

# PROCESS SENSORS AND INSTRUMENTS

Takeshi Yasuhara  
Tokao Urushibata

## 1. FOREWORD

Process sensors and instruments consist of industrial process sensors, analyzers, measuring instruments, radiation sensors, etc. They are used in a wide range of applications from industrial process supervision and control to analysis and inspection for factory automation.

## 2. TREND FROM THE STANDPOINT OF NEEDS

The recent trend from the standpoint of needs in this field are described below.

- (1) From PA (Process Automation) to FA (Factory Automation)

In the past, the instruments were mainly for fluid measurement, but the measurement objectives have expanded to powders, solids, and to measurement of quality and properties of industrial products. Formerly, a need arose to perform item-consuming complex measurements (analysis, etc.) more quickly.

- (2) Flow to rationalization and total systemization

In the flow of the construction of a total system, etc. including process energy saving, conservation of resources, and other efficiency improvement and production management, there is a strong demand for systemization, expansion of the application of analysis technology, etc. of measurement sensors.

- (3) Internationalization

Japan's measurement technology is, of course, the highest level. It goes without saying, there is a strong demand by NIES for their supply, even for Europe and America, and plan export, equipment and system OEM supply, or technology transfer are advancing and measurement sensors are being developed from an international standpoint.

## 3. TRENDS FROM THE STANDPOINT OF SEEDS

The trends from the standpoint of seeds are described below.

- (1) An application of microprocessor

Many process sensors and measuring instruments already contain a microprocessor and how to make them header is becoming the theme of the current stage. The measurement range is expanded and higher quality signals are obtained by introducing data processing, time division multiplex processing, digital conversion operation, measurement parameters communication, and other advanced technology.

- (2) Application of semiconductor process and micro-machining technology

Greater upgrading of sensors themselves and smaller, cheaper, and more advanced functions sensors are realized by applying construction technology.

- (3) Transmission and communication technology

The advance of transmission and communication technology is making transmission between measurement sensor and computer, DCS, etc. more rational and total system construction easier. Transmission medium is advancing from analog, digital, voltage, and current to optical digital signal, etc.

Fuji Electric can meet the flow of needs and needs described above.

## 4. PROCESS SENSORS, ANALYSERS & RADIATION MEASURING INSTRUMENTS

The essentials of process sensors, analyzers, radiation measuring instruments, etc. are introduced below.

- (1) Process sensors

Upgrading of the differential transmitter (FC), ultrasonic flowmeter, magnetic flowmeter, Karman vortex flowmeter and other major process sensors used to measure flow, differential pressure, pressure, level, etc. is planned. These are being made intelligent by the incorporation of a microprocessor simultaneously with improvement of the sensor itself and the diverse needs from all fields is being met. Market expansion is also proceeding through the acquisition of national explosionproof standards, construction standards, etc.

Regarding systemization, we have completed the world's first optical fiber instrumentation system (FFI system) and a wide range of systemization is being achieved with the cooperation of other measuring instrument manu-

facturers.

The international field bus specialists conference is advancing systemization at IEC and ISA (by SP50 members) and a field bus standardization draft is being studied. Fuji Electric is also participating in these and making proposals.

## (2) Analyzers and measuring instruments

Various analyzers have been available for process use for some time. In infrared applications, non dispersive type infrared analyzers are being upgraded and a new automobile exhaust gas tester with built-in microprocessor and using a solid-state sensor has been completed. Regarding Fourier transform infrared spectrometer (FT-IR) newly developed as measuring instruments, various applications were provided.

In oxygen meters, a small zirconia sensor using new construction technology was completed and its application to various fields is being studied.

As for measuring instruments using laser light, a particle counter using the scattering of laser light widely used in quality control of modern products, etc. was developed and an instrument which senses particles in pure water and on a silicon wafer was completed.

## (3) Radiation Sensors

Radiation sensors are much used in the radiation monitoring equipments which are installed for the security management from radiation exposure at nuclear power plants and hospitals, than the instruments in investigation.

The performance on detectivity of  $\gamma$  and  $\beta$  ray monitors has been requested the technical limit, according to the

principle of "ALARA" (As Low As Reasonably Achievable) on radiation exposure.

Recently on the basis of increased experience and knowledge, however user seek for not only detectivity performance but also these functions as follows.

- a) Cost down with mass usage of monitor.
- b) Change over to active measuring methods from inactive one such as film badge.
- c) Establishment of systematic monitor construction.
  - 1) improvement of reliability and stability.
  - 2) standardization of communication ability.
  - 3) achievement of interigent function.
- d) More accumulation of the data on performance.

To satisfy these new requests on the radiation monitors and the sensors, we have focused our effort to the development of new type silicon radiation sensors, these are applied to a personal alarm dosimeter, and a  $\gamma$  ray survey-meter etc.

And also we have tried to unit sensor and amplifire in one enclosure, to send out standardized output signal which ensure systematic monitor construction. In the field of process instrumentation, it is important to measure neutron flux at nuclear power reactors, and  $\alpha$  ray flux at nuclear fuel treatment facilities, so that we developed  $^3\text{He}$  rem response reackage neutron survey meter, and have intended to develop a silicon neutron sensor and a  $\alpha$  ray sensor.

