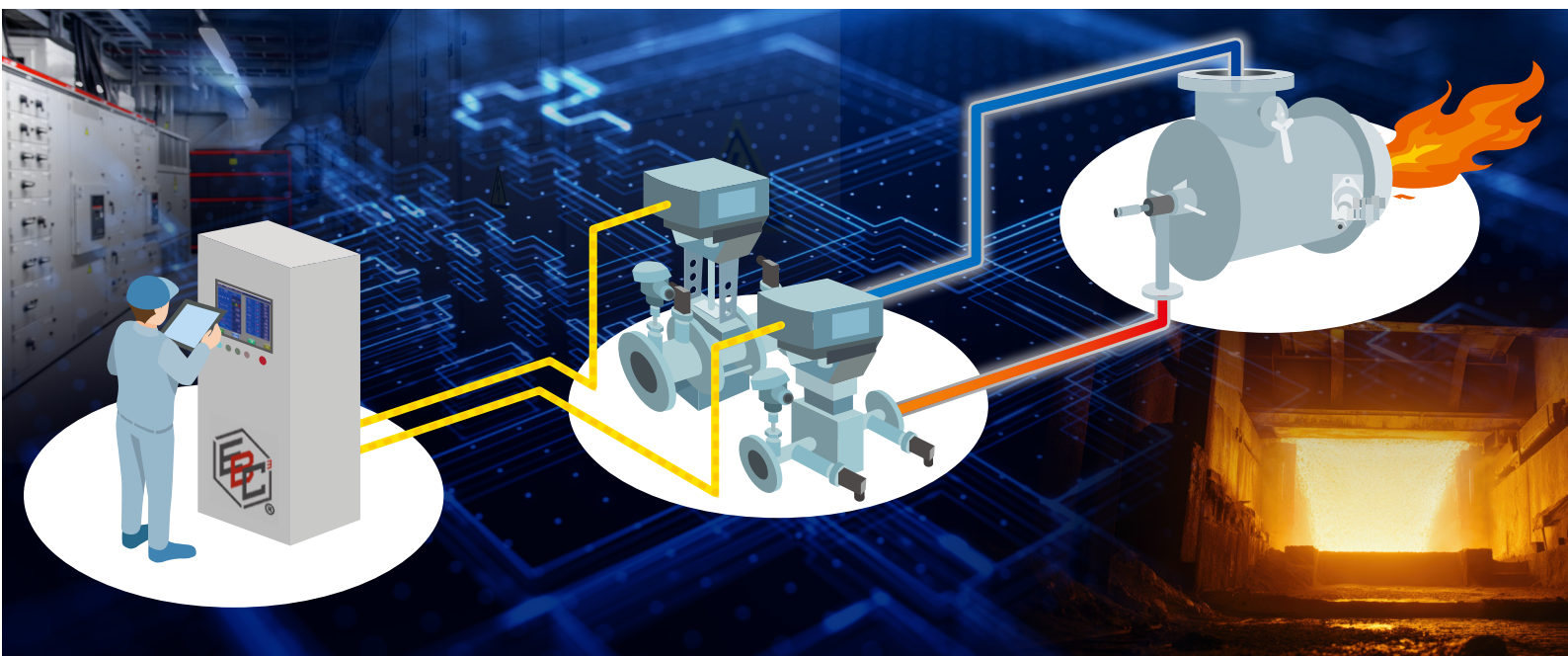




EBC³ EASY & ECO. BURNER CONTROL DEVICE QUICK GUIDE



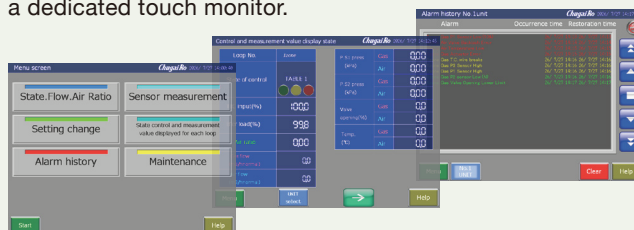
Simple and precise air ratio control

Proprietary Technology

- Proprietary control technology provides excellent responsiveness to load fluctuations.
- Supports oxygen enriched and regenerative burners through flexible system configuration.

Easy Operation

Intuitive information monitoring and setting adjustments via a dedicated touch monitor.



Comparison with Conventional Method

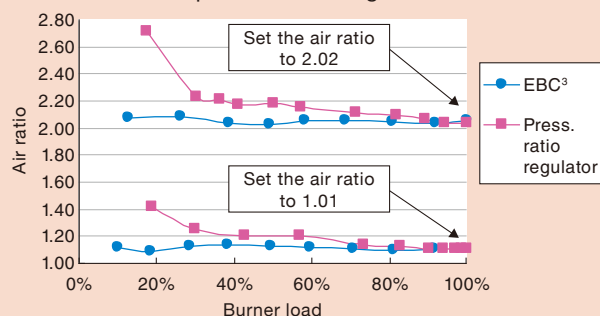
Compared with flow control

High responsiveness

High accuracy

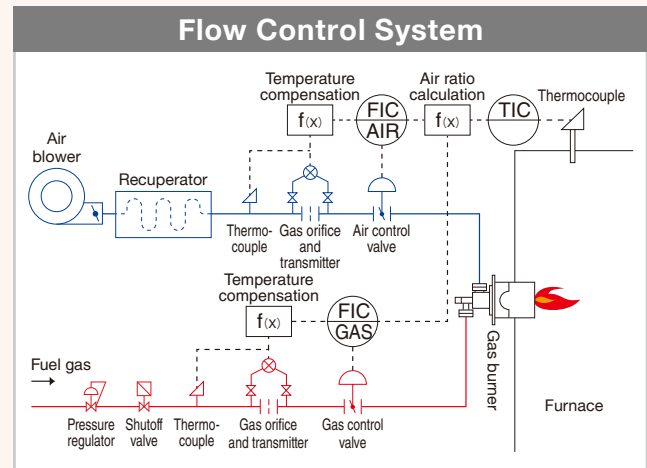
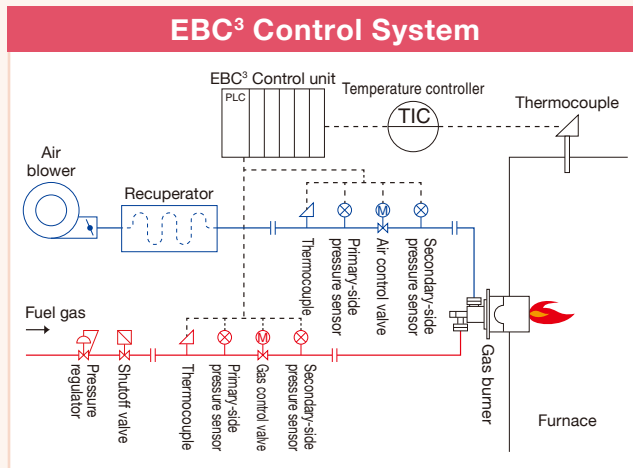
Space saving

EBC³ is easy air ratio control that is difficult to achieve with conventional pressure ratio regulator.



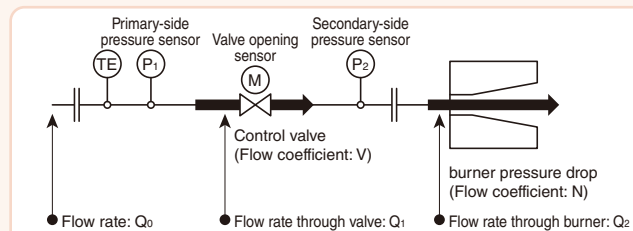
Comparison of air ratio control performance during burner load changes

EBC³ Compared with flow control



Features

- The flow coefficients V and N are continuously used for flow rate calculation based on preset values, providing excellent responsiveness.
- Since the flow rate is calculated using only the primary pressure, the error is smaller compared with calculations based on differential pressure.
- When using preheated air, compensation is performed using the supplied thermocouple.
- Since it uses a feedback control method, the air ratio may become unstable due to response delays.
- Flow measurement during turndown operation has a large error. (The differential pressure across the orifice, which determines the flow rate, becomes very small during turndown operation, causing errors from the pressure sensor to be included.)
- When using preheated air, additional compensation equipment is required.



EBC³ Control Concept (No Third-Side Pressure Sensor)

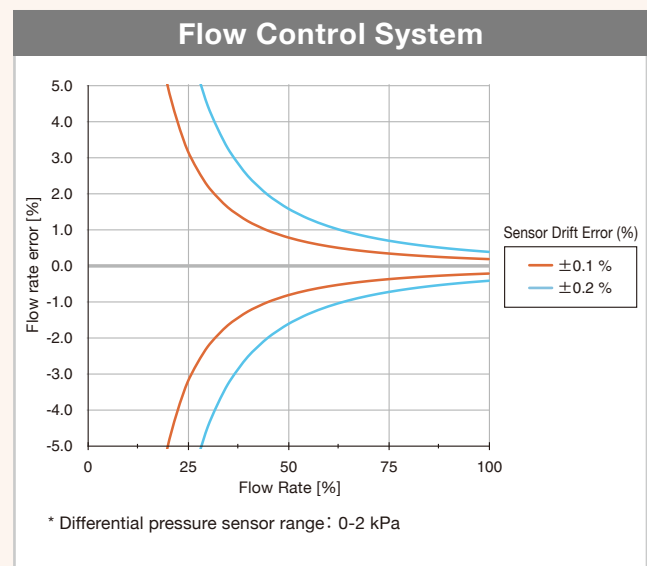
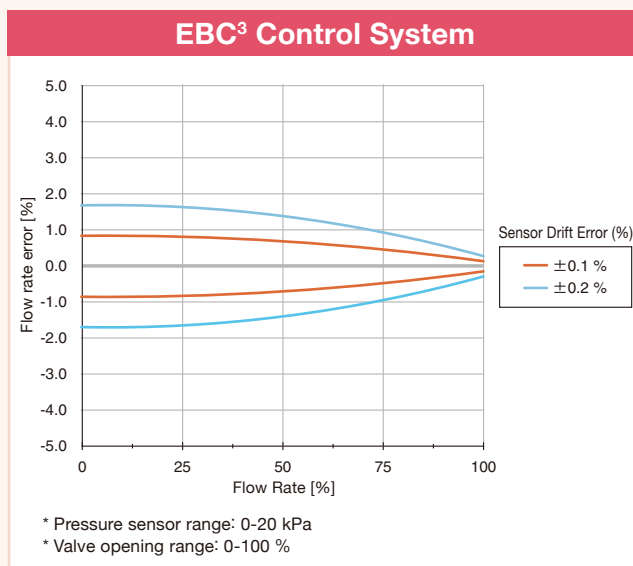
$$\begin{aligned} Q_1 &= V \sqrt{P_1 - P_2} \quad \text{①} \\ Q_2 &= N \sqrt{P_2} \quad \text{②} \\ Q_0 &= Q_1 = Q_2 \quad \text{③} \end{aligned} \quad \Rightarrow \quad Q_0 = \sqrt{\frac{N^2 \times V^2}{N^2 + V^2}} \times \sqrt{P_1}$$

①, ②, ③ Based on the equation

The flow rate is calculated using the burner-specific coefficient N, the control valve opening-specific coefficient V, and the measured value P₁.

Control Error

The graph shows the flow rate error ratio when a drift error (zero-point shift) occurs in the sensors used for flow rate calculation. For EBC³ control, drift errors are assumed for the primary-side pressure sensor and the valve opening sensor, while for conventional flow control, a drift error in the differential pressure sensor is assumed. In flow control, the orifice differential pressure becomes extremely small at low flow rates; therefore, even a slight drift error can significantly increase the flow rate error. In EBC³ control, since the flow rate is calculated using only the primary-side pressure, the impact of drift errors is minimal.

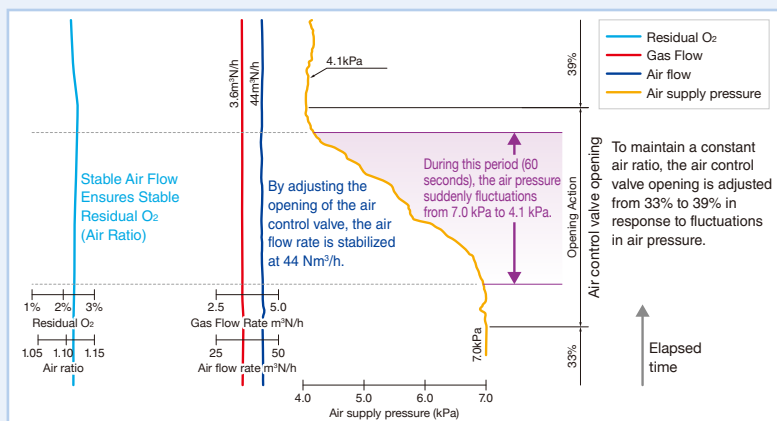


Drift Error: An error in which a zero-point shift (drift) is added to the measured value.
Sensor range × drift error rate = drift amount.

EBC³'s Control Characteristics

High Accuracy Through Flow Rate Prediction Outstanding Responsiveness

The EBC³ calculates the flow rate every 0.5 seconds and controls the system by continuously predicting the flow rate for the next control cycle. Unlike conventional Flow Control systems, its accuracy is not affected by reduced differential pressure across the orifice. In addition, because the EBC³ does not rely on flow-rate feedback, it delivers exceptionally fast response. Even when disturbances such as sudden pressure fluctuations occur, it quickly restores the air ratio to the target setting.

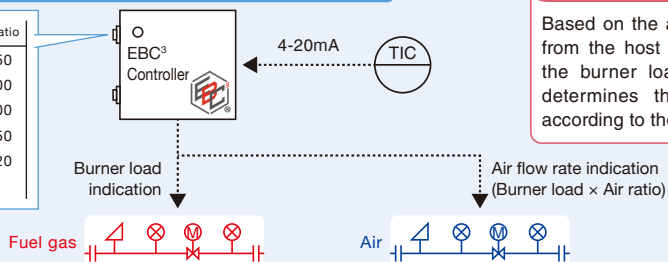


Versatile System Configurations

The EBC³ standard configuration uses "Internal air ratio pattern" mode, which controls combustion based on the air ratio values registered in the controller's internal table. In addition, the A offers other control functions using analog signals from the host system, including "External air ratio setting" mode, which regulates the air ratio based on analog signals, and "Two fluid independently control" mode, which independently controls the gas circuit and air circuit. By adding a third pressure sensor and an orifice, the EBC³ can also be applied to burners such as regenerative burners, where pressure loss varies depending on the operating conditions.

Need to control with a predefined air ratio pattern?

TIC	Burner load	Burner load	Air ratio
0%	10%	10%	3.50
10%	10%	20%	3.00
20%	25%	30%	2.00
30%	40%	40%	1.50
40%	55%	50%	1.20
⋮	⋮	⋮	⋮



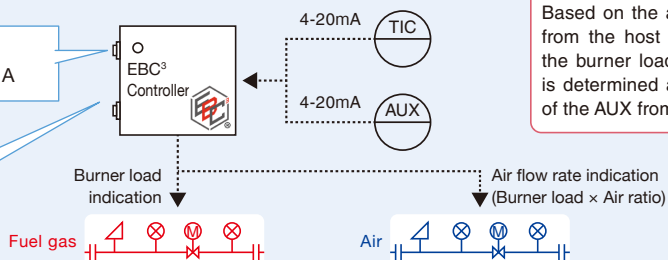
Internal air ratio pattern mode

Based on the analog value of the TIC signal from the host system, the EBC³ determines the burner load internally. The EBC³ then determines the air ratio value internally according to the determined burner load.

Need to set the air ratio from a DCS or host system? Need to perform exhaust gas feedback control?

Air ratio range
1.00-2.00 at 4-20mA

TIC	Burner load
0%	10%
10%	10%
20%	25%
30%	40%
40%	55%
⋮	⋮



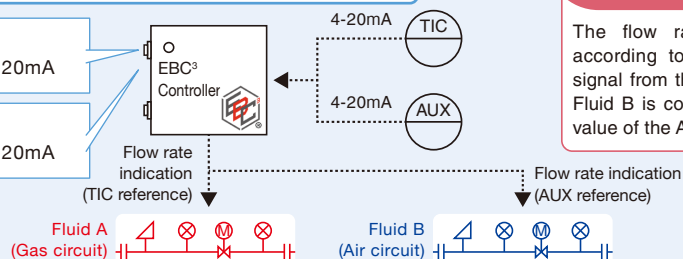
External air ratio setting mode

Based on the analog value of the TIC signal from the host system, the EBC³ determines the burner load internally. The air ratio value is determined according to the analog signal of the AUX from the host system.

Need to independent flow control of secondary air or other fluid without air ratio control?

Fluid A range
0-300m³/h at 4-20mA

Fluid B range
0-500m³/h at 4-20mA



Two fluid independently control mode

The flow rate of Fluid A is controlled according to the analog value of the TIC signal from the host system. The flow rate of Fluid B is controlled according to the analog value of the AUX signal from the host system.

Note: The third pressure sensor can be selected as either used or not used for all mode.

Installation Examples

Forging Furnace

Features

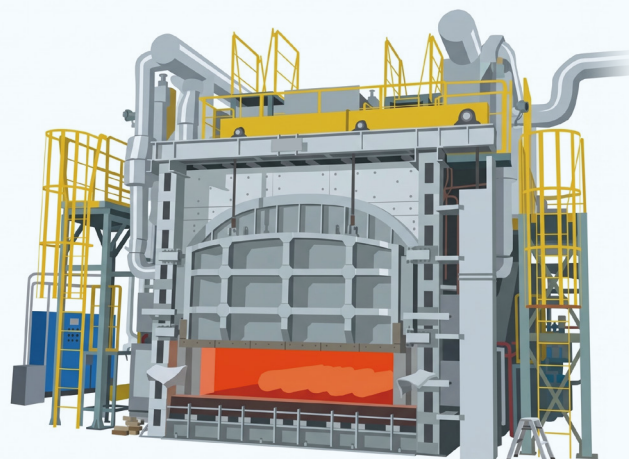
A furnace used to heat billets and preformed parts for hot forging of steel and non-ferrous metals. For steel applications, a uniform temperature distribution is often required at temperatures of 1,150–1,300°C, while aluminum applications typically require approximately 500°C.

Key Points for Furnace Operation

When processing various types of materials in a single furnace, operation at high furnace temperatures with a low air ratio, as well as uniform temperature distribution at lower furnace temperatures, may be required. Since the air ratio needs to be adjusted according to the material being processed, easy and flexible adjustment of the air ratio is essential.

Benefits of Introducing the EBC³

- Achieves control with a turn-down ratio of 1:10 and an air ratio of 5.00. The enhanced mixing effect of excess air combustion enables a uniform temperature distribution at low furnace temperatures without the need for a circulation fan.
- By switching operation tables (setting tables for burner firing rate and air ratio) according to the processed material with a simple switch operation, the EBC³ reduces the burden of furnace operation management while achieving a uniform temperature distribution.



DX Gas Generator

Features

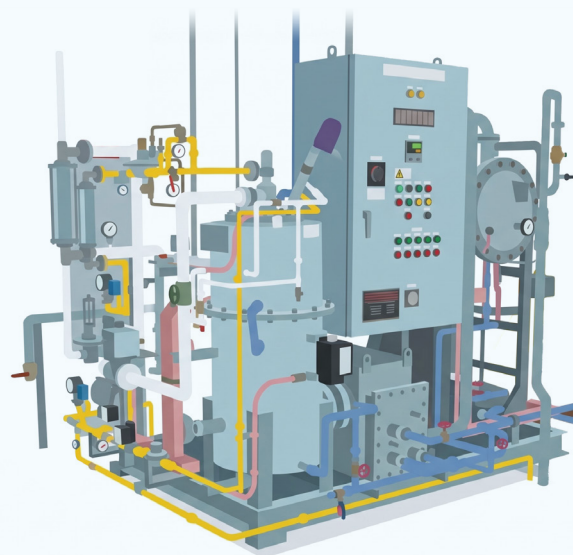
A system that generates DX gas from combustion exhaust gas. DX gas is a type of atmosphere gas used for the heat treatment of various metals.

Key Points for Furnace Operation

The CO concentration in the combustion exhaust gas must remain constant even when the consumption of DX gas changes. Conventionally, the burner firing rate was kept constant to maintain a stable CO concentration, and any excess DX gas was discharged.

Benefits of Introducing the EBC³

- Enables burner firing rate turndown while maintaining the required CO concentration, allowing DX gas production to be adjusted to match demand.
- By applying "External air ratio setting mode", the air ratio can be controlled according to the CO analyzer measurement, enabling stable CO concentration control as well as flexible adjustment of the target CO concentration.



Continuous Annealing Furnace

Features

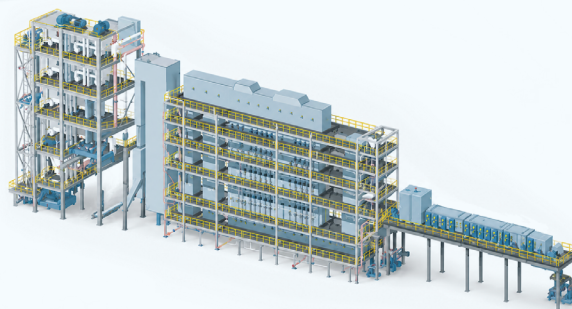
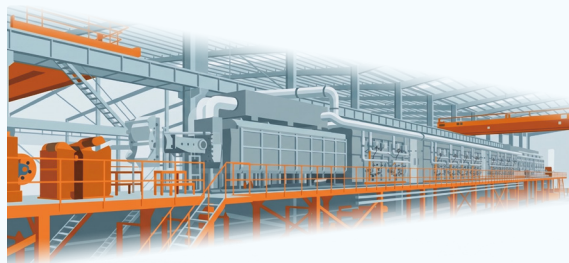
A furnace that continuously heats and cools metal materials while controlling the conveying speed to soften the material and relieve internal stresses. In continuous annealing furnaces, the firing rate of the inlet-side burner tends to vary according to the conveying speed.

Key Points for Furnace Operation

Changes in the material charging cycle, conveying speed, or temperature setpoint cause fluctuations in the firing rate of the inlet-side burner. Stable furnace atmosphere control is essential to ensure uniform oxide scale formation and consistent product quality.

Benefits of Introducing the EBC³

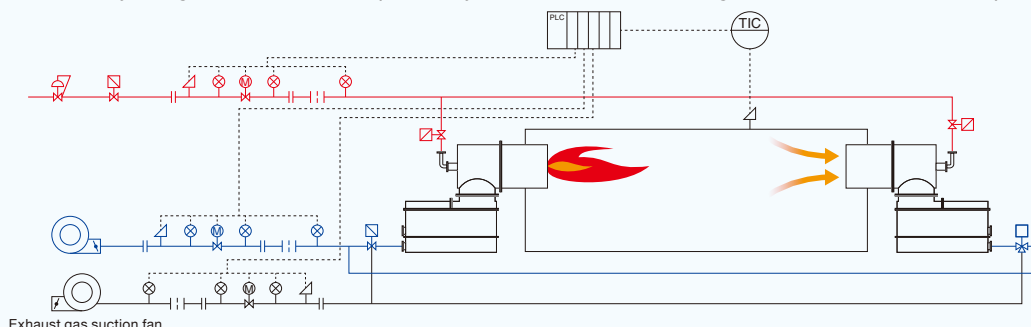
- Stabilizes furnace temperature and atmosphere by controlling the firing rate and air ratio of the inlet-side burner according to the conveying speed and operating conditions.
- By applying "External air ratio setting" mode, the air ratio can be controlled according to the O₂ analyzer measurement, improving product quality consistency and increasing yield.



Application Example

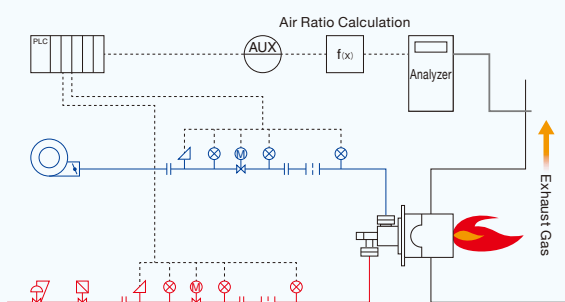
Application to Regenerative Burners

By installing an orifice and a third pressure sensor, the EBC³ can compensate for pressure loss variations in the regenerator. In addition, by using the "Two fluid independently control" mode, exhaust gas flow rate control is also possible.



Atmosphere Control with Exhaust Gas Feedback

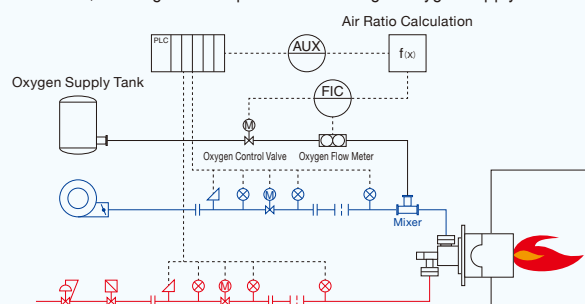
By determining the EBC³ air ratio based on the output of the exhaust gas analyzer, stable exhaust gas composition can be maintained.



Note: The air ratio calculation must be performed externally (e.g., by an host system PLC).

Energy Savings and Higher Flame Temperatures with Oxygen-Enriched Combustion

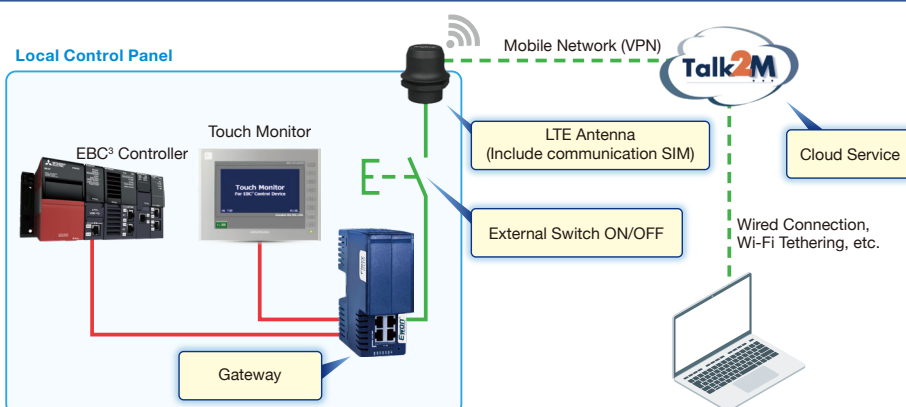
By determining the EBC³ air ratio based on the oxygen enrichment level, air ratio (oxygen ratio), and oxygen flow rate, the EBC³ provides stable oxygen-enriched combustion. The system also supports conventional air combustion, allowing flexible operation according to oxygen supply availability.



Note: The air ratio calculation must be performed externally (e.g., by an host system PLC).

Remote Monitoring (Optional)

By connecting the remote monitoring gateway and related equipment to the EBC³ controller via Ethernet, our technical engineers can remotely monitor the operating status of the EBC³. Even in the event of a malfunction, remote investigation can be performed to quickly identify the cause and support a rapid recovery and restart of the equipment.



サーモテックで未来をひらく



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