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TECHNICAL TRENDS OF MEASURING INSTRUMENTS AND CONTROL SYSTEM

Shigeo Kuroiwa
Toshiyoshi Hamada

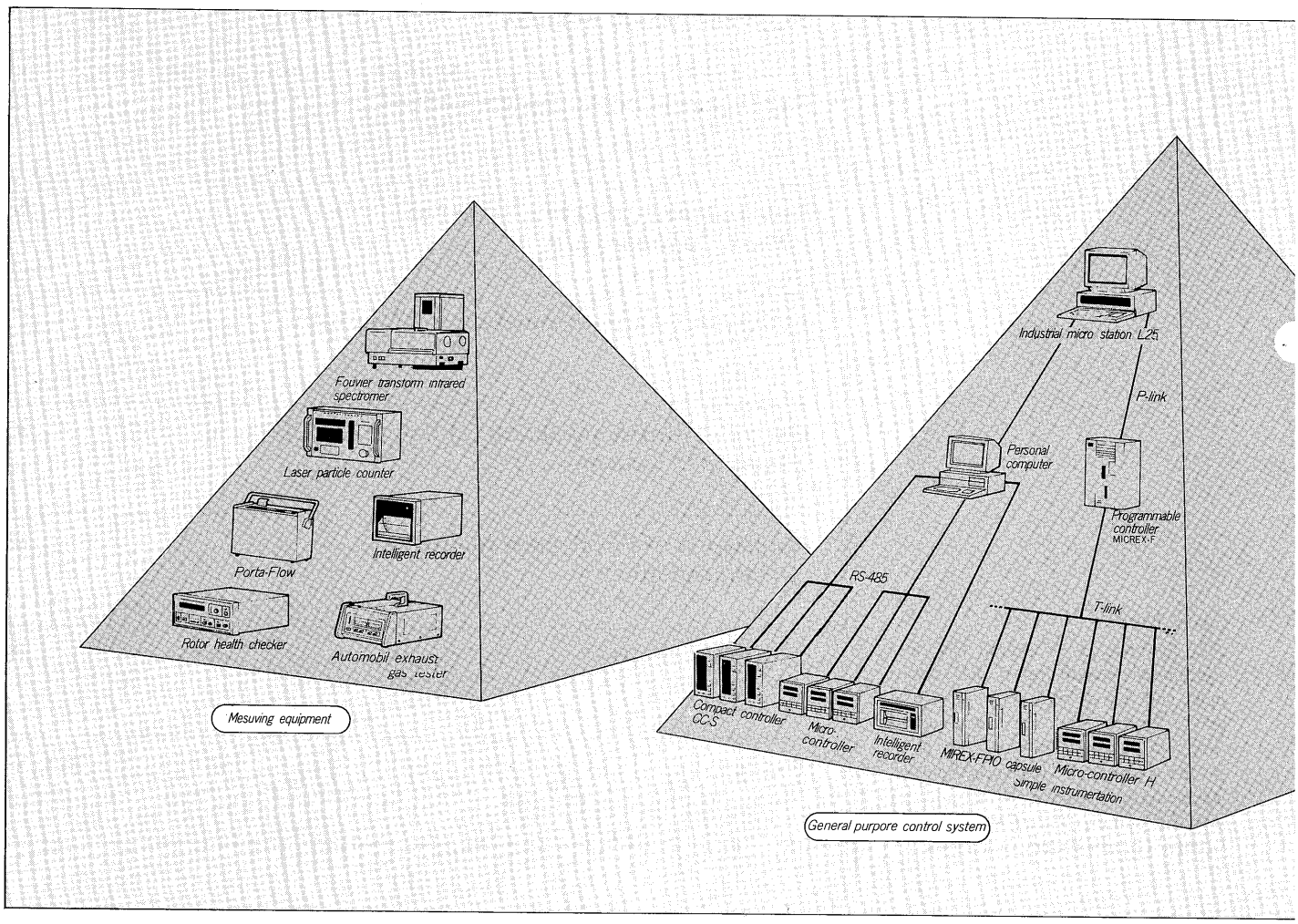
1 FOREWARD

Recently, in Japan, the stable growth of the industrial world, highly appreciated yen, pressure from developing countries, and other social and technological changes have been accompanied by a demand for exhaustive rationalization, higher technology, and more sophisticated information.

Against this background, measuring instruments and control systems are spreading from PA (Process Automation) to FA (Factory Automation), SA (Social Automation), and LA (Laboratory Automation).

Fuji Electric is developing new technologies based on its accumulated know-how to meet these social needs. The recent trends of measuring instruments and control systems are viewed and Fuji Electric's new technologies are outlined here.

Fig. 1 Fuji instrumentation control system



2 TRENDS OF MEASURING INSTRUMENTS

2.1 Trends of measuring instruments

Besides the appearance of new materials as sensing devices and the growth of new machining and manufacturing technology, more sophisticated measuring instruments are being steadily developed through advances in electronics technology. The directions of this development are:

(1) Compounding

Sophisticated measurement by combining sensing technology and information processing technology. Measuring instruments which process signals in combination with many different sensors.

(2) Intelligent (functionality)

Use of a microcomputer to realize functions which are difficult to realize with conventional sensors.

(3) Miniaturization

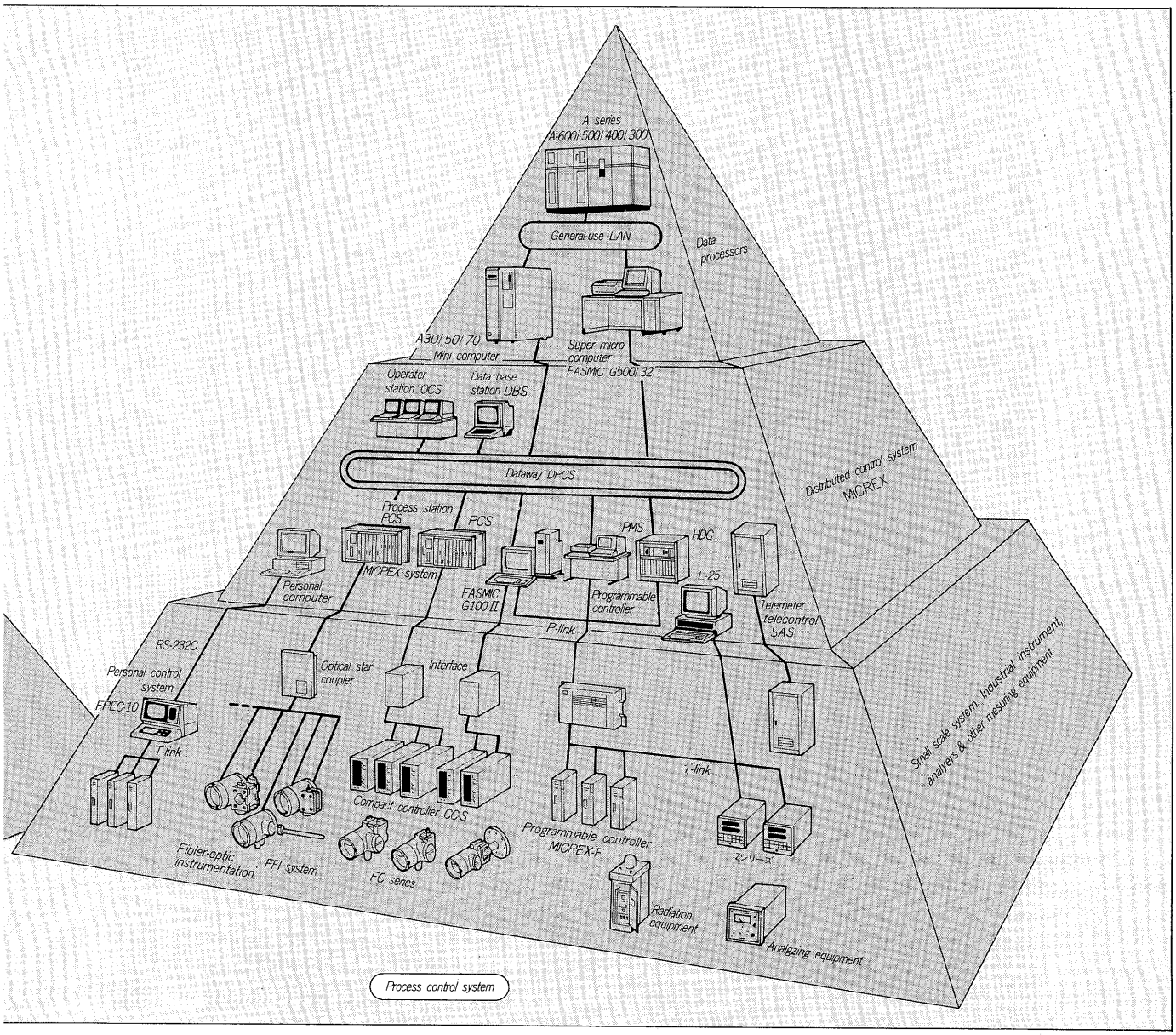
Miniaturization of sensors by advances in semiconductor production technology and micromachining technology. Miniaturization by high integration of LSI, miniaturization of electronic components, and the popularization of electronic circuit surface mounting technology. Development of smart sensors.

(4) Higher reliability

Solid-state sensors. Higher reliability of electronic components. Improvement of reliability by incorporation of a self-diagnosis function in measuring instruments.

(5) Lower cost

Lowering of costs by new machining technology, manufacturing technology, and mass production system, electronic components·cost reduction and lowering of costs by rationalization of the production line by using computers.



2.2 Fuji Electric measuring instruments

The capacitance type FC series pressure & differential pressure transmitters are recognized in the world market, centered about Europe and the U.S., for its excellent functions, performance, cost, and reliability, and has capture more than 10% of the world market. They are also the nucleus of the fiber-optics field instrumentation system (FFI).

A immersion type level meter using an optical fiber transmission system was developed as one application of the capacitance type pressure gauge. This meter solves the problem of damage to instrument by lighting in dam water level measurement, and other applications in which the sensors are installed remotely.

Insuccession of one package type which integrate the sensor and converter, a separate type intelligent, miniaturized electromagnetic flowmeter (Compact Flow) which separate converter and sensors was completed and serialized. The applicable caliber was expanded and the range of applications widened.

An ultrasonic flowmeter was developed as a unique Fuji Electric technology and was widely recognized in the market. The portable type ultrasonic flowmeter (Portaflow) is highly evaluated for its ease of use. Recently, many inquiries have also been received from overseas and its range of applications is expanding further with upgrading of conventional products.

As for thickness gauges, the infrared thickness gauge is mainly used to measure the thickness of plastic film and its practically is recognized and it is increasing in popularity.

Fuji Electric has also accumulated much infrared gas analyzer technology and has a record of delivery to many fields, including overseas. The fields of application of the infrared gas analyzer is sure to expand in the future. The oxygen analyzer using zirconia ceramics has a record of achievements centered about combustion management. Recently, zirconia oxygen sensor has been reduced to several mm by using fine ceramics technology and the sensor with a new power saving construction which does not require a reference gas is being commercialized.

The Fourier-transform infrared spectrometer is Fuji Electric's first analyzer for the true laboratory (research laboratory) and a low-price popular type was completed after a high class device. This instrument will have a large impact on the world of the dispersion infrared spectrometer which has been so popular in the laboratory up to now.

The recent growth of semiconductor production technology has been accompanied by an increase in the need for measurement of small foreign matter (particles) in pure water and chemical solutions and a particle counter using the scattering of laster light is being practicalized. Fuji Electric was the first to commercial such a counter and has secured a leading position in this field.

A small 144 W x 144 H mm square hybrid recorder with analog and digital functions (smart recorder) was commercialized after a large (432 W x 288 H mm) unit. This small recorder can also record and print difference operations. This small recorder has two models, a single pen model and a six dot model, were added to the series.

In radiation measurement technology, Fuji Electric developed a silicon semiconductor sensor and established mass production technology. This led to the birth of a radiation measuring instrument with a stable and economical solid-state sensor. In particular, a smaller (pocketable) upgraded measuring instrument was born. The field of application of this instrument will expand in the future. At the same time, plastic sintillator application technology is being upgraded and the width of this technology is expanding steadily.

3 TRENDS OF INSTRUMENTATION CONTROL SYSTEMS

3.1 Trends of instrumentation control systems

The recent trend of instrumentation control systems is the fixing and diversification of the distributed control system (DCS) by the growth of microprocessor technology as hardware and the application of advanced control, artificial intelligence (AI) as software and the demand for new processes, maximum rationalization to cope with the strong yen, and total FA (CIM: Computer Integrated Manufacturing).

(1) Open system (EIC integration)

The capability to link DCS by general use LAN (Local Area Network) is necessary so that systems from PA to total FA can be built to cope with multiple vendors. Moreover, a rational system for not only I (instrumentation DCS), but also integrating E (electrical machinery PLC) and C (computer) in the same system is built.

(2) Diverse systems

Not only CRT operation DCS, but also horizontal expansion of controllers up to general-use temperature controllers, linking with sequence control PLC (Programmable Controller) and other vertical expansion, as linking with business computers and application of personal computers and diverse systems from process computers (minicomputers as industrial computers) are spreading.

(3) Fiber-optic instrumentation using intelligent sensor

Fuji Electric is taking the lead in making sensors smarter and fiber-optic construction.

(4) Application of advanced control and AI

The application of various advanced control and expert systems for the application of modern control theory are being advanced from auto-tuning of PID control.

3.2 Fuji Electric instrumentation control technology

Fuji Electric was the first to domestically manufacture measuring instruments as a consolidated electrical machinery manufacturer in 1935 and offers the world top class measuring instrument technology FC series transmitters, total systems based on superior electronics and computer technology and features, and various packages to meet diverse needs.

3.2.1 New series of distributed control system MICREX

New third generation MICREX systems (PCS-500, OCS-1500, DBS-1500, etc.) have been developed as a higher level series of the MICREX-P (PCS-100, OCS-150/200/1100) and MICREX-E (HDC-100, PMS-100/200).

An instrumentation control system centered about the MICREX is shown in *Fig. 1*.

This is a functional system with international competitive power with EIA integration and open system (use of international standard internal bus, general-use LAN) with "from PA and TA (Total Automation)" as the watchword.

The new A (ACE) series was added as the computer.

3.2.2 Diverse systems

(1) Personal control system FPEC-10

This system is for small and medium size plants connecting a PLC/MICREX-F PIO capsule and MICREX-P CRT operator station OCS and has been used by many users ever since its introduction was last year because of its simple engineering.

(2) Compact controller CC-S

Many compact single loop controllers have been delivered since it was placed on sale in 1979. The CC-S, which substantially upgrades this controller, has now been placed on sale as an internationalized third generation controller.

(3) General-use temperature controller Z series

Fuji Electric has offered many kinds of temperature controllers for machinery production, etc. The microcontroller E and H have now been placed on sale as a new series backed by the use of custom LSI and other high technology. Microcontroller H allows the construction of a system for small and medium installations linking a industrial use L25 personal computer and PLC/MICREX-F, etc.

3.2.3 Fiber-optic field instrumentation system

In 1985, Fuji Electric reached the top in the world and has developed an FFI intelligent optical-fiber instrumentation system and is offering it internationally. The FFI bus is aimed at international standards and is being promoted as a practicalized field bus featuring an intrinsically safe explosion-proof construction. In 1986, cooperating with Chiyoda Chemical Engineering and Construction Co., Ltd. Optomation Co., Ltd. was established and sales expanded and further expansion is expected. Instruments are also being developed cooperatively with many companies and optical-fiberization is being promoted with "optical-fiber leads brighter instrumentation future" of field instruments as the watchword.

3.2.4 Advanced control and AI

Fuji Electric offered a PID auto-tuning function with DCS is 1978. This advanced installation up to the single controller CC-S and temperature controller Z series. Power is being exerted in a form which leads this field, such as offering of the personal computer-based true expert system COMEX, installation of general-use fuzzy control packages FRUITAX in a personal computer, introduction of various AI packages to a computer, etc.

4 CONCLUSION

Fuji Electric intends to concentrate its power as a consolidated manufacturer to supply measuring instrument and control system matched to user needs based on the developments described here. The guidance and support of users and concerned parties in the future is solicited.

TOPICS

'87 JEMIMA INTERNATIONAL EXHIBITION

Fuji Electric participated in the '87 JEMIMA International Exhibition held at the INTEX Osaka, Japan.

JEMIMA SHOW is the biggest total instrumentation and control exhibition in Japan.

Held from October 20 to 24, the exhibition attracted the attention of the users, distributors and makers and was attended by 37,000 people.

Fuji's themes were "Process Automation & Factory Automation to Total Automation" and "Optical-Fiber links to a brighter future".

Fuji Electric displayed state-of-the-art instrumentation and control equipment and automation systems, computers and sensors.

Fuji Electric has been establishing an export organization, also to contribute to the promotion of process automation and factory automation around the world.