



COMPONENTS OF A PLC-BASED BMS/CCS SYSTEM

August 2021

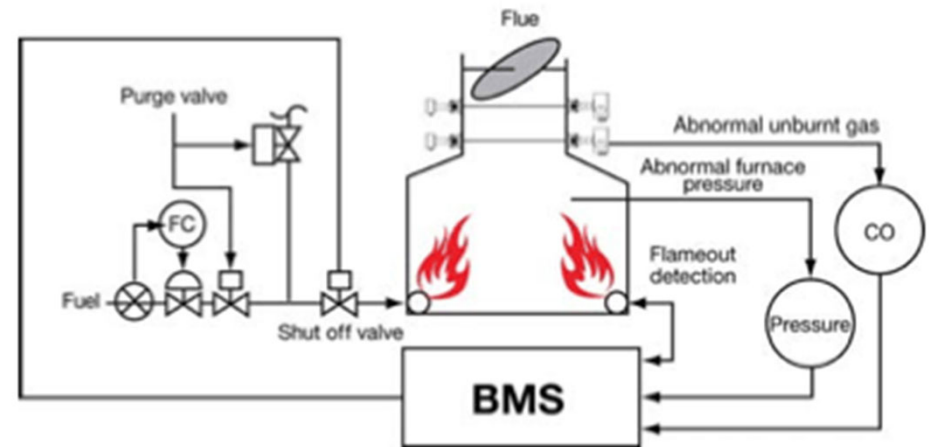
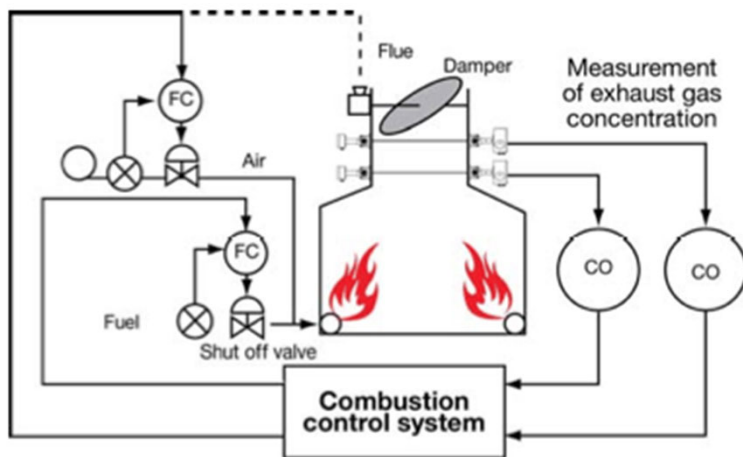


Burner control

Divisions of burner control

Most types of burners used in process control will require by an applicable code that there is a flame safeguard and instrumentation system in place. Control can be further divided into two categories:

- Combustion Control System (CCS)
- Burner Management System (BMS)



Burner control

Combustion Control System

The combustion control system (CCS) regulates the furnace air and fuel inputs to maintain the air-fuel ratio. This ratio must be within the limits required for continuous combustion and flame stability throughout the modulating operating range, allowing the burner to safely adjust output from a minimum to a maximum in a linear manner. Servo motors are used to regulate dampers on the air and valves on the fuel to precisely control the input at all stages of combustion. This precision also provides repeatability whether the burner is increasing or decreasing output.

Basic components of a CCS system are:

- Servo control with feedback
- PID load control
- Safety logic to verify that all servos move in ratio
- Safety logic to verify that all outputs are working properly

Burner control

Burner Management System

The burner management system (BMS) is a system dedicated to burner safety. The BMS controls the safe starting and stopping of burners. A BMS can be programmed using an industrial PLC or a complete microprocessor-based BMS (also known as a **Flame Safeguard**) can be used. Regardless of type, a BMS has inputs and outputs to connect to all the required parts of the burner. A BMS can be designed for a single- or multi-burner application.

Basic components of a BMS system are:

- Interlock monitoring
- Fuel monitoring
- Flame monitoring
- Ignition control
- Main burner control
- Safety logic to verify that outputs are working properly

Instrumentation

Fireye components

Fireye can provide most of the specialized instrumentation that is needed for a PLC-based BMS or CCS system.

- Flame monitoring
- Servo control
- Combustion analysis



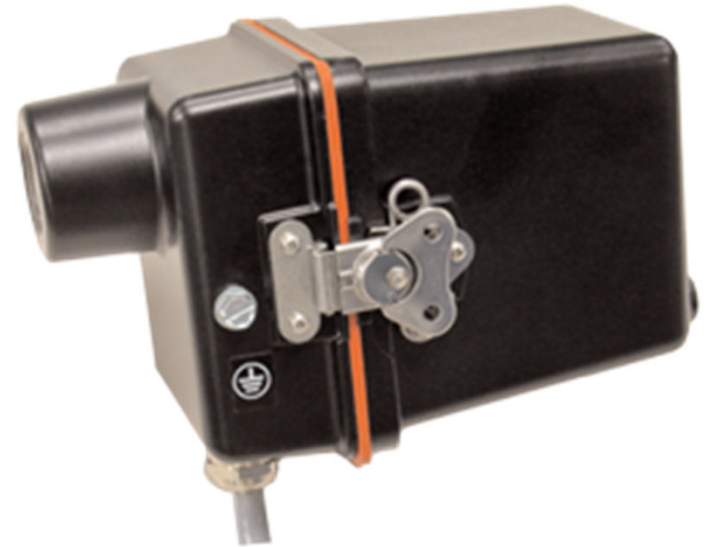
Fireye can provide **“Everything but the PLC for your BMS/CCS application”**.

Flame monitoring

Simplicity 65UV5

The Simplicity 65UV5 is a fully integrated scanner that does not require programming, making it an easy-to-use scanner.

- 8-pin quick disconnect (QD) connector
- 24VDC powered
- Voltage-free flame relay (fault relay internally wired in series) with additional voltage-free fault relay
- 4-20mA analog output for flame signal
- Two-color LED for status annunciation
- Class I, Div. 2 (groups A, B, C, D) and ATEX hazardous area classification



Flame monitoring

Phoenix 85 series (85UVF, 85IRF)

The Phoenix 85 series offer self-check models for detecting either ultraviolet or infrared radiation. Flame profiles can be programmed, including background flame.



- 8-pin quick disconnect (QD) connector
- 24VDC powered
- Voltage-free flame relay (fault relay internally wired in series) with additional voltage-free fault relay
- 4-20mA analog output for flame signal
- Keypad setup with LEDs for flame indication
- Class I, Div. 2 (groups A, B, C, D) and ATEX hazardous area classification

Flame monitoring

InSight (95UV, 95IR, 95DS)

The InSight scanners offer self-check models available for detecting either ultraviolet radiation, infrared radiation or both in one unit. Flame profiles can be programmed, including background flame.



- 12-pin quick disconnect (QD) connector
- 24VDC powered
- Voltage-free flame relay (fault relay internally wired in series) with additional voltage-free fault relay
- 4-20mA analog output for flame signal
- Keypad with display for monitoring and programming
- Inputs to select file (profile) to use – four available
- Modbus communication
- Class I, Div. 2 (groups A, B, C, D) hazardous area classification
- ATEX hazardous area classification with proper housing

Flame monitoring

InSight II 95DSS3

The Insight II 95DSS3 scanner can detect both ultraviolet and infrared radiation in one unit. Flame profiles can be programmed, including background flame. There are additional connectivity options for displays and remote viewing and data collection.



- 8-pin and 12-pin quick disconnect (QD) connectors
- 24VDC powered
- Two voltage-free flame relays (fault relay internally wired in series) with additional voltage-free fault relay
- Two 4-20mA analog outputs for flame signal and flame quality
- Inputs to select file (profile) to use – four available
- Modbus communication
- Class I, Div. 2 (groups A, B, C, D) hazardous area classification
- ATEX hazardous area classification with proper housing

Flame monitoring

InSight II 95DSS3 display

The 95DISP-1 display is available for programming parameters and monitoring operation. This display mounts directly on the scanner.



Flame monitoring

InSight II 95DSS3 wireless transmitter

The 95WIDISP-2 display is available for programming parameters and monitoring operation. The transmitter mounts directly on the scanner and the receiver is handheld and uses batteries. Infrared technology is used for the 95WISP-2.



Flame monitoring

InSight series 4 (95UVS4, 95IRS4)

The InSight series 4 scanners offer self-check models available for detecting either ultraviolet or infrared radiation. Flame profiles can be programmed, including background flame.

- 12-pin quick disconnect (QD) connector
- 24VDC powered
- Voltage-free flame relay (fault relay internally wired in series) with additional voltage-free fault relay
- 4-20mA analog output for flame signal
- Keypad with display for monitoring and programming
- Inputs to select file (profile) to use – four available
- Modbus communication
- Class I, Div. 2 (groups A, B, C, D) hazardous area classification
- ATEX hazardous area classification with proper housing



Flame monitoring

Hazardous area housings

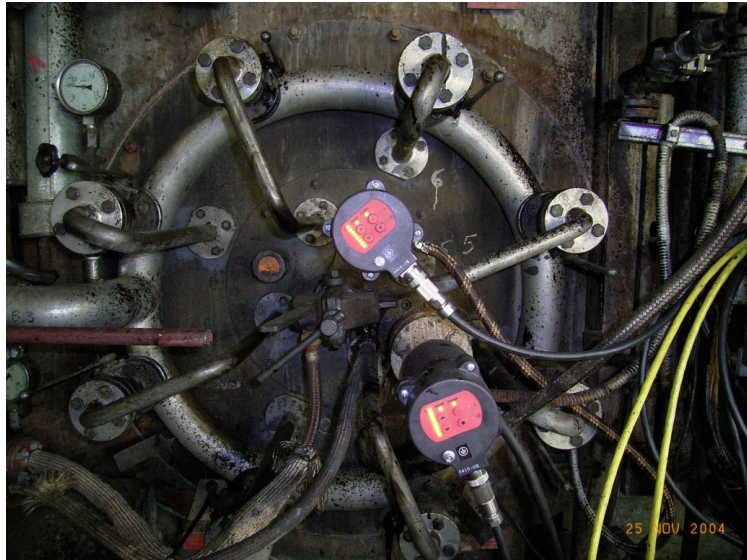
All models are approved for use in Class I, Division 2 groups A, B, C and D. Simplicity and Phoenix models are also ATEX approved, and all InSight models offer ATEX housings.



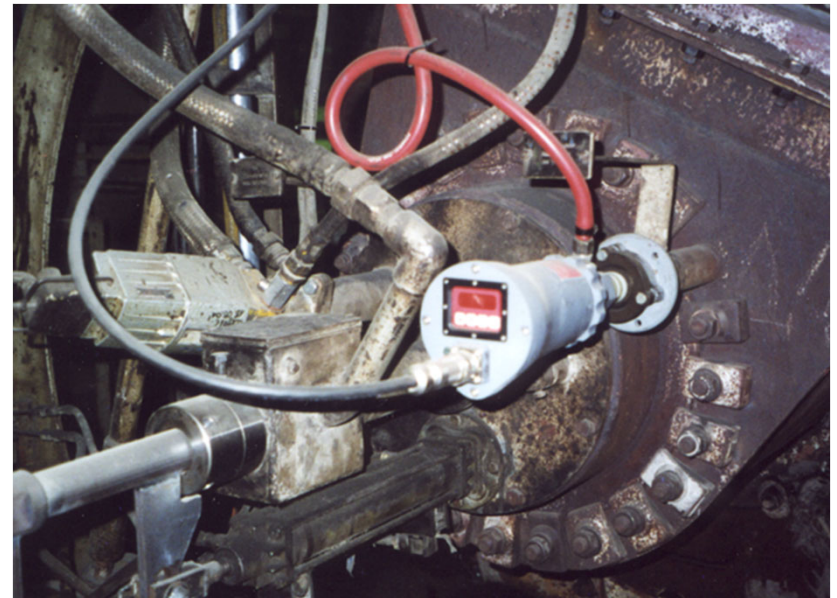
Flame monitoring

Integrated scanner application photos

Phoenix



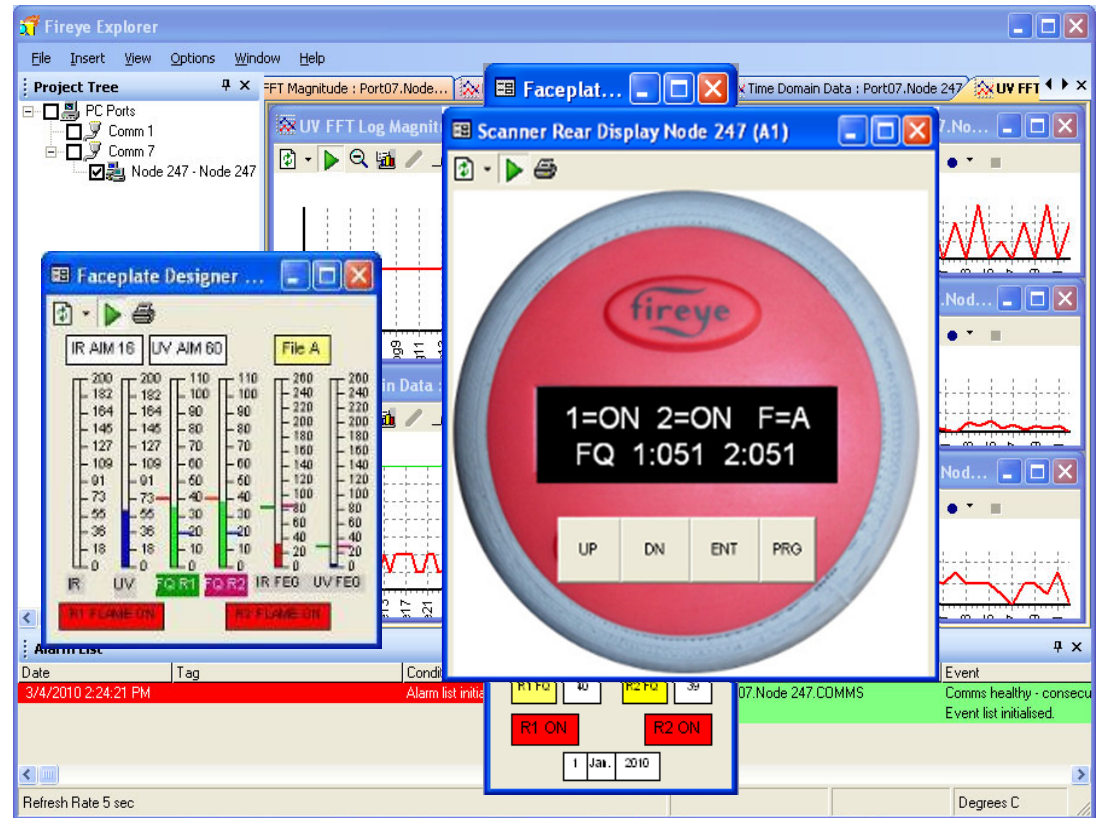
InSight



Flame monitoring

Fireye Explorer (FEX) software for remote communication

Fireye Explorer software is available for connecting a PC to multiple Modbus compatible InSight, InSight II or InSight 4 scanners on a network. Each scanner can be monitored or controlled remotely using this software. There are additional features such as trending to help with troubleshooting any issues with the flame.



Flame monitoring

MBCE flame sensor modules

The MBCE flame sensor modules provide a double-pole flame relay with an analog output for signal strength. They are mounted on a standard 11-pin octal DIN-rail relay base, making these modules a compact option for flame detection.



- Signal threshold adjustment via trim pot
- 120V model is UL listed
- 230V model is CE listed
- 4-20mA analog output for flame signal
- Models available for use with standard flame rod or Fireeye low-voltage range of UV scanners
- Multiple MBCE sensors can be used on an application

Flame monitoring

UV1AL for MBCE UV models

The UV1AL series scanners are designed for front mounting which may allow the scanner to obtain a clearer view of the flame. The UV1AL comes with either a 0.915m (3') or 1.83m (6') TC-ER rated cable attached. The UV1AL has a 1/2" NPT female thread for mounting directly to a sight pipe.



UV1AL

The UV1AL, UV90L and UV5 ultra-violet flame scanners are non-self-checking and should be applied only to burners that cycle a minimum of once per 24 hours. Cycling the burner once every 24 hours of continuous run time can be implemented into the BMS PLC programming to satisfy this requirement.

Flame monitoring

UV90L for MBCE UV models

The UV90L series scanners are designed for front and lateral (90°) mounting which may allow the scanner to obtain a clearer view of the flame. The UV90L provides a field wired terminal block.



UV90L (Cable purchased separately)

The UV1AL, UV90L and UV5 ultra-violet flame scanners are non-self-checking and should be applied only to burners that cycle a minimum of once per 24 hours. Cycling the burner once every 24 hours of continuous run time can be implemented into the BMS PLC programming to satisfy this requirement.

Flame monitoring

UV5 for MBCE UV models

The UV5 series scanners are designed for front and lateral (90°) mounting which may allow the scanner to obtain a clearer view of the flame. The UV5 provides a detachable 2m (80") UL rated cable.



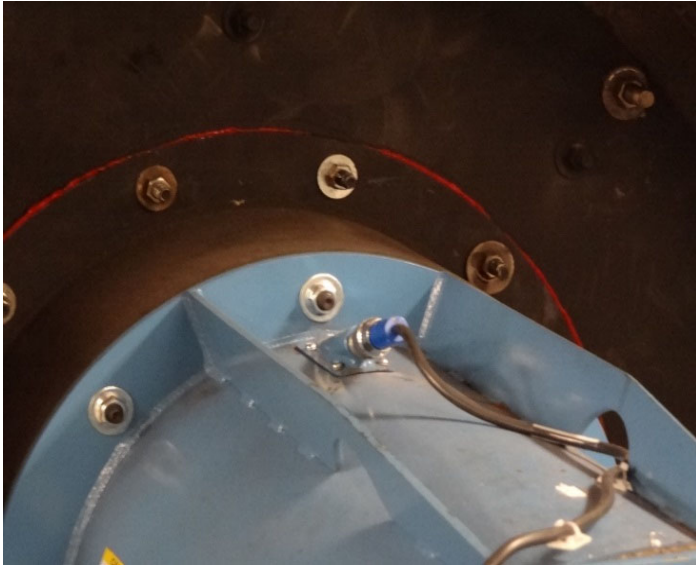
UV5

The UV1AL, UV90L and UV5 ultra-violet flame scanners are non-self-checking and should be applied only to burners that cycle a minimum of once per 24 hours. Cycling the burner once every 24 hours of continuous run time can be implemented into the BMS PLC programming to satisfy this requirement.

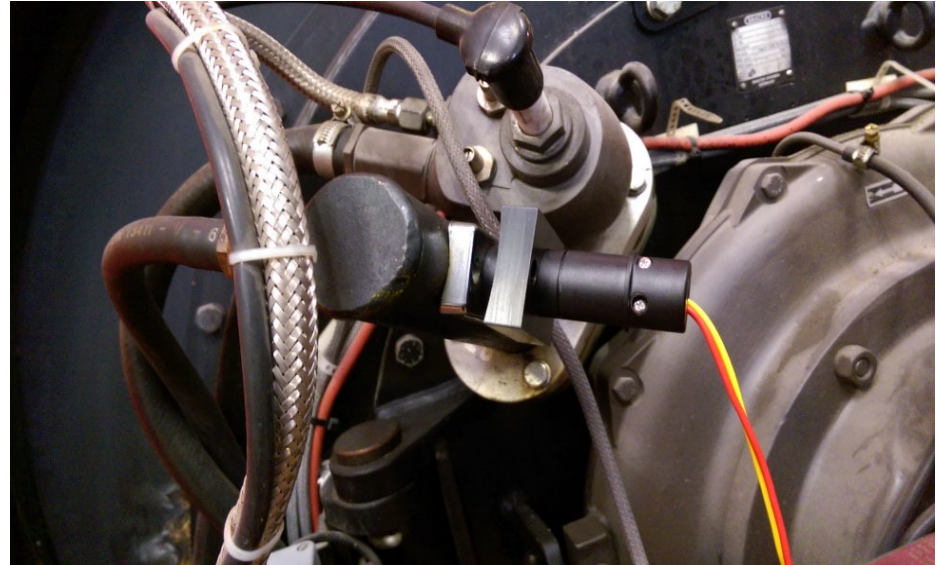
Flame monitoring

UV scanner application photos

UV1AL



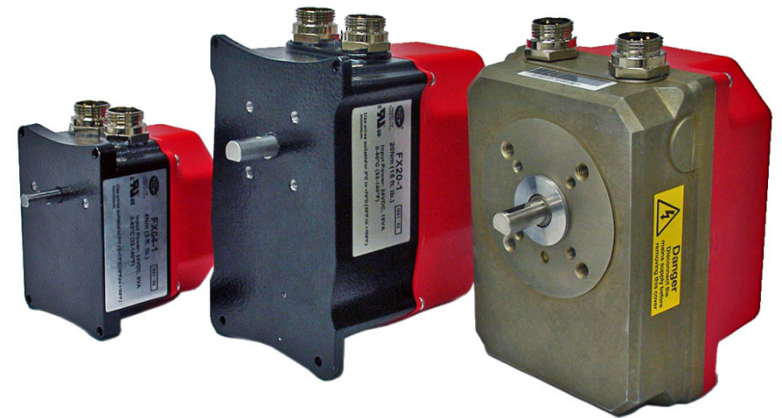
UV90L



Servo control

FX series servos

There are three sizes of servo available with the FX series: 4Nm (3 ft.-lb.), 20Nm (15 ft.-lb.) and 50Nm (37 ft.-lb.). Each of these is 24VDC powered and operates using Modbus RTU at 19.2k baud (models are also available at 56k baud).



There is also an option for servos with quick-disconnect (QD) cables. Using the QD cables makes it easier to service a burner if the servos need to be quickly disconnected for maintenance.

Servo control

Up to ten servos in a network

The Modbus address is set in the FX series servos using a rotary switch. Up to ten different addresses are possible. The rotary switch makes changing a servo in the field easy since all that needs to be done is to match the address setting. If more than ten servos are needed for an application, a second serial port can be used to add additional capacity.

Power requirements:

- **FX04:** 7.5W
- **FX20:** 35W
- **FX50:** 38W

Servo control

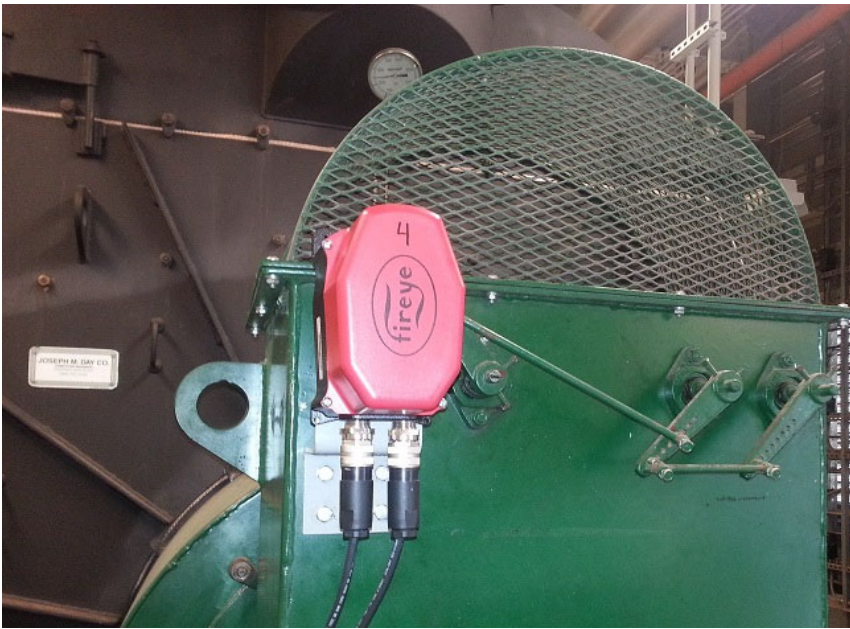
FX series servos other features

- Stepper motor control offers 0.1 angular degree of accuracy
- 99.9 angular degrees of rotation
- Variable speeds of full-stroke movement from 30 to 120 seconds
- D-type shafts
- CW or CCW rotation with manual movement buttons under the cover to ease setup
- IP65 (NEMA 4X) rated

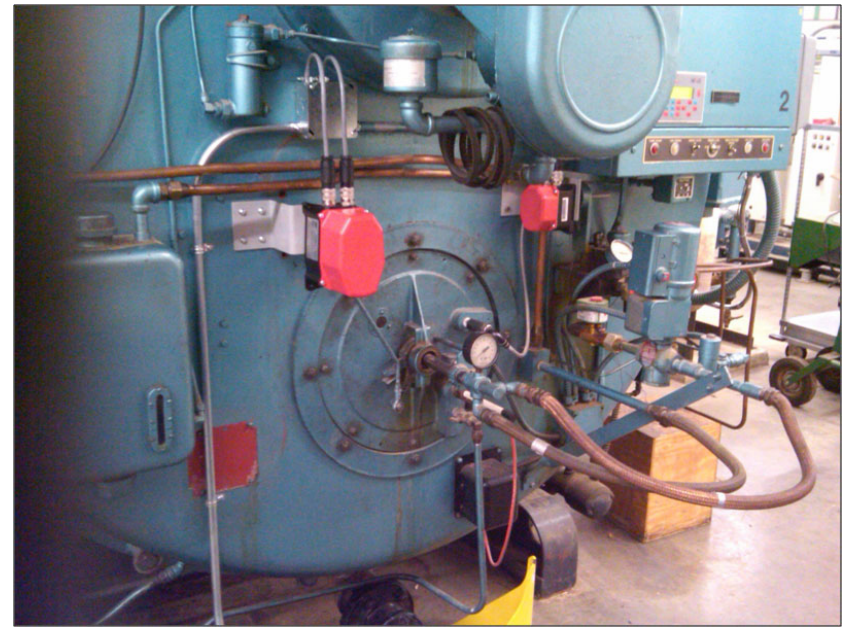
Servo control

Servo application photos

FX20



FX04/FX20



Combustion analysis

NXCESO2 in-situ oxygen probe

The Fireye NXCESO2 zirconium dioxide probe is designed to provide continuous oxygen concentration readings using a Modbus RTU connection. This allows the PLC to trim one or more channels of combustion to obtain optimum combustion efficiency.

The NXCESO2 requires 24VDC power to be provided.

The NXCESO2 incorporates a type K thermocouple to measure flue temperatures up to 426°C (800°F).

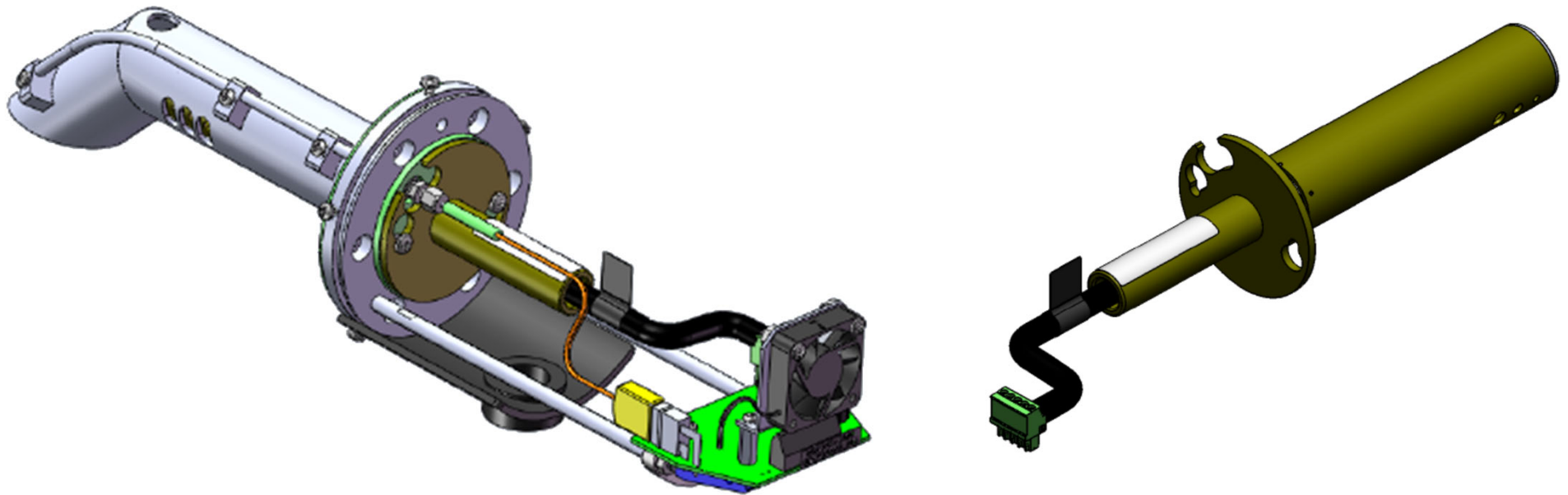
Two insertion depths are available: 216mm (8.5") and 407mm (16").



Combustion analysis

NXCESO2 removable probe

The probe assembly in the NXCESO2 is easily removed for service or replacement. This eliminates the need to remove the probe assembly from the stack.

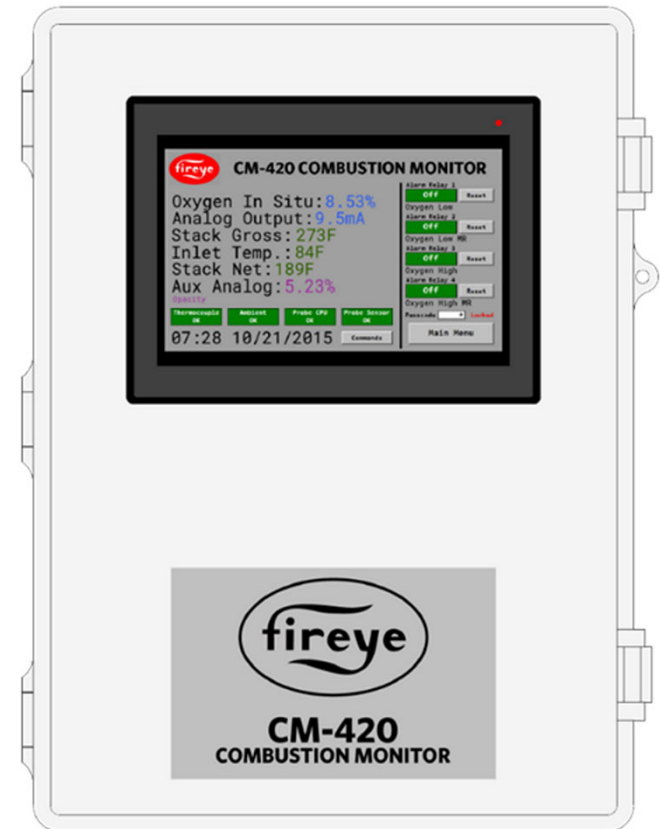


Combustion analysis

CM-420 combustion monitor

The CM-420 combustion monitor connects to an NXCESO2 oxygen probe and provide a local display with a 4-20mA output for connection to the PLC. Four programmable alarm relays are provided as well as a full Modbus TCP or RTU interface.

The CM-420 enclosure is UL 508A listed (enclosed industrial control panels) and is housed in an IP66 (NEMA 4X) rated polycarbonate enclosure.





EVERYTHING BUT THE PLC... ...FOR YOUR BMS/CCS APPLICATION

FLAME MONITORING



- Relay output for flame
- 4-20mA for flame signal
- Flame rod
- UV, UV self check

MBPF, MBCE Flame Sensor Modules

- Relay outputs for flame, alarm
- 4-20mA for flame signal
- IR, UV or dual
- Quick disconnect models available
- Programmable



Fireeye Integrated Flame Scanners

SERVO CONTROL



- Three sizes available: 4Nm, 20Nm and 50Nm
- Control and feedback via Modbus RTU
- Quick disconnect models available

FX Series Servos

COMBUSTION ANALYSIS



- 4-20mA output for oxygen %
- Four alarm outputs
- Two 4-20mA inputs
- Modbus RTU, TCP



CM-420 Combustion Monitor NXCESO2 Oxygen Probe

For more information contact your OEM or distributor.

Fireeye, Inc.
3 Manchester Road
Derry, NH 03038
www.fireeye.com





THANK YOU

