

Exploring the Application of PLC Technology in Mechanical Electrical Control Devices

Xinyu Zhang *

College of Information Science and Engineering, Huaqiao University, Xiamen, China

* Corresponding author Email: 1425331240@qq.com

Abstract: China's industrial sector has made great progress after years of development, and the field of science and technology has promoted the rapid growth of the industrial economy through technological upgrading. In the face of the new situation of social development, the previous manual mode of operation can no longer meet the development of the times, so it is necessary to make innovations in machinery manufacturing. Taking industrial production as an example, PLC technology is a new type of technology that can greatly improve the efficiency of industrial production and enhance the productivity of enterprises, thus solving the problems of production relations and productivity. It can be seen that in the future development stage PLC technology can get better development, especially in the field of electrical control using PLC technology, can improve the safety of electrical control devices, but also in the automation level, the level of efficiency has a good role in promoting. This article will focus on the application status of PLC technology, and a detailed description of mechanical electrical control. The impact of this technology on mechanical electrical control will be analyzed, focusing on existing control systems, such as FCS systems and DCS systems, which are the more common types of control systems today. Finally, the specific application areas of the technology in the mechanical electrical control system are analyzed, such as the basic control system of the DCS system and the integrated control system. During the application of the above content will be affected by a variety of variable factors, around which the analysis can be carried out to improve the automation level of mechanical electrical control devices.

Keywords: PLC Technology; Mechanical Electrical Control Device; Control Type.

1. Introduction

Automation technology plays a very important role in the development of China's industry, which started in 1990. In the field of production, computer control technology and communication technology can be combined to improve the accuracy of control. The use of high-speed computer technology during this period has led to a comprehensive upgrade of the control system, while microelectronics technology has also been combined to transform the previous mechanical instrument panel into an automated instrument panel display device through analog signals.

This has led to the third automation technology reform, which can be regarded as a technological upgrade. However, society is constantly changing, and the control system is the core part of the industrial production, so the overall performance of the control system can be improved and the practicality can be strengthened to bring better technical support to people's production life, thus promoting the development of PLC automation control technology. This programmable controller is widely used in the factory sector, but it was first used in the automotive industry, and its initial application started in 1970. After more than 20 years of research and experiments, there has been a great leap in the control capacity and processing speed, and after 1990, the electrical control industry in China began to promote changes in efficiency through programmable controllers, especially as our economy continues to develop and the demand for industrial products begins to grow, so that in the production field it is necessary to meet the market demand through fast production methods. The control system of PLC technology has been studied. For example, DCS systems and PID loop control systems have become the choice of many factories.

Analysis of the nature of PLC technology can be seen as an

open control system, and has more innovative points, the technology contains a variety of advanced technology types, such as computer digital communication, intelligent sensing control technology, etc., the application of this technology to the mechanical electrical control industry has greatly promoted the development of the industry, but also to make China's mechanical electrical control technology has a qualitative leap, and ultimately achieve the information technology upgrade. Upgrade.

2. Overview of Related Theories

2.1. PLC Technology Overview

The full name of PLC technology is programmable controller, and it is widely used in many fields, such as memory CPU and other devices, but it needs to be combined with power supply to achieve the corresponding functions during the use, and the design for CPU is the core of the technology. The CPU coordinates the processing of the contents of the field, sets up the scanning device in advance, stores the user data and program contents of the programmer in advance, and then converts the user information according to the operation of the system. The system is controlled by the power supply, and the operating status can be checked internally, and the instructions and syntax can be tested. In the process of memory device design, it is necessary to achieve the corresponding functional information storage and transfer through a variety of electronic modules, all executed within the system program function, some users cannot achieve the data reading, so also use the programmer to extract or transfer data into.

During the use of PLC counting, often need to be paired with other areas of technology, such as computer automation, these technologies assist the application of PLC systems can

allow the program to store a large amount of data information so as to control the production of machinery, it can be seen that PLC has a number of advantages, specifically the following aspects:

(1) can achieve the perfect integration of mechanical and electrical, the use of PLC equipment in a number of areas can show the advantages of convenience, in the installation process, through a simple installation can achieve the corresponding functions, especially automation systems connected to computer systems, can effectively enhance the efficiency of system control, while PLC equipment in the programming period through simple statements and architectural diagrams can better explain the relationship between the functions. relationship.

(2) has a powerful anti-interference. In the process of mechanical electrical control in the past, often subject to a variety of factors, which can lead to poor mechanical electrical control, through the use of PLC technology can effectively enhance the ability to resist interference, while in the system will also involve a variety of circuit modules, but the system will come with its own internal isolation function, so it has a strong anti-interference characteristic.

(3) a wide range of applications, especially in the electrical system can use PLC technology, in a number of industrial areas will often see the use of P2C technology figure, in the mechanical production process can be processed on the existing data, in the electrical system have good compatibility, can improve the efficiency of mechanical production during the factory production. On the other hand, PLC technology can be integrated with other types of technology to enhance the degree of electrification control.

(4) in the process of system operation can achieve internal detection, mechanical systems often have more security risks during operation, the use of PLC technology can be self-testing in the system to find problems can be timely alarm. Users during the use of PLC technology can effectively check the causes of failure, and make maintenance plans in advance, which can ensure the stable operation of mechanical systems.

(5) mechanical electrical control device overview

Computer technology in the current era has a far-reaching development, and this technology is applied to the field of industrial production, which has given rise to more new industrialized production mode, in the industry so science and technology effectively drive the industry, so science and technology effectively drive the degree of mechanical electrification of industrial production, the existing new technology combined with mechanical electrical control devices, the current control system can be optimized for the enterprise The combination of existing new technologies to mechanical and electrical control devices can optimize the current control system to bring better conditions for enterprise production. In the mechanical control device to add electrification control need to introduce electrical equipment, so that the secondary control circuit, the equipment will be connected to the power supply, the use of high voltage and high current to achieve self-control of the system, especially in the operation of mechanical and electrical equipment, can effectively detect the failure of production, in advance of the system to make effective maintenance to ensure the smooth operation of the system. For the user, through the mechanical electrification control can improve the accuracy of control, but also to enhance the safety of the system.

The significance of PLC technology in the mechanical electrical control device Help to improve the convenience of

work

Traditional mechanical electrical control devices require manual operation of staff, there is the problem of inefficiency, and the use of PLC technology can set the corresponding program, through the programmable language can achieve the corresponding function, and then combined with the electrical control device, can effectively realize the automatic operation of the system, and in the platform can develop a variety of personalized control functions, so that the device can be convenient The use of PLC technology, in the better convenience in the operation of the rapid modification can effectively improve the efficiency of the operation, but also to save the workload of personnel, in the system can also achieve a variety of control functions, for enterprises want to achieve fine management has a very important role in promoting. It is very important for enterprises to achieve fine management.

2.1.1. Help to Improve the Level of Automation

The integration of PLC control technology in the field of mechanical and electrical control can effectively drive the automation level of enterprise production. For enterprises, it can improve the existing automation operation efficiency, accelerate the production progress of enterprises to expand the scale of development of enterprises. The previous mechanical and electrical control mode is not flexible and requires a lot of manual assistance, which is tedious in terms of code setting. However, the use of PLC control technology can enhance the flexibility and efficiency of the code setting, but also reduce the difficulty of control, in the system can achieve fully automated operation, during the application of PLC technology contains a variety of modules, such as data transmission, data collection, data interaction and sequence control, these modules through the Internet platform can achieve data processing and transmission, while Can also be carried out on the existing graphical data processing, the results of more intuitive output to enhance the intuitive results, so that staff can make better judgments based on the final results. In addition, the use of PLC technology can effectively carry out automatic search of the system, especially the key nodes of data, if there is an abnormality or failure, the system can be automatically detected internally, thus enhancing the security of the system, in the operation of the system can also ensure more reliable, so as to avoid the risk of system operation in advance, the enterprise can save production costs. The use of PLC technology can also be used with the enterprise's internal ERP system to achieve the interaction of information transmission of various types of data and information can be shared, promoting the integration of information technology within the enterprise, in terms of system functions can achieve a more powerful expansion. At the same time, the existing data can be analyzed automatically, and if there is a problem in the production process, the system will automatically alert the staff for disposal.

2.1.2. Help Improve the Operation of the Device Effect

The application of traditional mechanical and electrical control devices often causes a variety of problems, because the previous mode of work requires the setting of a large number of switching logic, so the results do not reach the ideal state, the operation of the device often have a variety of problems, the existing variables cannot be timely control, so it is impossible to predict the errors in the operation of the system, even if the system problems cannot be effectively adjusted in a timely manner. All these will affect the efficiency of the operation of the device. The use of PLC

technology can effectively improve the efficiency of the switch logic control, especially through the automation of simulation can achieve better application, the system of key node information prediction and analysis, so that a reasonable control of a variety of variable information into the intelligent detection technology, this way of view has a better target, on the other hand, to monitor the operation of the system, the system can be found in a timely manner. On the other hand, the system operation can be monitored, and the system operation failure can be found in time, which effectively improves the reliability of the system, so the operation effect has a qualitative leap.

3. Second PLC Technology of the Main Control Types

3.1. DCS System

In the system through the microprocessor can achieve a variety of centralized and decentralized control, this type of system is called DCS system, the system can be centralized or decentralized control mode to achieve accurate control of the system, is a typical representative of the new era of instrumentation control system. The use of such systems allows for integrated internal control, improves the efficiency of system management, and allows for precise operation of machinery, and electrical controls combined with extensive computer technology can be effective in the field and at monitoring stations. Common electrical control devices often use the DCS system, where various functions can be managed centrally and effectively, especially for decentralized mechanical electrical control devices, which can be managed centrally through the system. The DCS system can effectively improve the safety and stability of electrical control devices, and the system can collect information from the site in real time, and then integrate various types of information to ensure that the system can be properly controlled, and faults in the system can be detected in time during this period. The DCS system will collect and organize the fault information, and then automatically make adjustments to improve the smoothness of the system operation.

3.2. FCS System

This system is also called FCS system, which uses information technology and communication network to form a bus control system within the system to realize the overall control of mechanical and electrical devices. In the field of mechanical and electrical devices, this system has a certain scope of use, but it is necessary to optimize the existing network environment, so it is necessary to ensure that the network transmission environment of the FCS system, through the system can realize the two-way dissemination of information, the network environment can be the actual mechanical and electrical control of information transmission. The system relies on the existing digital communication environment in order to improve the productivity of mechanical and electrical devices. The system enables intelligent production services within the company, and when it comes to electrical production projects, fully automated operations can be performed, which can bring good results for the installations. In addition, the use of this system, combined with a large number of applications, allows for the implementation of multiple control units, enabling diversified control in the production area and further optimizing the existing production efficiency. The FCS system can be

analyzed from the point of view of future development to achieve an ideal operation, especially for the highly centralized operation of mechanical and electrical systems, with a number of functions such as multi-node digital communication. It ensures the integrity of the mechanical and electrical systems, and is a good driver for industrial enterprises. At the same time the system also has a high adaptability to the network, in many aspects can adapt to the production environment, the staff can use the control device set up in advance to achieve automated operation.

Three PLC technology in the mechanical electrical control device application analysis

3.3. Application in DCS System

DCS system internal microprocessor can realize a variety of centralized and decentralized control, can improve the control of the existing system, can belong to the current stage of the creation of new instrumentation control system, for the system, can effectively achieve a variety of information processing, comprehensive coordination and decentralized management ability is strong. The DCS system can effectively improve the safety and stability of electrical control devices, and then integrate various types of information to ensure that the system can be properly controlled. During this period, faults in the system can also be found in time, through the automatic processing can avoid the failure of the operation of the program to ensure that the system can operate normally, so the use of this type of PLC technology in mechanical and electrical control can improve the operational efficiency of enterprises, thereby driving the improvement of production safety.

3.4. Application to the Operation of Internal Combustion Locomotives

In the application field of internal combustion vehicles, the indicators usually have a variety of changes, but must reasonably control the range of change in the index, if beyond the safety level, will certainly lead to safety risks, the system is subject to more interference factors during operation, if not timely control, will certainly lead to a large difference in the operating index, will cause serious safety risks to the system operation, in the operation of internal combustion locomotives PLC technology can be used during the operation of internal combustion locomotives, which can analyze and count the various aspects of system operation in detail, thus helping to improve the accuracy of the operator's operation and ensure the safety of the system. PLC technology is used to control internal combustion engine applications, which often rely on the internal transmission turbine output fluid pressure to achieve accurate control. In the oil circuit management, the operating condition of the oil circuit is changed to achieve the adjustment of the operating status of the internal combustion engine, so the standard parameters such as water temperature and oil pressure must be operated strictly in accordance with the predetermined target, so as to enhance the safe operation of the internal combustion locomotive.

3.4.1. Application to the Basic Control System

During the use of PLC technology, it is necessary to complete the components of the basic control system through a variety of steps. First of all, it is necessary to design the application scheme to match the actual one to ensure that the basic control system and PLC technology can be integrated together, and in addition, it is also necessary to consider a

variety of factors affecting the operation of the basic control system and make adjustments in combination with the existing PLC technology content. In particular, the equipment model, communication status, electrical equipment, PLC technical indicators, etc. have a large difference, around these elements of the existing design program design, the staff and designers require high requirements, the need to find timely amendments, so as to enhance the application of PLC technology out of the regularity of the drawing design problems, the existence of unreasonable places to be modified, so as to design at the beginning to ensure the application of the later effect.

3.4.2. Applied to the Integrated Control System

In the field of integrated control systems also need to use some of the functions of the PLC control system to meet the needs of electrical control, the type of equipment can be divided into two types, a PLC central system as well as other equipment. In the process of mechanical and electrical control device operation, the PLC central system and other electrical equipment to make the corresponding requirements, so in the beginning of the design must be in accordance with the central structure of the design, especially the calculation control system, also belongs to the type of central structure design, so in the production process must correspond to the simple structure, but the simple production process and structure in the practical application will also have more problems. If one of the devices fails, it will affect the safety of the whole integrated system control, and in serious cases, it will lead to paralysis and failure of the system, and then the whole system must be fully repaired in order to completely fix the failure, but it will consume a lot of time and energy.

Applied to the setting of logic switches

In the field of mechanical and electrical equipment control, the need to use the logical relationship between the switch in order to achieve functional conversion, PLC technology applied to any system requires the use of logic switch settings, which is also an important feature of PLC technology, so during the application of PLC equipment, the need to replace the relay system, especially in the electrical equipment production line and machine tool links are required to collect. Compared with the traditional control system PLC technology will not be restricted by a certain part of the PLC system can be analyzed and set up in a variety of modules, which can ensure that the mechanical and electrical equipment to meet the use of each module needs, and ultimately promote the production line switch reasonable layout.

3.4.3. Applied to the Fault-finding System

In the system fault detection, PLC technology also has an important application. PLC technology used in mechanical and electrical equipment can achieve real-time supervision of the internal operation of the system, the operating data will be transmitted to the backstage operation department, the operation department will analyze the feedback data information to analyze the causes of failure, especially mechanical and electrical equipment often have a variety of failures, through the system can be found in a timely manner the parts of the fault, and PLC system to send an alarm, which is conducive to Management quickly solve the problem.

3.4.4. Application to the Control of Production Variables

In the production process, it is necessary to achieve effective control of various production variables, especially when it comes to key technical aspects, it is necessary to

control every analog quantity. But the production line involves more variables, relying on the existing staff cannot grasp the variables generated by the situation, so you can use PLC technology to make up for the shortcomings, the use of the technology can be reasonable control of production variables to ensure that these variables are in the control range.

3.5. PLC Technology in the Mechanical Electrical Control Device Application Measures

In the electrical control system can use PLC technology to optimize the existing level of automation, but also to enhance the operation of the device, during the use of PLC technology needs to pay attention to the type of application, in the management level should also be correctly recognized the potential of the technology, so it must be around the technology to make the corresponding research to enhance the level of application, specifically the following recommendations.

3.5.1. Follow the Scientific Working Principle

Instant application involves a variety of technical indicators, so we must follow the scientific working principles, the strict use of PLC technology standards. First of all, we must analyze the type of mechanical electrical control device and the actual operational needs, in order to give the corresponding design scheme, to ensure that the relevant technical standards to meet the design needs, on the other hand, we must also consider the effectiveness of the application of technology in order to promote the implementation of the device. Second, the design must be reviewed after completion, so that specialized staff can discuss the details of the other case and find out the hidden problems of the design in advance in order to improve the quality of the system. When the audit is completed after the completion of the need to pass a small-scale trial, which is conducive to the early detection of problems, in the current period can find the corresponding solutions, in the later application period to ensure the application effect. Finally, we also need to ensure that the application of PLC technology and mechanical and electrical equipment control devices can achieve perfect integration, around the schematic analysis can circumvent this problem.

3.5.2. Clarify the Type of Application of PLC Technology

In the selection of the corresponding type of technology, must take into account the current operating conditions, only choose a suitable technical solution to ensure that the mechanical electrical control device can effectively run, the current period of China's mechanical electrical control devices is generally used DSC and FCS two systems. The two types have their own advantages, in which DSC belongs to the decentralized control system, can achieve effective integration of the system, the management of decentralized unified to enhance the efficiency of coordinated management. At the same time, it is combined with computer equipment to establish on-site monitoring stations, so as to strengthen the integration of mechanical and electrical control devices, ensure the effective operation of the system, and to investigate the existing safety problems in a timely manner. On the other hand, FCS technology belongs to the field bus control technology, the need to use the current network communication function so that PLC technology and network information technology integration together, but must ensure a good operating environment, during the use of the ability to

use the kind of network to enhance the data transmission channel bidirectional transmission characteristics are conducive to enhance the existing level of automation.

3.5.3. Do a Good Job in the Design of the Relevant Systems

The use of mechanical electrical control devices, combined with PLC technology must pay attention to the effectiveness of the application, to achieve these purposes, you need to ensure the perfection of the system through a variety of means, during the design period to do a good job corresponding to the statistical work, the first design corresponding to the schematic diagram, must be strictly in accordance with the type of electrical control device, PLC needs to develop a reasonable schematic diagram, which is conducive to the content of the complete This will help to show the complete content. According to the content of the feasibility analysis, looking for design drawings among the problems to make corresponding improvements, the use of PLC technology to focus on the design of the circuit system protection system design and the stability of the control system. Secondly, we should also pay attention to the design of the control system, especially in PLC technology, the control system is the most central focus on the operating principle and application functions to achieve control. Only the integration of the functions, in order to integrate the scattered design together, and ultimately form an effective PLC control architecture. Finally, during the design of the communication network system to enhance the degree of application of PLC technology, so to strengthen the design of the communication network system to enhance the reliability of information transmission.

3.5.4. Strengthen the Switch Logic, Analog Control

The use of PLC technology can enhance the stability and reliability of the mechanical electrical control system, the technologies in China's industrial sector also has a wide range of applications, especially in the mechanical electrical control devices began to pay attention to the optimization and upgrading of PLC technology, through the technology can enhance the integrity of the functions, especially in the field of switching logic control, the use of PLC technology logic control characteristics work out the corresponding Optimize the traditional form of internal control technology of relays, has not been able to meet the needs of the current era, and the use of PLC technology can be executed in accordance with the circuit sequence logic work, the system can improve the efficiency of operation, but also to focus on the switch amount of logic control, but also to make reasonable control can not only focus on a particular device, but the need to use the switch logic control method to all production line links In order to ensure that the production process is effectively monitored and controlled, the value of the device can be effectively utilized to bring better impetus to industrial production. But during the analog control need to pay attention to the control of variables, through the previous form of control, combined with PLC technology to analyze and judge, and ultimately the formation of analog control within the system to establish a digital management mechanism, this management can improve the quality of the production chain.

4. Conclusion

The above shows that PLC technology in the field of mechanical and electrical control can have a very important impact, the system integrates automation technology and

computer technology, can improve the stability of mechanical and electrical equipment and production lines, so the technology has more advantages, has a very important position in the field of mechanical and electrical. So, in the process of practice need to strengthen the in-depth study of PLC technology, the performance of continuous optimization, in order to promote the sustainable and stable development of industry.

Acknowledgments

First of all, I would like to thank my supervisor. My mentor is very knowledgeable, disciplined, and innovative, and his unselfish attitude and innovative spirit have deeply influenced me. In life, I have also benefited from her positive and optimistic attitude towards life and her strict style of handling things. As a mentor, she has been very kind to me, and as an elder, she has been very caring to me, so I would like to send my sincerest thanks to her.

Secondly, I would like to thank my parents, who have given me selfless love and great support during my growth path, and who have worked hard for me to live a carefree life.

Finally, I would like to thank my classmates and hope that our friendship will continue to flow.

References

- [1] Zhong Lei. Research on the fault of electrical control system of construction machinery [J]. Internal Combustion Engine and Accessories,2022(01):79-81. Huang Zuguang,Wang Wenhao, Xue Ruijuan,Jiang Zheng. Safety function requirements and verification methods for wireless control systems of mechanical and electrical equipment[J]. Precision Manufacturing and Automation,2020(04):28-31+64.
- [2] Hu, Mengqian, Zhang, Xiaona. Research and application of digital control technology for electrical machinery and equipment--a review of Mechanical Electrical Control and Automation [J]. Mechanical Design, 2020,37(12):160.
- [3] Ma Zaimin. The application of PLC in the electrical control system of typical production machinery [J]. Electronic World, 2021 (01):208-209.
- [4] Jiang Kun. Specific application of PLC technology in mechanical electrical control devices [J]. Electronic World, 2021 (03):180-181.
- [5] Zhang Haiying. The application of PLC technology in mechanical electrical control devices [J]. Electronic Technology and Software Engineering,2021(13):115-116.
- [6] Zhu Cuixia, Deng Rongqi. The application of PLC technology in mechanical electrical control devices [J]. Electronic Technology and Software Engineering,2021(17):113-114.
- [7] Guo Wu. Application of PLC automation technology in mechanical electrical control [J]. Paper Equipment and Materials, 2021,50(06):37-38.
- [8] Zhang J, Meng Gqian. Application of PLC technology for mechanical electrical control devices [J]. Electronic Testing, 2021 (20):139-140.
- [9] JWang Xingzhao. PLC technology in the application of agricultural machinery electrical automatic control [J]. Southern Agricultural Machinery,2021,52(22):195-196. Zhen Ming. Analysis of the application of PLC technology in mechanical electrical control devices [J]. Science and technology wind,2020(34):185-186.
- [10] Guo Xuanming. Application of PLC control in automated production design--Review of Mechanical Electrical Control and PLC Application [J]. Machine Design,2020,37(10): 152.

- [11] Xiang Wanqin,Ao Wei. Mechanical electrical control and electrical automation development application discussion--Review of "mechanical electrical control and PLC applications" [J]. Mechanical Design, 2020,37(11):150.
- [12] Liu Bo. PLC automation technology based on the application of agricultural machinery electrical control [J]. Southern Agricultural Machinery, 2020,51(22):50-51.
- [13] Bo Runfang. Analysis of the application of PLC technology for mechanical electrical control devices [J]. Shandong Industrial Technology, 2019(01):135.
- [14] Ge Kun. Practical research on the application of PLC technology in mechanical electrical control devices [J]. Internal combustion engine and accessories,2019(03):192-193.
- [15] Zhang Shu. Practice and investigation of PLC-based technology in mechanical electrical control devices [J]. Science and technology wind,2019(07):130.
- [16] Dong Longhu. Practice and investigation based on PLC technology in mechanical electrical control devices [J]. Building materials and decoration,2019(12):234-235.
- [17] Xing Jieli. Application of PLC technology for mechanical electrical control devices [J]. Equipment management and maintenance,2019(14):226-228.