

# Configuration Strategy and Application of Siemens PLC Control Network

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**Abstract:** Siemens PLC provides a variety of control networks to meet the communication and control tasks of different automation systems. Through the analysis of Siemens industrial control network products, this paper puts forward some configuration methods of Siemens PLC control network. This paper expounds how to choose the control network scheme according to the specific situation of the control system in engineering practice. In this paper, the topology diagram of the control network is given, and the characteristics of the system configuration are summarized. It can provide reference for the design of similar monitoring system.

**Keywords:** PLC & PC; Control network; Allocation strategy

## Introduction

Siemens PLC control network is mainly developed in computer automation control, digital analog communication and intelligent instrument technology. Enterprises in the process of industrial production, the use of Siemens PLC can effectively ensure the safety of industrial production, anti-interference ability is particularly strong, the probability of accidents is also particularly low. In order to meet the needs of enterprises at different levels of automation system control network, Siemens PLC research and development of control network products are particularly rich, these products in performance and other aspects have a very big difference. Therefore, enterprise users in the selection of Siemens PLC control network products, to actively according to the actual situation of the enterprise, select a reasonable product, reduce the economic production cost of the enterprise.

## 1. Siemens PLC control network type

### 1.1 Point-to-point interface network

The point-to-point interface network can define the communication protocol by the user, which is a free communication method. Under the application of this kind of network, S7-200/300 PLC can realize the data exchange with any communication protocol open equipment such as controller, printer, scanner, frequency converter, bar coder and so on. The currently available communication protocols include ASCII driver, RK512, etc.

### 1.2 Industrial Ethernet

Industrial Ethernet conforms to the international standard IEEE802.3. It is a communication network designed specifically for industrial applications. It can communicate through optical cables, coaxial cables, industrial twisted pairs, etc. The protocols used are TCP/IP and ISO protocols. Siemens Industrial Ethernet has a maximum coverage of 150km, which can be connected to 1024 network nodes at most, and the data transmission rate is 10/100 Mb/s, supporting wide area networks.

### 1.3 Profibus network

The Profibus network is composed of three mutually compatible parts: Profibus-PA/-DP and Pro2fibus-FMS. It conforms to the IEC61158 international standard and is mainly used for on-site communication and workshop monitoring. The network can exchange data with up to 127 network nodes, and up to 10 repeaters can be connected in series to extend the communication distance. The maximum transmission rate is 12 Mb/s. The Profibus network is open, allowing many users to develop different products but all comply with the Profibus network protocol, that is, all products under the Profibus network can be connected to the same network for data exchange. It can meet the production control needs of different fields.

### 1.4 MPI network

MPI network is also called multipoint interface. MPI protocol is a network communication protocol of Siemens internal standard, and its physical layer is RS-485. Siemens PLC can build an MPI network by connecting the programming interface MPI on the CPU and the programming interface on the network card of the upper computer. The maximum transmission rate of the network is 12 Mb/s. Siemens PLC can be connected to and run on multiple devices such as computer, C7, human-machine interface, STEP7 software, etc. at the same time through the MPI network. The number of connections depends on the type of CPU used. In practical applications, this feature can be used to realize the economic and effective configuration of the PLC control network.

The MPI control network is suitable for communication requirements with low communication rate requirements and small

amount of information transmission. It can form a small PLC control network without additional hardware and software to realize the communication of data and information. It is economical, effective, Convenient operation, low cost and other advantages.

### **1.5 PPI network**

PPI network is a control network specially developed by Siemens for S7-200PLC. It is also a master-slave protocol. That is, the slave station will only send information when the master station requires it, and respond to the corresponding request based on the address information. Will take the initiative to send information. This kind of network communication interface is integrated on the S7-200CPU, and can use ordinary double-core shielded twisted-pair cables for network communication. The baud rate is 9.6/19.2/187.5 kb/s.

### **1.6 AS-i interface (sensor-actuator interface) network**

The Siemens PLCAS-i interface control network conforms to the international IECTG17B standard. It is located at the bottom of the automatic control system and can only transmit a small amount of data information. It is usually used to connect on-site binary devices with AS-i interfaces.

Among the numerous network types of Siemens PLC, their functions are very different, and each has certain advantages and disadvantages, but they are all designed to meet the needs of different levels of control networks. Generally speaking, control networks can be divided into two categories: one is a communication network that meets international standards, namely industrial Ethernet, Profibus, AS-i interface; the other is a dedicated communication network developed by Siemens, namely MPI , PPI, point-to-point interface. When the user chooses to control the network, the first consideration is to determine the specific type of network.

Generally speaking, communication networks that comply with international standards, such as industrial Ethernet and Profibus, have transmission speeds, transmission distances, and transmission capacities that are far superior to dedicated communication networks, and are powerful and provide interconnection and interoperability when forming networks. Good and flexible. However, it is often necessary to add more software and hardware facilities, the one-time investment cost is relatively large, and the development process of technology application is also relatively complicated.

For example, for a communication network that conforms to international standards, Industrial Ethernet is a communication system used at the management level and the unit level. It is used for communication occasions where time requirements are not too strict and a large amount of data needs to be transmitted, and it can be connected remotely through a gateway. However, industrial Ethernet is the product of the extension of ordinary Ethernet technology in the control network. The CSMA/CD media access control method is adopted, which is non-real-time in nature and cannot meet the real-time requirements of communication in the industrial automation field. Therefore, industrial Ethernet has always been considered unsuitable for use in the underlying control network. Another example is Profibus, a communication network that complies with international standards. It is significantly better than PPI and MPI networks in terms of performance. Its electrical transmission distance can reach 9.6 km. If optical cable is used, the transmission distance can reach 90 km, and the transmission rate can reach 12Mb/s. For non-Siemens devices to be interconnected with the Profibus control network, as long as the device supports Profibus related protocols and can provide GSD files and communicate. But relatively speaking, its software and hardware investment is relatively large, and the development cost is relatively high.

For the dedicated communication network developed by Siemens, such as MPI, PPI, and point-to-point interface, the main performance is not as good as the communication network that meets international standards, and it is also difficult to achieve interconnection and interoperability with non-SIMATICNET products, but its software and hardware investment costs Lower, it also occupies an important share in the development and application of control networks.

For example, MPI communication is a simple and economical communication method used when the communication rate is not high and the communication data volume is not large. It can form a small PLC control communication network, realize a small amount of data exchange between PLCs, and realize networkization without additional hardware and software expenses. The cost is low, and the usage is simple. It is a cost-effective network solution for Siemens PLCs. plan. Another example is the use of PPI protocol for communication between S7-200 series PLCs is very convenient, without any additional software and hardware, only use NETR/NETW two sentences to communicate, but its transmission capacity and transmission rate are low.

## **2. Configuration requirements of Siemens PLC control network**

### **2.1 Communication ability**

In Siemens PLC network control, the following network communication functions must be possessed, S5 compatible communication, S7 basic communication, standard communication and OP communication. S5 compatible communication can receive and send ports to optimize the communication between STMATICS5 and S7 series. S7 basic communication can provide simple and powerful communication tasks for PLC network control. The realization of S7 basic communication needs to pass the MPI network; At the same time, it also has SFC that can be used for user programming. OP communication is mainly to use PLC for data communication to realize programming and human-computer interactive operation services. Standard communication enables communication between various manufacturers and different automation systems. In the actual engineering application process, it is necessary to actively select appropriate communication functions based on the specific conditions in the Siemens PLC control network.

### **2.2 Communication interface**

At present, the interface modes of Siemens PLC control network mainly include PG/PC communication card, module processor, PLC special communication module and PLC host programming interface. The PG/PC communication card is mainly used to control the connection of the PG/PC side of the network, and connect the PG/PC equipment to the corresponding network. However, due to its variety, it is necessary to carefully distinguish each function during the selection and use process. difference. For example, the CP5511 device is not equipped with a microprocessor. At this time, the computer can be connected to the MPI network, which can

effectively ensure the connection of later work. The module processor is mainly connected to the PLC side. The module processor is extremely intelligent and can automatically connect the PLC to the appropriate network, and the application to the system CPU is also very small, reducing the burden on the CPU. There are also big differences in the types and functions of the module processors. In the process of selection and use, you also need to make a careful distinction. The programming interface of the host computer in the Siemens S7 series can double as a communication interface in the control network. For example, the S7-200 series can not only have a programming interface on the PLC host, but also provide a dedicated MPI and PPI control network communication interface.

### 2.3 Transmission medium of Siemens PLC control network

In the Siemens PLC control network, there are many types of transmission media to choose from. In the Siemens PLC control network, there are many types of transmission media to choose from. Take Profibus-DP network as an example, the transmission medium of this kind of network can adopt the following several ways. First, electrical data transmission. Electrical data transmission uses standard circular cross-sections, shielded twisted-pair cables with PE sheaths, and underground cables for data transmission. Second, wireless data transmission. The wireless data transmission is mainly through the infrared connection module, and the wireless data transmission is carried out within a distance of 15 meters. Third, optical cable data transmission. Optical cable data transmission mainly uses plastic or glass fiber optical cables for data transmission. This method of data transmission has a particularly long transmission distance, and can be used not only indoors, but also for outdoor network data transmission.

## 3. Configuration strategy and application of Siemens PLC Control network

### 3.1 Specific application in water company

Generally speaking, a water company is composed of two different departments in terms of operation, namely the water source area and the water plant area. Generally speaking, a water company is composed of two different departments in terms of operation, namely the water source area and the water plant area. Compared with other large-scale production enterprises, the water company needs to control the network TV, and the amount of information transmission that needs to be controlled in the specific operation process is less, and the data transmission distance is also shorter, so in the specific operation process In the MPI network communication mode in the Siemens PLC control network can be used. In the process of applying Siemens PLC control network, the water company constructed a small control network through the application of MIP communication method. Through analysis, it can be found that the MPI network mainly consists of three slave stations in the water source area, a PLC master station, and an upper computer in the water plant. The CPU model used by the master station is S7-300PLC of 3121FM. And the model of the CPU used by each slave station is S7-200PLC of 224XP. Then, use the RS485 repeater to expand the original network (this link is carried out in the physical layer), and appropriately extend the communication distance. In this design process, in order to ensure that the remote communication service can meet the remote monitoring and working needs of the water plant, the communication distance should be appropriately extended. Through analysis, it can be seen that the extension to 1.2km is an ideal length, which not only meets the operational requirements. , And it will not cause waste of resources. In addition, through analysis, it can be found that the water company has relatively low requirements for timeliness in the control tasks, so the passive mode can be selected in the specific working mode between the master station and the slave station. Generally speaking, the signal transmission is completed by the master station, and the monitoring function is fully exerted, so as to realize the comprehensive control and supervision of the water plant and provide high-quality water for the community. In addition, a complete MPI network should be used to cover the upper PC and PLC in the specific design process.

### 3.2 Specific applications in iron and steel enterprises

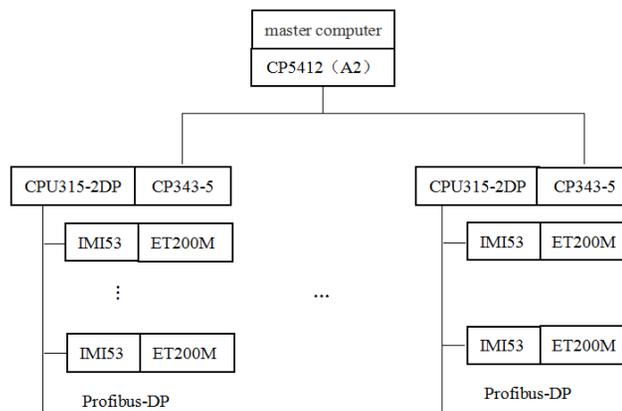


Figure1: Profibus controls the network topology

As we all know, steel companies will involve many objects that need to be controlled in the specific production process. Among them, the more critical control objects are coolant beds, pushers, cutting machines and other equipment that need to be used in the steel production process. There are many types of equipment, and each type of equipment plays a different role in the steel production process. Therefore, the control point is relatively complicated, and because the amount of information transmission is relatively large, this increases to a certain extent. It is difficult to control. Based on this, the Siemens PLC control network selected by steel companies in the specific production process should be a Profibus network compatible with national standards to avoid adverse effects on steel production. After steel companies make specific decisions, they also need to divide the control system to form multiple PLC control stations based on the actual production situation of the company itself and the specific location of the equipment in the production

workshop. At the same time, it is necessary to ensure the data between different points. Communication can be completed through chain control technology to achieve the final production goal. In addition, the Profibus-DP network has two different access methods in the field data link layer, namely the token bus method and the hybrid method. The former is to use the token to transfer the library information to the main station, and the main station can request or send data information from the main station after obtaining the token.

However, the slave station is different. It needs to react passively or send data information to the main station during the specific operation. This method is difficult to report that the data can be highly efficient and accurate in the specific transmission process. Therefore, in the process of optimizing the Siemens PLC control network, all control stations are often set as the master station. In this way, it can be ensured that the data information inside the control system can be exchanged freely to ensure the stable operation of the system sex.

In addition, in the specific configuration process, in order to reduce costs and improve the safety and reliability of the system during operation, the steel plant uses a 315-2DP CPU for S7-300PLC in all main stations. It can be found through actual application results that the integrated Profibus-DP network can be used as the master station with this type of CPU, so that a first-level subnet can be formed in specific operations.

In addition, through the application of the ET200M module as a remote I/O slave station, the construction of the Profibus-DP control network topology is completed. Analyzing the problem from an overall perspective, it is not difficult to find that the Siemens PLC control network is essentially a two-level subnet structure, and the main role of the Profibus network at the bottom is to provide corresponding communication services for the PLC master station and the remote slave station. To ensure the reasonable transmission of information, the main function of the top-level Profibus-DP subnet is to provide corresponding data communication between the PLC master station and the upper computer. Due to the large amount of data transmission involved between different master stations and the upper computer and the master station, in the specific design process, the top-level subnet is best to use the multi-protocol hybrid mode to complete the corresponding operation operations, so as to ensure reasonable operation sex.

After iron and steel enterprises have applied Siemens PLC control network, through long-term application practice, it can be found that the automation control and production efficiency of equipment in iron and steel enterprises have been significantly enhanced, and production costs have also decreased, which has improved the economic benefits of enterprises. It can be seen that reasonable application of Siemens PLC control network and reasonable configuration of it can promote the healthy development of the engineering field.

## References:

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- [1]Chen Y, Wu J. Configuration Strategy and Application of SIEMENS PLC Control Network[J]. Modern Industrial Economy and Informationization, 2016.
- [2]Wang L . Configuration Strategy and Application of Siemens PLC Control[J].Instrument user,2017.