Linear Heat Detection by PROTECTOWIRE® FireSystems
Agenda

1. Analog and Digital Linear Heat Detectors
2. Fiber Optic and Thermocouple Linear Heat Detectors
3. Applications
4. Q&A Wrap up
Digital Linear Heat Detector was invented and patented in Pembroke, MA by Gerald Holmes of The Protectowire Company in 1938. Protectowire is both UL Listed and FM Approved for the past 70 years.
What is a Linear Heat Detector?

- LHD is a continuous heat detector capable of detecting heat anywhere along its length and often described as a continuous chain of individual spot heat detectors.
- The sensor cable is comprised of either two or four conductors, all individually insulated by heat sensitive polymers.
Analog Linear Heat Detection

- This type of detector is traditionally comprised of (2) wires coated in a negative temperature coefficient designed to detect temperature change and (2) supervisory wires to monitor the loop.
- As the negative temperature coefficient polymer coated around the conductor heats up, the resistance then decreases to allow more current flow.
  - The interface module monitors the circuit for a change in resistance. A large enough decrease in resistance causes the module to indicate an alarm.
Analog Linear Heat Detection

- Slight ambient temperature changes can have the same effect as large localized temperature changes.
- For example the following conditions would all trigger an alarm condition on a detector with a maximum ambient temperature of 115ºF:
  - 500 feet of detector at 135 ºF
  - 130 feet of detector at 160 ºF
  - 20 feet of detector at 195 ºF
  - 10 feet of detector at 210 ºF
  - 3 feet of detector at 240 ºF
Analog Linear Heat Detection

- Proprietary interface units are compatible with any FACP
- Interface units are available in (2) wire or (4) wire configurations
- Requires calibration if/when ambient temperature changes
- Technology does not allow for alarm point location
- Product is considered restorable up to 250 ºF
- Length per zone: up to 500 feet
- Difficult to splice

→ NFPA 2016 Section 14. Table 14.4.3.2 Test Methods
Initiating Devices – (d) Heat Detectors
Fixed-temperature, rate-of-rise, rate-of compensation, restorable line, spot type (excluding pneumatic tube type): Perform heat test with a heat source or in accordance with the manufacturer’s published instructions. Assure that the test method for the installed equipment does not damage the nonrestorable fixed-temperature element of a combination rate-of-rise / fixed-temperature element detector.
Digital Linear Heat Detection

- Digital LHD is supervised by a conventional initiating device circuitry.
Digital Linear Heat Detector Operation

(Three conditions of digital linear heat detection)

Current regulated by end of line resistor which flows through the detector loop to provide monitoring.

In the case of an open circuit, current flow stops and the monitoring device shows this as a “trouble” state.

A short caused by heat (above a preset threshold) initiates an “alarm”.

PROTECTOWIRE FireSystems
Digital Linear Heat Detection

- This technology does not require proprietary interface units
  - Detector is a contact device
- Calibration is not necessary for ambient temperature changes
- Alarm point location is possible
- Non restorable detector
- Length per zone: up to 10,000 feet
- Easy to splice

→ NFPA 2016 Section 14. Table 14.4.3.2 Test Methods
Initiating Devices – (d) Heat Detectors
Fixed-Temperature, Non-restorable Line Type: Do not perform heat test. Test functionality mechanically and electrically. Measure and record loop resistance. Investigate changes from acceptance test.
Fiber Optic Linear Heat Detector
Fiber Optic Linear Heat Detector

- A unique programmable linear heat detection system
- Immune to EMI and RFI
- Functions on the principals of back scattered light from a laser beam pulse sent down the fiber cable
- The fiber controller calculates the temperature using the ratio between the stoke and anti-stokes frequency bands
  - Stokes – temperature independent
  - Anti-Stokes – temperature dependent
- Capable of detecting changes as small as one degree Celsius per minute (~2 °F).
Fiber Optic Linear Heat Detector

- Technology allows for multiple partitions within a single channel
- Different alarm criteria in the same or multiple partitions
- Range 1, 2, 4, 6, 8, 10 km per channel
- Number of measurement channels: 1, 2 or 4 (up to 10, 8, 6 km/channel respectfully)
- Spatial resolution: 1M – 5M adjustable

Exceeding maximum temperature
Exceeding defined rate-of-rise
Deviance from zone average (adaptive maximum)
Fiber Optic Linear Heat Detector

- Fiber controllers are (4) wire devices compatible with any FACP
- Extensive calibration is required during installation and setup
- Alarm point location is possible
- Restorable up to 235 ºF
- Length per channel: up to 32,808 feet (10km)
- Fusion splicing only – minimize line loss

→ NFPA 2016 Section 14. Table 14.4.3.2 Test Methods Initiating Devices – (d) Heat Detectors

1. Fixed-temperature, rate-of-rise, rate-of compensation, restorable line, spot type (excluding pneumatic tube type)
2. Fixed-Temperature, Non-restorable Line Type
The Digital Thermocouple Linear Heat Detector is constructed of a twisted pair of dissimilar metal spring conductors (copper coated and constantan) coated with a heat sensitive polymer designed to soften at a specific temperature.
Digital Thermocouple Linear Heat Detector

* Normal condition not shown (green LED).

When a short occurs a thermocouple junction is formed. The monitor circuit measures the temperature of the short.

A short (no heat present) initiates a short fault, not an alarm.

An alarm (short with heat) indicates a fire and initiates an alarm condition.
Digital Thermocouple Linear Heat Detector

- Digital thermocouple technology offers short circuit discrimination
  - Mechanical damage (short at ambient temperature) = short fault/trouble
  - Heat actuation (detector reaches meets or exceeds fixed temperature) = alarm

- Module is 4-wire device compatible with any FACP
- Calibration is not necessary for ambient temperature changes
- Alarm point location and temperature confirmation are provided as standard features
- Non-restorable detector
- Lengths per zone: up to 4,000 feet (1200 m)
- Easy to splice

→ NFPA 2016 Section 14. Table 14.4.3.2 Test Methods
Initiating Devices – (d) Heat Detectors
Fixed-Temperature, Non-restorable Line Type: Do not perform heat test. Test functionality mechanically and electrically. Measure and record loop resistance. Investigate changes from acceptance test.
Questions to Ask When Applying LHD

• What type of application are you protecting?
  – Commercial
  – Industrial

• What environmental conditions are present?
  – Bases, acids, solvents, hydrocarbons, dust, oil, water

• Interior or exterior application?

• Is this a classified hazard?

• What will the maximum ambient temperature be?
  – Including seasonal temperature fluctuations

If answered YES, to one or more then LHD should be considered for your application.
## Linear Heat Detectors

<table>
<thead>
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<th>Conditions</th>
<th>*CTI</th>
<th>*CTI-X</th>
<th>PHSC-EPC</th>
<th>PHSC-XCR</th>
<th>PHSC-XLT</th>
<th>PLR-R</th>
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*Thermocouple LHD is designed to discriminate between a short and an alarm.*
Applications

POWER
- Cooling Towers
- Cable Trays
- Conveyors
- Transformers
- Electrical Apparatus
- Solar Panels

WAREHOUSES
- Refrigerated Storage

PETRO CHEMICAL
- Fuel Storage
- Liquid Fuel Storage Tanks
- Wet Benches

SELF STORAGE
- Self Storage Facilities

ANIMAL HOUSING
- Barns and Stables

NEW CONSTRUCTION/RENOVATION
- Temporary Protection

TRANSPORTATION
- Hangars & Terminals
- Tunnels
- Metro Systems
- Industrial Machinery
- Bridges
- Platforms
- Vehicle Systems
Cable Trays

- Extended Runs
- Early overheat protection
- Transition from horizontal to vertical runs
- Provides coverage in limited access or restricted areas

- Proximity coverage
- Alarm point location
Conveyors

- Proximity location enables quick detection
  - Friction from belt slippage
  - Bearing failure
  - Maintenance work nearby - welding
- Robust detector, suitable for harsh elements

- Can be installed inside covered conveyors with messenger wire
- Detector can be used to activate deluge systems and equipment shutdowns
Transformers

- Mounted directly to the deluge/sprinkler system
- Proximity detection
  - Easy installation & testing
- Multiple runs
  - Pre-alarm & alarm
- Weather resistant
- Detect overheat allowing for equipment shutdown
Electrical & Engine Compartments

• Compatible with 12V vehicle systems
• LHD flexibility allows for proximity detection and installation versatility
• Low maintenance and rugged
Cooling Towers

- Suitable for harsh environments
- Place detector around fan motor & wood fill
- Absolutely NO splices
Floating and Fixed Roof Tank

- Simple – cost effective means of detection
- Intrinsically Safe installation
  - Hazardous/classified locations
  - Class B Configuration
- Reliable performance
- Stainless steel mounts suggested
- Retractable cable available supports LHD
Refrigerated/Warehouse Storage

- Install detector on the load beam in the flue space
- Great application for thermocouple LHD
- NEVER mount to in-rack sprinkler pipes
Aircraft Hangars

- Follow manufacturers listed spacing and NFPA requirements
- Bring the EOL junction box down to convenient level for easy testing or wire Class A
- LHD is easy to install and maintain
- Fixed temperature detector is immune to rapid temperature changes
Aircraft Hangar False Alarms

- Short circuit discrimination minimizes false activations
Tunnel Applications

- Perfectly suited for long runs of LHD
- Resistant to corrosive gases/exhausts
- Easy to install/maintain and test
- Potential application for messenger wire
- Alarm point location is required per NFPA 502
New Construction & Renovation

- Temporary protection
- Easy installation, cost effective solution
- Compatible with an existing FACP
- Thermocouple LHD ideal for construction zones
Self Storage Facilities

- Easy testing – no privacy invasion
- Continuous coverage
- Alarm point location allows for hot spot identification
- Low maintenance
Solar Panels

- Flexible proximity detection
- Zone mapping necessary
- Early detection
- Alarm point location
- Thermocouple LHD is recommended
Property Protection - Fences

- Outdoor non invasive protection
- Used for vineyards, farms, other types of property protection
- Simple testing and maintenance
- Extended coverage runs
Unique Applications – Inflatable Dome

- Owner switched to a fiber optic system as previous system was experiencing frequent lightning strikes
More Unique Applications

- Iconic towers
- Railroad trestles
- Subfloors
- Interstitial spaces
- Historic covered bridges
- Religious institutions
- Concealed spaces

- Extended service life
- Ease of testing – hard to access installations
- Reliable performance
- Proximity detection
The first name in linear heat detection.

Please contact info@protectowire.com if you have any questions.