Development and implementation of standardized measurement and control system

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Abstract: At present, due to the variety of product models and the increasing production data, the existing single machine based tester can not meet the needs of production. This paper introduce how to design and develop a centralized measurement and control system for servo products through standardized design and craft configuration.

1. Introduction

1.1. Background
In order to ensure the quality stability of servo products, it is necessary to test and analyze the assembled servo products. At present, due to the variety of product models and the increasing production data, the existing single machine based tester can not meet the needs of production. First, the development of the tester is not standardized, which not only causes great difficulties to the maintenance, but also leads to heavy workload of designing and implementing the new tester; Second, the direct operation in the debugging site not only limits the flexibility of personnel, but also has certain security risks. In order to improve the operation flexibility and reduce the security risks, the demand for remote control is becoming more and more urgent. However, the existing methods can not meet the above needs, so the development and implementation of centralized measurement and control system for servo products is put on the agenda.

1.2. Current situation analysis
According to the current situation of testers, the most prominent contradiction is reflected in the operation process of different models of testers, and there is no unified standard for software writing. In the development of new models, it is often from the beginning to carry out the system outline design, detailed design, development, debugging, operation, resulting in a wide range of software versions, which not only brings some difficulties to the maintenance of the software, but also adds a lot of inconvenience to the operation of the operator. As shown in Figure 1

![Figure 1 The development of new models](image)

1.3. Design goal
In view of the above situation, this paper will discuss how to establish a standardized way to implement
the same process for different models and different products, as well as to replace software programming with standardized configuration, so as to ultimately improve the development cycle of new model test equipment and reduce the learning difficulty of operators. as shown in the figure below:

![Diagram](image1)

**Figure 2 The design goal of development of new model**

2. **Detailed technical scheme of the project**

2.1. **Standardized design of testing technology**

Firstly, the routine test process is analyzed, as shown in the figure below:

![Diagram](image2)

**Figure 3 The routine test process**

The main steps are as follows:

1. Generate test waveforms (including sine wave, square wave, triangle wave and other standard waveforms or arbitrary waveforms composed of data points) for data driving and acquisition.

2. After the completion of the acquisition, the collected data needs to be stored as data files. The stored data files are named according to certain rules, and each data file contains basic information such as the number of test channels, test points, test interval and so on.

3. After the data is saved, the test data is processed, including static characteristics such as zero position characteristics, power consumption characteristics and dynamic characteristics such as position characteristics, transient characteristics and frequency characteristics. Different characteristic processing is strictly calculated according to the specific characteristic processing algorithm to get the product characteristic index.

4. After data processing, get the test characteristic index, judge whether the index is within the specified range, and mark the index when the index is out of tolerance.

The above test process is classified and sorted, and the test parameters required by the test process are classified into test process parameter set, test processing parameter set and test index parameter set, so as to form experiment file (hereinafter referred to as "exp file"), process file (hereinafter referred to as "pro file") and standard file (hereinafter referred to as "STD file").

The above files form the standard configuration file structure of the test sub items. Combined with the requirements of test automation, the test project is composed of multiple test sub items. The test sub items in the test project can be fully automatic or single test according to the needs. The structure of the test project is as follows:
A test project can completely describe a test task. When different models and products carry out different test tasks, it is mainly reflected in the different configuration of the test project. Different standardized configuration instructions are established for different parameter sets.

2.2. Communication standardization

(1) Flexible protocol identification

In the design of this system, the adaptation with different models and different types of products is considered, so all the possible situations in the test are investigated and clarified in detail, and different models of testers are allowed to cut the protocol according to the actual situation. In the actual test process, the protocol is initialized according to the following procedures, as shown in the figure:

The centralized control terminal sends TCP/IP connection request to the testing device. The testing device receives the request, establishes the connection, and sends the protocol string suitable for its own needs. The centralized control terminal performs anti-parsing and initializing protocol according to the received protocol string. After this process, the centralized control terminal and testing device reach an agreement and start the test.

Note: Protocol strings are packaged in XML format, and the sequence of protocol strings in XML is the identification number. For example, `<array><Val>testtype</Val><Val>Save type</Val></array>`, the ID of “testtype” is 1 and the ID of “save type” is 2.

(2) Data packaging method:

The packet is divided into four parts. The first part is the length of the whole packet (excluding the
length part), accounting for four bytes; The second part is the identification bit, which takes up two bytes. The identification bit is confirmed after receiving the protocol string and initializing the protocol. The third part is the data bit, which determines the length according to the actual situation; The fourth part is the checkmark, which takes one byte. The data coding is carried out in a agreed manner.

2.3. *Standardized design of test process*

On the basis of process standardization configuration, the test process is standardized, as shown in the figure below:

![Figure 7 The Standardized process of testing](image)

The difference from the conventional mode is that the software needs to analyze the configuration file in the design process, and according to the requirements of the configuration file, generate waveform signal, collect and store data, analyze test data, generate data reports, and finally judge the results.

Any testing of product should follow the rules above, so as to normalized operation and standardized processes.
2.4. **overall design**

Based on the above standardized design, the centralized measurement and control system mainly includes four parts: system, configuration, test, and data processing. As shown in the figure above: the configuration module is the embodiment of process standardization design; The test part is the embodiment of test process standardization and communication standardization; Data processing is the implementation of process standardization design.

The lower computer test module needs to set the hardware driver according to the actual situation, convert the process configuration information into the corresponding signal according to the standardized definition, and store the data. Finally, through the process standardization design and process standardization design, the differences of hardware resources are shielded, and the unified operation, unified data structure, unified test process and unified data processing and interpretation are presented to the operator. Remote access to different test equipment is realized.

3. **Implementation effect**

After software design and development, the implementation effect is shown in the following figure: In the case of sufficient hardware resources, it can establish a connection with different test equipment and carry out test tasks at the same time; The system provides the representation of tab page and tile, as shown in the figure below:
4. summary
The intelligent production line measurement and control system improves the automation level and shortens the production cycle. It realizes the transparency and real-time remote monitoring of the production process, achieves the effect of man-machine separation, ensures the safety of operators, and
realizes the whole process data management. Through the standardized interface design and standardized operation process, it not only realizes the standardized configuration and process operation of the test process, reduces the technical requirements for the operators, but also provides the Standard Specification for the design and implementation of the subsequent new tester, and reduces the difficulty of the subsequent system integration.

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