

Modular design of electronic control for automatic production line of brasque burdening packing

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Abstract. The electronic control modularization technology of the automation production line of brasque burdening packing provides a positive impetus to the development of related industries. In order to further improve the theory and technology of electronic control module in China, in this paper, the related theories were first outlined, and the design of the electronic control modularization technology for automation production line of brasque burdening packing was discussed, and the associated diagnostic system was further referenced to analyze the constructed modules. The results show that the control module hardware and software equipment are running normally, and the system has higher productivity than traditional technology. The aim of the study is to provide reference for the development of related technologies.

Key words. Brasque burdening packing, automatic production line, electronic control modular.

1. Introduction

With the development of the times, today's international environment has begun to gradually toward the direction of development, and has begun to take economic and scientific development as the theme of the development of the times. Under the theme and background of new era development, each country and region have begun to regard scientific development as the first productive force of its economic development. In this context, many new technologies and theories have been continuously introduced and applied in the production of various industries, which have had a significant positive impact on the further development of the industry and the improvement of production efficiency. With the rapid development of the times, the world economy has been greatly improved. At the same time, various industries in the world have begun to develop in a more automated and concise way. Especially since the industrial revolution, each country and region has greater demand for the

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promotion of economic strength. Due to the further liberation of human hands, the process of automation has made human resources more efficient. Because of the reduction of the negative influence caused by subjective factors, the development of the whole enterprise is more sustainable. China has also begun to apply automation technology in the production process of some industries, and has achieved some results in the development of the times. This study will design and research the electronic control modularization of automatic production line of brasque burdening packing. The research aims to provide theoretical support and reference for the improvement and development of related technology and theory in China.

2. State of the art

In the new era of economic development, a number of new enterprises and fields began to be developed, such as the development of the electronic control module, which gradually becomes one of the basic industries for the production of various electronic products in the high-speed development of the electronic age [1]. Through the analysis of the current status of the development of electronic control module, many research scholars found that the production of the electronic control module has the defects in the manual operation, which makes the packaging of the ingredients not perfect enough, which has a negative impact on the development of other electronic industries [2]. With the gradual increase in the importance of electronic control module, now the industry has gradually become an important industry in the development of today's era, which can provide some parts for the development of other electronics industry, so as to provide a great impetus to the economic development of the world electronics industry [3]. In the demand of the times, many scholars have put forward new technologies and theories and have applied them to the practical development of electronic control modular production [3]. As a new technology, computer technology has brought more new technology to the development of today's era and has had a positive impact on the development of various industries [4]. Now a lot of research scholars believe that computer aided technology has enabled many industries to become more automated, and enabled enterprises to collect large amounts of related basic data, at the same time, it also further enhanced the production efficiency of related enterprises, thereby enhancing the level of enterprise's comprehensive competition [5]. Therefore, the automated production line processes are also being gradually applied to the development of electronic control modules.

3. Methodology

Since the first industrial revolution, the world has gradually entered the era of industrialization, making people's production and life greatly changed. Since the modern industrial revolution, the world has gradually entered the era of electronic information. The development of this era is characterized by the gradual emergence of some electronic products and the application of people's production and life, so

as to bring more comprehensive joy to people's life. In the new era background, China has further followed the course of the development of the times, and gradually entered the era of electronic information, China's electronic industry has begun to develop. With the rapid development of some electronic industries and the inevitable trend of the times, nowadays, in order to make our electronic products more colorful, our electronic industry needs to design the control module of all kinds of electronic products [6]. A lot of control module production has been applied to the actual electronic products, such as television sets, air conditioning and other control modules, which makes it more satisfied with some of the needs of people compared with the early electronic products, and then makes its function have a more perfect development [7]. With the increasing diversity of electronic products, the design of electronic control templates has gradually been required and put into actual industrial production. More perfect electronic control template production technology plays an important role in the development of production in the electronic industry, and gradually becomes an indispensable technology for the development of the times [8]. In this study, through the investigation of the current electronic module design enterprises in China, the author found that nowadays, in the top ten electronic module design enterprises in our country, foreign-funded enterprises accounted for a larger proportion, Sino foreign joint ventures enterprises followed. There are only one local electronic module enterprises in our country (Fig. 1), which indirectly shows that the comprehensive level of electronic module design enterprises in China is still relatively backward.

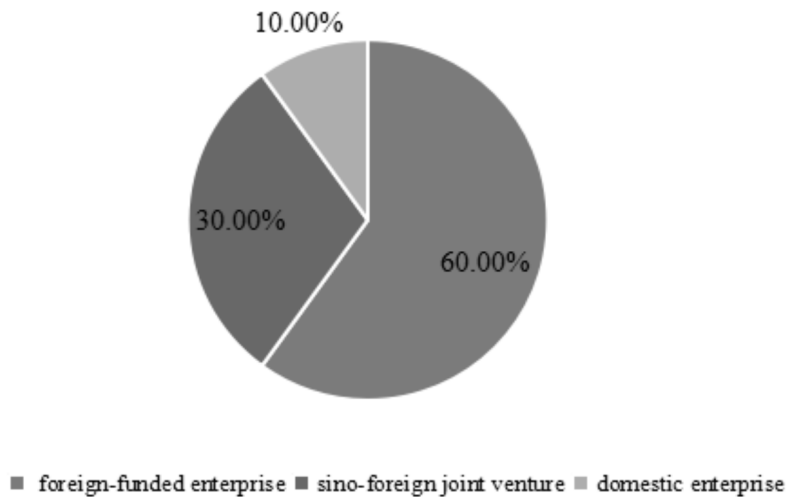


Fig. 1. China's top ten electronic module design enterprises

On the basis of understanding the present situation of the development of electronic module design enterprises in our country, the author summarized the causes of the backward production of electronic control module in China (see Fig. 2). The main reasons are as follows: (1) because the electronics industry started relatively

late, China has not yet formed a more perfect development model, therefore, the continuity of the production structure has further affected the development of the electronic model design enterprise; (2) the electronic model design enterprises in our country use more traditional methods of manual production because of more, so that the production efficiency is low, and the cost of human resources increases, which further indirectly affects the improvement of comprehensive level of the industry; (3) because the enterprise has not formed the pillar enterprises of our country, which makes the country pay less attention to it and leads to less research on this industry in China, China has not formed a more perfect theoretical system, which makes the development of this enterprise suffer some theoretical restrictions; (4) because the enterprise is deeply affected by the traditional technology, the enterprise cannot integrate with the new technology and theory, and then cannot form a new production mode suitable for the development of the times. On the basis of research on the related problems, many research scholars have begun to put forward some new technology into the production of electronic module design enterprises, which promotes the continuous improvement of production efficiency, further makes its products more perfect, so as to provide certain technical support for the development of the entire industry scale [9]. As an important innovation link in the design of electronic control module, the automatic production line of brasque burdening packing has a positive influence and a great impetus to the development of this enterprise. However, due to the backward development concept of some enterprises in our country, the introduction and combination of this technology are not enough, which has a negative effect on the improvement of the design of the electronic control module [10]. In view of this situation, this study researched and analyzed the relevant theories of the electronic control module design of the automated production line of brasque burdening packing, and summarized the advantages of the technology. The research aims to provide some reference and theoretical support for the continuous development of related products and industries.

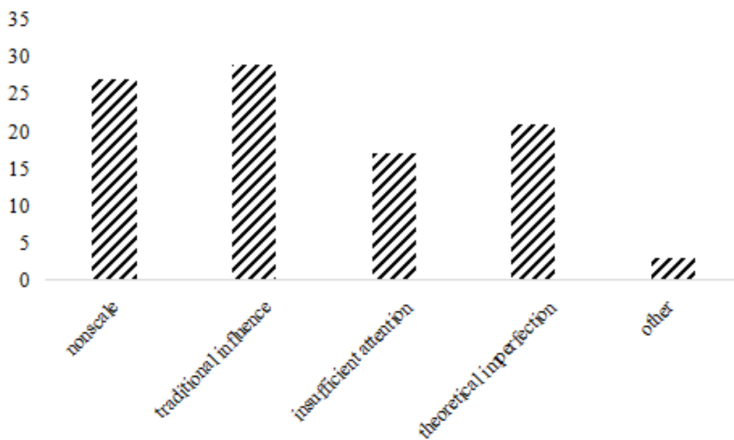


Fig. 2. Lack of enterprise development of electronic control module in China

Firstly, through the reading of relevant materials, this study summarized the process flow of the production line of brasque burdening and its related subsystems to determine the design principle of the production line process and comprehensively analyzed the characteristics of its various subsystems, thus forming a clearer theoretical basis.

Secondly, according to the relevant theoretical basis, this study chose and designed the main hardware equipment of the electronic control module of the brasque burdening production line. The design of electronic control module was mainly based on SIMATIC S-300 system. The module is highly scalable and has relatively high performance. On the basis of the acute design of the control system of the main control module, the author designed and studied the sensor and transmitter of the production line, including temperature, temperature, weighing and speed measurement and other main sensors. The model formulas for the working process of weighing and speed measuring sensors are formulas (1) and (2). Only by optimizing the parameters of the system can the sensor be more efficient. The model formula is as follows

$$\frac{M}{0.7 \times N} \leq m \leq \frac{M}{0.6 \times N}, \quad (1)$$

where M is the total weight of the product delivered by the production line, N is the number of weighing sensors in the whole production line, and m is the weight of a single weighing sensor.

$$w(t) = qv, \quad (2)$$

where $w(t)$ is the comfortable flow of a speed sensor, q is the actual load value of the material on the sensor (kg/m), and v is the speed of the conveyor belt of the production line (m/s).

Thirdly, after the selection of the hardware equipment for the entire brasque burdening production line was completed, the author further designed the system communication of the entire production line. The main application technology was the PROFIBUS system. Through the network information link way, the research enabled each link to obtain certain connection through the local area network, thus realizing the final basic data sharing.

Fourthly, based on the design of all the programs, the study further introduced the PROFIBUS theory to carry out anti-jamming diagnosis of the whole transmission system. The basic characteristics of this kind of theory are shown in Table 1.

Table 1. Basic features of a transport medium based on PROFIBUS-DP

Network topology	Linear bus, there are active bus terminals at both ends of the bus, bait rate ≤ 1.5 Mbit/s allows the use of short wiring
Medium	Shielded twisted pair cable
Station count	Without repeater, each divided into 32 stations; with repeaters, there can be assigned up to 127 stations
Plug connector	9-pin D-type plug

This research finally put the related production line to the actual electronic products enterprises, studied and discussed the modular design of electronic control of automatic production line for brasque burdening packing and the advantages of its applications from an example point of view.

4. Result analysis and discussion

All aspects of the traditional packaging production line mainly include the charging of the raw material of the product, the storage of raw materials, the weighing of raw materials, raw material delivery of the conveyor belt, mixing and packaging of raw materials. The associated process is shown in Fig. 3 (Mishra et al. 2009) [11].

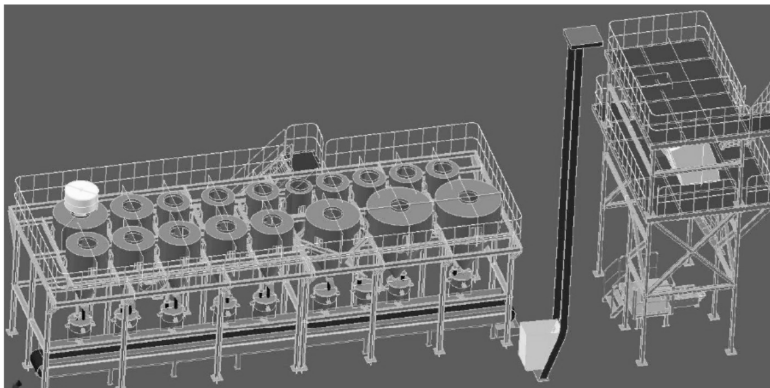


Fig. 3. Process flow of brasque material production line

As an important part of the automated production line of brasque burdening packing, the electronic control module can meet the needs of people, and can also effectively improve the production efficiency in the whole production process. Studies have pointed out that the electronic control module of automatic production line for brasque burdening packing is mainly composed of workstations that monitor and control the entire operation process (see Fig. 4) and related SIEMENS PLC S7-300 systems. The whole control module collects the data of all the links and sends the commands generated by the central system into the control module of each link through the monitoring equipment, and carries on the relevant parameter operation to the whole process, monitors the whole operation process, so that the parameters produced by all links can be recorded and adjusted in a timely manner, which can effectively help the central control system for real-time monitoring of all sectors, and further help the staff to conduct real-time monitoring, so as to realize the whole operation process and improve the production efficiency, and convenient for the management.

Based on the understanding of the relevant theories, this paper further analyzed and discussed the application of the electronic control module of the automatic production line for SIMATIC S-300 brasque burdening packing in the actual electronic products enterprises (Rashid et al. 2015) [12]. The author introduced the

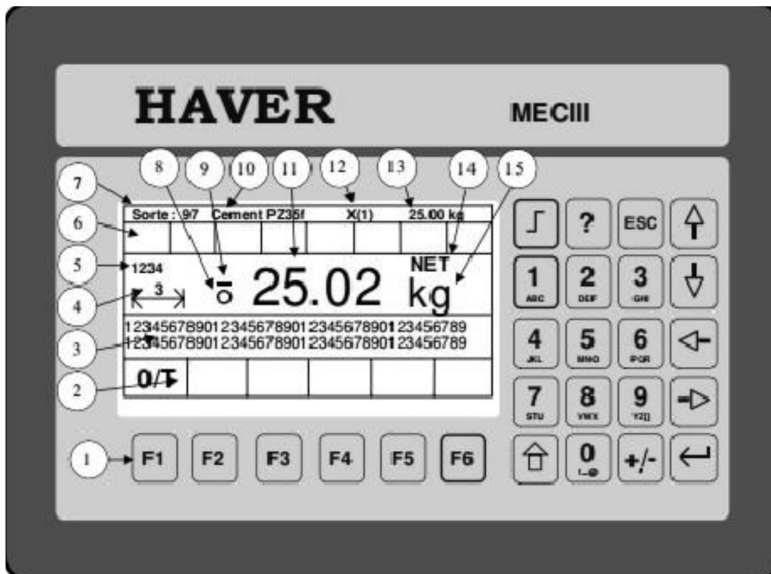


Fig. 4. Construction of automatic electronic control module for brasque burdening packing

PRORIBUS system to diagnose the hardware and software of the automated production line to determine the safety and reliability of the control system (Francisca, et al. 2010) [13]. Firstly, this study analyzed and diagnosed the hardware of the electronic control module. Among them, the diagnosis of hardware equipment was mainly in its sensor and calculator and analysis of operation process of electromagnetic valve, so as to determine whether the operation process was normal, and ensure the normal operation of the whole automation production line (Arasan et al. 2008) [14]. The related hardware test results are shown in Table 2. The results show that all the sensors, transmitters and actuators of the electronic control module used in this system can be operated normally, which can provide technical support for the subsequent applications (Srivastava et al. 2014) [15].

Table 2. Hardware device test results of electronic control module system of automatic production line of brasque burdening packing

Sensors and transmitters					
Temperature sensor	Weighing sensor	Speed sensor	Displacement sensor	Flow sensor	Level sensor
30–40 °C	0.6–0.8 kg	1–1.5 m/s	1–1.5 m	0.4–0.5 M	4–20 mA
Actuator					
Solenoid valve			Electric control valve		
Magnetic force can operate normally			After collecting the relevant data, it can be adjusted automatically		

Then, this study further studied and analyzed the software equipment of the whole system. The diagnosis of software was mainly based on the transmission rate of its basic data. In connection with different links, it is necessary to diagnose the length of the network cable, and the cable should be selected first without a screw lines. This study compared and used three different cables, A, B and C. The parameters of different cables are shown in Table 3. Then, the author analyzed the relationship between baud rate of three different cables and the length of cable, as shown in Table 4. Through the analysis, it can be seen that in three different cables, the performance of cable A is better, which has stronger impedance strength under the influence of the electromagnetic radiation environment, so it has higher anti-interference performance, so as to make the operation process more stable. And the results show that when the baud rate exceeds 500, this may have a higher requirement for the length of the cable, so the author believes that in order to ensure the transmission efficiency of the cable for the relevant basic data, it is necessary to determine the length of the cable used

Table 3. Cable parameters of different models

Cable type	Impedance	Capacitance	Loop resistance	Gauge	Conductor area
Type A	135–165 Ω	<30 pf/m	110 Ω /km	0.66 mm	>0.34 mm ²
Type B	95–125 Ω	<20 pf/m	140 Ω /km	0.82 mm	>0.34 mm ²
Type C	65–80 Ω	<20pf/m	120 Ω /km	0.66 mm	>0.52 mm ²

Table 4. Correlation analysis of baud rate and cable length of different types of cables

Baud rate (kbit/s)	Distance/segment (m)		
	Type A cable	Type B cable	Type C cable
9.6	1200	1100	950
19.2	1200	1100	950
93.75	1200	1000	950
187.5	1000	900	700
500	400	350	350
1500	200	170	190
12000	100	90	50

Finally, this study compared and analyzed the electronic control modularization of the automatic production line for brasque burdening packing and the traditional production line technology. The results are shown in Fig. 5. The results show that the electronic control modularization technology of the automatic production line for brasque burdening packing can effectively improve the production efficiency of the production line, and further save human resources, thereby reducing the cost and making the production benefit higher. Therefore, in the subsequent development of related industries, it is necessary to continuously improve and develop the electronic

control module technology of the automatic production line for brasque burdening packing, so as to provide technical support for the development of related industries.

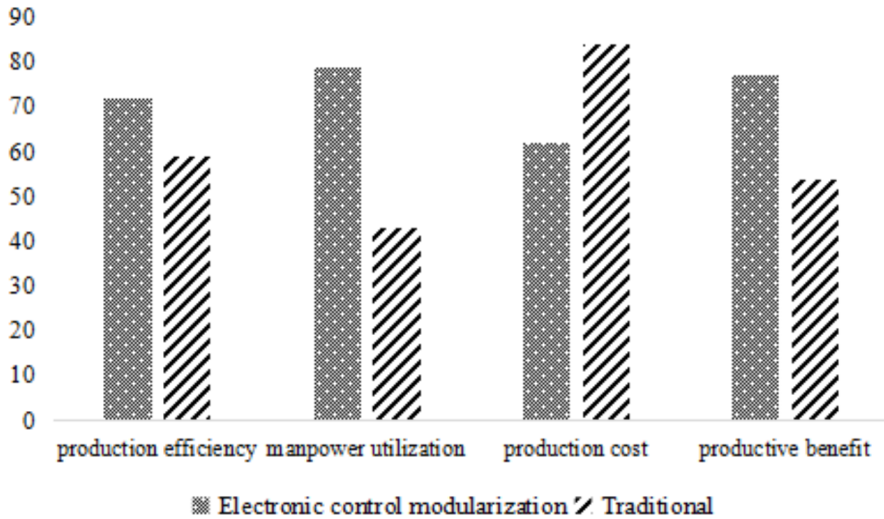


Fig. 5. Comparison and analysis of the electronic control modularization of the automatic production line of brasque burdening packing and the traditional production line technology

5. Conclusion

With the development of the times, every industry has developed a lot, especially the development of electronic enterprises has brought a very important impetus to the development of the comprehensive economic level of the world. In this trend, the electronic control module technology of the automatic production line for brasque burdening packing has brought a positive impetus to the development of various electronic industries. However, the relevant industry in our country still lacks a deep understanding of the technology and theory, the technical development of the relevant industry in our country is not perfect enough. In order to provide theoretical basis for the development of related technologies and theories in China, the relevant theories were summarized, the design theory of hardware and software facilities was further described, and the hardware and software performance of the electronic control module was diagnosed. It is concluded that the electronic control module technology of the automatic production line for brasque burdening packing has a positive influence on the development of the related industry. Because of the lack of cognition of the relevant theories, the research has some shortcomings, but it can provide the theoretical basis for the related research.

References

- [1] S. RYALAT, R. DARWISH, W. AMIN: *New form of administering chlorhexidine for treatment of denture-induced stomatitis*. Therapeutics and Clinical Risk Management (2011), No. 7, 219–225.
- [2] L. A. CASEMIRO, C. H. G. MARTINS, F. C. P. PIRES-DE-SOUZA, H. PANZERI: *Antimicrobial and mechanical properties of acrylic resins with incorporated silver-zinc zeolite—part I*. Gerodontology 25 (2008), No. 3, 187–194.
- [3] H. GUPTA, A. BHAT, K. D. PRASAD, K. M. S. PRASAD, K. V. KUMAR: *An innovative method of incorporating antifungal agents into tissue conditioners: An in vitro study*. Trends in Biomaterials and Artificial Organs 25 (2011), No. 2, 63–66.
- [4] V. R. SANTOS, R. T. GOMES, R. A. DE MESQUITA, M. D. DE MOURA, E. C. FRANCA: *Efficacy of Brazilian propolis gel for the management of denture stomatitis: A pilot study*. Phytotherapy Research 22 (2008), No. 11, 1544–1547.
- [5] N. EMIRA, S. MEJDI, M. AOUNI: *In vitro activity of Melaleuca alternifolia (tea tree) and eucalyptus globulus essential oils on oral candida biofilm formation on polymethylmethacrylate*. Journal of Medicinal Plants Research 7 (2013), No. 20, 1461–1466.
- [6] A. MERTAS, A. GARBUSINSKA, E. SZLISZKA, A. JURECZKO, M. KOWALSKA, W. KRÓL: *The influence of tea tree oil (Melaleuca alternifolia) on fluconazole activity against fluconazole-resistant candida albicans strains*. BioMed Research International (2015), ID. No. 590470, 1–9.
- [7] B. T. BAL, H. YAUZYILMAZ, M. YÜCEL: *A pilot study to evaluate the adhesion of oral microorganisms to temporary soft lining materials*. Journal of Oral Science 50 (2008), No. 1, 1–8.
- [8] W. M. AMIN, M. H. AL-ALI, N. A. SALIM, S. K. AL-TARAWNEH: *A new form of intraoral delivery of antifungal drugs for the treatment of denture induced oral candidosis*. European Journal of Dentistry 3 (2009), No. 4, 257–266.
- [9] H. KOMINE: *Predicting hydraulic conductivity of sand–bentonite mixture backfill before and after swelling deformation for underground disposal of radioactive wastes*. Engineering Geology 114 (2010), Nos. 3–4, 123–134.
- [10] Z. MINGHUA, F. XIUMIN, A. ROVETTA, H. QICHANG, F. VICENTINI, L. BINGKAI, A. GIUSTI, L. YI: *Municipal solid waste management in Pudong New Area, China*. Waste Management 29 (2009), No. 3, 1227–1233.
- [11] A. K. MISHRA, M. OHTSUBO, L. Y. LI, T. HIGASHI, J. PARK: *Effect of salt of various concentrations on liquid limit, and hydraulic conductivity of different soil-bentonite mixtures*. Environmental Geology 57 (2009), No. 5, 1145–1153.
- [12] H. M. A. RASHID, K. KAWAMOTO, T. SAITO, T. KOMATSU, Y. INOUE, P. MOLDRUP: *Temperature effects on geotechnical and hydraulic properties of bentonite hydrated with inorganic salt solutions*. International Journal of Geomate 8 (2015), No. 1, 1172–1179.
- [13] F. M. FRANCISCA, D. A. GLATSTEIN: *Long term hydraulic conductivity of compacted soils permeated with landfill leachate*. Applied Clay Science 49 (2010), No. 3, 187–193.
- [14] S. ARASAN, T. YETIMOGLU: *Effect of inorganic salt solutions on the consistency limits of two clays*. Turkish Journal of Engineering & Environmental Sciences 32 (2008), No. 2, 107–115.
- [15] A. SRIVASTAVA, S. PANDEY, J. RANA: *Use of shredded tyre waste in improving the geotechnical properties of expansive black cotton soil*. International Journal Geomechanics and Geoenvironment 9 (2014), No. 4, 303–311.

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