

# SMOKE OPACITY MONITOR

Model JC-30D-EZ

The Preferred Instruments JC-30D-EZ Smoke Opacity Monitoring System assures an accurate measurement of the smoke emissions from boilers, incinerators, kilns, and similar sources of intermittent, visible emissions. Typical applications include commercial buildings, schools, hospitals, apartment complexes, and industrial plants. The information provided encourages increased emphasis on clean, efficient combustion and effective air pollution control.

The newly redesigned light source uses a low voltage, pre-focused, LED lamp with a projection angle of 5° to reduce scattered light inaccuracies. The light detector is a solid state, photopically filtered photoelectric cell. The unit's built-in optical "bull's eye" and variable blink rate LED assist in alignment verification. Lenses are specially designed for easy cleaning without dismantling the installed assembly. Equipped with the updated automatic opacity calibration, allowing the JC-30D-EZ to calibrate without the need of personnel. The information provided encourages an increased emphasis on clean, efficient combustion and effective air pollution control. Optical Sensing Assembly included.

## Long Life LED Light Source

## Updated Automatic Opacity Calibration

- Allows the JC-30D-EZ to calibrate without the need of personnel.

## Early Warning Message and Relay Contact

- Deteriorating combustion conditions can be detected early before developing into major problems.

## Burner Safety Shutdown Message and Relay Contact

- Dangerously high opacity is an indication of an unsafe, likely fuel-rich flame condition.

## Single pass design, no moving parts

## High Visibility Bargraph and Numeric Display

## Three Alarm Sequences (field selectable):

- Standard
- NYC BAR
- Wood / Coal Overfire Air Fan

## NEMA 4 Front Panel

## Flexible Communications for Data Logging:

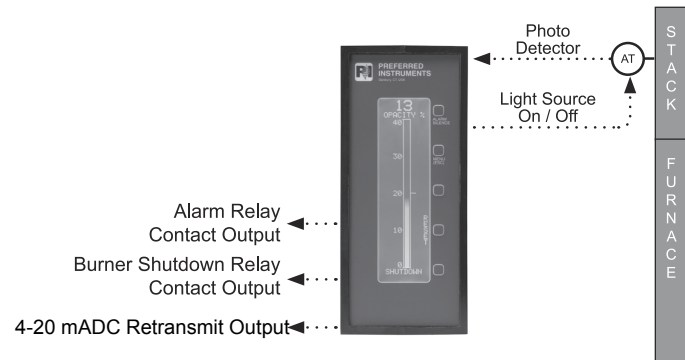
- 4-20 mADC Opacity Re-transmission
- RS485 Modbus Interface

## **Automatic Calibration**

The JC-30D-EZ includes a 120 VAC input that monitors the burner fan starter coil and initiates an Automatic Calibration cycle whenever the burner fan stops running (ensuring a clear stack condition). This prevents nuisance burner trips due to dust buildup. "WARNING: CLEAN LENSES NOW" is displayed when the dust level is high. At the completion of the Calibration Cycle, the JC-30D-EZ turns off the light source until the fan restarts, extending the life of the bulb. A Calibration Cycle can also be manually initiated from the JC-30D-EZ Menu (after a lens cleaning, re-alignment, etc).



JC-30D-EZ shown in "SHUTDOWN" condition  
(alarm message & reset pushbutton visible)



Typical JC-30D-EZ Arrangement

Instruments & Controls

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## Description

The JC-30D-EZ Smoke Opacity Monitor is a microprocessor-based indicating instrument with a smoke duct mounted optical sensing assembly. The system provides a continuous opacity readout, alarm indication and shutdown capability. The smoke opacity percent is continuously displayed using a highly visible backlit LCD display. An intuitive bargraph display and alarm message provides rapid recognition of combustion conditions. All adjustments can be made directly from the faceplate of the instrument by scrolling through user-friendly, English language menus.

The light source uses a low voltage, pre-focused, LED lamp with a projection angle of less than 5° to reduce scattered light inaccuracies. The light sensor includes a solid state, photopically filtered photoelectric cell. The unit's built-in optical "bull's eye" and variable blink rate LED assist in verifying alignment. Lenses are specially designed for easy cleaning without dismantling the installed assembly. Cap seals and/or cooling blowers may be required for high temperature applications, and refractory lined breechings. Please contact factory for details. Detector has a large lens that dramatically reduces inaccuracies due to ambient light and misalignment. Calibration is automated, there are no manual adjustments.

## Operation

The indicating instrument continuously displays the percent smoke opacity and provides the following alarm and control sequences. Typically, the JC-30D-EZ alarm relay activates an external alarm bell or horn, and the shutdown relay is used to shut down the burner.

### "Standard" Operating Sequence

**Smoke Opacity exceeds setpoint:** Bargraph blinks and "ALARM" message appears.

**After 20 seconds "smoke-puff" delay:** Alarm relay (K1)

contact activates, the remote alarm bell or horn is activated. Pressing the "alarm silence" button deactivates (K1) relay and the external bell or horn.

**Smoke Opacity continues for 120 seconds (adjustable):** The shutdown relay (K2) activates in manual reset mode, "shutdown" message appears, and the (K1) relay re-activates. When the smoke opacity condition clears, the JC-30D-EZ "reset" pushbutton must be pressed to reset the shutdown relay in order for the burner to restart.

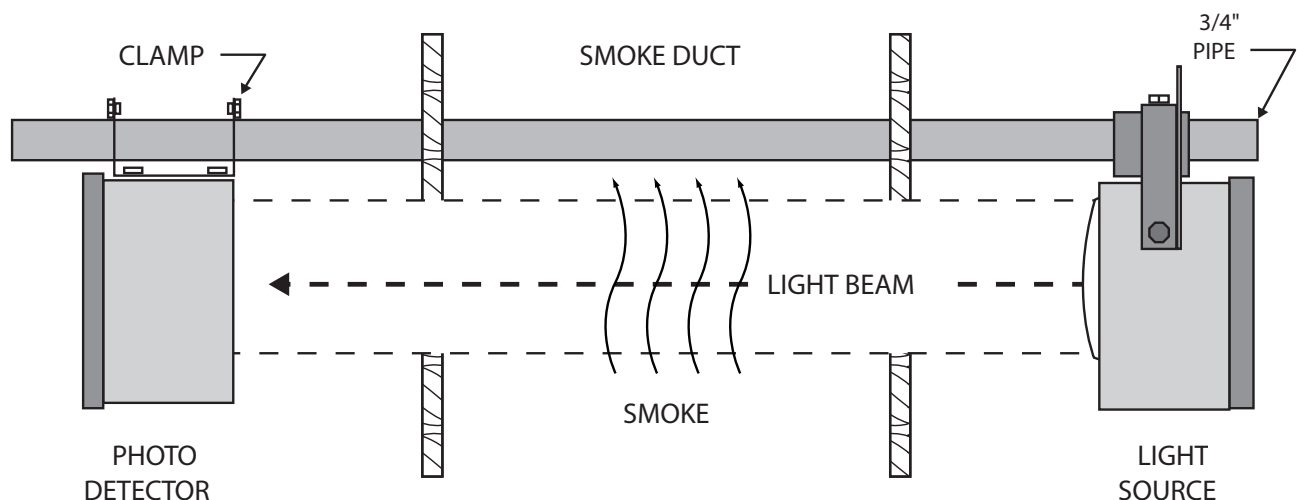
**Smoke Opacity returns to normal:** "Alarm" message disappears.

### "NYC BAR" Sequence

This sequence is similar to the Standard Operating Sequence (above), but conforms to the New York City D.E.P. Bureau of Air Resources requirements. The (K1) relay activates instantly and the (K2) relay delay is fixed at 120 seconds (not adjustable). The 19085D Light SensorAlarm Test filter complies with NYC BAR requirements.

### "WOOD / COAL" Overfire Air Fan Sequence

This sequence is used with stoker fired boilers. See the Standard Operating Sequence (above) for (K1) relay and "alarm silence" button operation. The (K2) relay is used to reduce opacity by activating an overfire air fan or damper. When opacity has been above setpoint for 15 seconds (adjustable) the overfire air relay (K2) activates and a "fan on" message appears. When the smoke clears and drops below setpoint, the (K2) relay remains activated for an additional 180 seconds (adjustable) to help prevent a re-occurrence of excessive smoke.



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## Specifications

### Panel

Power Supply: 120 VAC 50/60Hz, 15 VA  
Case Size: 8" H x 3.5" W x 7.5" D  
Enclosure Type: NEMA 4 faceplate, Flush Mounting  
Ambient Temp.: +32° to +122° F ambient  
Digital: High Contrast LCD Display  
4" high, 0.5% Resolution Bargraph  
Status Messages: ALARM, SHUTDOWN,  
WARNING: CLEAN LENSES NOW  
EXCESS LIGHT  
Alarm Setpoints: Adjustable 5-50%

### Light Source and Light Sensor

Calibration: Automatic, Off-Line  
Spectral Response: Photopic  
Peak and mean within 500-600nm  
Angle of Projection: <5°  
Operational Error: <5%  
Span Drift: <2%  
Zero Drift: <2%  
Calibration Error: <1% (Linearity)  
Response Time: <10 seconds for 95% change in opacity  
Sighting Distance: 1 to 8 foot smoke duct.  
3 to 10 foot optical path length  
Wiring Distance: 500 ft. max (16 ga. wire)  
250 ft. max (20 ga. wire)  
Sensor Housing: 3/4" pipe mount

### Outputs

Relay Outputs: Two SPDT Relays  
10 A resistive, 8 FLA, 1/2 HP,  
120 VAC

### Retransmission

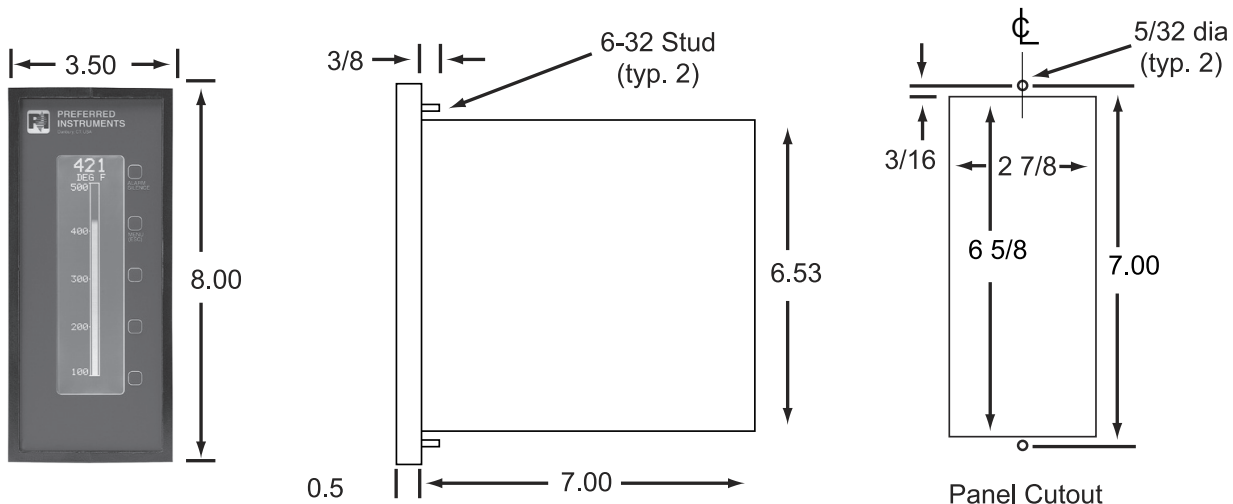
Output: 4-20 mADC, 650 ohm load max  
Network Output: 1200-38400 baud, RS485 Modbus,  
ASCII or RTU

## Ordering Information

1. JC-30D-EZ Monitor, 190851S Light Source, 19085D Light Sensor.

## Optional Accessories

1. Pressure cap set with purge and non-purge fittings (107226P)
2. Pressure cap set with integral blower (2 blowers) (190275A)
3. Remote audible / visual alarm (SDA-VB)
4. Alarm bell, 6" dia., 85 db (SDA-B6)



# SMOKE OPACITY MONITOR

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## SPECIFICATION

Provide a Smoke Opacity Monitor for each stack. The smoke monitor shall consist of a light source, solid-state optical detector, and microprocessor based alarm and indicating instrument. The instrument shall provide a smoke opacity percent display in engineering units, early deteriorating combustion conditions warning indication, burner Safety Shutdown indication and relay contacts. The instrument shall continuously indicate smoke density on a highly visible backlit LCD display. Provide an integral or separate 4", 0.5% resolution (minimum) bar graph display in engineering units with visual alarm setpoint indication. Provide an "Alarm Silence" and "Manual Reset" pushbutton and two 10 ampere relays. Tamper proof calibration without user accessible knobs or adjustments that effect calibration. Calibration should be fully automated with no need for operator and shall not require inserting calibration filters into the light beam up on the stack. Must have calibration from 0-100% opacity digital display, 4-20mA out, and Modbus RS485 capabilities for building automation integration. The housing shall be panel mountable, fully gasketed with NEMA 4 front face. All adjustments shall be made from the front panel display in engineering units. No external "configurator" or laptop shall be required. The "Standard" Operating Sequence shall be as follows: When smoke density exceeds setpoint, the bar graph shall flash, and an "Alarm" message shall appear. After a 20 second "smoke-puff" delay the "Alarm" relay contact closes the circuit for the remote alarm device. Pressing the "Alarm Silence" pushbutton resets the alarm relay to silence the alarm device. If the smoke density reduces below the setpoint within 120 seconds (adjustable), the bar graph stops flashing and the "Alarm" message disappears. If the smoke density exceeds the

setpoint for 120 seconds or more, the "Shutdown" message shall appear, the "Alarm" relay re-closes and manually reset "Shutdown" relay contact open to shut down the violating burner. Pressing the "Alarm Silence" pushbutton resets the alarm relay to silence the alarm device. When the smoke density then falls to below the setpoint, the "Shutdown" message will remain on and the "Shutdown" relay will remain in the manual reset mode. With smoke opacity cleared, pressing the "Reset" pushbutton will reset the system, the "Shutdown" message will disappear, and the "Shutdown" relay will reset to permit normal burner operation. In order to avoid nuisance burner trips due to dust build-up on the light source and sensor, the instrument must include an automatic, unattended re-calibration cycle whenever the burner fan stops running (ensuring a clear stack condition). The optical sensing unit lenses shall be designed to accommodate regular cleaning without dismantling the installed assembly. Light Source and Detector will sight 100% of the effluent path length. Light Source will utilize a pre-focused sealed beam lamp with a maximum 5 degree projection angle. Photo Detector shall include a photopically filtered, solid state photo cell and alignment verification bull's eye. The Instrument shall include a RS485 Modbus network interface and a 4-20 mAdc retransmit output to communicate to a future Data Acquisition System (DAS) or Building Automation System (BAS). The Instrument shall be manufactured and labeled in accordance with UL508A requirements (CSA C22.2 #14 for use in Canada). Inspection and labeling shall be supervised by UL or other OSHA approved Nationally Recognized Test Lab (NRTL). Must be UL508 listed. The draft control system shall be a Preferred Instruments, Danbury, CT, Model JC-30D-EZ