

## Auto Combustion System Solution For Wall-Mounted Gas Boilers

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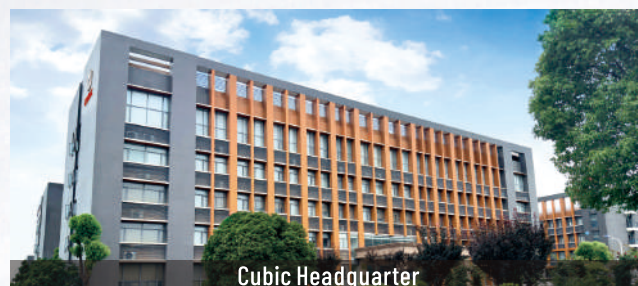
# About Cubic

Cubic Sensor and Instrument Co., Ltd. (hereinafter referred to as "Cubic") is a publicly listed company in SSE STAR Market (stock code:688665), specializing in smart gas sensors and superior gas analyzers. Set up in 2003, situated at "Optics Valley" of Wuhan, China, Cubic has established gas sensing technology platforms including optical technologies (NDIR, Ultraviolet, Light Scattering, Laser Raman), ultrasonic technology, MEMS metal oxide semiconductor (MOX) technology, electrochemical technology, ceramic thick-film technology based high temperature solid electrolyte technology and so on. At present, Cubic has obtained more than 160 patents at home and abroad, with abundant products widely used in various fields of HVAC, industrial safety, automotive electronics, medical & healthcare, smart metering, scientific instruments, low-carbon thermal engineering.

Cubic has established four major R&D and industrialization bases, including Cubic Headquarter, Cubic R&D Center, Cubic Jiashan Facotry, and Cubic Hungary Factory, with a total area of nearly 100,000 square meters. Cubic has a provincial-level enterprise technology center and a gas analysis instrumentation engineering technology research center in Hubei Province of China. At the same time, Cubic energetically participates in the national technological innovation system and has successively obtained many national and provincial projects which support Cubic incessant innovations. Those projects contain the National Major Scientific Instrument and Equipment Development Project, the Ministry of Industry and Information Technology Internet of Things Development Special Project, the Ministry of Industry and Information Technology Strong Foundation Engineering Sensor "One-stop" Project, the Ministry of Science and Technology Science and Technology Boost the Economy 2020 Key Special Project, and the Hubei Province Technical Innovation Major Project, etc. Cubic has been regarded as a major gas sensor manufacturer and representative enterprise by industry authorities at home and abroad and won the "Most Influential IoT Sensor Enterprise Award" by the China Internet of Things Industry Alliance.

With decade-long dedications in technical innovations, strict quality control and global business strategies, Cubic, as a leading manufacturer of high-quality gas sensors and sensor solutions, has obtained the recognition of many well-known Fortune 500 companies as well as other domestic and overseas leading companies in different fields. Cubic products have been exported to more than 80 countries and regions, besides, Cubic is moving towards a higher target to be the international brand in the field of gas sensors.

## Cubic At Glance



Cubic Headquarter



Cubic R&D Center

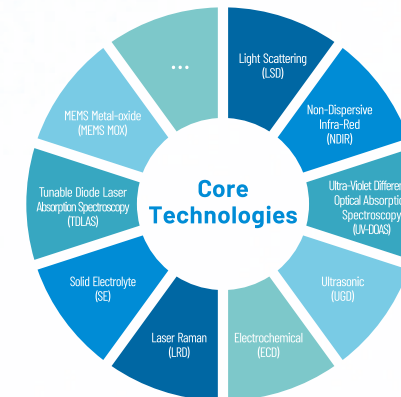


Cubic Jiashan Factory



Cubic Hungary Factory

## Core Technologies



**22 Years**  
NDIR and NDUV Technologies

**17 Years**  
Ultrasonic Technology

**15 Years**  
Laser Raman Technology

**10 Years**  
MEMS MOX Technology

## Research & Development Capabilities



300+ R&D engineers



5000+ m<sup>2</sup> gas sensor reliability testing center



Over 30 technology projects



CNAS certification



CMA certification



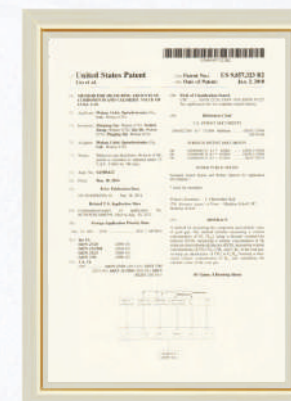
UL60335-2-40 certification



Intertek laboratory certification

## Patents

Total **233** patents obtained





# Self-developed Core Components

## Smart Combustion Control



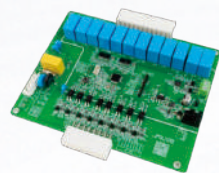
Gas valve



Venturi premixer



Fan



Self-cleaning controller



Wall-mounted gas boiler controller



Wall-mounted gas boiler display screen

## Intelligent Gas Sensing & Monitoring Technology



Gas flow meter



Air flow meter



Gas calorific value sensor



Oxygen (O<sub>2</sub>) sensor



Carbon dioxide (CO<sub>2</sub>) sensor



Carbon monoxide (CO) sensor



Methane (CH<sub>4</sub>) sensor



Nitrogen oxide (NO<sub>x</sub>) sensor

## Clean & Efficient Combustion Technology



Condensing heat exchanger



Premix burner



## Technology Research & Development

Cubic leveraged gas flow and calorific value sensors to systematically integrate and upgrade the combustion system, which consists of premix burners, heat exchangers, fans, gas valves, and sensors. Based on traditional flame ionization current combustion control methods, Cubic has innovatively developed a new technical approach based on air/fuel flow and calorific value sensor feedback regulation, standing at the leading level in the industry.

Cubic has launched the **C200 Series Auto Combustion System** and the **C300 Series Auto Combustion System** for fully premixed wall-mounted gas boilers. These systems can significantly improve the operating efficiency of wall-mounted gas boilers by 3% to 5%, easily meet the NOx pollutant emission level 5 standards, and greatly enhance the system's adaptability to gas pressure, gas composition, environmental wind pressure, and installation conditions.

The newly introduced auto combustion system solution can help extend the maintenance interval of the wall-mounted gas boiler by more than two times. While enhancing the level of intelligence, it significantly improves user experience.



## Quality Management

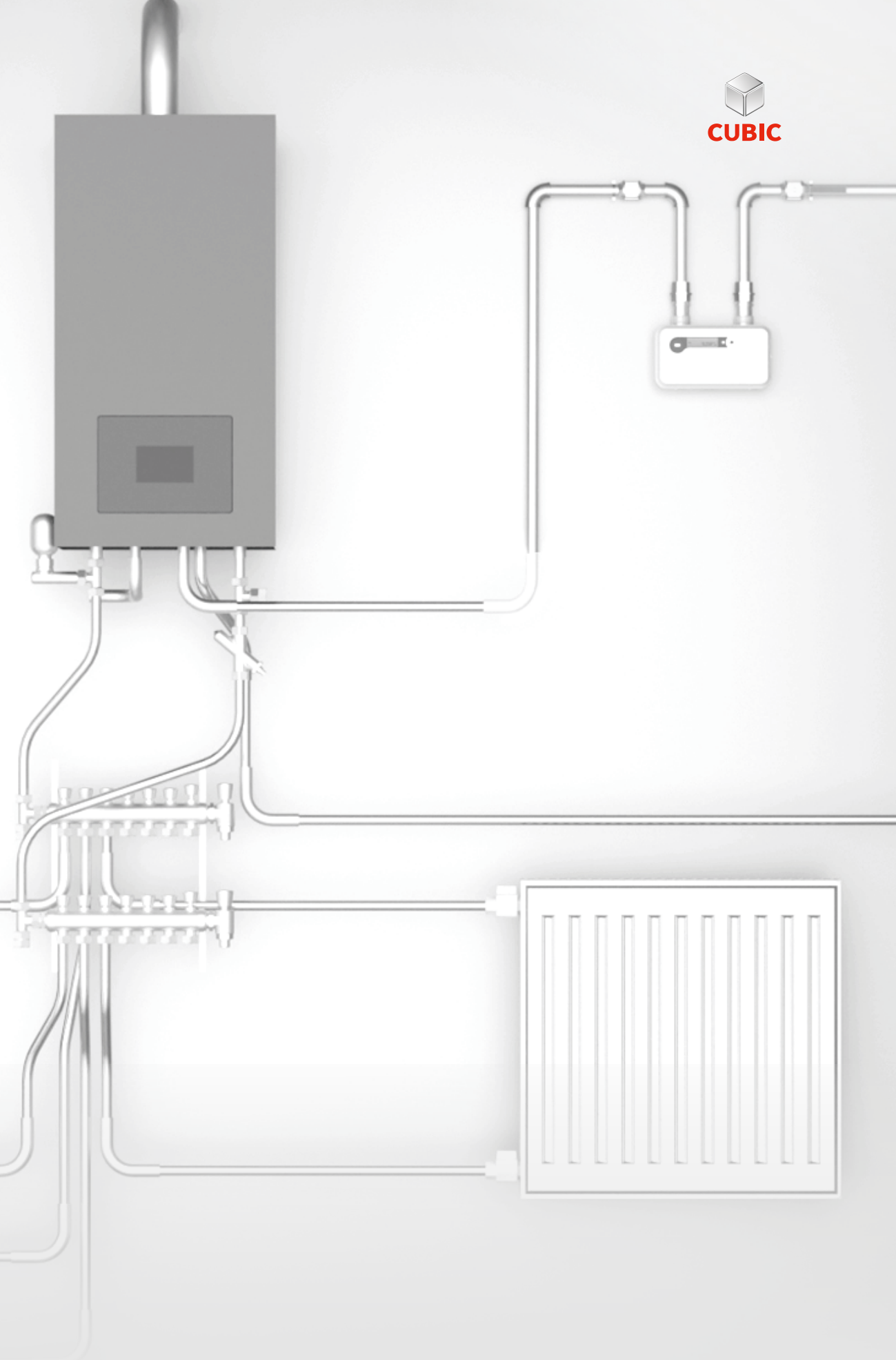
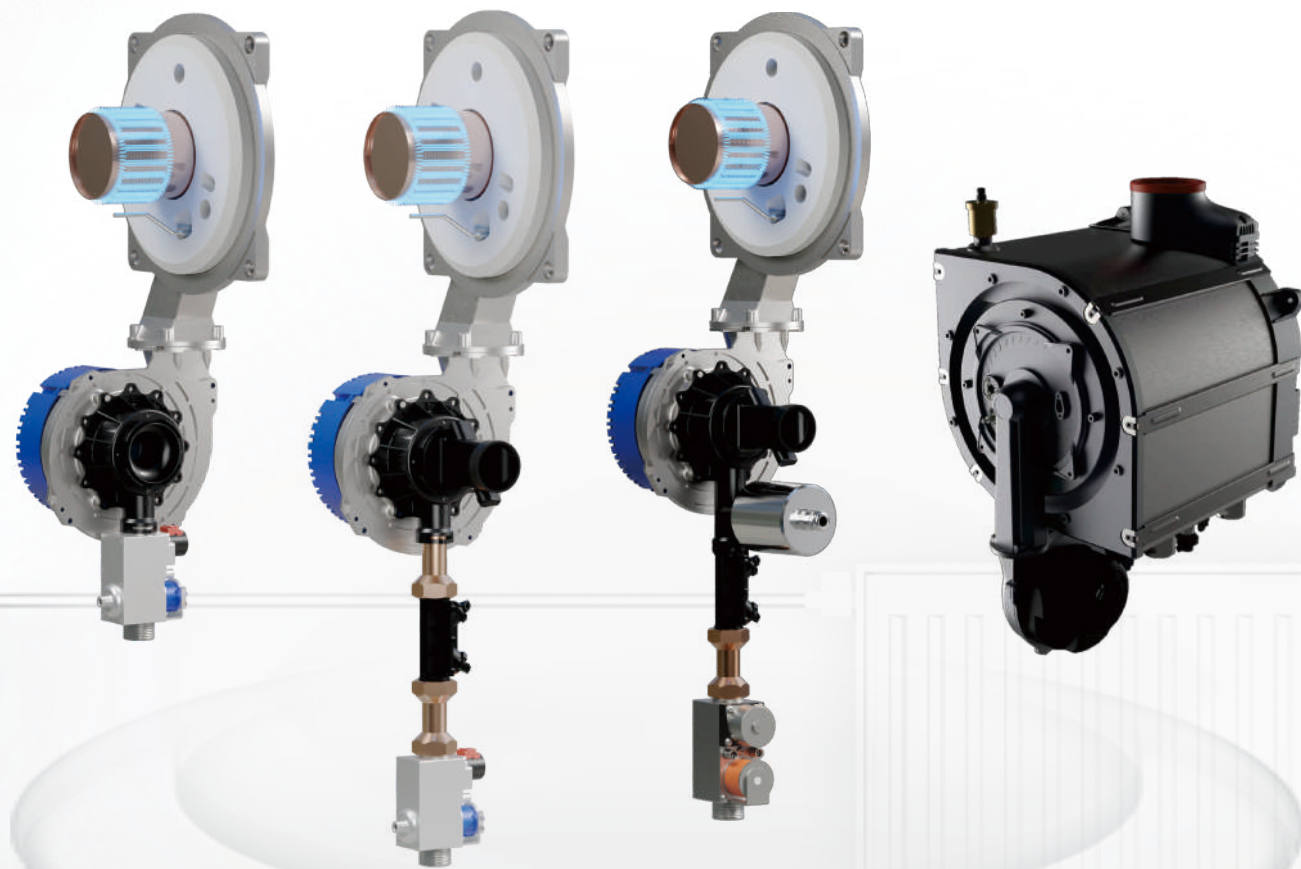


## Enterprise Recognition





## Cubic Auto-combustion System Solutions



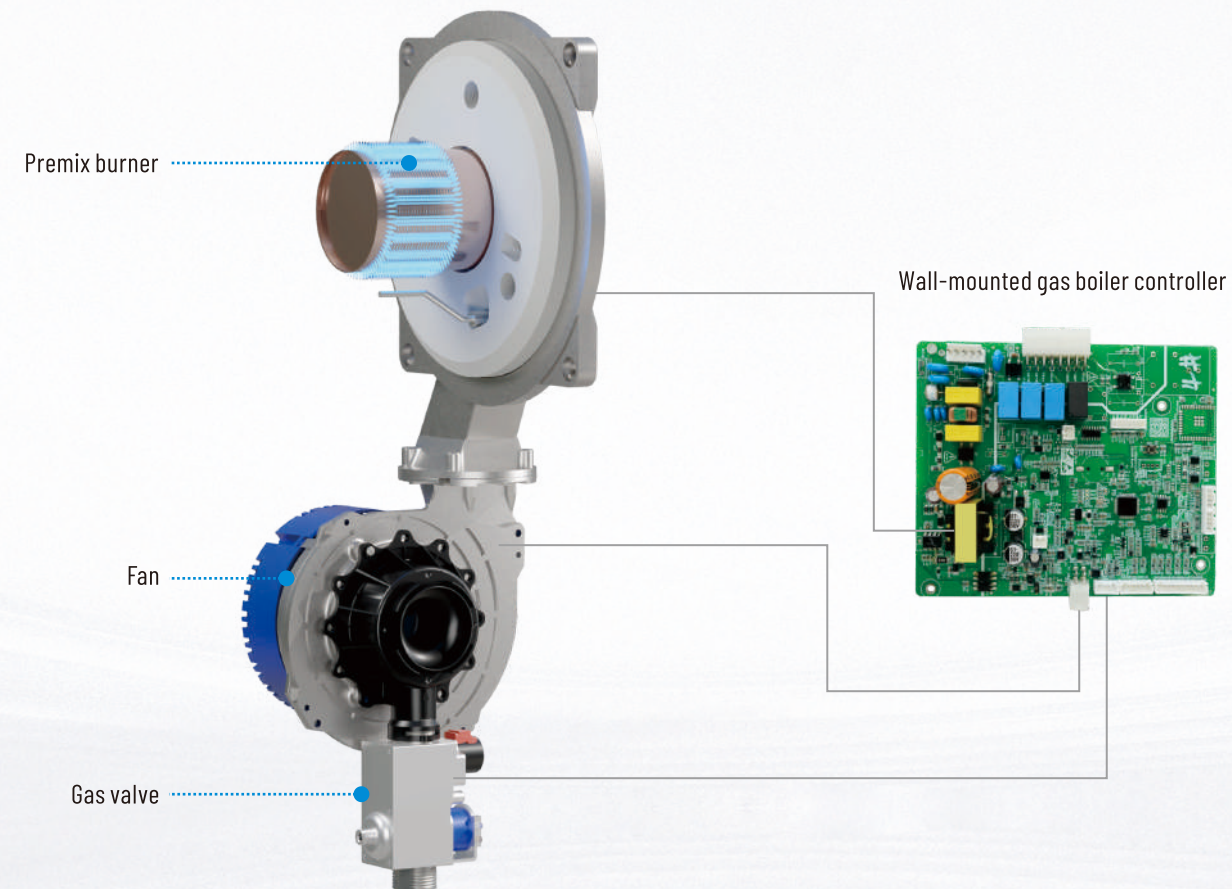
■ C210 ACS   ■ C220 ACS (Plus)   ■ C230 ACS (Ultra)   ■ Commercial ACS



## I C210 Auto-combustion System

For fully premixed condensing wall-mounted gas boilers

Based on high-performance actuators and controllers such as fans, gas valves, and premix burners, with a built-in intelligent combustion control algorithm, Auto-combustion System provides high-efficiency, low-carbon combustion solutions for the wall-mounted gas boiler industry.

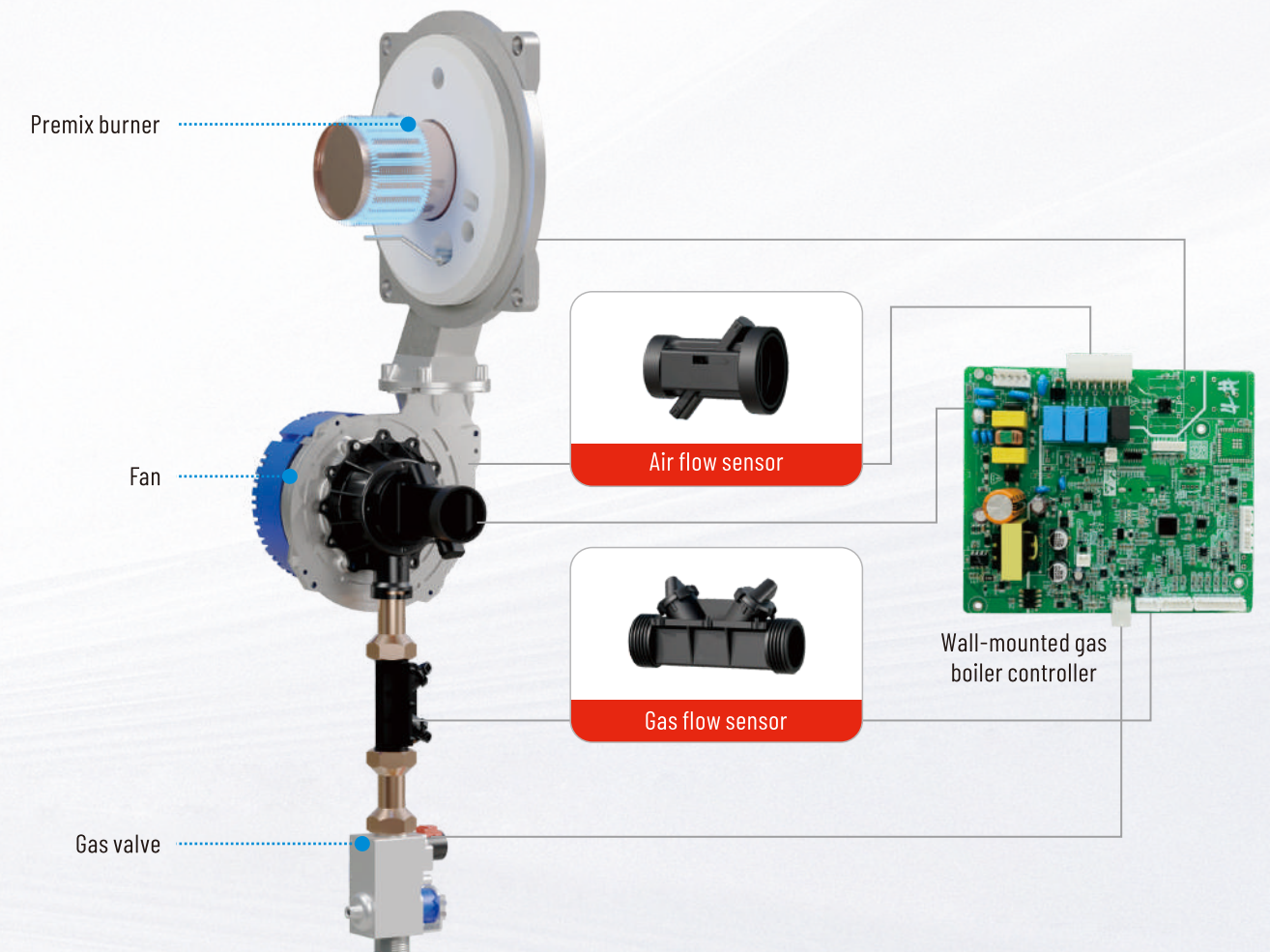


- Combustion modulation ratio over 7:1.
- Built-in high-precision fuzzy PID temperature control algorithm.
- Combined with a condensing heat exchanger, the thermal efficiency can reach up to 108%.
- Flue gas CO concentration and NOx concentration below 30 mg/kWh.

## I C220 Auto-combustion System (Plus)

For fully premixed condensing wall-mounted gas boilers

Based on high-performance actuators, controllers, and high-performance sensors, Auto-combustion System (Plus) provides a smart adaptive combustion solution for the wall-mounted gas boiler industry.

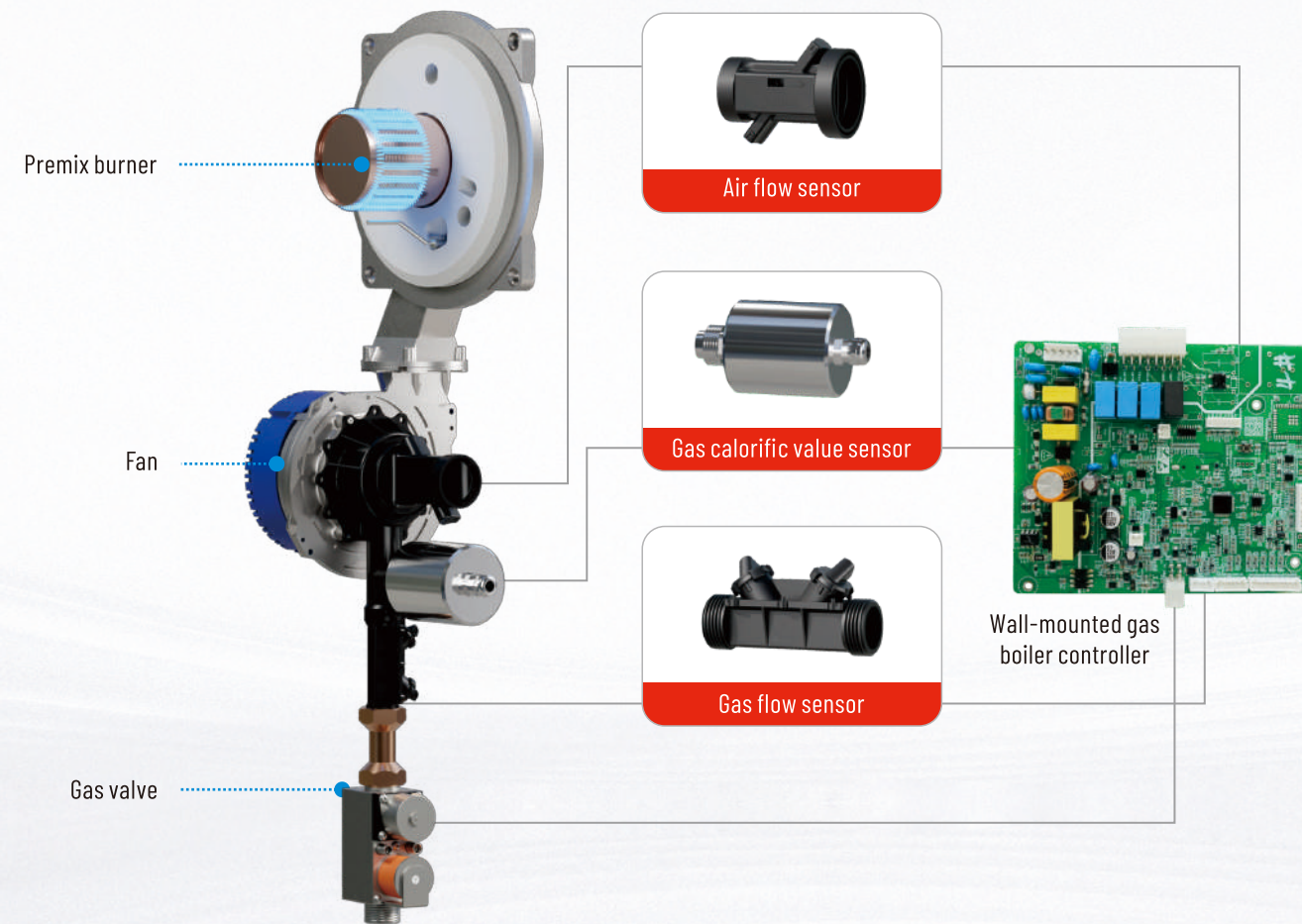


- Real-Time Combustion Monitoring System: Patented sensor components detect operating variables in real-time and automatically adjust in real-time.
- Automatic Adaptation to Various Gas Sources: Capable of perfectly adapting to different types of gas and accommodating gas pressure fluctuations.
- Adaptive to Various Complex Environments: Through sensor components, the system can handle changes in external wind pressure, altitude, flue variations, and other complex environments.
- No Need for Professional Tools or Regular Maintenance: With adaptive technology, gas emissions can be reduced, and the risk of deflagration or CO poisoning is eliminated without the need for professional flue gas analyzers for tuning.
- Commercial-Grade 32-bit Independent Power Main Control Board: Equipped with a commercial-grade intelligent core motherboard, it responds rapidly to instantly deliver optimal combustion conditions and maintain peak performance.
- New Class 1 Energy Efficiency Ratio (GB20665-2015): With energy efficiency up to 109% and a combustion modulation ratio as high as 9:1.



## I C230 Auto-combustion System (Ultra)

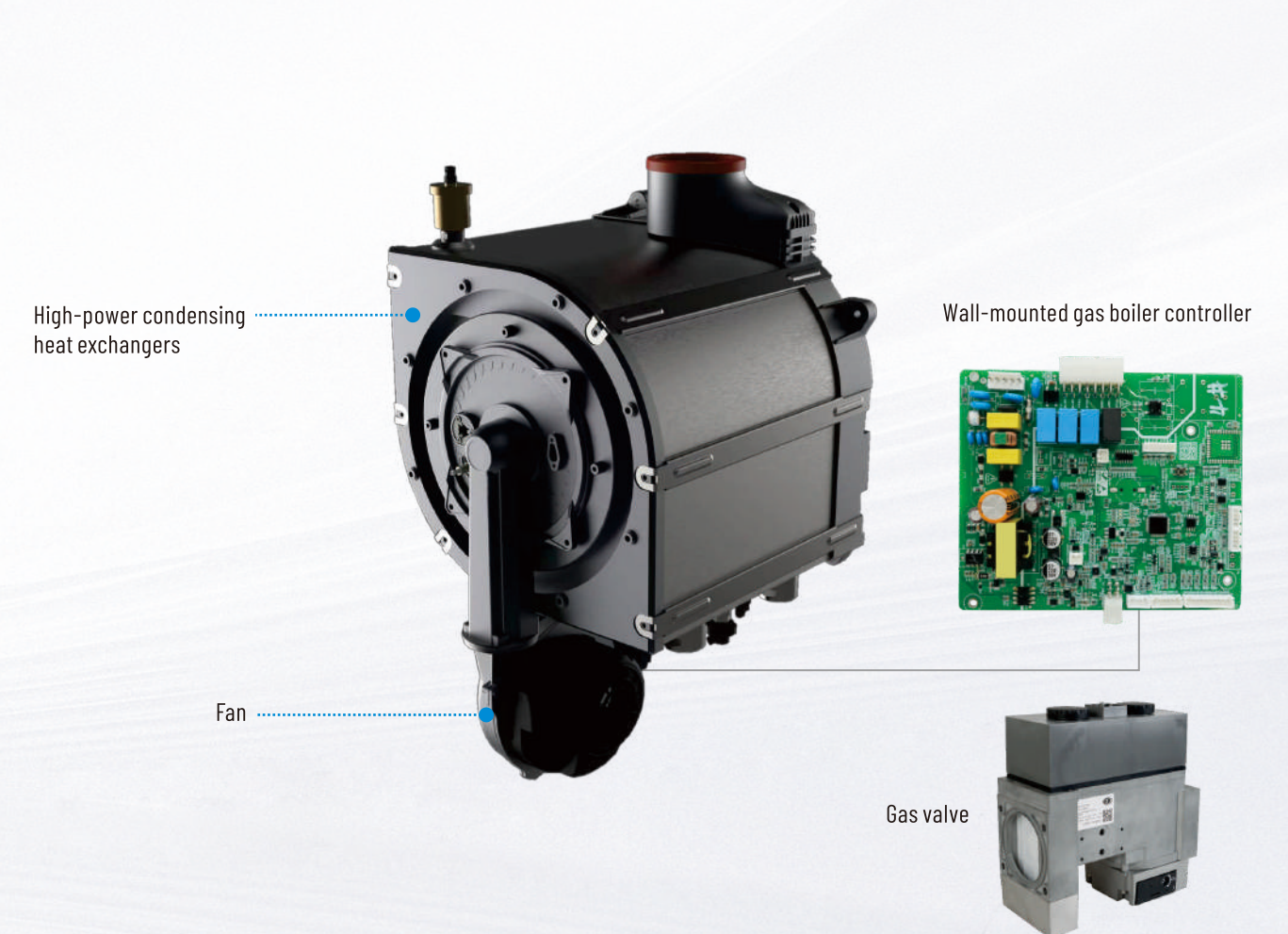
Based on high-performance actuator, controller and sensors (air flow sensor, gas flow sensor and gas calorific value sensor), Auto-Combustion System (Ultra) provides a smart adaptive combustion solution for the wall-mounted gas boiler industry.



- Based on changes in natural gas components, the system is adjusted adaptively to adapt to various gases.
- Automatically match the ignition conditions based on the gas components, effectively eliminating ignition failures caused by seasonal changes in natural gas components.
- No manual operation or modification is required, and hydrogen-blended natural gas (hydrogen blending ratio below 30%) is automatically adapted.
- Real-time detection of thermal efficiency of wall-mounted gas boilers, real-time monitoring of gas consumption
- New first-level energy efficiency, thermal efficiency up to 109%.
- Combustion modulation ratio reaches 9:1.

## I Commercial Auto-combustion System

Based on high-power condensing heat exchanger, high-performance fan, gas valves and burner, it provides high-efficiency and low-carbon solution for the commercial boiler industry (single unit power 65~99kW).



- 304 stainless steel for coil & body, with excellent corrosion resistance and low sensitivity to water quality.
- The burner can be adapted to a hydrogen doping ratio of 0~30%, adaptable for various gases, including natural gas, LPG, hydrogen-doped gas, etc.
- The special flue gas condensation recovery cavity structure can greatly improve the condensation recovery efficiency of water vapor in the flue gas, and the heat exchange efficiency significantly improved.
- A complete set of commercial gas hot water/heating module boilers with a central boiler controller for multiple gas boilers to be freely combined to operate in parallel to achieve clean and efficient heating.
- Equipped with Cubic high-precision flue gas sensors, calorific value analyzer, gas flow sensors, to achieve intelligent control.

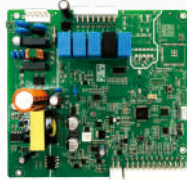


# Smart Combustion Control Solutions

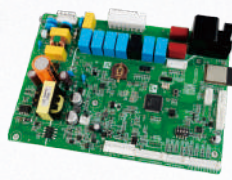
## Wall-mounted Gas Boiler Controller



C100 Series



C200 Series



C300 Series

## Fan



F100

## Venturi Premixer

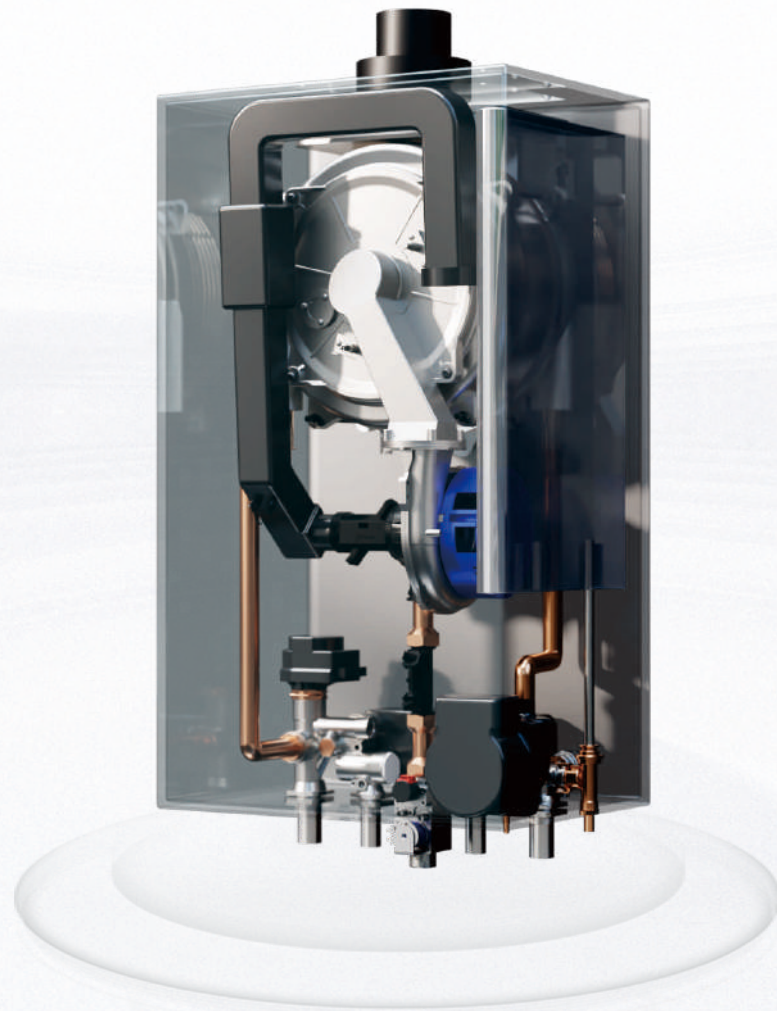


P100

## Gas Valve



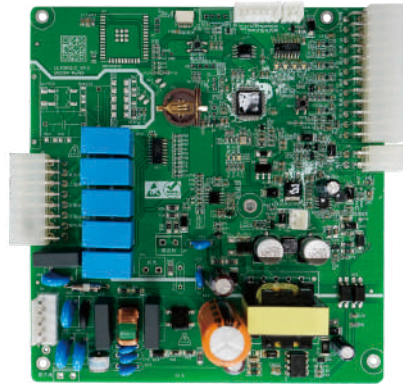
V100



## C100 Series Wall-mounted Gas Boiler Controller

### Features

- Various mainstream pneumatic valves (220VAC) supportive
- Variable frequency fans (220VAC) and variable frequency fans (24VDC/2A) supportive
- PID-regulated quick constant temperature algorithm for hot water, with a temperature control accuracy of  $\pm 2^{\circ}\text{C}$
- Various 220V AC fixed frequency water pumps and AC three-way valves compatible
- Designed with an external igniter, strong anti-interference capability
- Built-in ion flame detection system for real-time feedback on flame presence
- Wide-voltage switching power supply design
- Equipped with overvoltage, overcurrent, and short-circuit protection
- Multiple fault, anti-freeze, and temperature protection mechanisms, with a long lifespan (>10 years)
- Built-in Wi-Fi module, wireless/wired communication (reserved)
- Various industrial serial port LCD displays compatible



### Specifications

Accuracy of Temperature Control	$\pm 2^{\circ}\text{C}$
Gas Valve	Pneumatic (220VAC)
Fan	DC brushless variable frequency fan (220VAC)
External Sensors	N/A
NTC Temperature Sensor	10K, B value unlimited
Dimensions	150mm*140mm*1.6mm
Water Pump & 3-way Valve	Voltage 220VAC/Current $\leq$ 5A
Lifespan	> 10 Years
Reference	GB 25034-2020; GB 6932-2015; GB/T 38603-2020; GB/T 42169-2022
Operating Conditions	$-15^{\circ}\text{C} \sim +65^{\circ}\text{C}$ ; 0~93%RH
Operating Gas Pressure	86kPa~106kPa
Voltage	AC220V $\pm$ 10% (50Hz $\pm$ 1%)
Rated Power	50W

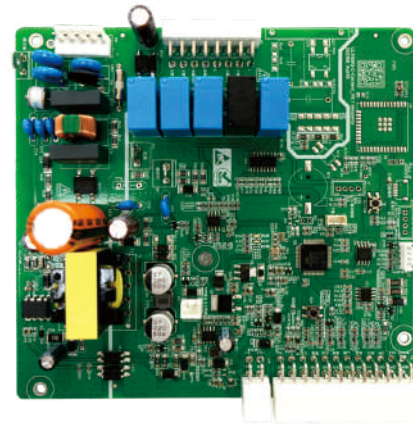
\* For more technical information, please contact: [sales@gassensor.com.cn](mailto:sales@gassensor.com.cn)



## C200 Series Wall-mounted Gas Boiler Controller

### Features

- Various current-type proportional valves (200VDC) supportive
- Variable frequency fans (220VAC) supportive
- O<sub>2</sub>, CO, CO<sub>2</sub> sensors signal connection
- Gas flow meter and air flow meter sensor signal connection
- Self-adaptive fuzzy PID-regulated quick constant temperature algorithm for hot water, with a temperature control accuracy of  $\pm 1^{\circ}\text{C}$
- Various water flow sensors, water pressure sensors, and temperature sensors compatible
- Various 220V AC fixed frequency water pumps and AC three-way valves compatible
- Designed with an external igniter, strong anti-interference capability
- Built-in ion flame detection system for real-time feedback on flame presence
- Wide-voltage switching power supply design
- Equipped with overvoltage, overcurrent, and short-circuit protection
- Multiple fault, anti-freeze, and temperature protection mechanisms, with a long lifespan (>10 years)
- Built-in Wi-Fi module, wireless/wired communication (reserved)
- Various industrial serial port LCD displays compatible



### Specifications

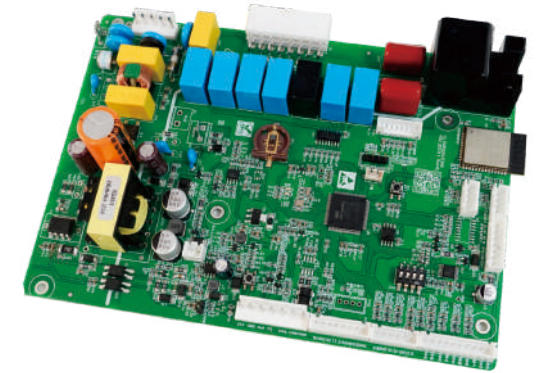
Accuracy of Temperature Control	$\pm 1^{\circ}\text{C}$
Gas Valve	Current-type proportional (200VDC)
Fan	DC brushless variable frequency fan (220VAC)
External Sensors	Air flow meter; gas flow meter
NTC Temperature Sensor	10K, B value unlimited
Dimensions	160mm*135mm*1.6mm
Water Pump & 3-way Valve	Voltage 220VAC/Current $\leq 5\text{A}$
Lifespan	> 10 Years
Reference	GB 25034-2020; GB 6932-2015; GB/T 38603-2020; GB/T 42169-2022
Operating Conditions	$-15^{\circ}\text{C} \sim +65^{\circ}\text{C}$ ; 0~93%RH
Operating Gas Pressure	86kPa~106kPa
Voltage	AC220V $\pm 10\%$ (50Hz $\pm 1\%$ )
Rated Power	50W

\* For more technical information, please contact: sales@gassensor.com.cn

## C300 Series Wall-mounted Gas Boiler Controller

### Features

- Stepper motor proportional valves (200VDC/24VDC) supportive
- Self-developed fans (220VAC) and fans (24VDC/2A) supportive
- O<sub>2</sub>, CO, CO<sub>2</sub> sensors signal connection
- Gas flow meter and air flow meter sensor signal connection
- Self-adaptive fuzzy PID-regulated quick constant temperature algorithm for hot water, with a temperature control accuracy of  $\pm 0.5^{\circ}\text{C}$
- Water flow sensors, water pressure sensors, temperature sensors compatible
- 220V AC fixed frequency water pumps and AC three-way valves compatible
- Designed with an external igniter, strong anti-interference capability
- Automatic water replenishment and automatic pressure relief functions
- Built-in ion flame detection system for real-time feedback on flame presence
- Wide-voltage switching power supply design
- Equipped with overvoltage, overcurrent, and short-circuit protection
- Multiple fault, anti-freeze, and temperature protection mechanisms, with a long lifespan (>10 years)
- 3C certification compliance
- Built-in Wi-Fi module, wireless/wired communication (reserved)
- Various industrial serial port LCD displays compatible



### Specifications

Accuracy of Temperature Control	$\pm 0.5^{\circ}\text{C}$
Gas Valve	Stepper motor proportional valves (220VDC/24VDC)
Fan	DC brushless variable frequency fan (220VAC)
External Sensors	CO sensor, O <sub>2</sub> sensor, air flow meter, gas flow meter
NTC Temperature Sensor	10K, B value unlimited
Dimensions	183mm*130mm*1.6mm
Water Pump & 3-way Valve	Voltage 220VAC/Current $\leq 5\text{A}$
Lifespan	> 10 Years
Reference	GB 25034-2020; GB 6932-2015; GB/T 38603-2020; GB/T 42169-2022
Operating Conditions	$-15^{\circ}\text{C} \sim +65^{\circ}\text{C}$ ; 0~93%RH
Operating Gas Pressure	86kPa~106kPa
Voltage	AC220V $\pm 10\%$ (50Hz $\pm 1\%$ )
Rated Power	50W

\* For more technical information, please contact: sales@gassensor.com.cn



# F100 Fan

## Introduction

Cubic F100 fan is primarily applied in the wall-mounted gas boiler industry to continuously provide air and gas flow, ensuring stable combustion. By employing PWM (Pulse Width Modulation) frequency control for fan speed, it achieves precise control of the air/fuel ratio and efficient, stable combustion.



## Specifications

Power	AC230±10%V
Frequency	50Hz
No-load Input Power	(PWM100%)80±8%W
Speed Control	PWM (7%~100%)(full speed operation while no speed control signal)
Protection Rating	IP20
Number of Poles	4
Number of Phases	Single-phase
Rotational Speed	2 pulses per revolution (pulse voltage amplitude 12V)
PWM Signal	1~6KHz,DC24±0.5V
Speed Control Range	800~8500 r/min
No-load Speed	(PWM100%) 8500±5%r/min
Maximum Airflow	89m <sup>3</sup> /h
Maximum Static Pressure	4500Pa
Operating Temperature	-10°C~+70°C
Insulation Resistance	> 100MΩ
Dielectric Strength	AC1800V/1s, Leakage current< 3mA
Overcurrent Protection	Limited current 1A
Stall Protection	Restart after approximately 5s after the stall is cleared
Rotation Direction	CCW(from air intake)
Noise (no-load test)	< 75dB (A)(7100 r/min); < 55dB (A)(5000 r/min); < 40dB (A) (2000 r/min)

\* For more technical information, please contact: sales@gassensor.com.cn

# P100 Venturi Premixer

## Introduction

Cubic Venturi premixer is a gas/air mixing device that ensures the gas and air flow rates are always maintained within the appropriate ratio range.



## Features

- High modulation ratio
- Fixed holes compatible with mainstream fans on the market
- Adjustable installation direction and angle
- Light structure and low cost

## Specifications

Venturi Model	P100
Modulation Ratio	1:10
Throat Diameter	22mm

# V100 Gas Valve

## Introduction

Cubic V100 gas valve is suitable for fully premixed wall-mounted gas boilers. It adopts a stepper motor to control the gas flow regulation, with a modulation ratio exceeding 12:1. Cubic V100 features excellent stability and repeatability, with minimal hysteresis and high accuracy. Additionally, the valve is equipped with a special pneumatic pressure stabilization module, which maintains a constant outlet pressure within a certain range when there are changes in gas pipeline pressure or sudden fluctuations in gas flow.



## Specifications

Target	Natural gas, LPG
Rated Operating Pressure	2.0 kPa
Maximum Operating Pressure	6.0 kPa
Gas Pressure Resistance	200.0 kPa
Rated Valve Opening Voltage	DC 24 V/DC 200V
Inlet & Outlet	G 3/4"
External Leakage	< 30ml/h (plus gas pressure 15 kPa)
Internal Leakage	< 30ml/h (plus gas pressure 6 kPa/15 kPa)
Operating Conditions	-15°C~+70°C, 20%RH~90%RH (Non-condensing)
Storage Conditions	-20°C~+80°C, 20%RH~90%RH (Non-condensing)
Stepper Motor	DC 12V pulse
Installation	The air inlet is oriented vertically downwards, with an angle of inclination ≤ 10°
Reference	GB/T 39488-2020; GB/T 39493-2020; CJ/T 450-2014; CJ/T 398-2012
Dimensions	115mm*40mm*80mm

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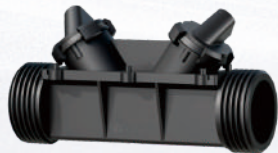


# Smart Gas Sensing Solutions

## Air Flow Sensor



## Gas Flow Sensor



## Gas Calorific Value Sensor



## Air Flow Sensor

### Introduction

Cubic air flow sensor is installed at the front air intake of the wall-mounted gas boiler fan. It adopts ultrasonic measurement principles to monitor and provide real-time air flow signal.



### Features

- Small size
- High stability
- High sensitivity
- Long lifespan
- Maintenance free
- Fast response

### Specifications

Voltage	5V DC
Communication	UART TTL
Measurement Range	2.5~60m <sup>3</sup> /h
Accuracy	± 3%
Operating Conditions	-10℃~70℃; 0~93%RH
Operating Gas Pressure	Normal pressure
Dimensions	80mm*60mm*55mm
Material	High-strength plastic (refer to nylon material)

\* For more technical information, please contact: [sales@gassensor.com.cn](mailto:sales@gassensor.com.cn)



# Gas Flow Sensor

## Introduction

Cubic gas flow sensor is installed at the connection point of the gas pipeline between the gas valve and the Venturi premixer of the wall-mounted gas boiler. It adopts ultrasonic measurement principles to monitor and provide real-time gas flow signal.



## Features

- Small size
- Fast response
- High sensitivity
- High accuracy
- Long lifespan
- Maintenance free

## Specifications

Voltage	5V DC
Communication	UART TTL
Measurement Range	0.2~4.5 m <sup>3</sup> /h
Accuracy	± 3%
Operating Conditions	-10°C~70°C; 0~93%RH
Operating Gas Pressure	10kpa
Dimensions	83mm*27mm*45mm
Material	High-strength plastic (refer to nylon material)

\* For more technical information, please contact: sales@gassensor.com.cn

# Gas Calorific Value Sensor

## Introduction

The gas calorific value sensor is installed at the gas outlet of the gas flow meter and uses tunable laser absorption spectroscopy technology to measure the composition and calorific value of the gas in real time.



## Features

- Available for multiple components detection including methane, propane, carbon dioxide, and hydrogen (customizable)
- Unaffected by other gases, water vapor, and dust
- High accuracy under all temperatures and concentrations conditions
- Fast response, <10 seconds
- Long lifetime >10 years

## Specifications

Voltage	5V
Power	2.5W
Communication	TTL(3.0V)
Interface Socket	PH-4A
Measurement Range	CH <sub>4</sub> :0~100%   C <sub>3</sub> H <sub>8</sub> :0~20%   CO <sub>2</sub> :0~20%   H <sub>2</sub> :0~30%
Accuracy	± 5%LEL
Resolution	0.1% LEL
Working Condition	-25°C~55°C; 0~98%RH(Non-condensing)
Max Working Pressure	10kPa
Caliber	3/4 External thread
Dimensions	120mm*80mm*80mm
Material	304 Stainless steel housing

\* For more technical information, please contact: sales@gassensor.com.cn