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Fieldbus: technology application in a ^{60}Co sterilization plant

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Abstract

Process instrumentation was made by pressure signals in the 1940s. In the 1960s, 4–20 mA analogue signals were introduced. The development of digital processors in the 1970s sparked the use of computers to monitor and control instruments from a central point. In the 1980s smart sensors were developed and implemented in digital control, microprocessor environments. Fieldbus is a generic-term that describes a new digital communications network. The network is a digital, bi-directional, multidrop, serial-bus, and communications network used to link isolated field devices, such as controllers, transducers, actuators and sensors. Fieldbus technology may improve quality, reduce costs and increase efficiency because information is transmitted digitally without analog to digital or digital to analog converters, which also minimizes hardware errors. Fieldbus communication is based on two-wire communication, interconnecting all the components in the system. This paper introduces Fieldbus technology in a ^{60}Co sterilization plant.

Keywords: Fieldbus; Sterilization plant

1. Introduction

IPEN is designing a multi-purpose gamma processing plant for contract irradiation service. This paper is based on the design of the control system for this irradiation plant.

2. Control system

Fieldbus is a digital communication technology, bi-directional, connecting instrument to instrument and instrument to computer. Basically it is a Local Area Network — LAN (International Journal of Instrumentation and Control, ISA, 1994; International Society for Measurement and Control, ISA, 1996).

Nowadays, intelligent systems and signal transmitters have complex hardware but they are easy to maintain. Fieldbus technology has been available for five years (Peluso, 1994; Pereira, 1994), and is becoming a new era in industrial automation. This network has a natural barrier for use. The definition, intrinsically safe, is not clear as in relay logic.

Two topologies and two configurations were studied. Figs. 1 and 2 are bus topology and tree topology, respectively. Fig. 3 shows a ring system configuration and Fig. 4, a selected system, i.e., U system mounted in a final configuration.

In the selected system (Fig. 4) the field device TT is a temperature transmitter, IF is current–Fieldbus inter-

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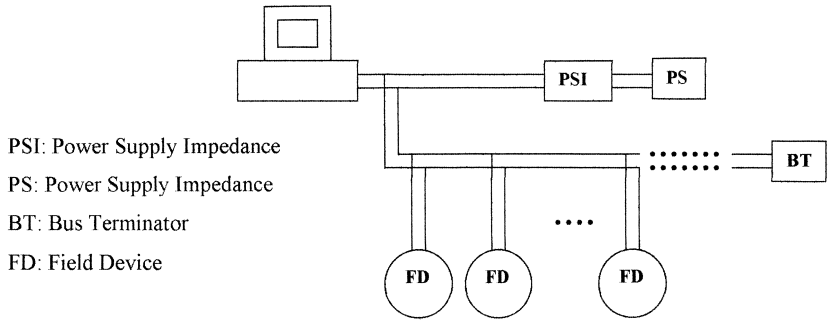

Fig. 1. Bus topology.

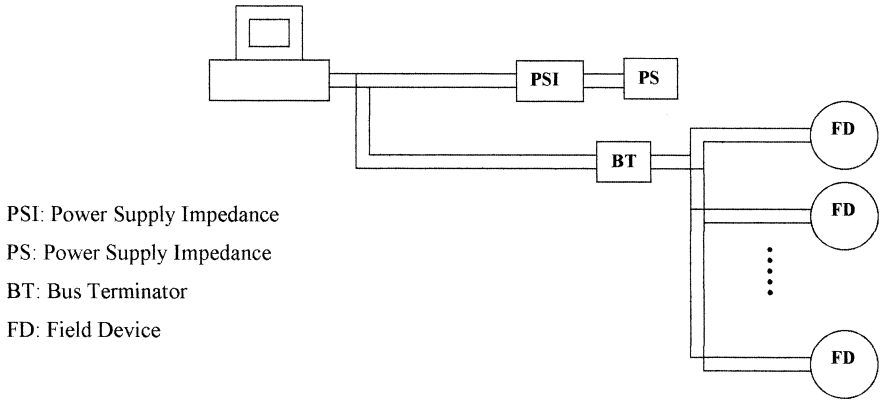

Fig. 2. Tree topology.

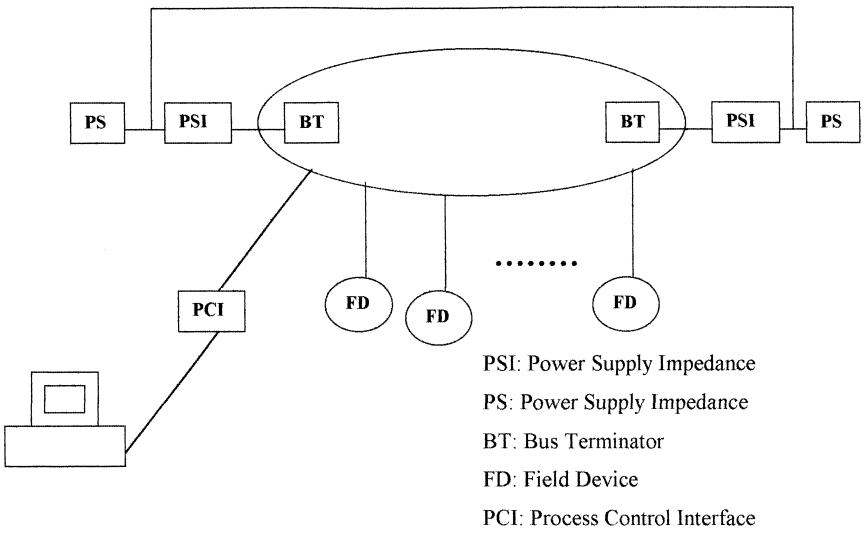

Fig. 3. Ring system (bus topology).

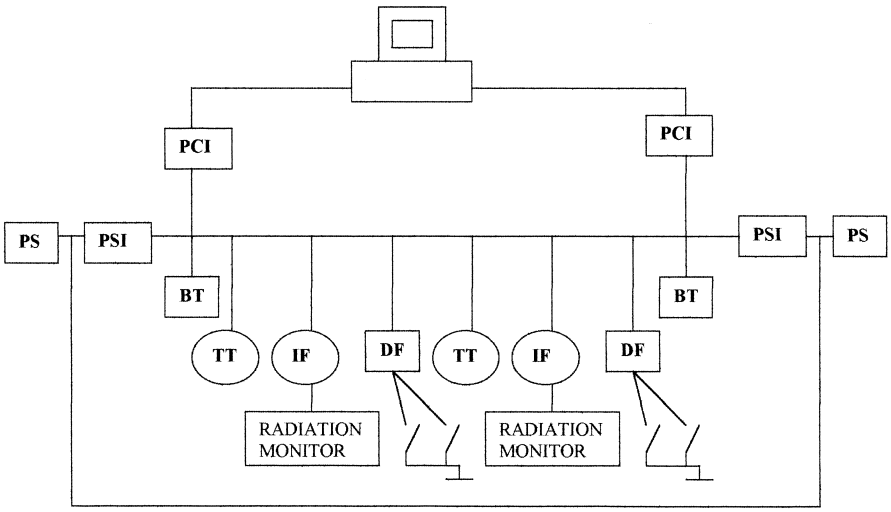

Fig. 4. Fieldbus network (U system, bus topology).

face, DF is digital–Fieldbus interface. This system has bus topology and U configuration.

The network may have 1000 m twisted pair wiring, connecting the field devices with the computer at 2.5 Mbit/s rate transmission. Radiation facilities (Longley et al., 1994), may have some particular characteristics like radiation damage to cables.

Mineral insulation wires can replace twisted pair wiring but wiring distance will be 90 m at 31.25 kbit/s transmission rate.

3. Results and conclusions

This study was completed by simulating the proposed systems using the software SYSCON (SMAR, 1997) which allows evaluation of the logic, response and safety level of the configurations.

The study concluded that a U configuration presents better results than a ring configuration because it is not electromagnetically susceptible. Moreover, even being susceptible, the consequences do not show relevance. Equally important, bus topology reduces installation time. The safety of the plant will be maintained at a quite constant level with conventional electronic systems. A formal fault tree analysis was used to confirm the safety level.

One great advantage of Fieldbus comes from the fact that it needs only one-fifth the wiring required in a conventional system, which represents a cost reduction to the installation.

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