

- Combustion control in a single unit
- Air or fuel primary
- Air or oxygen or both as oxidants
- Milliamp or t/c process input
- Flexible ratio controls
- Furnace pressure PID loop
- Plain English configuration menu
- Diagnostics messages



INTRODUCTION

In industrial processes, a precise mix of fuel and air for combustion is required for maximum efficiency, low emissions, and low operating costs. The North American **MARC IIIE** Combustion Controller is designed to effectively regulate these variables in industrial furnaces, kilns, dryers, boilers, etc. To assure optimum operating conditions, it can react to status inputs from and send signals to the process.

OVERVIEW

The 8199 provides process and ratio control of industrial combustion applications in a single easy-to-use unit. Here is how it accomplishes the key benefits.

- Maximum efficiency comes from optimum ratio setting, permitting reduced excess air, and the use of flue gas oxygen measurement as a ratio trim to adjust for fuel or other process variations.
- Maintaining precise ratio is important in minimizing NO_x and CO effluents. Tight flow control in proper ratio and/or the use of oxygen instead of air contribute to reduced emissions to meet the strictest of environmental regulations.
- Proper operation is assured by messages and actions if the unit discovers an internal fault, discrete inputs to change the operating state, and discrete outputs that can act as process permissives.
- Low operating costs come from the above goals being met, all within one attractively priced instrument. Its built-in diagnostics effect quick return to service and its uncomplicated keypad and clear message display simplify its use.

The functions include:

1. Control of a temperature, pressure or other process variable with proportional-integral-derivative (PID) control software.

2. Oxygen or air as the oxidant
3. Two fuel flows and two air/O₂ flows.
4. Ratio control with either air/O₂ or fuel as primary flow signal.
5. Furnace pressure PID control.
6. Oxygen trim on the ratio.

Digital event outputs from the unit can notify the operator of thresholds in operating conditions or trigger changes in the process, such as opening a second fuel valve when the process reaches a certain temperature.

Discrete inputs read by the controller change its operating state to match furnace conditions (purge, low fire, or hold, etc.). The unit and inputs associated with the process are alarmed. An alarm triggers a display of abnormal condition and defaults the unit to an operating mode to assure process safety: hold, shut down, etc.

PROCESS CONTROL

The MARC® IIIE main process control loop accepts a 4-20 mA input signal or thermocouple and executes PID control. The unit has predefined menu entries to serve J, K, N, R, and S type t/c's, and treat the system as a temperature control with display in degrees F or C. It can alternately read a milliamp signal and treat the loop as a pressure control with display in psig or kPa. Finally, the 4-20 mA input can be treated as a generic signal with any range up to 0-4000.

If the application only calls for ratio control of flows, the input signal can be set up as a milliamp demand input. In this case the demand signal acts as setpoint for the primary flow, bypassing the process variable PID.

AIR OR OXYGEN

Air or oxygen can be used as oxidant. The MARC® IIIE receives two oxidant flow inputs. Proper application can enable the user to have 1 or 2 air flows, 1 or 2 oxygen flows, or one of each. The 8199 drives one valve for the proper fluid for over all control of the process.

RATIO

The ratio function is very flexible. Air/oxygen or fuel can be set as primary. The ratio calculation is based on the sum of the fuel flows and the sum of the oxidant flows. For example, gas as one flow and oil as the second can be accommodated as can air as one oxidant and oxygen as a second. Oxidant and fuel flows can be manually adjusted if the need arises.

When heat demand changes are called for, lead/lag prevents either fuel or air/O₂ from excursions that could cause an extreme lean or rich condition. This is especially valuable during upsets.

With an analyzer available to measure the flue gas oxygen content, the unit can provide PID trim control of the ratio based on the feedback from the stack. This loop displays input and output and can be operated in manual when necessary.

FURNACE PRESSURE

The MARC IIIE also provides furnace pressure PID control. This loop is complete with all the services needed to perform this function:

milliamp input from an EPIC® II transmitter or other sensor, current loop output, display of operating parameters, alarming of abnormal pressure excursions, and manual/auto access.

LOGIC INPUTS

Several logic inputs cause the 8199 to assume different operating states. Those states are purge, hold, excess air, low fire, and custom light off.

- Purge commands the air control valve to go wide open (disabled for oxygen service) and fuel to close.
- Hold locks air/O₂ and fuel valves in current positions.
- Excess air drives the air valve wide open regardless of the position of the fuel valve.
- Low fire drive both air/O₂ and fuel valves to minimum while maintaining ratio.
- Custom light off drives both valves to predefined positions that are ideal for proper ignition of the burner.

Refer to the specifications for input signal ratings.

EVENT OUTPUTS

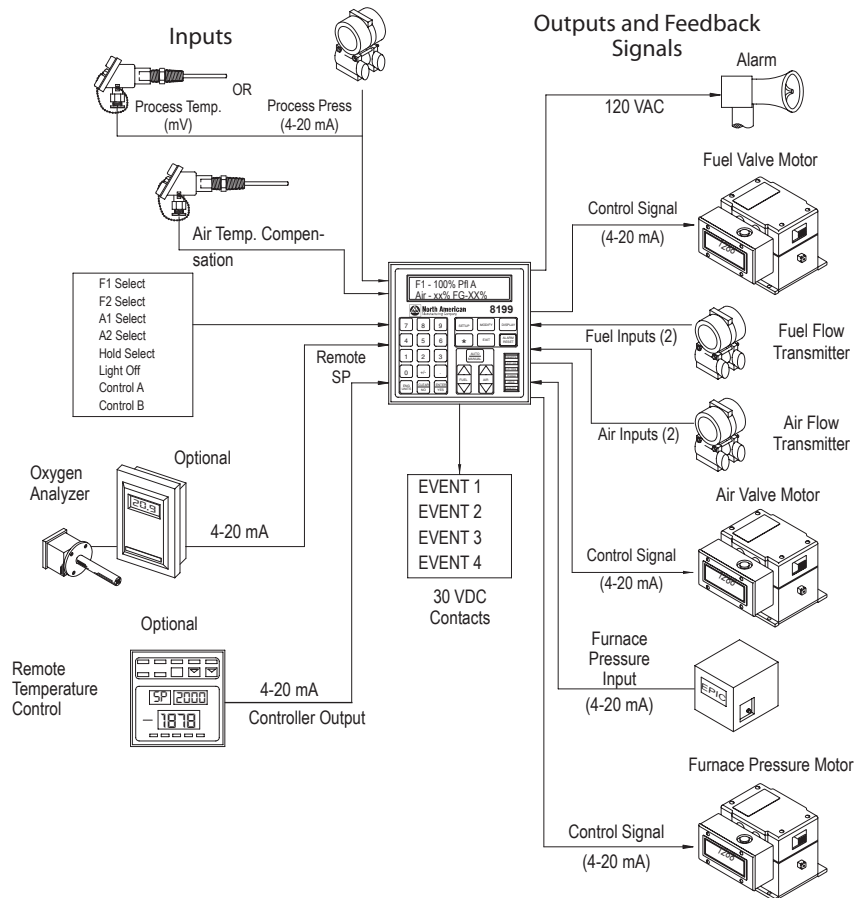
Planned events can be set up to trigger external actions. Each of 4 events closes a contact when ratio or a process input rises above or drops below a given setting.

ALARM OUTPUTS

The 8199 provides contact output signals to report off-normal process conditions, external or internal. Externally generated alarms occur when process inputs become unreliable because of improper signals (open t/c or milliamp reading out of range). The 8199 also provides a ratio and a furnace pressure alarm.

The MARC IIIE is rich in diagnostic capability. It constantly checks its own health with a watchdog timer and checksums, and tests for other possible errors in the device electronics. Under such conditions, the unit reports the type error and/or trips the fault alarm relay and indicator light.

TYPICAL 8199 SYSTEM



SPECIFICATIONS

Operating temperature: 0 to 130 F (–17 to 55 C)

Power source: 120 V ac (102-132 V ac) 0.25 amp 50-60 Hz

Dimensions:

Behind panel: 5¹/₄" × 5¹/₄" × 9" (133 × 133 × 229 mm)

Front panel: 6⁷/₁₆" × 6⁷/₁₆" × 1" (164 × 164 × 25 mm)

Panel cutout: 5⁷/₁₆" × 5⁷/₁₆" (138 × 138 mm)

ANALOG INPUTS

Process control inputs: Thermocouple or milliamp input: One galvanically isolated direct thermocouple or milliamp signal. Type J, K, N, R, and S thermocouple with cold junction compensation or linear 4-20 mA input. Accuracy: 0.2% of range ± one digit typical and temperature drift.

Air temp. compensation input: One galvanically isolated direct thermocouple input, type J, K, N, R, and S thermocouple with cold junction compensation. Accuracy: 0.2% of range ± one digit typical and temperature drift.

Other milliamp inputs: Accuracy: 0.2% of range ± one digit typical and temperature drift.

Fuel inputs: Two 4-20 mA fuel inputs from orifice pressure transmitter or mass flow transmitters. Built-in software converts from differential pressure to flow (selectable).

Air/O₂ inputs: Two 4-20 mA inputs from orifice pressure transmitter or mass flow transmitters. Built-in software converts from differential pressure to flow (selectable).

Remote setpoint: One 4-20 mA input. Selectable for control of temperature or air/fuel ratio.

Furnace pressure: One 4-20 mA input.

Oxygen sensor: One 4-20 mA input.

Demand input: Received at the process control input terminals (4-20 mA).

ANALOG OUTPUTS

Fuel, Air/O₂, and furnace pressure motor drives: One drive each, 4-20 mA each, 500 ohm maximum load impedance.

DIGITAL INPUTS

Eight circuits accepting isolated contacts powered from the 8199 for fuel and air selection, purge, hold, custom light-off, low fire, and excess air.

DIGITAL OUTPUTS

System and warning alarm: One electro-mechanical relay, form C contact; 120 V ac, 1 A max.

Event outputs: Four electro-mechanical relays, form A (NO), contact rating 30 V dc max., 250 mA max.

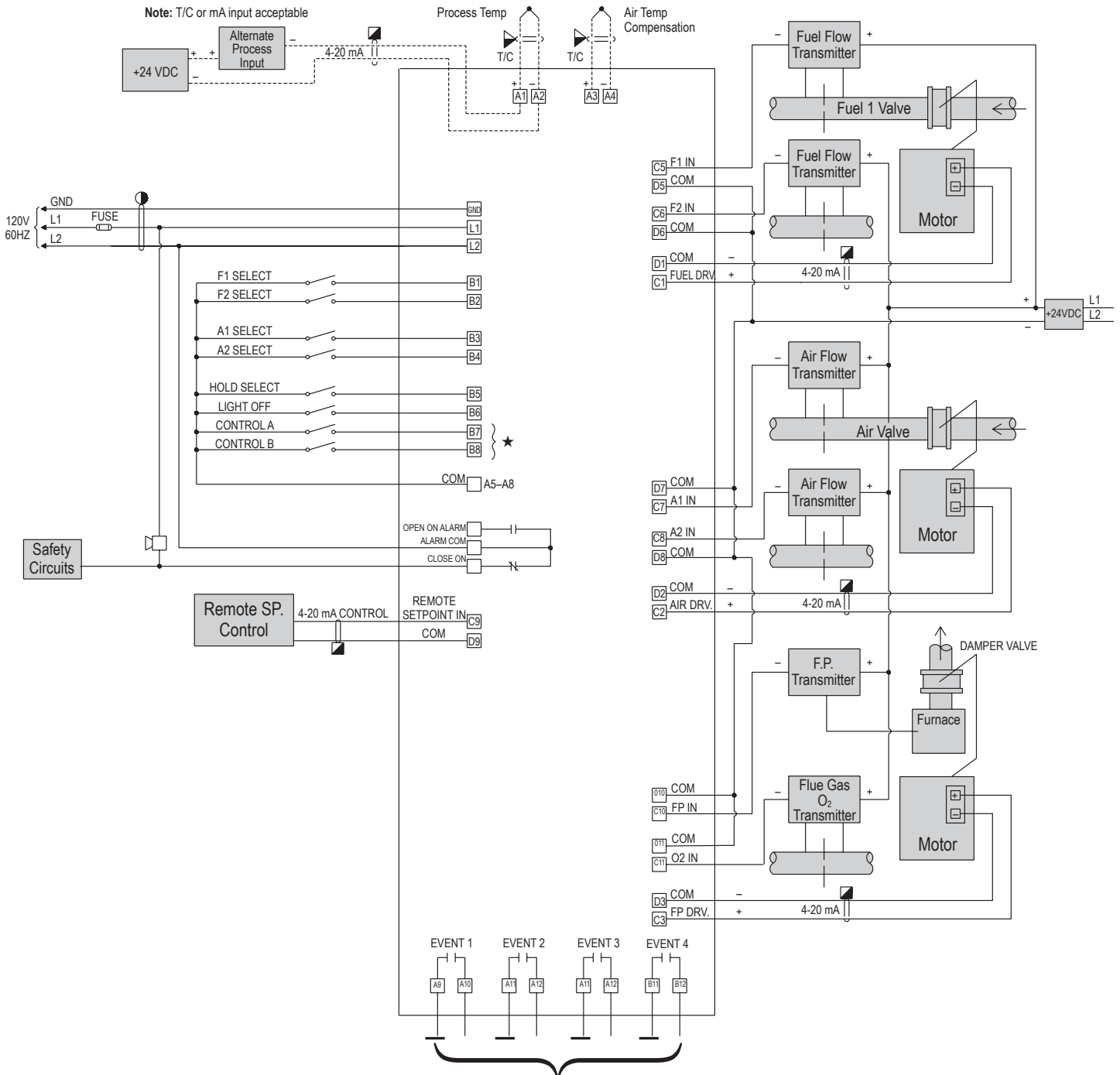
FRONT PANEL

Keyboard: Tactile feedback.

Indicator lights: Fault, Alarm, Hold, Low Fire, Light-Off, and Remote Setpoint.

Display: 2 × 20-character vacuum fluorescent.

WIRING DIAGRAM



Notes:

- Run in separate conduit
- ▲ Run T/C leads direct in separate conduit
- ▣ Run in shielded cable

★ **Truth Table A**

Control (B7)	Control (B8)	State
OFF	OFF	Normal
ON	OFF	Low Fire
OFF	ON	Purge
ON	ON	Excess Air

Fives North American Combustion, Inc.

4455 EAST 71st STREET, CLEVELAND, OH 44105 USA

Tel: 216.271.6000 Fax: 216.641.7852

email: fna.sales@fivesgroup.com • www.fivesgroup.com/fivesna