

# RECENT TRENDS OF MEASUREMENT AND CONTROL SYSTEMS

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## 1. FOREWORD

Recent rapid changes in the economic situation, international situation, and other social environments and the diversification of user needs, shortening of the product cycle, and other market environmental changes are accompanied by plant equipment investment for greater rationalization and advanced informationalization. In the large trend toward total FA of this industrial world, major advances and expansion are seen in measurement and control systems as the nucleus of PA (Process Automation), FA (Factory Automation), OA (Office Automation), LA (Laboratory Automation), and SA (Social Automation) systems.

This special introduces the recent measurement and control field technical trends at Fuji Electric. Sensor technology and instrumentation control system trends are developed below as the background of these.

## 2. TREND OF SENSORS AND FIELD INSTRUMENTS

### 2.1 Sensor market trend

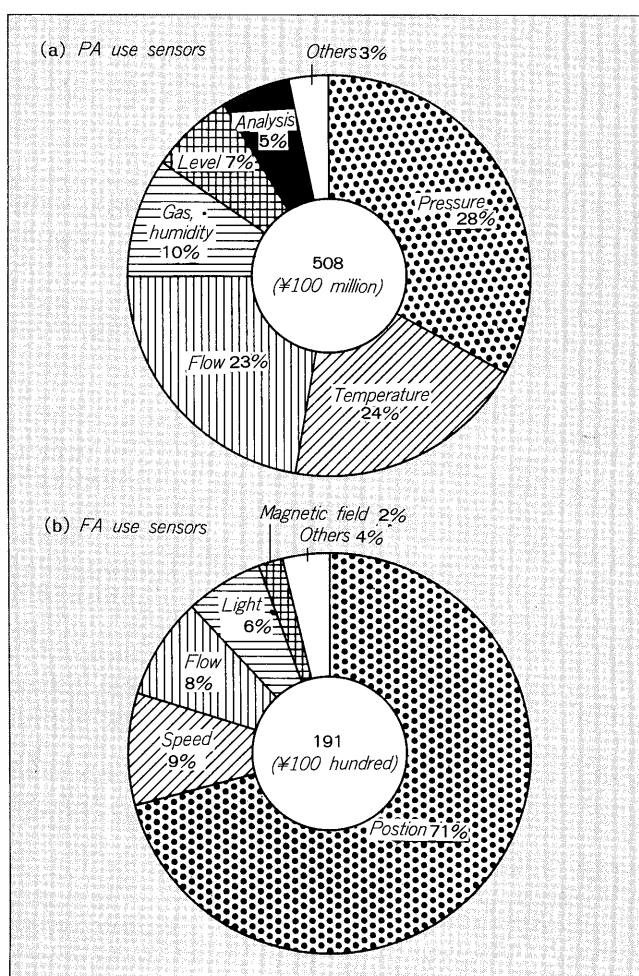
The 1987 production record of the Japanese sensor market was ¥3526 hundred million (+4% over the preceding year). Of this, ¥508 hundred million was for PA use and ¥191 hundred million was for FA use.

In PA, more than 80% of the measurement objectives are the basic measurement of temperature, pressure, flow, and level, and the trend is toward an increase of the need for gas and humidity and analysis and other analyzers. For FA, 70% of all sensors are position sensors. (Fig. 1)

The technical trend of sensors is shown below.

- (1) Use of optical fiber . . . Use of digital communications
- (2) Intelligent (or smart) sensor . . . Advanced functions and higher precision by microprocessor use
- (3) Field bus . . . Use of digital communications
- (4) Use of semiconductor manufacturing and micro-machining technology
- (5) Application of ceramics and biochemistry . . . Zirconia, biosensor, etc.

Fig. 1 PA, FA use sensor production (1987)



### 2.2 Fuji Electric sensor field instruments

Fuji Electric is putting power into general sensors including those for PA and FA use.

This year, the new generation FC series was developed at the electronic transmitter FC series which is active around the world as FA sensor field instruments. A large family of instruments is added to the world leading optical fiber field instrumentation system FFI developed and mar-

keted in 1985 and overall opticalization of field instrument sensor actuators is realized.

2.2.1 New generation electronic transmitter FCX series

Accuracy and stability were improved by using a miniature sensor that uses the advance floating cell capacitance detection method developed from the floating cell which is a feature of FC transmitter and a microprocessor. It can also be used as a smart type.

A full series devices, from pressure, differential pressure and level from low pressure to high pressure were developed and sold.

2.2.2 Fiber optical field instrumentation system FFI

Opticalization and smartness are being promoted in the field instrumentation field with “optical-fiber leads brighter instrumentation future” as a common theme. Fourteen companies displayed a cooperative exhibit at Inter Opto ’89 held in July 1989 and its spread attracted considerable attention. The record of the system connected to the distributed control system MICREX also increased and appraisal of its features was also established, in addition to the noise immunity, intrinsic safety, and other features of FFI.

It is also proposed as a fiber optical field instrument bus (FFI-BUS) to the Field Bus International Standard WG of the IEC (International Electrotechnical Committee). Evaluation by the international evaluation party WIB and other developments are being made as a world-wide FFI.

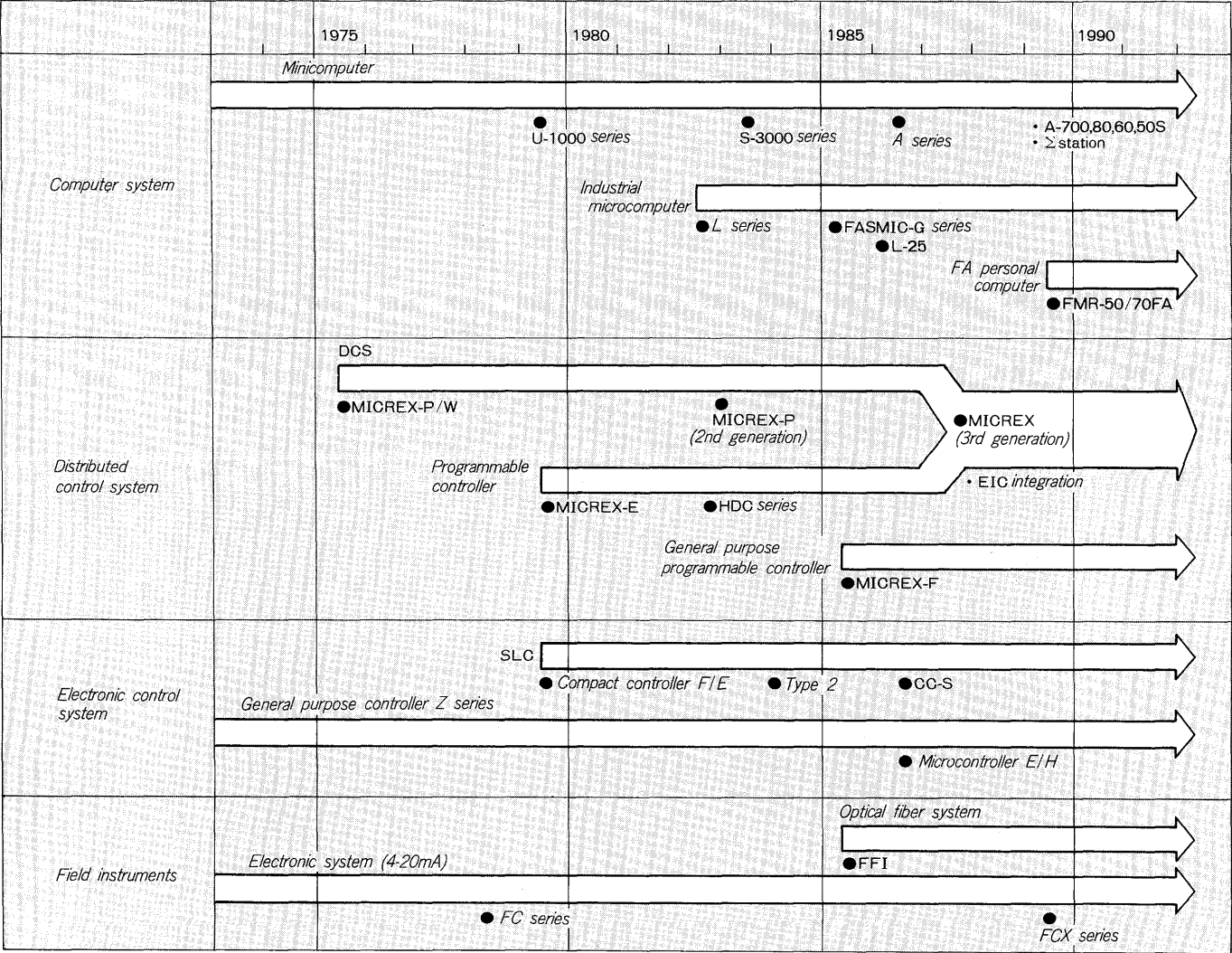
2.2.3 Expansion of analyzer

In the analyzer field, the following type addition and expansion and development were performed:

- Development of zirconia O<sub>2</sub> analyzer
- Water quality analyzer . . . Development of a series of four types: ammonia meter, total nitrogen meter, three-component nitrogen meter, and total phosphor meter
- Particle counter . . . Addition of type for particle distribution measurement and agents by argon and semiconductor laser as a particle counter for ultra pure water
- Expansion of applications of Fourier transform infrared spectrometer FTIR

3. TREND OF INSTRUMENTATION CONTROL SYSTEM

Fig. 2 Progress of measurement and control systems



### 3.1 Market trend of instrumentation control system

The center of an instrumentation control system is a microcomputer based distributed control system DCS. In Japan, the industrial use microcomputer market had a 1987 production record of ¥1370 hundred million (+19% from the preceding year), 23,180 units (+56% from the preceding year), and is growing rapidly. Of this, DCS occupy 54%, telemeter and telecontrol systems occupy 15%, and industrial use personal computers occupy 6% (number of units ratio).

The main technological trend is shown below.

#### (1) Expansion of distributed control system

The range of DCS is expanding from instrumentation control systems for FA to total FA and CIM (Computer Integrated Manufacturing). To realize this, an open system which connects E (electric control), I (Instrumentation control), and C (computer), opening of MAP (Manufacturing Automation Protocol)/TOP (Technical and Office Protocol), and other communication protocol, and completion of CRT operation are demanded.

#### (2) Diversification of mini-automation

Development of a system combining SLC (Single Loop Controller), general purpose temperature controller, and general purpose PLC (Programmable Logic Controller) and FA personal computer and other mini-automation diversification is advancing.

#### (3) Popularization of AI advanced control

#### (4) Popularization of engineering work station EWS

#### (5) Networking with field instruments (field bus)

realization of a link with FI, and other system expansion is planned and is established as an EIC integrated automation system and numerous results are achieved.

(Fig. 3) Completion of CRT touch operation EWS was planned.

As a computer, a station was also added and the A Series was realized.

#### 3.2.2 Mini-automation

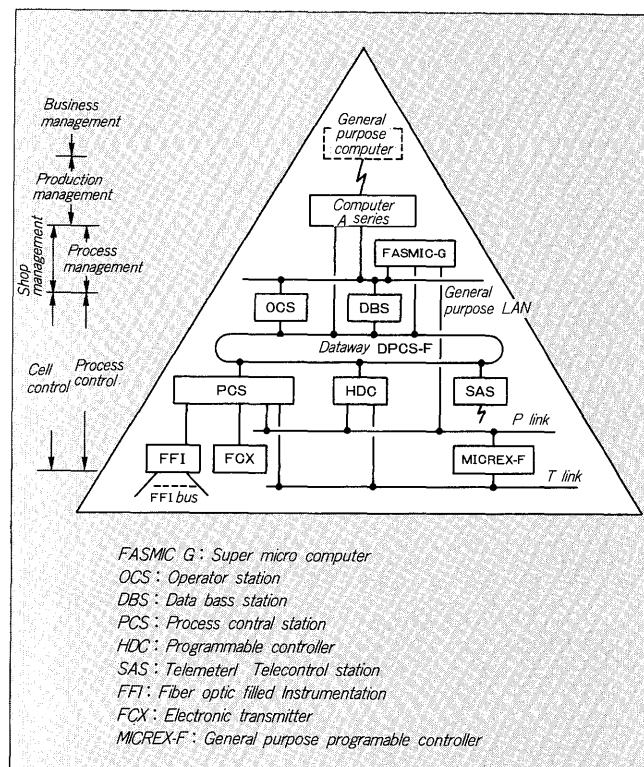
Fuji Electric offers many kinds of systems as mini-automation.

The new series microcontroller E/H of the general purpose temperature controller Z series forms an F&Z, P&Z free link system linked with a general purpose PLC MICREX-F and personal computer.

The SLC compact controller CC-S expanded the series.

The FA personal computer FMR-50/70FA is being marketed and the logger system FADAP and building

Fig. 3 Distributed control system MICREX



automation system FECS, and other package systems are also being expanded.

the logger system FADAP and building management system FECS, and other package systems are also being expanded.

#### 3.2.3 AI advanced control

Fuji Electric is putting power into AI (Artificial Intelligence) advance control technology. The AI advanced control work station AWS which concentrates these at a work station was developed. Installation and execution of fuzzy control by control station PCS HDC was made possible.

### 4. CONCLUSION

Fuji Electric intends to concentrate its power as a consolidated manufacturer to supply measuring construction and control system matched to user needs for coming 1990's. The guidance and support of users and concerned parties in the future is solicited.

The main results of development described here are exhibited at Interkama and JEMIMA show at October, 1989.