# Yokogawa's Industrial Measuring Instruments for Energy Conservation and Environmental Preservation

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***Yokogawa has been improving the efficiency of customers' production for over 90 years since its establishment, by offering measurement, control and information technologies. Yokogawa's various sensors, or industrial measuring instruments to convert physical quantities to electrical signals, can identify changes in the production process precisely and in real-time. Yokogawa also provides data loggers which manage and analyze the fundamental data acquired, and highly-reliable control systems which control customers' production fields efficiently and effectively. This paper introduces Yokogawa's major measuring instruments which are useful for energy conservation and environmental preservation.***

## INTRODUCTION

Yokogawa has been improving the efficiency of customers' production for over 90 years since its establishment, by offering measurement, control and information technologies. Yokogawa's various sensors, or industrial measuring instruments to convert physical quantities to electrical signals, can identify changes in the production process precisely and in real-time.

To enhance energy conservation and environmental preservation activities in the factory, it is crucial to visualize the related data. Our industrial measuring instruments, which measure data accurately, quantitatively, and in real-time, help achieve real visualization.

Our industrial measuring instruments can measure not only the physical quantities of temperature, pressure, and flow in the production process but also the amount of greenhouse gas or wastewater discharge from the factory, and are useful for identifying energy losses and preserving the environment. Moreover, the measured data is managed or analyzed by our data loggers or used by highly-reliable production control systems for optimal control, thus contributing to economical, efficient, and environmentally friendly production.

## MAJOR INDUSTRIAL MEASURING INSTRUMENTS

This paper introduces the functions and features of our major industrial measuring instruments, shown in Figure 1, useful for reducing energy consumption and preserving the environment


**Figure 1** Yokogawa's Major Industrial Measuring instruments

### ■ Zirconia oxygen analyzer

The principle of zirconia oxygen analyzers is as follows: Platinum porous electrodes are attached to the interior and exterior of the zirconia cylindrical element. Heating the element and contacting the gases of different oxygen partial pressures with the each side of the element result in the effect of an oxygen concentration cell.

Our zirconia oxygen analyzers have been used as oxygen sensors for combustion facilities such as heating furnaces and large boilers in intensively energy consuming industries including iron and steel, electric power, oil and

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petrochemicals.

Our products help achieve more effective combustion by managing and controlling oxygen concentration, lowering $CO_2$, NOx, and SOx emissions, and reducing energy consumption as well as preventing global warming.

■ **Pressure transmitter**

We have conducted extensive research on oscillating density sensor technologies which require precise metal processing, and developed a silicon resonant sensor through the research. This sensor contains H-shaped resonators made of single-crystal silicon in a high-vacuum shell, and enables measuring pressure with high repeatability, high precision, and low hysteresis.

The DPharp EJX series differential pressure and pressure transmitters are the latest models of the best-selling DPharp series with more than 1.2 million units in operation worldwide. The EJX transmitter can precisely measure combustion gas pressure and exhaust gas pressure, thus contributing to energy conservation and environmental preservation. Eliminating redundant use of fuel and achieving optimal control reduce the emissions of greenhouse gases such as $CO_2$.

■ **Tunable diode laser spectroscopy analyzer**

The tunable diode laser spectroscopy analyzer applies absorption spectroscopy method by using a wavelength-tunable semiconductor laser, and identifies the gas concentration by measuring the amount of light that is absorbed while the laser travels through the gas being measured.

Yokogawa's tunable diode laser spectroscopy analyzers are used as gas sensors for controlling combustion in facilities such as heating furnaces and large boilers. The monochromatic light from the semiconductor laser tuned to the absorption wavelength of the gas composition ($O_2$, CO, $H_2O$, and $NH_3$) to be measured is irradiated directly to the process gas, and one absorption spectrum line of the gas is measured to identify the concentration of gas components. The analyzer directly measures gases without any sampling equipment (preprocessing device) and so the output signals are quickly obtained. Moreover, its peak area approach enables fast measurement in most applications without interference caused by other elements.

Our products achieve more complete combustion by managing and controlling oxygen and CO concentration, lowering $CO_2$, NOx, and SOx emissions, and reducing energy consumption as well as preventing global warming.

■ **Infrared gas analyzer**

The infrared gas analyzer measures gas concentration by using a mass flow sensor detecting the amount of infrared rays absorbed through the sample cell.

Yokogawa's infrared gas analyzer can simultaneously and continuously measure the concentration of up to five components (four components selected from among NO, $SO_2$, $CO_2$, CO, and $CH_4$, and $O_2$).

The results can be used as environmental management data by comparing with the values defined in the environmental regulations of each country, contributing energy conservation as well as prevention of global warming.

■ **Magnetic flowmeter**

According to Faraday's electromagnetic induction law, electromotive force is induced in a conductor when moving through a magnetic field. A magnetic flowmeter uses this law to measure the flowrate by considering a conducting fluid as the conductor and providing electrodes to transmit the induced electromotive force externally.

The ADMAG magnetic flowmeter adopts the dual frequency excitation method to suppress fluid noise and achieve high stability. It accurately measures the flowrate of electrical conducting fluids such as purified water and waste water, thus helping to reduce energy consumption as well as prevent global warming.

The ADMAG AXR series two-wire magnetic flowmeter, launched in 2009, achieves an significant power saving of 96% to 99% compared with our existing four-wire magnetic flowmeter. Moreover, it doesn't require any AC power and can apply a two-wire system, dramatically reducing the initial instrumentation cost.

■ **Turbidimeter**

Yokogawa offers turbidimeters based on different measurement methods suitable for various conditions. The laser turbidimeter is ideal for detecting membrane ruptures or monitoring status during filtration through membrane, which is an advanced processing method for purifying water. The right angle scattered light turbidimeter identifies turbidity by measuring transmitted light, because light incidence into water is reflected and scattered on particles, and the amount of light transmitted decreases in proportion to the length of optical path and turbidity.

Yokogawa's turbidimeters accurately measure the turbidity of whichever purified or waste water, thus contributing to the reliance and safety of social infrastructure and environmental preservation.

## CONCLUSION

In this paper, we outlined industrial sensors for measuring energy in factories, the amount of greenhouse gas emissions, the amount of water discharge, etc. Yokogawa also offers various industrial sensors with unique principles and technologies including vortex flowmeters for measuring the flowrate of gas, steam, and liquid and dust monitors for measuring the amount of dust emissions from factories to comply with the Air Pollution Control Act and municipal laws. Data loggers for managing and analyzing data from industrial sensors and control systems are provided as well.

We will continue to develop industrial measuring instruments that contribute to energy conservation and environmental preservation.