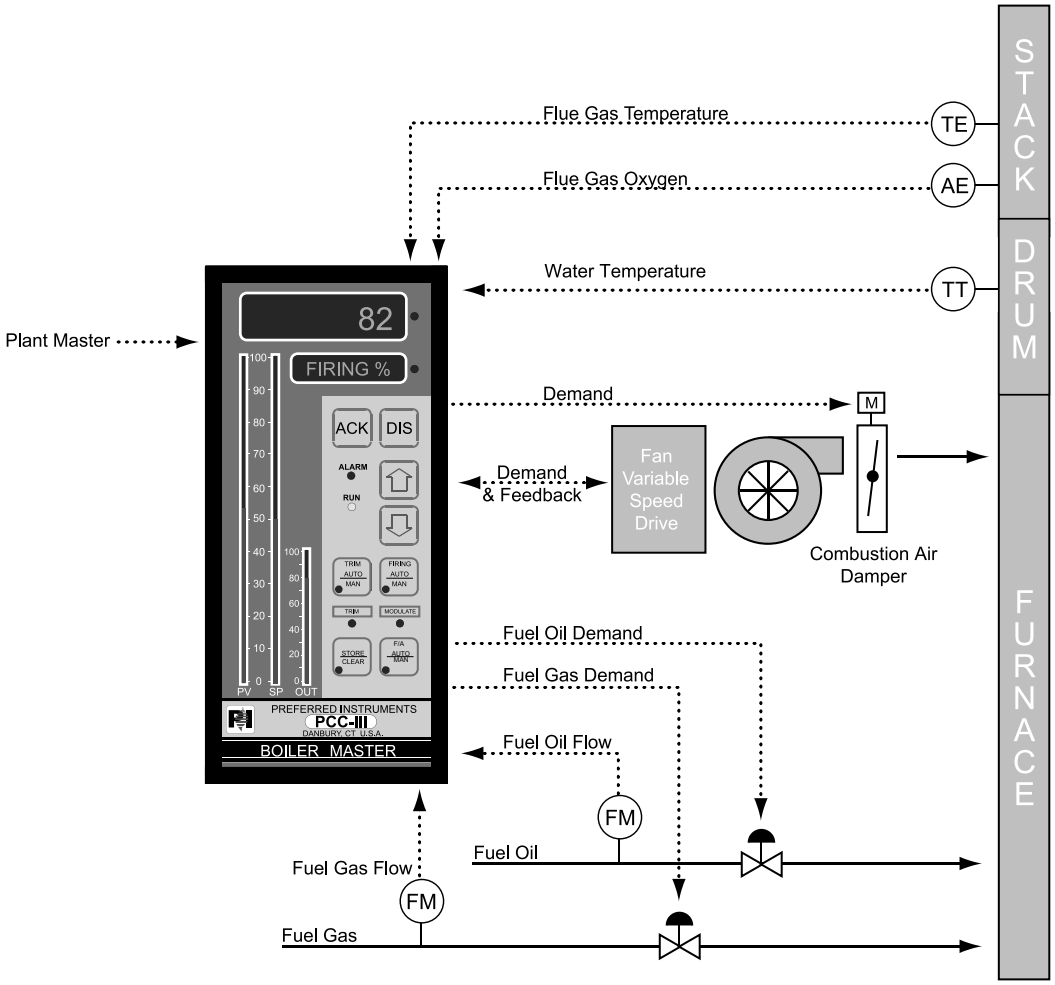
BURNERMATE MODEL BM-HWFMC

Hot Water Boiler Fully Metered Combustion Control



BurnerMate BM-HWFMC Combustion Control System

Application

The BurnerMate **Model BM-HWFMC** provides automatic firing rate control for new or existing hot water boilers using fully metered combustion control. Both the fuel flow and the air flow are accurately measured. Measured temperature or pressure is used to generate a setpoint for fuel flow and air flow. The fuel flow setpoint is compared against actual fuel flow to control the fuel metering valves and the actual air flow is compared against the air flow setpoint to control the air control damper. Cross Limiting using measured fuel and combustion air flow is employed for safety and to prevent combustibles or smoke during load changes. Fully Metered control with Oxygen trim minimizes extra excess air.

- Hot Water Temperature Is Maintained using local PID setpoint control. PID control provides efficient, accurate control by eliminating drum pressure "offset" (error). Also responds to Plant Master demand.
- Minimum Fuel Usage – Measured fuel, air flow and flue gas Oxygen is used to continuously adjust (trim) the fuel/air ratio. Oxygen trim saves fuel by fine tuning the burner to operate safely and reliably at reduced excess air levels throughout the burner firing range
- Minimum Fan Power Usage – Fan speed control minimizes damper pressure drop related to fan power usage
- Real Time Boiler Efficiency Display – Allows the boiler operator to instantly identify inefficiencies and potential operational problems
- Safe and Dependable Boiler Control – Flue gas temperature and Oxygen are monitored. Warning alarms and burner safety shutdown interlocks are available

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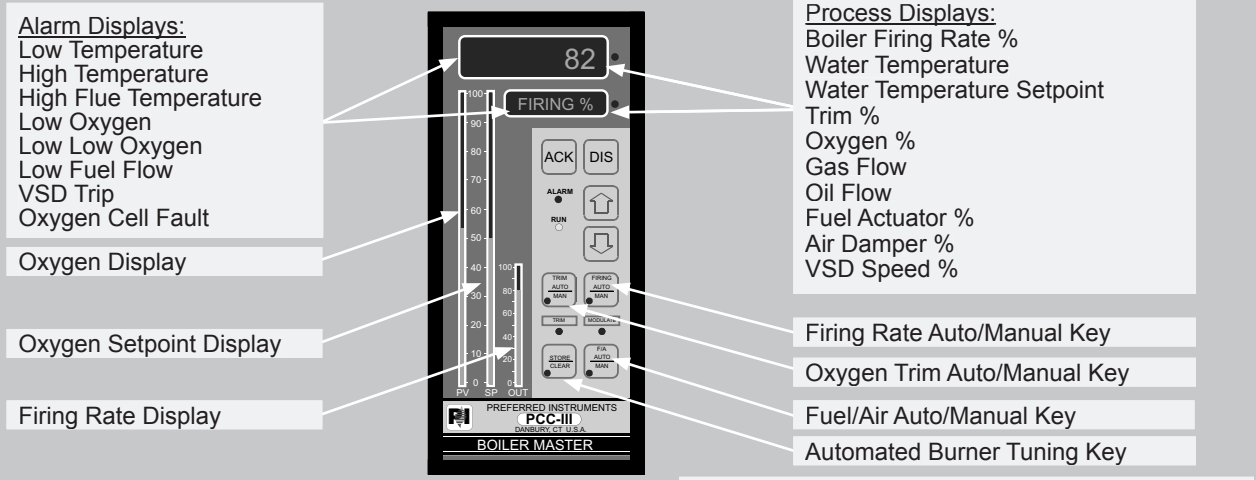

BurnerMate Model BM-HWFMC Front Panel

Specifications

BurnerMate Panel

Controller:	**PCC-III-FZ00** (*see page 190*)
Input Power:	120 Vac (+/- 15%)

Inputs

Water Temperature:	4-20 mAdc
Flue Gas Temperature:	T/C (Option "-ZP")
Flue Gas Oxygen:	**ZP** Probe (Option "-ZP")
Plant Master:	4-20 mAdc*
Fuel Gas Flow:	4-20 mAdc*
Fuel Oil Flow:	4-20 mAdc*
Air Flow:	4-20 mAdc
VSD Speed Feedback:	4-20 mAdc (Option "-VSD")

Outputs

Fuel Oil Valve Actuator:	4-20 mAdc*
Fuel Gas Valve Actuator:	4-20 mAdc*
Air Damper Actuator:	4-20 mAdc
VSD Speed Demand:	4-20 mAdc (Option "-VSD")

*These features are standard, but their use is selectable at time of start-up.

Ordering Information

Description	Catalog Number
Hot Water Boiler Control	**BM-HWFMC**

Additional Ordering Information and Suggested Specifications

1. See page 198 for **Model ZP** In-Situ Oxygen Sensor
2. See page 211 for Variable Speed Drive (VSD)
3. See page 205 for actuator
4. Consult factory for low fire fuel change over and VSD bypass

Order Sensors Separately (Optional)	Catalog Number
Hot Water Temperature Transmitter, 4-20 mAdc, 0 to 500° F, NEMA 4, Smart with 4½" depth	**Consult Factory**
Thermowell, SS, 4½" x ½ NPT	**Consult Factory**
Oil Flow, Oval Gear type, 4-20 mAdc, NEMA 4	**Consult Factory**
Gas Flow, Thermal Insertion Mass Flow, 4-20 mAdc, NEMA 4	**Consult Factory**
Air Flow, Differential Pressure Transmitter, 4-20 mAdc, NEMA 4, Smart with 3 valve manifold	**Consult Factory**

BURNERMATE MODEL BM-HWFMC
Suggested Specifications

1. Application
The control system shall be designed to minimize consumption of both electricity and fuel within the limits of stable burner operation. The system shall use a flow meter cross-limited full metering combustion control logic scheme with Oxygen trim and variable speed combustion air fan control to maintain water temperature at the selected value. Positioning systems that depend on actuator feedback pots for cross limiting are not acceptable. The control system shall be microprocessor-based and suitable for wall or windbox mounting. All the logic required to ensure that pre-purge, post-purge, light-off, and burner modulate cycles are automated shall be provided.

2. Combustion Control
The fuel flow control loop shall be cross-limited with the air flow control loop so that fuel demand cannot be increased until an air flow increase is proven by the air flow measurement loop and air demand cannot be decreased until a fuel flow decrease is proven by the fuel flow measurement loop. Additionally, fuel demand cannot be increased beyond a certain amount above the measured air flow and air demand cannot be decreased beyond a certain amount below the measured fuel flow. Fuel/air ratio shall be established and adjusted by the use of a "soft" function curve relating fuel flow setpoint to air flow setpoint. Oxygen trim shall be accomplished by varying the fuel/air ratio and shall include separate characterizable Oxygen setpoint curves for both oil and gas fuels based on firing rate. Fuel valve and air damper shall be modulated in response to an external Plant Master demand signal or measured steam pressure compared to setpoint. Provision shall be made to automatically switch the control mode from metering to positioning control of the air control damper whenever the firing rate of the unit is below the turndown range of the air flow transmitter. This control system shall require the burner to be shut down to change fuels. At a minimum, the control system shall display the following: Boiler Firing Rate, Hot Water Temperature, Hot Water Temperature Setpoint, Gas Flow, Oil Flow, Flue Gas Oxygen, Fuel Valve Position, Air Damper Position and VSD Speed. The control system shall include a dedicated, normally energized, fail safe relay output contact in the "running" interlock circuit of the flame safeguard that will cause a fired equipment shutdown in the event of: low Oxygen, low fuel flow, high flue gas temperature, VSD fault, or controller fault.

3. Boiler Efficiency Calculation
Real time boiler efficiency shall be calculated. The calculation shall be based on the ASME "by losses" method and must utilize real time inputs of boiler firing rate, flue gas Oxygen, flue gas temperature and fuel selected. Two sets of adjustable fuel chemistry data parameters shall be included, and firing rate scaled radiation losses shall be used for maximum accuracy. NOTE: Flue gas temperature transmitters must be provided and installed at each boiler outlet.

4. Boiler Controllers
To assure system integrity, a pre-wired and factory-tested, microprocessor-based, multiple loop controller system shall be provided. The controller shall include process variable and "first - out" annunciator displays with 16 character English language descriptions, two 50 segment bargraphs to display the controlled variable and setpoint, one 20 segment bargraph to display the loop output, 120 Vac discrete inputs and outputs, and 4-20 mAdc analog inputs and outputs. Configuration and calibration data shall be stored on redundant non-volatile EEPROM memory modules. The backup memory module shall automatically download into the primary memory in the event of primary memory data corruption. All control logic, tuning, and fuel/air ratio curves shall be field configurable. If required to allow field modifications to the controller logic, provide one configuration tool or laptop computer per facility.

5. Flue Gas Oxygen Analyzer
Provide a boiler breeching mounted in-situ, zirconium oxide Oxygen analyzer for each boiler. Extractive or "Wet Cell" type Oxygen analyzers are not acceptable. The probe shall be of a suitable length for sensing the Oxygen level in the middle ⅓ of the breeching. All wetted parts shall be stainless steel. The Oxygen analyzer shall include a digital controller that performs continuous self-diagnostics with diagnostic codes for at least 10 common faults. The system shall automatically send the trim actuator to the 'null' position and trigger the alarm dry contacts in the event of an Oxygen analyzer fault. The detector shall be field replaceable without removing the probe from the stack and shall not require special tools. The analyzer shall automatically perform periodic detector cell impedance tests to be used by the operator as an indication of calibration shift. Analyzer calibration shall be pushbutton semi-automatic (no trim pots), with English language prompts and diagnostic messages. Analyzer output shall be field selectable as 0-10% or 0-21% without field recalibration.

6. Communication
Each controller shall be equipped with an optically isolated RS485 modbus communications data highway and shall allow: Auto/Manual mode change, setpoint change, variation of the manual output, sensing and silencing of alarms, change of any configuration parameter (including PID tuning constants), change of timers, etc. Provide all equipment capabilities specified in this paragraph, even if a connecting SCADA system is not included in this project.

7. Quality Assurance
The system shall be factory manufactured and tested according to UL508A requirements (CSA C22.2 #14 for use in Canada). The control system shall be a Preferred Instruments, Danbury, CT, **BurnerMate Model BM-HWFMC-ZP-VSD**.