire detection system are also important considerations. Non-intrusive access and low maintenance requirements of a fire detection system can keep TCO[3] low.

SecuriHeat d-LIST line-type heat detector (LTHD) is an ideal solution to address the key challenges of ensuring a reliable and prompt fire detection for textile mills. It is an electronic sensor cable system that has been specially designed for EN 54-22 [8] and can be used as an integrating or non-integrating line-type heat detector. This sets the system significantly apart from conventional point-type heat detectors while still offering precise localisation of a fire incident. Other key advantages include its relatively high sensitivity; low maintenance; fully weather resistant; discreet and easy to install. Alternatively, SecuriHeat ADW LTHD can be adopted as a cost-effective option for smaller scale mills or machinery, where a shorter run of sensing tubes is sufficient when only single or dual fire zone coverage is required.

[3] Total Cost of Ownership

Challenge	Securiton advantages
Large Open Space	SecuriHeat d-LIST and ADW meet design requirements of flexible placement of sensing cables/tubes for ceiling level detection and localised heat detection where hazards or hot smoke propagation are identified in the event of a fire.
Diluted hot smoke and heat dispersion due to forced, changing or natural ventilation	Use of SecuriHeat LTHD for heat detection, integrated with sprinkler actuation. The detection systems have the sensitivity and flexibility to react to relatively small fires even in an open area. Sensing cable/tube spacing may be reduced yet still maintain optimal cost advantage.
Wide ambient temperature range	SecuriHeat LTHD products can operate in wide range of ambient conditions. The SecuriHeat d-LIST sensing cable operating temperature range is -40°C to +85°C (-40°F to +185°F), while the SecuriHeat ADW sensing tube operating temperature range is -40 to +300°C (-40 to +572°F).
Complex design considerations (include difficult or hazardous ambient conditions)	SecuriHeat d-LIST offers two levels of alert and alarm per detection zone, facilitate both earlier incident alert to tackle potential fires to minimise damage and disruption, and fire alarm to be integrated with pre-action sprinklers for timely fire suppression and fire services notification. Small cable diameter and small minimum bending radius with flexible junction box connection for easy install, troubleshooting and services. SecuriHeat ADW offers two levels alert and alarm per detection zone, facilitate earlier incident alert to minimise damage and disruption, and fire alarm to be integrated with pre-action sprinklers for timely fire suppression. Unique features such as option of 1 or 2 inbuilt detector models, non-magnetic and non-rusting sensing tubes with almost infinite product life works in toughest environments. SecuriHeat ADW is available as HD (Heavy Duty) product variant with suitable accessories for inside hazard classified area installation.
Risk-based detection	SecuriHeat d-LIST works with high precision temperature sensors embedded in tough cable for pinpoint monitoring where specific addressable detection and alarm are needed. SecuriHeat ADW sensing tubes can be positioned in virtually all environments. They can be bent to shape to cater for open space and object localised detection, including concealed spaces.
Obstructed or difficult access	SecuriHeat LTHD main detector units can be installed outside the protected spaces, or away from the operation or public traffic areas.
False alarms	SecuriHeat d-LIST can uses highly sensitive rate-of-rise detection combined with different alarm thresholds for maximum reliability (algorithm specific and maximum alarm parameter sets). SecuriHeat ADW adopt unique highly sensitive rate-of-rise detection combined with fixed threshold alarm for maximum reliability. The Dynamic Heat Watch feature allows the system to discern between ambient heat rises and a real fire system through verifying rate-of-rise anomaly after initial detection.
Low TCO and easy access for maintenance	Routine service and testing are done from the main detector unit. Easy to clean with pressure washers and common chemicals. The whole detection system and sensing cables/tubes require no or minimal routine maintenance.

Table 1 Challenges to and solutions for textile mills protection with reliable fire detection

4 Optimised design & Use Cases

SecuriHeat LTHD products can be used as a supplementary detection method where heat detection is suitable for object protection of textile machines. The cost-effective SecuriHeat ADW is an integrated line type heat detector with a response behaviour based on heat differential and/or maximum heat. It is suitable for smaller or self-contained textile production equipment that requires single or dual fire zone coverage. The product self-check feature and the periodic, automatic test are other advantages for use in applications where the legally prescribed functional and maintenance checks are performed outside the protected zone due to machinery hazardous operations in busy manufacturing or production areas. On the other hand, SecuriHeat d-LIST cable sensor system can be used in all types of textile machine processes, large and small, to cater for designs where addressable heat detection and alarm control are required.

This chapter outlines design recommendations and methods using SecuriHeat LTHD products to protect industrial equipment in textile mills as follows:

1 Design codes of practice.
2 Design criteria for risk-based local detection with SecuriHeat LTHD products.
3 Application scenarios for production line object protection.
4 Features and benefits.
5 Integrated verify, control and respond.
6 Minimal system access for ITM.
7 Support with peace in mind.

4.1 Codes of practice

According to general regulations, built environments such as textile mills must comply with life and building safety provisions (e.g., NFPA 1 [9], NFPA 101 [10] and NFPA 5000 [11]) as prescribed per international and local codes in accordance with relevant building occupancy classification (e.g. industrial) or property uses (manufacturing or storage). Although prescriptive building and life safety codes stipulate the need for fire detection in addition to other fire safety measures in industrial occupancies with various uses, these requirements may allow for enhancements or refinements based on a proper risk management assessment and operational characteristics of the building use at the time of the assessment.

The risk assessment and design considerations require fire engineering professionals to work within the prescriptive constraints of the applicable building codes while applying the best engineering practices to address industry and building occupancy specific needs[4]. In particular the risks, the requirements for uninterrupted business operation and the critical need for early detection of a fire inside these facilities shall be adequately addressed. In this regard, Performance-based Design (PBD) (e.g. [12]) with a risk-based approach (e.g., NFPA 551 [13], ISO 16732-1 [14]) to the optimisation of fire detection and protection, and human interaction to supplement prescriptive baseline design, is key to meeting requirements of both prescribed and practical building and life safety.

Textile mills are often classified as ‘Manufacturing Occupancies’ with Associated Fire Hazard Categories of HC2 or HC3 depending on the actual site operation parameters. In addition, considering general codes and standards such as these mentioned above, FM Global provides comprehensive Property Loss Prevention Data Sheets to address unique built environment and asset risk management. The following are examples that may be used as guidance as to the best fire detection design practice to protect textile mills and their business continuity:

- Business Asset Integrity DS 9-0 [15] and Fire Protection for Non-storage Occupancies DS 7-57 [16].
- Fire Protection for Textile Mills DS 7-1 [17] (covers the fire hazards and necessary protection recommendations for various textile processes that use both natural and synthetic fibres).
- Associated support infrastructure and general ambient condition management from DS 7-73 for Dust Collectors and Collection Systems to DS 7-76 for Prevention and Mitigation of Combustible Dust Explosions and Fires.
- Related storages such as DS 8-7 for Baled Fiber Storage and DS 8-23 for Rolled Nonwoven Fabric Storage.
- Handling and management of flammable materials such as DS 7-29 for Ignitable Liquid Storage in Portable Containers, DS 7-32 for Ignitable Liquid Operations and DS 7-98 for Hydraulic Fluids.

Although there might be marginal differences from one country to another in Deem-to-Satisfy (DtS) prescriptive building and fire code requirements on fire detection, a combination of DtS prescriptive and risk-based design approach is the best engineering practice to meet prescriptive requirements as well as to satisfy facility operators’ need for business continuity and property protection.

[4] Each country or state/province may have its own (or adopted) building and fire code or directives. Examples are the Muster-Verwaltungsvorschrift Technische Baubestimmungen (MVV TB) in Germany, The Regulatory Reform (Fire Safety) Order 2005 in the UK and National Building Code of India 2016.

To select a suitable fire detection system, relevant design and alarm codes must be applied. Examples of these include NFPA 72 [18], BS 5839-1 [19], VdS 2095 [20], and others like AS 1670.1 in Australia [21], NEN 2535 in Netherland [22], R7 in France [23] and DBI 232 in Denmark [24]. Considering requirements from all relevant codes and standards, industry code of practices and government regulations for safety, an approach combining risk and PBD is a fitting fire engineering methodology to devise a suitable fire detection solution to safeguard textile mills. As an example, for the design and installation of LTHD, NFPA 72 [18] stipulates that LTHD cables or tubing installed must be no more than 50.8 cm (20 in) from the ceiling. However, such standard requirement is limited because it applies to only flat ceilings and is not affected by the total ceiling height. Other research and performance testing may be referred to for better linear heat cable placements (e.g., [25]).

An adequate fire detection system that automatically alarms local fire services can make a huge difference in minimising the damage that a potential fire can cause. The ability to detect and alert early also allows local building management or facility operators to control the initial outbreak or to remove potential hazards that would help the fire grow. Early detection of a fire helps to avoid business interruption and facilitates orderly and safe evacuation as the fire evolves. When a suitable fire detection system can be designed and installed at a low TCO[5], the system can achieve building and life safety objectives as well as protection of business assets.

Table 2 illustrates how SecuriHeat LTHD Fire Detection system performance, as well as other design parameters such as environmental conditions and typical applications, are defined. Note that SecuriHeat LTHD products meet all response classes and all environment groups per EN 54-22 [8]; and supported key temperature classes and range of spacing options per NFPA 72 [18].

Design Parameters	BS/EN 54-22 [8][6]		NFPA 72 [18]	
Class vs. Detection Range	**Response Class**	**Detection Range °C (°F)**	**Temperature Class**	**Response Temperature °C (°F)**
	A1	54 - 65 (129 - 149)	Ordinary	58 - 79 (136 - 174)
	A2	54 - 70 (129 - 158)	Intermediate	80 - 121 (176 - 250)
	B	69 - 85 (156 - 185)	High	122 - 162 (252 - 324)
	C	84 - 100 (183 - 212)		
	D	99 - 115 (210 - 239)		
	E	114 - 130 (237 - 266)		
	F	129 - 145 (264 - 293)		
	G	144 - 160 (291 - 320)		
Environment Group	**Environment Group**	**Temperature Range °C (°F)**	n/a	
	(E)1	-5 to +40 (+23 to +104)		
	(E)2	-10 to +55 (+14 to +131)		
	(E)3	-25 to +70 (-13 to +158)		
Typical Applications and Boundary Conditions	E1: Indoor; Stable and Clean Conditions; Commercial and industrial E2: Indoor; Varying and polluted environment; Commercial and industrial E3: Outdoor; Harsh conditions			

Table 2 Design and performance parameters for LTHD per codes and standards

[5] TCO: Total Cost of Ownership (of an Early Warning Fire Detection system)
[6] ISO 7240-20 [6] and AS 7240-20 [6] are derived from BS/EN 54-20.

4.2 Design criteria

Both SecuriHeat ADW and d-LIST can be used for protecting textile production line machinery.

A summary of SecuriHeat d-LIST key performance parameters is shown in Table 3 below.

Model	Key performance parameters
SecuriHeat SCU 835 (d-LIST) classes and sensors cable	
Classes	Integrating: A1I, A2I, BI, CI Non-integrating: A1N, A2N, BN, CN
Cable length	SEC-15 cable 2 x 350 m (1'148 ft) per controller
Addressable sensors # (Zone)	2 x 100 sensors (in 1-32 zones) Sensors embedded in the cable at intervals of: 1, 2, 3, 4, 5 or 10 m (3.3, 6.6, 9.9, 13.0, 16.5 and 33.0 ft.)
Rating and operational data	
Rating	SCU 835 Sensor Control Unit (evaluation unit): IP65 SEC-15 cable: weather-proof fully sealed system
Operating temperature	SCU 835 Sensor Control Unit: -25°C to +70°C (-13°F to +158°F) SEC-15 cable: -40°C to +85°C (-40°F to +185°F)
Measuring temperature range	SEC-15 cable: -40°C to +120°C (-40°F to +248°F) Temperature resolution of 0.1°C (0.18°F)
Sensing Cable Attributes	Cable diameter: 15 mm (0.59 in); min. bending radius: 250 mm (9.8 in)
Detection and actuation	Maximum temperature and temperature changes (differential or integration algorithm)
# of Relays	4 Built-in; Expanded to 16 with REL 835 Module
Product type approval standards and compliance level	
EN 54-22:2015+A12020	Integrating and non-integrating LTHD; response classes above
UL 521; NFPA compliant	Response Classes: LOW, ORDINARY, INTERMEDIATE

Table 3 SecuriHeat d-LIST SCU 835 controller and SEC-15 cable

A summary of SecuriHeat ADW products key performance parameters is shown Table 4 below.

Model	Key performance parameters
SecuriHeat ADW classes and tube	
Classes	see Table 2
Sensing tube length	EN 54-22: 2 x 10 - 140 m (33 - 459 ft) copper tubes NFPA 72: 2 x 10 - 200 m (33 - 656 ft) copper tubes
Tube type	Copper (TU 5/4 Cu)
Rating and operational data	
IP device approvals	IP65
Operating temperature (main control unit)	-30 to +70°C (-22 to +158°F)
Operating temperature (sensing tubes)	Copper: -40 to +300°C (-40 to +572°F)
# of Relays: Built-in (Expanded – Module)	2 (10 – 2 x RIM36)
Product Type Approval Standards and compliance level	
EN 54-22	Classes A1I to GI
UL 521 – ULC-S530-M91	per EN 54-22 Classes A1I to GI
FM 3210 / NFPA 72	Classes Ordinary, Intermediate, High

Table 4 SecuriHeat ADW product key performance parameters

4.3 Application scenarios

Although fire detection for textile equipment protection takes a risk-informed PBD approach, other building areas that host production line machines are mandated to satisfy the requirements of local fire safety codes, relevant codes and standards which can all be useful references as the basis of design. A summary of Securiton design literature for factories and related areas is included in chapter 4.3.3 below.

Assuming wider area protection is in place, SecuriHeat d-LIST or ADW is used for localised object detection with PBD approach to enhance detection performance and address specific risks from risk-based safety assessment to detect fire at its incipient stage, avoid property loss due to fire damages and ensure business continuity. In general, simply follow relevant codes and standards for the design of heat detection system to meet prescriptive requirements. The sensing cables or tubing can be flexibly installed for open space ceiling level protection or localised area protection in likely area of heat build-ups caused by incipient fires.

Textile machines vary in size and may form a self-contained production line. Detection alarms may therefore be required to be addressable within a specific fire zone or risk locations for faster response or targeted power downs. Additional considerations are given to address different fire risk scenarios and ambient conditions to ensure suitable product type-approved equipment and accessories are deployed.

4.3.1 Risk-based local detection: SecuriHeat d-LIST

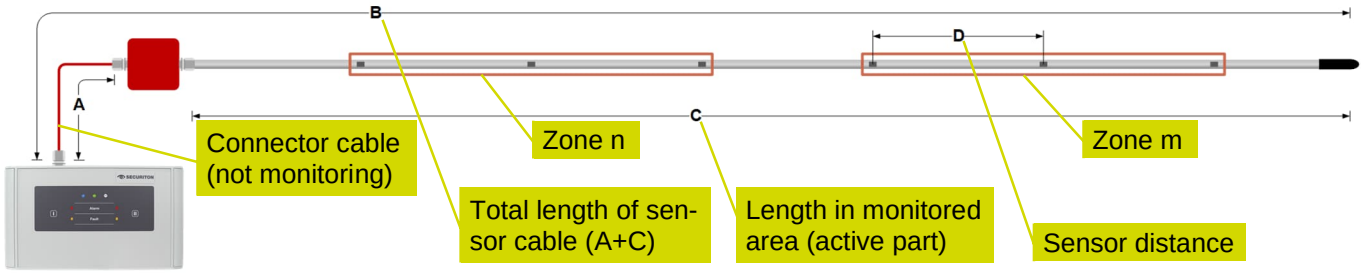
Textile mill production lines involve sequential processes for creating textiles through fibre processing, spinning yarn, weaving or knitting fabric, and fabric finishing. Each process can include a variety of equipment from cutting, sewing, dyeing, to inspection and final packaging machines. The objective of SecuriHeat d-LIST design is to effectively provide localised object detection around the production line machinery, or inside in the case of self-contained production machines, considering potentially obstructed objects, such as machine safety guiderails, as well as to match FFFS[7] zoning for the purpose of sprinkler water release control where applicable.

Key advantages of d-LIST include very long sensing cable for large area coverage, and large number of standard sensors built in at flexible interval selections as well as branched out with individual sensors for addressable fire detection for fire zone alarm and risk-based detection of fire for added alarms at specific risk locations. Even when protecting large production line machineries, the main SecuriHeat d-LIST control units themself can be located outside of the hazardous or busy manufacturing operation areas, for easy access with no business operational interruption.

Figure 2 below illustrates:

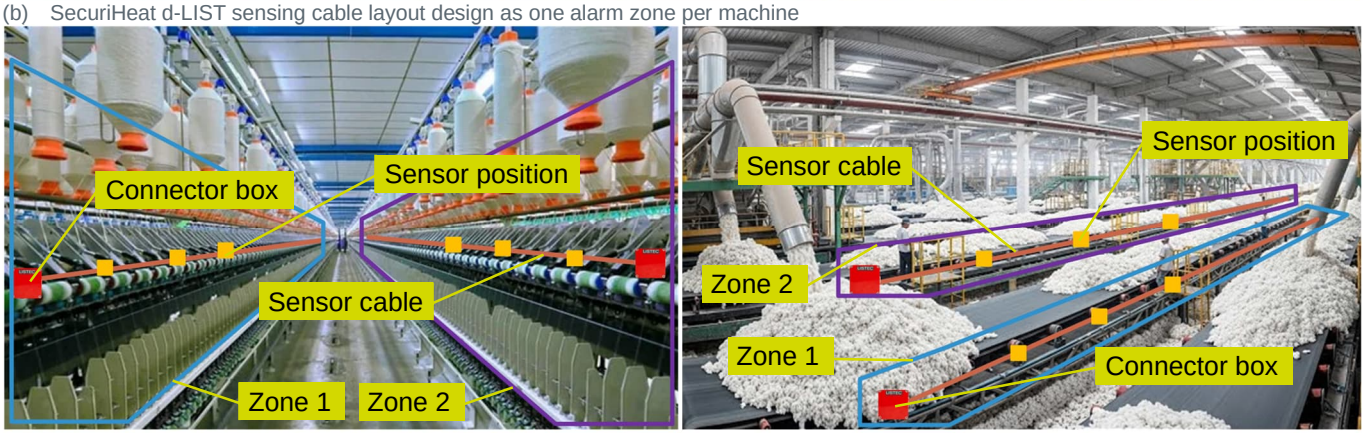
(a) SecuriHeat d-LIST flexible system design with stable, precise zoning function. This does not require extra cable, hence maximising efficiency.
(b) SecuriHeat d-LIST sensing cable layout design with one alarm zone per individual textile machine.
(c) Risk-based design for typical long distance production line machinery such as spinning mill (left) and raw cotton processing (right). Cable runs close to (but not touching) known fire hazards such as motors and belt conveyor rollers, which are known friction points. If suitable SEC-15 cable option is chosen as to allow individual sensors to match these hazard points, SecuriHeat d-LIST is sensitive enough to alert to a problem even before fire starts, as both friction points and faulty electrics can generate heat before ignition.

[7] FFFS: Fixed Fire Fighting Systems



(a) Typical SecuriHeat d-LIST sensor cable arrangement

(b) SecuriHeat d-LIST sensing cable layout design as one alarm zone per machine



(c) Risk-based design for typical long production line machine such as spinning mill (left) and raw cotton processing (right)

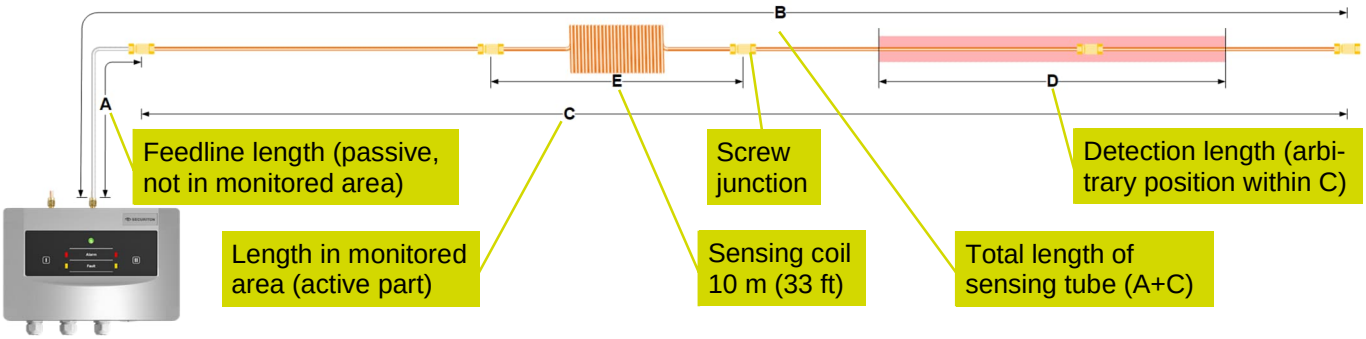
Figure 2 SecuriHeat d-LIST placement in production line machinery (risk-based local detection)

Additionally, it should be noted that:

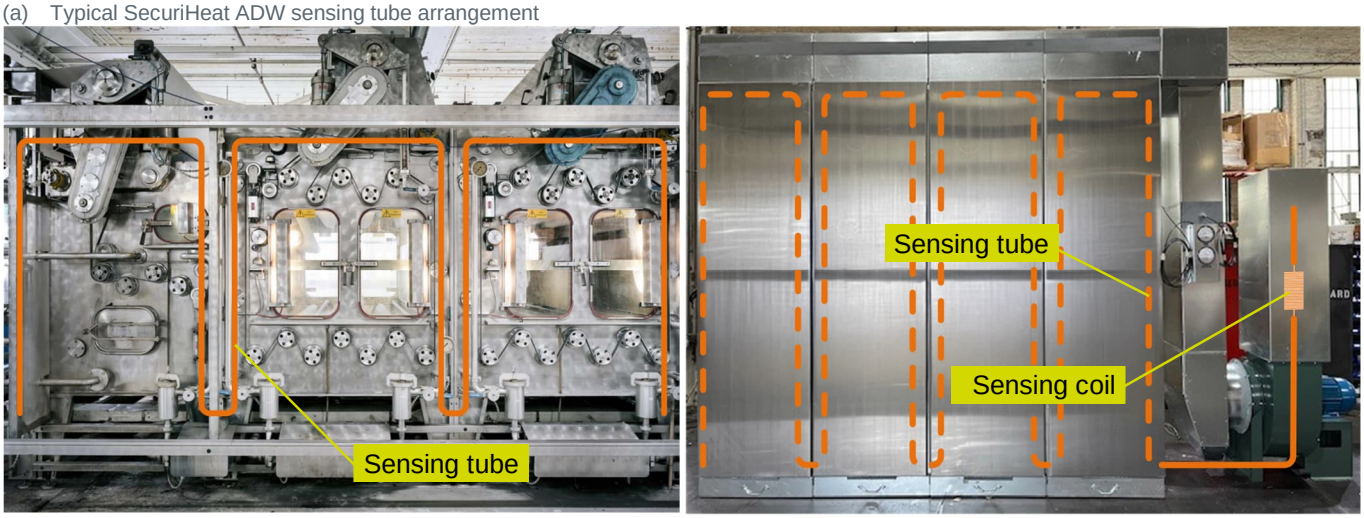
- Sensing cables run generally straight but are flexible enough to be bended to go around obstacle and other fittings like safety guiderails, or other mechanical and electronic equipment as necessary.
- In a risk-based design (Figure 2 (b) and (c)) additional external sensors can be added to areas with a high risk of overheating. Such unique object fire hazards include motors, electrical distribution, conveyors and areas of high-speed mechanical moving parts.
- When running sensing cables through or close to each protected machine, sensors can be allocated at locations with the most fire risks and grouped into desirable alarm zones.
- When use SecuriHeat d-LIST as part of fire detection for code compliance, the area of coverage includes the entire zone is aligned with relevant fire code requirements, such as compartmentation, fire alarm notification or need for FFFS system integration.
- SecuriHeat d-LIST allows installers to add branches and connect controllers easily with connector boxes (CBO 15).
- Alarm zones can be designed per machine area or at certain interval in the case of long production lines. The detection and alarm thresholds can be configured for a maximum of 32 different zones. Every ten seconds, the system measures the temperature on the sensors and compares this with the programmed threshold values.
- Choice of Max Alarm, Difference respectively; Integration Alarm to enable Pre-signals in order to investigate and manage fire incidents earlier.

4.3.2 Risk-based local detection: SecuriHeat ADW

SecuriHeat d-LIST is usually the best option for protecting production line equipment due to its scalability without loss of sensitivity and the capacity to protecting a large area a considerable distance from the main control unit with addressable alarms. In some cases, however, the lower cost SecuriHeat ADW can be used for smaller production lines or close protection of self-contained machines. For example, ADW can protect the dust extractor and collector. It offers a fire alarm per 10 - 200 m (33 - 656 ft) sensing tube length with two zones per detector unit – but sensitivity declines as more tubing is used. This can be compensated for by using sensing coils close to identified fire hazards (see Figure 3 (a)). Figure 3 (b) illustrates fire detection placement of SecuriHeat ADW for a smaller textile production line or self-contained machine, as well as object (e.g. dust collector) protection.



(a) Typical SecuriHeat ADW sensing tube arrangement



(b) Illustration of ADW sensing tube placement in production line machinery (left) and object protection using sensing coils (right)

Figure 3 SecuriHeat ADW placement in production line machinery (risk-based local detection)

Additionally, it should be noted that:

- The ADW detector unit can be installed either in the same protected area or outside if a convenient utility area is available.
- In case there is a temperature difference between the protected area (where the sensing tubes are installed) and the mounting location of the SecuriHeat ADW control unit, an external temperature sensor should be installed to compensate for this difference.
- When use SecuriHeat ADW as the only fire detection for code compliance, the area of coverage includes the entire zone in accordance with relevant fire code requirements, such as compartmentation, fire alarm notification or need for fire extinguishing integration.
- Choice of Max-Alarm, Diff-Alarms threshold respectively; Integration Alarm to enable Pre-signal for early alert for rapid local site response.
- When integrating with other building control systems, only Securiton authorised accessories and modules, such as RIM 36, XLM 35 and SIM 35 can be installed.
- To avoid leaks in the sensing tube due to mechanical stress, use a length of flexible Polyamide tube as a feedline between the ADW unit and the sensing tube (see Figure 3 (a)).

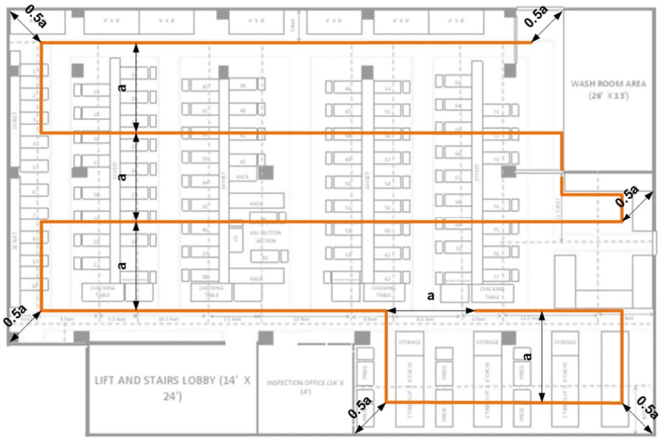
4.3.3 General building protection

As described in Chapter 2.1, textile mills and their entire operation, from raw material processing, production to storage, can consist of various building occupancy and use classifications per international and national codes and standards, and mandated by local Authority Having Jurisdiction (AHJs). For open space protection within a textile mill, where smoke detection is not suitable, the following design principles apply for heat detection (see Figure 4).

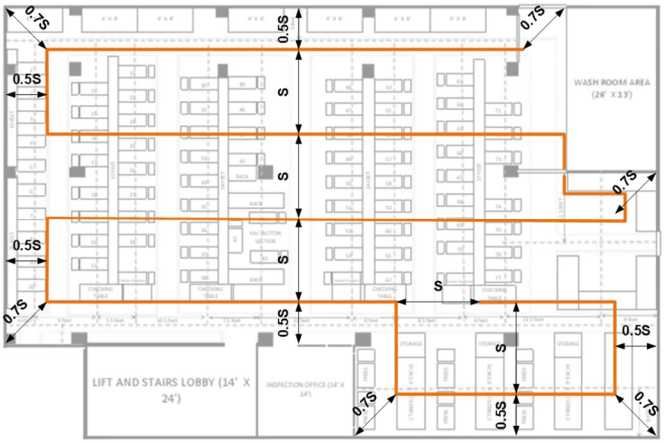
- Conveyance in looping shape (serpentine) is possible
- Maximum permitted distance ***a*** of sensing tube to sensing tube 7.0 m (23 ft)
- Maximum permitted distance of sensing tube to wall is ***b*** = 0.5***a*** = 3.5 m (11.5 ft)
- Provisions for ceilings with joists or beams according to country-specific directives must be followed

- Conveyance in looping shape (serpentine) is possible
- Maximum permitted distance ***S*** of sensing tube to sensing tube is dependent on the selected spacing:

Tube to tube *S*	Tube to wall 0.5*S*	Tube to corner 0.7*S*
15 ft (4.6 m)	7.5 ft (2.3 m)	10.5 ft (3.2 m)
20 ft (6.1 m)	10 ft (3.0 m)	14 ft (4.3 m)
25 ft (7.6 m)	12.5 ft (3.8 m)	17.5 ft (5.3 m)
30 ft (9.1 m)	15 ft (4.6 m)	21 ft (6.4 m)
40 ft (12.2 m)	20 ft (6.1 m)	28 ft (8.5 m)



(c) Spacing according to EN 54-22



(d) Spacing according to NFPA 72

Figure 4 Design considerations for EN 54-22 and NFPA 72

For general building protection and for relevant applications around textile mills which are not dealt with in detail in this Case Study, Table 5 below is a list of other Securiton industries and application design literature, available for free from www.securiton.com/en/industries-applications

Related Built Environment	Securiton Design Guide/Case Study
Storage	Distribution Logistics and Warehousing Industry [26]
Production areas	Industrial Manufacturing [27]
Hazardous	Intrinsically safe and hazardous areas [28]
Challenging environments	Harsh environments (dusty and corrosive) [29] EWFD to Replace Point Type Smoke Detectors [30]
Equipment & Object Protection	EWFD for Electrical and IT Cabinet Protection [31]
Infrastructure	Power Transmission and Distribution [32] EWFD for Cable Pathway Spaces [33]

Table 5 List of Securiton application design literature

4.4 Features and benefits

Securiton AG as a whole is certified in accordance with ISO standards 9001, 14001 and 45001 and thus meets globally applicable standards with regard to quality management, environmental management, and occupational health and safety management systems.

Securiton LTHD products provide comprehensive line-up for both addressable and non-addressable applications. SecuriHeat d-LIST and ADW offer unobtrusive, easy to install heat detection that is immune to harsh environments and can easily be cleaned and maintained. They are compatible with the principles of Intrinsically Safe Design and can be used in combination with SecuriSmoke ASD in the most demanding Performance-based Designs where Early Warning Fire Detection is crucial for fire and life safety, as well as protection of asset and business continuity.

Key features and benefits of SecuriHeat d-LIST and ADW products are summarised as follows.

Feature	Benefits
SecuriHeat d-LIST	
Individually assessable sensors	Rapid pinpointing of incipient fires
Sealed cable with choice of sensor spacings	Easy installation, no maintenance required
Extremely durable cables	Operate in extreme environments
2-Level of Alarms	Pre-signal: Verify and control (manually initiate the suppression) Alarm: Initiate fire alarm; call fire brigade; initiate suppression
SecuriHeat ADW	
Copper tubing	Resistant to harsh conditions to achieve best cost/benefit
Dynamic Heat Watch algorithm	Elimination of false alarms
Fully automatic system monitoring	Minimal maintenance
2-Level of Alarms	Pre-signal: Verify and control (manually initiate the suppression) Alarm: Initiate fire alarm; call fire brigade; initiate suppression

For large textile mills that require a number of SecuriHeat ADW or d-LIST or a combination of the two, detectors may be connected to a laptop for easy service and troubleshooting. SecuriHeat d-LIST and ADW follow identical design approach regarding system integration with building FAS. If a pre-action type sprinkler system or a water mist system is used, SecuriHeat detectors can also be configured to actuate the release of the fire extinguish systems.

4.5 Integrated verify, control and respond

SecuriHeat ADW provides one level of alert (‘Pre-signal’) and one fire alarm signal (‘Alarm’). Alerts escalating to alarms from an overheating component or incipient fire provide the early warning needed to prevent the incident from fire ignition or limit the fire spreading out. Table 6 summarises the use of 2 level of alarms of SecuriHeat ADW.

Level	Signal	Typical use
1	Pre-signal	Verify and control (manually initiate the suppression)
2	Alarm	Initiate fire alarm; call fire brigade; initiate suppression

Table 6 Alert and alarm levels for SecuriHeat ADW

SecuriHeat d-LIST features two levels of alert (‘Pre-signal’) and alarm signal (‘Alarm’). Typically, alert from one sensor escalating to alert from adjacent sensor or alarms from the originally alerted sensor provide timely alert to an overheating or incipient fire situation, while alarm signal is used for fire alarm as well as pre-action sprinkler actuation. Table 7 summarises the use of multilevel alarms from SecuriHeat d-LIST.

Level	Signal	Typical use
1	Pre-signal	Verify and control (manually initiate the suppression)
2	2nd sensor pre-signal	Automatic stop of operations and machinery; call emergency team
3	Alarm	Initiate fire alarm; call fire brigade; initiate suppression

Table 7 Alert and alarm levels for SecuriHeat d-LIST

4.6 Minimal system access for ITM

Due to the advanced automatic sealing test and automatic self-test functions of SecuriHeat ADW 535, the detection system is largely maintenance free. However, local codes and standards may require a periodic function check. For a safe execution of the functional test without entering the potentially hazardous area or disrupting operations inside the protected areas, make use of the conveniently located test coil.

The SecuriHeat d-LIST sensor cable and the external sensors are maintenance free, because they are completely shielded against external influences. In addition, the individual sensors are tested for their function in each measuring cycle. Individual sections of the cable can be replaced easily in case of mechanical damage.

In terms of testing a SecuriHeat LTHD system in production area where no flames or sparks are allowed, it is recommended to use hot water or PCM (Phase Change Material) heating pads as a safe heat source.

4.7 Support with peace of mind

SecuriHeat d-LIST and ADW products are supported by a range of software tools.

Support for	Support tool
SecuriHeat ADW	
Design	ADW HeatCalc allows the planning of security systems at a very early stage.
Install and commission	EasyConfig for simple systems. The practical ADW Config software tool is used for more complex systems and application-specific adaptations.
Monitor and manage	ADW HeatCalc and ADW Config. Extensive analysis functions and setting options ensure safe, cost-effective operation of your system.
SecuriHeat d-LIST	
Design, install, monitor and manage	SCU 835 can be operated and configured using the d-LISTconfig graphical user interface. Connection is possible via RS485, RS232, USB as well as the Ethernet interface.

Application support includes:
- Partner accreditation program
- Application and field engineering support
- Worldwide reach through a network of partners, with branch offices or local employees on every continent

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