The Research of the Automatic Control System
of Synthesizing Transformer Substation

Xin-Hui Du, Yan-Fang Zhu, Jian-Cheng Song, Zhi-Hong Xue
Taiyuan University of Technology, no.79, the street of Yin Ze, Taiyuan, China
Phone:(086)351-6014551 E-mail:tianmuqin@sohu.com

ABSTRACT:
Automatic Control System of Synthesizing Transformer Substation is a principal aspect of the research of distribution automation now. The paper introduced the main structure of Automatic Control System of Synthesizing Transformer Substation, that is hard structure of distribution combine with centralization, and this structure is the orientation of future. Base on this, the paper discussed soft & hard structure graphs of some main module (correspondence module, Data acquisition module, Supervisory control & measure module, Correspondence management module). At last, the paper told us the benefit, which Automatic Control System of Synthesizing Transformer Substation can bring.

KEYWORDS: Automatic Control System of Synthesizing Transformer Substation, substation, research

There are all kinds of industrial productive system in modern society. But modern electric power system is the hugest and the most complex among those. In such a huge and complex system, substation is a significant annulus. The circumstance of the running of substation affects directly the reliability and economy of the system. It requires that the automated level of substation running management is enhanced, and Automatic Control System of Synthesizing Transformer Substation is achieved. Automatic Control System of Synthesizing Transformer Substation assembles the secondary equipments (instrumentations, signal system, automated devices of relay protection, Remote Terminal Unit, etc.) by function and makes the design of the secondary equipment optimal. By using some advanced technique, like the technique of computer, modern electric technique, correspondence technique, the technique of treating signals, it achieves some integrated automated functions for the main equipment in substation and transmission & distribution circuit, such as auto-supervises, auto-meter, auto-control and protect, dispatch correspondence.

1. The basic subsystem of Automatic Control System of Synthesizing Transformer Substation and the function

   ①Supervisory control subsystem

   The function is: acquisition of data quantum (analological quantum, switch quantum, electric energy quantum), record sequence of events, record and oscillating of fault, metering distance of fault, operating & controlling, safety supervision, man-machine contacting, typing, treating and record data, analysis & supervision harmonic.
② Computer protection subsystem
Main and spare protection of high-voltage transmission circuit, main and spare protection of main transformer, the protection of reactive power compensative capacitor, the protection of bus bar, the protection of distribution circuit, select line of single-phase earthing about incompleteness system.

③ Voltage & reactive power integrated control subsystem
④ Low frequency & load shedding, automated devotion of spare powers subsystem
⑤ Correspondence subsystem
Include corresponding on-site and corresponding with super ordinate of Automatic Control System of Synthesizing Transformer Substation

2. The structure of Automatic Control System of Synthesizing Transformer Substation
Shown by fig.1

2. Illustration about some basic module
① Correspondence module
To the Automatic Control System of Synthesizing Transformer Substation, the type of main line correspondence system is more suitable. Follows are familiar: With the traditional RS-422/485 realize connect

Fig.1
main line at low speed. With control network partially realize connect main line at middle speed. Such as CAN(Control Area Network) main line on-site. With normal technique about LAN realize connect as distribution, such as Ethernet. The paper focuses on Ethernet.

The structure of Ethernet is the type of bus. Each part of bus doesn’t exceed 500m, is usually used in range from 1km to 10km, transmissible speed can reach 10Mbit/s, error rate is $10^{-8} \sim 10^{-11}$. It has good elasticity in expansion and interconnection. Its structure and work proc about sending message are shown by fig.2 (a) and fig.2 (b).

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1. Data acquisition module
   Data acquisition module is used towards collecting and saving analogical quantum. The principle of checking is shown by fig. 3.

   ![Fig. 3](image)

   It sample by communion sample mode, the flow chart is fig.4.

2. Supervisory control & measure module
   Data can be exchange at high speed by using the double-port RAM and data acquisition module. This module fulfill some tasks:

   Collect and treat the data of sample result, switch quantum, impulse quantum. Upload all real time data to correspondence management module, at the same time output switch quantum. Then carry on the next control command from correspondence management module.

   The principle of it is shown by fig. 5.
Is the state line of A/D conversion low electrical level?

Distribute to appointed site of each double-port RAM

Are there data sent to double-port RAM?

Startup A/D converting

Select an alleyway

Read and save data

Have complete sample in all alleyways?

The alleyway number reset

The alleyway number add 1

Fig. 4

Fig. 5
4. Correspondence management module

The function of this module is protecting supervisory control & measure module, managing correspondence between fault oscilloscope module and correspondence module, man-maching interlocution. It is consists of CPU, serial correspondence, display screen, keyboard, etc.

Fig. 6 is the software graph.

4. The benefit which Automatic Control System of Synthesizing Transformer Substation can bring

① Improve the quality of supplying power, the pass rate of voltage.
② Improve the safety and reliability of substation.
③ Improve management level about power system running.
④ Reduce the area of substation, and abase the cost and investment.
⑤ Reduce the quantity of maintenance, the labor on duty, realize decrease personnel and gaining profit

Above all, the development of the Automatic Control System of Synthesizing Transformer Substation technique, the improvement of the automation level, play an important role in unattended substation, raise the reliability of unattended substation and technique level obviously. It can result in that modern electric power system run safely and stable.

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