Smart substation secondary equipment plug and play technology application

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Abstract: Is proposed in this paper, including the design of intelligent substation, construction and operational stages within the whole life cycle of technology innovation, further analysis the secondary equipment key problems and techniques of modular design, to "plug and play" technology system research and the application in the smart substation as the main line, the paper introduces the construction stage in prefabricated tank secondary equipment standardization of interface design, this paper discusses the operational phase process layer intelligent device plug and play, avoid setting of relay protection and automatic recognition of intelligent tripping and migration research such as technology protection function. The construction period of the substation is greatly shortened, and the intelligent control is realized to "plug and play".

1. INTRODUCTION
To realize the plug and play function of secondary devices, the precondition is to standardize virtual terminals and communication interfaces, and the realization means is to set up and match communication links automatically. The "six unified" design ideas of secondary equipment of State Grid regulate the design of terminals of relevant protection screen, such as DC power supply section, AC voltage section, AC current section, positive exit section, negative exit section, etc. Therefore, the related circuits of secondary equipment in substation have good universality, and the secondary circuits of substation using standard modules are basically the same. On this basis, the standardization design scheme of secondary equipment interface in the prefabricated cabin is proposed. Intelligent substation operation and maintenance phase and requires to reduce the equipment failure time, improve the efficiency of the use of equipment, realize the interoperability of IED(Intelligent Electronic Device) and even interchangeability, convenient equipment maintenance, overhaul and replacement as well as the expansion of substation and automation system expansion. In this technical background, the concept of "plug and play" of secondary devices is introduced. "Plug and play" technology refers to the automatic access of new external devices to the system. The system automatically recognizes configuration changes without manual intervention. The application of plug and play technology can make the entire system easy to operate, high efficiency, reliable data collection, flexible display, and convenient dynamic configuration[1-6]

2. PLUG AND PLAY SECONDARY DEVICES
To realize the plug and play function of secondary devices, the precondition is to standardize virtual...
terminals and communication interfaces, and the realization means is to set up and match communication links automatically. In the virtual terminal automatic correlation scheme proposed by a 220kV substation, the interface specifications of interval protection and combination unit are shown in Table 1. Add the base description properties and interval description properties of the virtual terminal signal to the IED virtual terminal information. The virtual terminal signals within this interval are automatically correlated according to the basic description of the signal, and the multi-interval signal description is automatically correlated according to the interval description and basic description of the signal. The specific process is shown in Figure 1.

Schustack, Ehrlich, and Rayner put this question to the most direct test. In the experiment, the subjects read the same passage and gave names to the target words that appeared on the screen. The results showed that the fixation time reflected not only the process of lexical acquisition but also the process of article integration.

| Serial number | Items       | Control terminal electrical port | Field end I/O | Field end light port |
|---------------|------------|----------------------------------|---------------|----------------------|
| 1             | Wire diameter (mm) | 1.5 Core diameter: 0.9um single-mode | 16 (12-core multi-mode + 4-core single-mode) | 16 (12-core multi-mode + 4-core single-mode) |
| 2             | Core number | 8 4 single mode + 8 multi-mode | 11 6 multi-mode |                     |
| 3             | Air core number | 16 62.5um multi-mode | 16 (12-core multi-mode + 4-core single-mode) |                     |
FIG. 1 shows the design flow of virtual terminals as described by the signal standard. The intelligent equipment is arranged in the prefabricated intelligent control cabinet. "Intelligent component + aviation plug + control box" is used to replace the traditional wiring mode of "control cable + terminal row", as shown in Figure 2. After adopting this connection mode, the connection adopts the crimping type, which is more reliable than the screw connection. Can achieve standardized wiring, easy to replace; Suitable for MASS production of GIS manufacturers; Adapt to the complex and harsh environment on site; Intelligent equipment before the factory completed coordination, site construction convenient, less workload.

FIG. 2 Wiring mode of "Component + aviation plug + Control box"
Plug and play technology in operation and maintenance phase

In digital substation, as to the smart devices during cold standby or hot standby, need protection device manufacturers according to the system integrators for SCD intelligent equipment configuration, derived by using private tool vendors and need according to the characteristics of each device port configuration information such as modified, to download to the smart devices, finished cold standby and hot standby switching.

According to the SCD (full-station configuration description) file provided by the system integrator, through the model processing module of the process-layer central server, according to the module division, the process-layer central switch includes storage module, model processing module, file transfer module and communication module, as shown in Figure 3. Center server implementation of intelligent equipment storage module USES a plug and play scheme, process layer at the center of the server using SED (system exchange) file storage device configuration information, Sm) file is the second edition of IEC61850 is used to describe the system of information exchange between files, which according to the SCD file systems integrators, only to refine the process center server layer is responsible for the management of equipment configuration information, generate SED files.

Figure 3. A plug-and-play protection scheme is implemented in the core server mode

The model processing module is responsible for model processing : (1) parsing the process-level configuration information for obtaining ieds. (2) Generate process-layer configuration files in a common format, (3) communicate with IED, complete the process layer configuration file download, synchronization and other functions. Therefore, the model processing scheme of the process layer central server is shown in Figure 4.
The "function transfer" technology of protection measurement and control is based on the information sharing of different substation intervals, and the station protection and centralized measurement and control device can monitor the line protection, transformer protection, bus protection device and the working condition of corresponding measurement and control device of substation operation in real time. When the protection measurement and control device is abnormal, especially in the protection of a single set of configuration, it is very easy to cause a one-time equipment stop due to the abnormal secondary equipment. Through the migration technology, the corresponding protection measurement and control function can be realized by the station protection and the self-adaptive switching of the configuration function in the centralized measurement and control device, so as to avoid the loss of a power failure due to the lack of protection. The principle of protection function migration is shown in Figure 5.

Figure 4 Exports a single LED configuration file flow
Figure 5 protects the "function migration" principle

3. CONCLUSION
Smart substation "plug and play" technology is the outcome of further theory and practice of smart substation, the "plug and play" innovative technology is deeply integrated into the whole life cycle of substation, improve the security, availability and expansibility of the system. Thus, a more extensive and in-depth new form of technology development in the field of relay protection and automation based on the concept of "plug and play" technology will be formed, providing standard and reliable support for the comprehensive realization of intelligent substation and the completion of self-diagnosis, self-coordination and self-recovery application.

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