Design of General Test System for Optoelectronic Equipment Based on Computer

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Abstract. In recent years, with the popularization of optoelectronic equipment in various industries, various reconnaissance equipment and test equipment have also appeared. Traditional test technology and system functions can no longer meet the development of optoelectronic equipment, so it is imperative to introduce general test ideas and establish a general test system.

Keywords: Optoelectronic Equipment, General Test System, Software Design Structure

1. Introduction
With the development of technology, the test system becomes more intelligent and automated. The new universal test system is a combination of computer system and instrument system technology. The system utilizes the powerful functions and outstanding performance-price ratio of the computer system, and at the same time it also combines the corresponding hardware, this greatly breaks through the limitations of traditional instruments in data processing, display, transmission and storage.

2. Current status of photoelectric equipment test system
Independent photoelectric systems include lasers, visible light, infrared, digital cameras, etc., and these systems require the tracking seat to be highly maneuverable, fast in response, and able to track high-speed and high-acceleration targets. With the development of science and technology, the future of optoelectronic equipment will develop in the direction of high precision and strong anti-interference ability. The scope of application will also be wider. These optoelectronic devices require precise testing when they are applied. Therefore, the status of the test application of optoelectronic equipment is very important [1].

Optoelectronic equipment testing is today’s cutting-edge technology. At present, our army is equipped with a wide variety of optoelectronic equipment. The testing equipment currently equipped is based on the original optoelectronic equipment sub-systems' own testing equipment. Most of them use discrete components. There are the following Disadvantages:

1. The number of equipment is large, scattered and not supporting;
2. Low degree of automation, intelligence, generalization, poor stability, and high failure rate;
(3) The detection workload is large, the efficiency is low, and it is inconvenient for the judgment, analysis, statistics, storage and transmission of the detection data;

(4) Long maintenance period and high cost.
These directly affect the full play of the overall effectiveness of the equipment. In order to meet the operational needs under high-tech conditions in the future, it is imperative to design a new type of test system to replace the original system for accurate, fast, economical, and convenient field testing and maintenance of optoelectronics [2].

3. Design of general test system for optoelectronic equipment

3.1. The formation of optoelectronic equipment
The basic composition of photoelectric equipment is divided into hanging spherical turret and onboard display control processing system, as shown in Figure 1. From the perspective of hardware composition, the turret includes a U-shaped bracket, a spherical stage, an angle measurement system, an electronic control drive system, a gyroscope, a gyroscope stabilization loop, a photodetector, TV and infrared trackers, and interface circuits. Wait. In principle, the turret can be divided into two parts: stable platform and photoelectric payload (detector). The photoelectric load is installed on a stable platform. The gyro-stabilized platform isolates the vibration of the carrier to obtain a relatively stable platform space in inertial space. Driven by control instructions, the photoelectric load can realize the search, capture, tracking and positioning of the target.

Therefore, the gyro stabilization platform achieves two major functions: one is spatial stability, and the other is the ability to track targets. Detectors (payloads) can be used in different combinations according to different tasks. For photoelectric equipment that completes search and tracking tasks, they generally include visible light/low-light cameras, infrared thermal imaging cameras, and laser rangefinders. In addition, the payload can also be equipped with equipment such as laser illuminators, laser pointers, laser alarms, and graph spectrometers as required [3].

Many specific technical issues in system modular design, such as operating systems, application software, digital processing, packaging technology, high-speed networks, and human-machine interfaces, need to be continuously improved in order to obtain all the benefits that modular methods can provide. In the future, the optoelectronic system will develop in the direction of functional integration, small size, light weight and miniaturization.

![Figure 1. Typical photoelectric equipment hardware connection diagram](image)

3.2. Design of general test system for optoelectronic equipment
Under normal circumstances, the test system should have four basic functions, namely: signal measurement and control, data analysis and processing, calculation and output of test results, and storage of test results. Signal measurement and control are the main problems to be solved by the test system. General testing mainly solves the problems of multiple interfaces, inconsistent standards, and flexibility and adaptability of the test [4].

According to the test characteristics of the optoelectronic equipment system, the test content mainly includes communication test (communication with the tested device and communication with the tested device), mechanical test (such as lifting platform test, gyroscope test, angular velocity of the turntable, angular acceleration of the turntable, etc. Etc.), image algorithm processing and analysis (such as tracking accuracy, tracking speed, stabilization accuracy, angle measurement accuracy, optical axis consistency, etc.), three parts. Among them, communication testing and mechanical testing are the testing of control equipment and elevators in optoelectronic equipment; the processing and analysis of image algorithms are the main content of optoelectronic equipment testing and the research focus of general testing.

Different test systems have great differences in test capabilities and system structure, but for the optoelectronic equipment test system, when designing a general test system for optoelectronic equipment, the issue of hierarchy should be emphasized. Usually can be divided into three levels, namely the basic layer, system layer and application layer. The basic layer refers to the software and hardware equipment selected by the system designer when combining the test system. Generally, advanced and mature products should be selected so that the test system has a more reliable foundation. The advanced nature of the final system is determined by the basic level. The system layer should consider whether the selected software and hardware are compatible, matched, complete, and expandable. At this level, emphasis is placed on quality certification and reliability, as well as expansion capabilities. The application layer solves the interface relationship between the test system and the test object, and its focus is on the application software [5].

3.3. The versatility of the development process of the optoelectronic equipment general test system
The general test system structure has different definitions in different fields, but there are basic commonalities. As far as the test system is concerned, the essence of a general test system should be a standard application program on a general-purpose computer and a standard hardware module that follows the unified communication protocol, instead of a traditional test system that contains special applications and special hardware. system.

The universal system development process is one of the core issues of our design. It masters the principles of system development and measures whether a system is sustainable and reproducible. The development process is a process that the system must follow during the development process. It is established when the requirements are clear and the design ideas have been researched and verified. The development process of the optoelectronic general test system is developed during the development process of the system [6]. The process that personnel must follow in the development process, as shown in Figure 2 is the development process of the entire system.
4. The overall implementation plan of the general test system for optoelectronic equipment

4.1. Architecture of the test system

The general test system architecture of optoelectronic equipment is shown in Figure 3. The connection between the modules in the optoelectronic test system, the right side of the dotted line is the general test system. Through this diagram, you can basically understand how each part controls and communicates with each other through the core industrial computer. Communication is the core of the communication between the various parts of the test system. It is not only the communication between people and the test equipment and the equipment under test, but also an exchange between various equipment [7].
4.2. Software design structure
The development of system software is the key to the integration of optoelectronic equipment test systems. The design of test software must consider all aspects, make full use of advanced software programming technology, select stable operating systems and development platforms, from the compatibility, portability, openness, versatility, modularity, and easy upgrade of the software system. Comprehensive consideration of all aspects such as performance, carefully plan all parts of the software, try to shorten the development time of the software, save costs, reduce software complexity, and improve development efficiency.

In the process of test system development, software is an important factor affecting system cost and system development time, and plays an extremely important role. In terms of function, the software covers a wide range, from device drivers that control specific hardware interfaces to development environment packages needed to develop a complete system. The quality and performance of these software ultimately determine the quality and use of the test system developed [8, 9].

4.3. System software flow
In the test software framework, the read, interpretation, and execution of the test project process, the acquisition, judgment, and display of the measurement results are all scheduled by the main debugging program. The configuration parameters of test instruments and test items are saved by the project configuration file in the test process library, the test result data is managed by the database, and the task of the test process is to read the data in the configuration file, configure the test instrument, and perform the corresponding Data collection, analysis and calculation, and write test results to the test database, and generate reports.

The extraction of general software library, in the previous analysis of software generality, has structured the entire software, the division here is more detailed, and the future system expansion provides a good way and method. In this way, all modules are independent to form their own interfaces, and they do not interfere with each other when adding and modifying. According to test requirements, the system software is divided into test interface library, algorithm library (image...
algorithm library, mechanical algorithm library), test process library, operation log library, instrument driver library, test database (data report, graph), abnormal output Library, communication module library [10].

5. Conclusion
In short, with the rapid development of computer and communication network technology, it will definitely promote the distributed test system and remote fault diagnosis technology formed by high-speed computer network, so that the test technology can be applied in a wider range of fields.

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