APPLICATION DATA

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PAC 353™ COMBUSTION MANAGEMENT SOLUTIONS FULL-METERED, CROSS-LIMITED CONTROL

BENEFITS

◊ Compensates for fuel and combustion air flow variations
◊ Provides active safety constraints to prevent hazardous conditions

INTRODUCTION

This paper is one in a series that discusses Moore Products Co.'s Combustion Management Solutions. This installment discusses Metered, Cross-Limited Control.

BACKGROUND

The primary function of combustion control is to deliver air and fuel to the burner at a rate that satisfies the firing rate demand and results in a mixture (air/fuel ratio) that provides safe, efficient combustion. Insufficient air flow wastes fuel due to incomplete combustion and the overly rich mixture can be ignited explosively by hot spots in the furnace. Too much air flow wastes fuel by carrying excess heat up the stack. Combustion controls are designed to achieve the optimum air/fuel ratio while guarding against the hazard caused by insufficient air flow.

The metered, cross-limited control scheme is sometimes referred to as the standard control arrangement. The firing rate demand signal acts as a setpoint for both the fuel flow and air flow controller. For metered, cross-limiting control, the fuel and combustion air flows are used to improve control of the air to fuel ratio.

MEASUREMENT

In a metered control system, three measurements are used to balance the fuel/air mixture. These are the steam header pressure, the fuel flow and the air flow.

Steam Header Pressure
Steam header pressure can be measured using a gauge pressure transmitter.

Fuel Flow
The fuel flow can be measured using one of two instruments depending on whether fuel gas or fuel oil is being used. In either case, it is important that the meter used have a high enough turndown capability to provide accurate measurement under any boiler load condition.

Fuel Gas
The most common fuel gas is natural gas. This is normally metered using a differential pressure type flow meter and primary element such as an orifice plate. Select an instrument with high turndown capability. Additional features such as an integral square root extractor are also useful.

Fuel Oil

Typically used is #2 or #6 fuel oil, which can be heated to lower the viscosity. There will often be various other combustible liquids mixed into #6 fuel oil. The meter selected must have an unobstructed flow path to handle the high viscosity fluid. In addition, the meter must be able to withstand high temperature.

Air Flow

The air flow measurement can be made using a differential pressure flow meter consisting of a transmitter and primary element.

Generally the air flow into the furnace will be at a very low velocity and, therefore, create a very low differential pressure across most primary elements. In addition, quite often only a small permanent head loss will be tolerable.

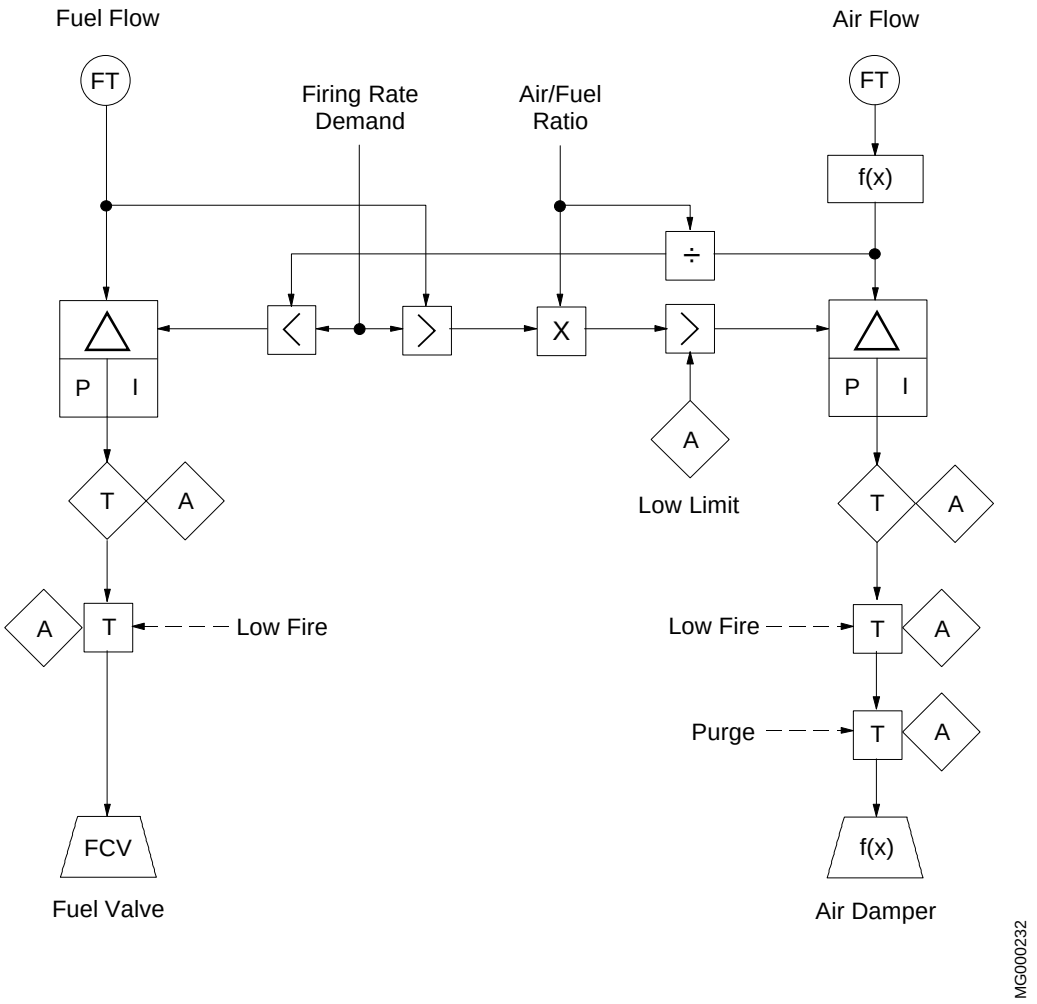
CONTROL

As shown in the figure on page 3, the combustion controls consist of fuel flow and air flow control loops that are driven by the firing rate demand signal. The characterizer on the air flow measurement scales the air flow signal relative to the fuel flow signal to provide the optimum air/fuel ratio. The characterizer points are determined empirically by testing the boiler at various loads and adjusting the fuel relative to the air at each test load as needed to achieve optimum combustion. This allows the air and fuel flow setpoints to be driven by the same firing rate demand signal.

The following table lists typical instruments for a metered, cross-limited control system. This list is a guide. Consult your Moore representative for more information.

Instrumentation List

ITEM	MODEL
Steam Header Pressure	340GGBHAAB5N113
Fuel Gas Flow Fuel Oil Flow	340DDBHAAB5N113 140AxxS3W1F1
Air Flow	340DBBSAAB5N113
Controller	353A2FNNNNNNNA4



Metered, Cross-Limited Combustion Control

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