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Research Article

Discussion on the rationality of the "test status" of the smart protection devices

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Abstract: Starting from the concept of "test status" of conventional substations, this paper analyzes the existing "test status" of smart substations, and points out that it is unreasonable, then suggests to modify it to "inspection status".

Key words: smart substations, test status, inspection status.

0 Introduction

Since 2007, the development of smart substations in Zhejiang power grid has gone through the stages of pilot planning, comprehensive construction, leading and upgrading. As of the end of 2016, Zhejiang Power Grid Corp built a total of 42 500kV substations, including 10 smart substations, accounted for 23.8%; 304 220kV substations, including 56 smart substations, accounted for 18.4%, and the proportion of smart substations are still rising, leading the development of the smart substation technology.[1]

The biggest difference is that smart substations using optical fiber and network communication to complete the function while the conventional station using electric cable, although the smart substations imitate conventional station and developed the concept of "virtual terminal", "soft platen", they still exists essential difference . Another important thing to note is that the concept of "test status" of the smart substations' protection is quite different from that of the conventional station. The IEC61850 protocol was imported from abroad the earliest, in fact there is no "test" concept, this concept is a common practice gradually formed in the pattern, but judging from the actual use of the effect is not particularly ideal, and this paper aims at the discussion of the "test" mode.

1 "Test status" of conventional substations

First, the function of the "test status" of conventional substations' protection devices is analyzed as follows. Only when the protection devices needing to maintain or protection devices being damaged and maintainer completing all safety measures (such as exiting the exit or failure platen, unlocking the public open end, unfolding failure circuit, unlocking telesignalling end, recording end), conventional substations' protection devices must set up " test status", and put the "test" platen into the device to identifies the device as "out of operation status". In other words, inputting "test" platen is identified as the protection devices' "test status", which is an absolutely safe status, and any work on the device will not cause any impact on the operating equipment or produce a corresponding telegram message. But for the protection device, whether the inputting or not of test platen will affect any function or logic of itself, so the function of the pressing platen is only used as a "logo".

2 "Test status" of smart substations

However, for the protection device of smart substations, the meaning of "test status" is completely different. At present, smart substations' relay protection equipment follow the test mechanism stipulated in reference 2, because the main functions of the smart station are realized through the interaction of messages, the test mechanism of the device is the processing mechanism of the message. Because the secondary circuit of conventional substations is mainly correspond to the GOOSE virtual circuit of smart substations (The sampling circuit of the conventional substations corresponding to the SV virtual circuit of the smart

substations, which will not be discussed here). In reference 2, the test mechanism for GOOSE message is specified as:

GOOSE message test processing mechanism:

1) When the device test platen is invested, the test in the GOOSE message sent by the device should be placed.

2) The GOOSE receiver device should compare the test bits in the GOOSE message received with the device's test status. Only when the two are in agreement, will the signal be processed or acted as an effective way.

3) If GOOSE interruption occurs when test is placed in the sender's GOOSE message, the receiving device should be reported to the specific GOOSE alarm interrupt, but should not be reported "alarm device (abnormal) signal, and no" alarm device (abnormal) lamp.

From the above mechanism, it can be seen that the test mechanism does not involve the handling of device failures, that is the problem. In the case of normal operation of the device, according to the above mechanism, only when one side of the protection device is put into test platen, and after the action of the protective device, the device on the side of the receiving protection trip is not consistent with the test status of the received message, so it will not respond to the protection trip order. Therefore, the mechanism can ensure that the protection device will not respond to the action message of the test equipment when the protection device has no fault.

3 Problems existing in the "test status" of the smart substations' device

However, when the protection devices occur a fault for some reason, the fault may occur in any part of the protection device, may be a digital receiver module, or the logical processing module, may also be the trip module, if only put "test "platen, then the tripping message sent out by the protective device is completely unpredictable, there may be a message with "test" flag, may also send messages without "test" flag, and may even trip message error, which may cause unpredictable effects on the operation of the equipment, so the so-called "test" mechanism is not mature, by only putting into the "test" platen is impossible to complete the task of complete isolation protection .From the scene, the truly logical "test" state should be: quit all the functional soft platen, export soft platen and receive soft platen, and cut off the optical fiber and network cable, so that we can truly isolate the operation equipment and achieve absolute safety.

In a sense, the implementation mode of the smart substations is actually to disassemble the function of the alternating current sampling, logic calculation and action export of the conventional protection device into three parts: the merging unit, the smart protection device and the smart terminal. Therefore, according to the concept of conventional "test", the combination unit, the protection device and the smart terminal of the smart substations should be all put into the "test" platen.

At the same time, the current and voltage circuit is unraveled before the merging unit. Unlock the exit loop after the smart terminal, cut off the network optical fiber of failure protection device. In this way, it is considered that the "sample - calculate - export" protection system has been completely isolated from the operating equipment, but it is obviously not a "test status" that is used at this stage. In addition, protection devices, merging units and smart terminals are secondary equipment. All of them may fail and need to be replaced. At this time, the traditional "test status" is redefined.

The "test mechanism" stipulated in reference 2 is only the internal mechanism of the protection system, in the strict sense, it can not be considered a real "test status" mechanism, so I think it is more reasonable to rename it as " inspection status ", the above mechanism should be renamed as a "inspection" mechanism. If the existing protection device, merging unit and smart terminal "test" platen was renamed "inspection" platen, and only maintainer can operate it, then the operator will not cause unnecessary misunderstanding, but also reduce the chances of wrong operation.

It is particularly important to note that the above "inspection" platen should not be put into operation during normal operation, but only in the process of maintenance of single protection equipment. That is to say, the real function of the "inspection" model is the means of being a "backup" security measure when the test equipment exit system carries out a maintenance test. When the equipment is damaged, the "inspection" platen can not be put into use, even if the "inspection" platen put into use, it is not helpful.

4 Conclusion

In the process of the development and perfection of the smart substation technology, the maintenance of

the smart substations will be a difficult task in the future. In view of the actual operation situation, the existing “test mechanism” is not mature. Therefore, this paper proposes to rename the existing “test” mode to “inspection” mode, and the true and reasonable “test status” of the smart substations needs to be discussed separately.

References

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