

[Back to Mechanical Services.](#)

## AUTOFLAME Combustion Management System



### Micro Modulation Exhaust Gas Analysis Maximum Energy Efficiency

#### Energy Saving from the MM/EGA System

#### M.M. SYSTEM (Micro Modulation)

To ensure maximum efficiency in the operation of any boiler, two requirements are of paramount importance, the first being that the air to fuel ration is kept to the minimum to ensure complete combustion within the limitations of the combustion head design and that these settings once arrived at are infinitely repeatable to an incredibly high degree of accuracy. The second requirement should be that the target temperature or pressure of the boiler is monitored by the combustion system and that at all times exactly the right amount of fuel and air is fired to achieve the target value and that at no time irrespective of load change is this target exceeded or fallen short of. The inherent hysteresis of all mechanical systems

that have traditionally involved cams and linkages to characterize the fuel air ration have made this sort of accuracy impossible. The accuracy of response of fuel input to the monitored target temperature/-pressure of the boiler has meant that the target value set by the operator has at most times been exceeded or fallen short of.

Autoflame Engineering have developed a system that overcomes all of these problems by utilizing the latest micro processor technology.

The Micro Modulation system provides an easily programmable and flexible means of optimising combustion quality throughout the load requirement range of the boiler/burner unit whilst ensuring that temperature is accurate to within 3 deg. F. and pressure to within 1.5 p.s.i. The maximum error in degrees angular rotation between the four servo motors at any position in the load range 0.1 degrees.

At the heart of the system is the control module which contains the micro computer and power supply. The display panel features touch sensitive key pad data entry and LED readouts and status indicators. The M.M. System displays the positioning data from 4 to a maximum of 8 individually controlled channels. The status function will display "required" and "actual" setpoint, burner firing rate % and the selected fuel. It is also possible to calibrate the M.M. to display instantaneous and totalised fuel flow measurements.

The position of each channel is monitored by a voltage dividing system enabling digitalized position information to be encoded into the control modules memory. The relative positioning of the channels are constantly checked by the system at the rate of 50 times per second.

The control philosophy, software and the individual components of the total system have been tested and approved by U.L. - T.U.V. - GASTEC - B.S.I. and C.E. This commitment in gaining the highest level of technical approval from internationally recognized test houses, guarantees the highest levels of safety and the complete confidence of the end user.

This new system of burner control achieves 'Locked On' near stoichiometric air fuel mixing throughout the fuel input range of the boiler while maintaining exact temperature or pressure target values. The load control incorporates full user variable P.I.D. control.

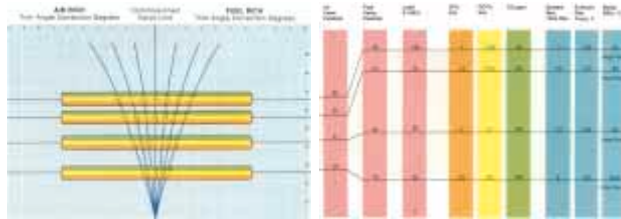
### **E.G.A. SYSTEM** (Exhaust Gas Analysis)

With the E.G.A. trim system facility it is possible to expand the M.M. so that it will measure and display O<sub>2</sub>, CO<sub>2</sub>, CO, exhaust temperature (NO, SO<sub>2</sub> monitoring only) together with boiler efficiency and at the same time inflict minute corrections on the air damper position to ensure that the originally entered commissioning data is adhered to irrespective of variations in stack pressure, barometric conditions or changes in fuel temperature and quality. Another standard feature on every module is a serial port which can be connected with appropriate interfacing to an energy management system to track and record the information that is generated by the E.G.A. system.

To expand the M.M. system to the above E.G.A. specification the additional sampling unit and exhaust gas sampling probe must be purchased. The M.M./E.G.A. control form is P + I + D and feed forward and interpolates between all entered data, it also carries error checking self diagnostic software for self identification of system component or data handling failure.

## HOW IT WORKS

The trim function is achieved by every paired value of air and fuel having stored values for O<sub>2</sub>, CO<sub>2</sub>, CO. Additional values for each of these gases are stored for "Fuel Rich" and "Air Rich" at a known deviation angle from the commissioned value. This data is processed and expressed as an angular correction value. In this way an exact amount of air damper trim may be inflicted at any time to return the system to its commissioned value at any load condition.



Click on one of these images to enlarge.

[Back to Mechanical Services.](#)

## Combustion Management Systems

## Main Features

- Micro Modulation Fuel/Air Ratio Control
- UV Flame Safeguard
- Burner Safety Control
- Gas Valve and Pressure Proving
- Precise Target Setpoint Control
- Fuel Flow Metering
- 3 Parameter Trim – O<sub>2</sub>, CO<sub>2</sub>, CO
- FGR Management Options
- Time Clock Facility
- Upgradable to operate with water level control module

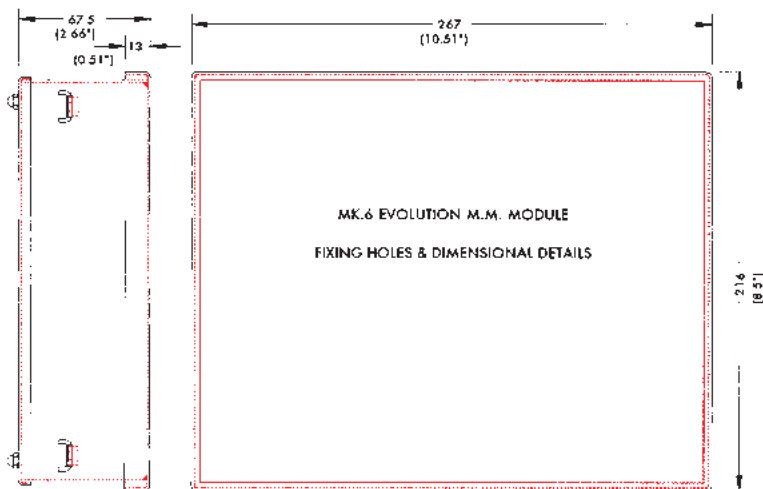
To ensure maximum efficiency in the operation of any boiler, two requirements are of paramount importance.

The first being that the air fuel ratio is kept at the minimum to ensure complete combustion within the limitations of the combustion head design and that these settings once arrived at, are infinitely repeatable to an incredibly high degree of accuracy.

The second requirement should be that the target temperature, or pressure of the boiler, is monitored by the combustion system and that at all times exactly the right amount of fuel and air is fired to achieve the target value.

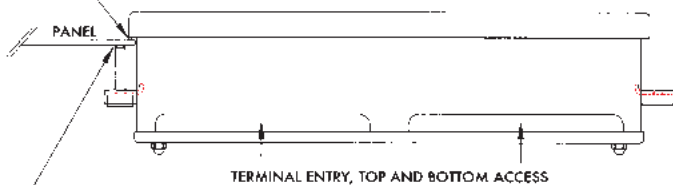
The inherent hysteresis of all mechanical systems that have traditionally involved cams and linkages to characterize the fuel/air ratio have made this sort of accuracy impossible. The accuracy of response of fuel input to the monitored target temperature/pressure of the boiler has meant that the target set by the operator has at most times been exceeded or fallen short of. AutoFlame Engineering was the first in the world to develop a system that overcomes all these problems by utilizing the latest micro processor technology.

The Micro Modulation System provides an easily programmable and flexible means of optimizing combustion quality throughout the load requirement range of the boiler/burner unit while ensuring the temperature is accurate to within 2°F (1°C) and pressure to within 1.5 psi. The positioning accuracy of the direct drive motors controlling the air damper and fuel valve is 0.1° angular at any position in the load range. At the heart of the system is the control module which contains the micro computer and power supply. The front panel of the control module features touch sensitive key pad entry data and a 1/4 VGA graphics display.



— IP65 RUBBER SEAL

CUT OUT REQUIREMENTS:  
HEIGHT=210 (8.27") WIDTH=261 (10.28")  
MINIMUM DEPTH REQUIREMENT=60 (2.36")



M.M. UNIT CLAMPED TO REAR OF ENCLOSURE USING  
4 X M5 SCREWS, THREAD LENGTH 35mm



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## Peripherals:



Positioning Servomotors



Load Detectors



Flame Scanners



Pressure Sensors



Infrared Upload/Download



# Mk6 Evolution M.M. Features & Benefits

## Micro Modulation Fuel/Air Ratio Control

Independently controlled fuel and air positioning motors with an accuracy of 0.1° of an angular degree • 4 separate fuel curves • 4 channels dedicated to Servo motors • 2 channels dedicated to variable speed drives • Selectable trim channel (damper or vsd) • 1/4" VGA display • Error diagnostic codes displayed • Single point change facility for commissioned fuel/air ratio • User definable optimum ignition position • FGR Management, delay from start-up to enable FGR until flue gas temp., boiler setpoint or time delay achieved

## Exhaust Gas Analysis

CO<sub>2</sub>, O<sub>2</sub>, CO trim, NO, SO<sub>2</sub> continuous monitoring and display • User definable combustion limits on all Exhaust gas values • Exhaust, ambient temperature and ΔT displayed • Combustion efficiency calculation - net or gross displayed

## Burner Control Box Functions

Full flame supervision with UV self-check for continuous operation, patented self adaptive UV amplification • Burner Control Functions with user configurable timings • Gas valve proving system with on-line pressure supervision • Oil pressure monitoring and display with limit checks • Air windbox pressure proving - display and supervision • Lockout history of last 16 incidents with date, time, function & reset • Burner Control Functions (Flame safeguard) selectable

## Setpoint control features

Internal 3 term PID control to required setpoint for both pressure and temperature • Software adjustable thermostat/pressure stat. facility • Second setpoint user adjustable • Time clock facility • Outside temperature compensation of boiler setpoint, with night set back facility • Intelligent Boiler Sequencing for both steam & hot water • Intelligent Boiler Sequencing for low pressure steam • Fuel Flow Metering - instantaneous and totalized • Hand/Auto/Low flame hold facilities • 4-20 mA input for external load control • 4-20 mA output of firing rate • Twin burner control capability

## User Features

Password protection, user configurable options and parameters • IR coms port for upload/download of commissioned data and operating history • All systems data exports via gateway (Modbus/Metasys) • Internal calendar clock display and logging functions • Proximity Sensor Screen Saver

## Specifications

120/230V, 50/60 Hz switchable standard operation • IP65/NEMA 4 enclosure with panel facia mounting • Manufactured under ISO9001, Year 2000 compliant • All inputs and outputs fully self checked (continuous operation)

Patents Applied for/Granted:

GB02138610, 1317356, 02169726, 00195866, 09/234,391 PCT/GB97/02010, 9715898.4, 9715899.2, 9715900.8



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