Design and Construction Management of Automation Instruments in Petrochemical Enterprises Under the Background of Artificial Intelligence

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Abstract. Automated chemical instrumentation has important significance on the petrochemical industry. In order to improve the overall performance of chemical instruments, we need to improve the automation control system constantly. This article mainly analyzes the development of automatic instrumentation and the intelligent development of automatic control device technology.

Keywords: Petrochemical Industry, Field Instrumentation, Control

1. Introduction
The petrochemical industry is mostly operating in high temperature, high pressure, flammability, and explosion environments [1]. And it’s dangerous and corrosive. Through the optimized control algorithm of the automated control system, we can systematically control the entire processing and manufacturing process of the petrochemical production process. This has greatly improved the efficiency of chemical production and achieved greater economic benefits.

2. The current development of petrochemical industry automation
In today’s society, with the progress of globalization and information technology, combined with the gradual shift of my country’s economy to marketization, large petrochemical companies are required to enhance their technical, economic and management capabilities, respond to the call of market demand, and improve their competitiveness and operating efficiency. In the petrochemical industry, automation is an important part of informatization. The petrochemical industry uses petroleum, natural gas and other raw materials to produce fuel oil (gas) three major synthetic materials (synthetic rubber, synthetic fiber, synthetic resin and plastic), as well as a variety of organic chemical raw materials, synthetic ammonia and other petrochemical products. Further extensions include oil fields, gas fields, and offshore oil and gas exploitation [2,3]. Therefore, my country has established three major group companies, PetroChina, CNOOC, and Sinopec. Petrochemical automation is also divided into refining and chemical automation, oil and gas field automation, offshore platform automation, and oil and gas pipeline automation.

The increase in the output of synthetic materials, natural rubber, steel, etc. provided by the petrochemical industry will promote the rapid development of related industries such as construction, machinery, electronic information, textiles, and agriculture, stimulate the demand of the petrochemical
industry, and promote the self-development of the petrochemical industry. The rapid development of dynamic technology.

3. **Classification and development of detection and control instruments in the petrochemical production process**

The petrochemical production process detection and control instrument refers to the general name of instruments that perform detection, execution, control, and display functions in the petrochemical production process. Process detection and control instruments include process detection and control instruments used in industrial processes (commonly known as "industrial automation instruments"). Process detection and control instrumentation is an indispensable technical tool in the petrochemical industry. It helps people measure, analyze, detect, and judge various information in petrochemical production to improve production efficiency.

3.1. **Classification of detection and control instruments in the petrochemical production process**

The detection and control instruments in the petrochemical production process can be divided into four categories: detection instruments, display instruments, control instruments, and actuators, as shown in Figure 1 [4]:

![Figure 1. Classification of detection and control instruments in the petrochemical production process](image)

3.2. **The development of contemporary automated instrumentation**

① The diversification, intelligence and precision of the development of process detection instruments. Traditional measuring instruments mainly exist in the form of hardware or solid software, because these instruments have poor flexibility, complex design, and poor independence, which make the development of automated instrumentation have great limitations. Nowadays, in the petrochemical industry, relatively high requirements are put forward for instrument control systems. Electric instruments are gradually developing in the direction of digitization and intelligence, and computer systems are developing in the direction of networking and openness. Process detection instruments are the basis for the detection, display, recording or control of process parameters in the industrial production process. Today's detection instruments are based on embedded microcomputers, which are characterized by intelligence and digitization. With the development and popularization of computer science and microelectronics technology, breakthrough changes have taken place in the structural concepts and design viewpoints of automated instruments, and automated instrumentation equipment with the characteristics of intelligence, bus, openness, and networking has been formed.

② The process control device is gradually developing towards an open distributed monitoring system. Distributed control systems (DCS), programmable logic controllers (PLC), and personal computer-based automation systems (PCA) are using microprocessor hardware and software and
communication network technology to follow standardization, openness, networking and Try to adopt the direction of excellent hardware and software commonly used in the market, and gradually and mutually integrate towards the open distributed monitoring system (O-DSC) [5].

4. The development trend of automation instruments and devices

According to the international development trend and combined with the development status of Chinese enterprises, the development of automated instrumentation has the characteristics of digitalization, modularization, intelligence, high precision, small size and light weight [6]. The emergence of digital technology has laid the foundation for the realization of test automation. The most important feature of the development of automatic control devices is intelligence, and Fieldbus technology enables the signal transmission between automatic control devices to change from analog to encoded digital, thereby realizing signal transmission.

4.1. Intelligent development of automatic control device technology

The intelligentization of automatic control devices refers to the development of various smart meters, templates, I/O modules, smart peripherals and other smart control devices with a microprocessor as the core. The addition of the microprocessor greatly improves the function of the control equipment, thereby simplifying the circuit, reducing the cost, and making the control equipment undergo substantial changes.

With the addition of a microprocessor, the intelligent control device has the advantages of high measurement accuracy, automatic error correction, self-diagnosis (self-inspection) capability, automatic calibration, flexible changes and advanced control compared with conventional control device systems. Therefore, the development and application of smart meters and devices has become the current development trend in the field of automatic control, and smart meters have gradually replaced conventional meters.

Figure 2 shows the control network architecture based on embedded Internet. Its characteristics are:
First, Ethernet runs through all levels of the entire network, and it makes the network a transparent application entity covering the entire enterprise [7,8]. It realizes the seamless combination of office automation and industrial automation in the true sense, so we call it a flat industrial control network. Its good interconnectivity and scalability make it a truly open The network architecture is a real unification. Therefore, the control network based on embedded Internet represents the inevitable trend of the development of a new generation of control networks, and the application of a new generation of intelligent instruments-IP intelligent field instruments will become more and more extensive.

A new generation of smart meters-P smart field meters are based on embedded Web server technology, support communication protocols such as HTTP/TCP/UDP/IP, and use Ethernet standard interfaces to achieve direct communication between field devices and the Internet. The IP intelligent field instrument solves the problem of direct access to the device. By assigning the correct P address, authorized users can access and control the controlled device at any Internet terminal.

At present, the embedded Ethernet controller produced by Hewlett-Packard has a 10-Base T Ethernet interface, runs FTP/HTTP/TCP/UDP protocol, and is used in field devices such as sensors and drives. The domestic Dongda Alpine Company has developed a remote maintenance and diagnosis system for its own CT products. US OPTO22 company adopts embedded Internet technology to research and develop the "Ethernet I/O system"-SNAP I/O system, which can access the I/O ports distributed on the remote equipment site through the Internet, thereby realizing the remote equipment Monitoring and control. The I/O read and write control is realized through a standard Web browser, and it provides support for SNMP, RDP, PPP, HTML, XML, WML and HDML protocols.
4.2. Fieldbus technology (FCS)
Due to the development of 3C (Computer, Control, Communication) technology, the process control system will develop from DCS to FCS (Fieldbus Control System). The field bus is a kind of ISO OSI model as the basic frame, combined with reality to simplify the data bus [9,10]. With the continuous development of complex industrial process technology, industrial process control puts forward high-level requirements for signal acquisition and data conversion. Due to the lack of openness, high cost, and concentration of faults in the traditional DCS system, a new generation of control system FCS that saves wires and interconnects between devices has been produced through the integration of digital communication technology, microprocessor technology, sensor technology, etc.

The development and maturity of fieldbus technology will make the current common distributed control system face a strong impact. The decentralized control system composed of fieldbus technology will have more decentralized functions, more flexible system structure, and greatly improved system reliability.

5. Conclusion
With the development of science and technology, the support of automation control technology in petroleum enterprises has been greatly improved. This has promoted the rapid development of petrochemical process control technology. The development of electronic technology and computer technology has made the updating speed of automation instruments and devices faster and faster. Among them, the intelligentization of instruments and fieldbus technology are the most promising technologies.

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