

# Flo-Cal High-Speed Calorimeter



## Description

The Flo-Cal is an online, high-speed calorimeter used to measure the heating value of combustible gases. The Flo-Cal fast response, reliable operation, and ease of maintenance and calibration have made Thermo the world leader in Wobbe Index and Calorific Value calorimeters.

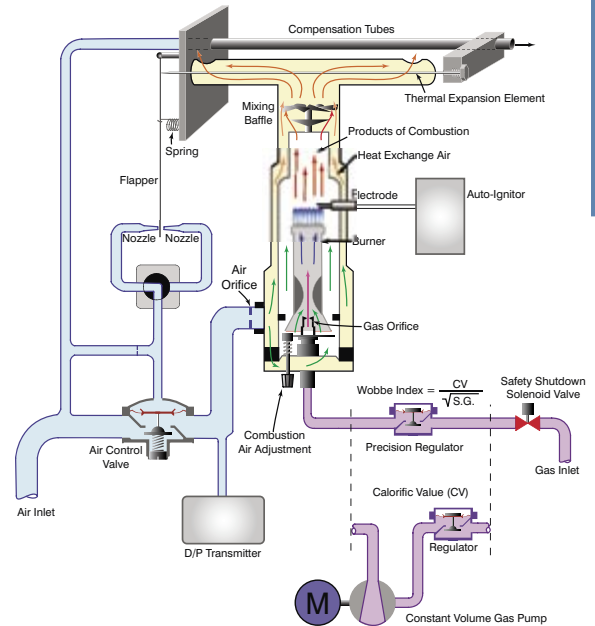
## Modes of Operation

The Flo-Cal has two basic modes of operation: Wobbe Index and Calorific Value. Wobbe Index provides a meaningful measurement of the actual heating characteristics of fuel gas. It is derived from the basic heat flow equation with Wobbe Index defined as the Calorific Value divided by the square root of the specific gravity. Wobbe Index measures the combined effects of fuel gas composition changes.

Calorific Value is the heat value of the gas at standard conditions expressed as Gross Heating Value or Net Heating Value. Gross Heating Value is the theoretical heat value of the gas at standard conditions. Net Heating Value is the actual available heat value of the gas at standard conditions. Net Heating Value is frequently used in calculations to determine the heat potential for the gas. A specific gravity measurement option is available for units measuring Calorific Value.

## Principles of Operation

Sample gas and combustion air are accurately metered and burned under closely controlled conditions. (See the



Functional Diagram

functional diagram.) A constant exhaust temperature is maintained by precisely regulating the combustion and cooling air to the burner as the heating value of the sample gas changes. Changes in air flow are used to accurately calculate the Wobbe Index or Calorific value of the gas.

An intelligent pressure transmitter converts pressure changes into the calculated output signals (4-20 mA and Modbus® protocol) for the appropriate measurement range. A local display is available at the transmitter for maintenance use. Auto-calibration is optionally available.

If the flame is extinguished due to shortage of sample gas or combustion air, mechanical failure, or electrical supply failure, a solenoid valve shuts off the sample gas supply. When all required conditions are established the sample gas supply solenoid is opened and the burner is automatically ignited.

## Specifications

### Operation Modes

Calorific Value or Wobbe Index. Either operational mode can read out in the selected measuring units of BTU/scf, MJ/Nm<sup>3</sup>, or Kcal/Nm<sup>3</sup>

### Range

Low range: <1500 BTU/scf

High range: >1500 BTU/scf

(where upper value of range is twice the lower value)

### Accuracy

Low range = ± 1.0% of full scale value

High range = ± 1.5% of full scale value

Accuracy specifications are for the Flo-Cal temperature controlled with ±15°F (-9.4 to -26° C) of ambient temp at time of calibration. If ambient temperature drifts outside or the ± 5° C range, the analyzer can experience a drift of 0.02% of full scale for each degree outside of the temperature range.

### Repeatability

Low range = ± 1% of full scale value

High range = ± 1.2% of full scale value

### Linearity

Low range = ± 1% of full scale value

High range = ± 1.2% of full scale value

### Response

Low range = 1.5 minutes (to 90% of new value) for changes > 30% of full scale, plus sample transport time

High range = 3.5 minutes (to 90% of new value) for changes > 30% of full scale, plus sample transport time

### Ambient Temperature

10 to 40° C

Must be controlled ± 5° C.

### Sample

Model 7000: 500 to 2500 ml/min (depending on gas heating value) at 3 to 5 psig (0.21 to 0.34 Barg)

Model 5000: 500 to 2500 ml/min (depending on gas heating value) at 3 to 60 psig (0.21 to 4.14 Barg)

### Utility Gases

Instrument air - 60 to 125 psig (4.14 to 8.62 Barg) @ 2.5 to 6.0 SCFM (71 to 170 L/m) dry, oil free.

An optional air blower is available for the Model 7000.

### AC Power

120 VAC ± 10%, 60 Hz @ 600 Watts

Alternate VAC/Hz available: 230/60, 100/50, 120/50, 230/50

### Area Classification

Model 7000: General Purpose  
Model 5000: NEC Class I, Div 1, Groups C & D - Explosion Proof; NEC Class I, Div 1, Groups B, C, & D - Explosion Proof, CSA approval; Flame proof CENELEC Zone 1, IIC enclosure (pending final SIRA certification)

### Mounting

Designed for wall mounting, no rear access required. Requires free ventilation on top for spent sample gas

### Weight

Model 7000: Approx. 150 lbs. (68 kg)

Model 5000: Approx. 550 lbs. (250 kg)

### Dimensions (HWD)

Model 7000 - 42 x 22 x 15 inches (107 x 56 x 38 cm)

Model 5000 - 77 x 38 x 27 inches (190 x 95 x 68 cm)



Model 7000



Model 5000



Temperature Controlled Free Standing Enclosure

Thermo Electron Corporation designs, develops, markets, and services sophisticated measurement instruments and on-line sensors to enhance production efficiency, meet regulatory requirements, and provide safe operation for the process control industry. Products incorporate advanced technologies to provide real-time analysis, data collection, and control functions. Our products are used in a number of industries, including oil and gas, chemical, petrochemical, refining, electric utilities, specialty gases, iron & steel, food & beverage, pharmaceutical, and semiconductors. Our worldwide presence and experienced staff enable Thermo Electron to provide rapid, expert preventive maintenance and after-market support services to our customers.

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## **Features**

**Fast Response and Continuous Operation**

**Wobbe Index or Calorific Value**

**Easy Maintenance And Calibration**

**High Reliability**

**Modbus RS-485 Network Communications**

**Continuous 4-20 mADC Output**

**Auto-Cal Feature Using Microprocessor Option**

**Flame Safety Automatic Interlock**

**Available In General And Explosion-Proof Versions**

**Specific Gravity Measurement Option**

**Proven Over 20 Years Online Experience**

## **Applications**

Refinery And Petrochemical Fuel Gas Monitoring

Steel Making (Coke Oven And Blast Furnace)

Furnace And Boiler Control

Flare Gas Monitoring For EPA Compliance

LPG/Air Blending

Land Fill Gas Monitoring

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