Industrial Flame Monitoring
Fuel Fired Process Safety Monitoring

LAR TRAINING
MAY 2015
How is IFM Used (Not Just as a Flame Switch!)
Typical Process Application for IFM
SIF: A Safety Instrumented Function (SIF) is a safety function with a specified Safety Integrity Level (SIL) which is implemented by a SIS in order to achieve or maintain a safe state.
Used in Voting Architecture Applications
Where Used?

• Industries:
  - Petroleum/Refineries
  - Petrochemical
  - Pulp and paper
  - Metals Processing
Process Applications

• Typical applications:

  - Industrials process boilers
  - Black liquor recovery
  - Co-generation boilers
  - Grate fired boilers
  - Cement or lime klins
  - Claus reactors (sulfur recovery)
  - Thermal oxidizers
  - Gas turbines
  - Flare stacks
### Viewing Head and Signal Processor Combinations

<table>
<thead>
<tr>
<th>Viewing Head</th>
<th>Signal Processor</th>
<th>View Type</th>
<th>Application</th>
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**Additional Information:**

- For additional information, refer to manual 60-2767.
- COOLING JACKET: Cooling jackets with Venturi nozzles for PIM-ND and PIM-DE.

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1. For OIL models, voltage range is 12-140 VDC/24VAC, 10-36VDC/24VAC input, max.
2. For OIL models, input voltage range is 12-36VDC/24VAC input, max.
3. For OIL models, input voltage range is 12-36VDC/24VAC input, max.
4. All models listed above except PIM-ND and CVB-100 are suitable for use in OI applications.
Typical Flame Envelope
Light Spectrum (What is Visible?)
Viewing Head Sensors

• Infrared (IR) - Solid state sensor

• Ultraviolet (UV) – UVTron tuve

• Flare Stack model (UV) – UVTron tuve

• Dual IR/UV – Solid state + UVTron tuve

• Integrated IR/UV VH/SP – 2 Solid state + UVTron tube
Viewing Head Sensors

- Infrared (IR) - Solid state sensor
  - Peak response at 1,400nm in the light spectrum

- Responds to IR radiation/flicker in the flame above (selectable):
  - 9Hz (U2)
  - 16Hz (S55XB, S55XBE)
  - 33Hz/155Hz (S70X/S80X)

- Output = Pulse stream of randomly spaced pulses whose average rate is proportional to the IR radiation/flicker frequency present in the flame

- Think of: AC Voltage with a DC component
• Viewing Head Sensors
  ▪ Ultraviolet (UV) – UVTron tube
    o Peak response at 210nm in the light spectrum
  ▪ Output = Pulse stream of randomly spaced pulses whose average rate is proportional to the **UV radiation** present in the flame
  ▪ Think of: DC Voltage
Sensors (Continued)

- **Infrared (IR) - Solid state sensor**
  - IR Solid state sensor
    - Longer wavelength discrimination
  - Measure flame strength flicker
    - Amplitude + modulations of the flame in the target zone
    - High IR levels that are not characteristic of the flame are ignored
    - 33Hz/155Hz (S70X/S80X)
  - Programmed + monitored via signal processor

![Diagram of sensor functionalities]
Sensors (Continued)

• Ultraviolet (UV) – UVTron tube
  ▪ UV Tube sensor
    o Very short wavelength discrimination
  ▪ Measure UV portion generated by the flame
    o Amplitude + random UV Tube pulses/firings in the target zone
  ▪ Programmed + monitored via signal processor
• Dual IR/UV Viewing Heads
  ▪ Independent configuration for each sensor
  ▪ Programmed + monitored via signal processor
Sensors (Continued)

• Integrated IR and/or UV Viewing & Signal Processor
  ▪ Features
    o 24 Vdc input
    o Touchscreen interface with scrolling menú structure
    o 100% programable through interface
    o 8 Files/flame profiles
    o Hazardous location approvals
• Integrated IR/UV Viewing Head & Signal Processor

• The U2 has a unique touchscreen interface
  • Circular scroll finger “touch Wheel” menú structure (similar to the iPod)
WATCHDOG III FLARE STACK MONITOR
IRIS MODELS P222 and S256B UV
Select Signal Processors

P522

P531

P532

700ACSP/DCSP
Flame Discrimination Adjustments

• Viewing Head Highlights
  ▪ Adjustable FLAME ON and FLAME OFF settings
    o The “pull-in” and “drop-put” thresholds of the flame relay.
  ▪ Adjustable UV and IR GAIN settings
    o Increase/decrease flame signal for flame discrimination + recognition
  ▪ Multiple SOLID STATE high pass flicker frequency settings
    o Adjust filter based on the flicker frequency on the flame
    o Provides good discrimination *between* flames and background
    o Ignore everything below

▪ UV flare stack application specific model
▪ Integrated IR/UV scanner and processor model
Example Processor Set-up Considerations
Example Processor Set-up Considerations
Example Processor Set-up Considerations
Scenarios that can be monitored
Viewing head mounting examples
Accessories

Viewing Head Mounting Examples: S70X/S80X

- Swivel Mounts: 1/2" NPTM to various connections
- 1/2" NPTF purge cone

Viewing Head Mounting Examples: S55XBE

- Swivel Mounts: 1/2" NPTM
- 1" NPTF purge cone
- PT Female (Cam Fit)
- 1/2" NPTF
Get a Better View with Fiber Optics

FIBER OPTIC VIEWING HEAD EXTENSIONS

Features:
- Transmission up to 25 feet
- Withstands high temperatures
- Withstands high vibrations (application dependent)
- Corrosion protected stainless steel construction
- Different lens assemblies available for changing the angle of view or for specific applications

Applications:
- Tilting burners firing pulverized coal, oil or gas
- Applications where normal sighting is impossible
- Hostile environments, such as:
  - Lime Kilns
  - Black Liquor Recovery Boilers
  - Thermal Oxidizers
- Incinerators - Biomass and other waste fuel streams
- Gas and Oil Fired turbine generator sets
Fiber Optic Considerations

When clear view of the flame is not possible, a fiberoptic system is used. This is referred to as a coal shroud at high load. It may extend where parallel sighting may not be suitable.
Fiber Optic Assembly

Fig. 1. Inner carrier assembly example (dimensions in in. [mm]).

Fig. 2. Outer carrier assembly example (dimensions in in. [mm]).

NOTE: Actual assembly dimensions depend on total fiber optic cable length ordered.
GHE Series Ignitors
GHE Series Ignitors

• Specifications:
  ▪ 1-7/8 (4.763) diameter/1-3 MMBTU/hr (~1-3 GJ/hr)
  ▪ 2-7/8 (7.303) diameter/2-10 MMBTU/hr (~2-10 GJ/hr)

• Components
  ▪ Burner mounting tube with flange, gas insert & gas/air flex hoses
  ▪ Inner probe assembly with probe, igniter tip & junction box
  ▪ Power pack (2,000Vdc, 12Joules)
  ▪ Cable with canon plug
GHE General Dimensions

Fig. 2. Igniter example.