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The Improvement of Triple Trip Realization Method of Circuit Breaker Trip Circuit Communication

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Abstract. Circuit breaker trip circuit (also known as control circuit) is the most important secondary circuit for relay protection. Among them, the "communication triple trip" (CTT) hard contact connected to the operation exit circuit of the protection device increases the complexity of the trip circuit and the difficulty of analyzing the trip circuit failure. When the system runs normally, the signal of "control circuit disconnection" cannot be accurately and timely uploaded to the operation monitoring background. When the system short-circuit fault occurs, the circuit breaker cannot operate correctly due to the trip circuit break, so the adjacent interval is connected by the near backup protection, thus causing the expansion of the accident scope. In this paper, it is proposed for the first time that the CTT hard contact protected by circuit breaker should be replaced by the soft CTT (i.e. the control word) of the protection device, so as to make the trip circuit reliable, clear and simple, and at the same time ensure the accuracy of the "control circuit break" signal.

Keywords. Circuit breaker trip circuit, relay protection, control circuit, hard contact, communication triple trip (CTT)

1. Introduction

To prevent a phase after disconnecting circuit breaker, caused by reclosing device refused to close the whole phase operation, and breaker trip can be realized by communication triple trip circuit, small impact on the system, which can be used as a circuit breaker of open-phase running a preventive measures in advance.

Reference [1] can guarantee three-phase tripping for any fault. However, the cable between screens needs to be laid, and the loop is complex. Reference [2] establishes communication triple trip hard contact which is connected together, but there is a parasitic loop, and the signal lamp is not correct when the communication triple trip contact is closed.

In this paper, it is proposed for the first time that the CTT hard contact protected by circuit breaker should be replaced by the soft CTT (i.e. the control word) of the protection device. After any fault line protection action, the logic of microcomputer

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relay protection determines whether the communication triple trip condition is met, and the three-phase trip order is issued by the relay protection if the condition is met.

2. The Checkup and Analysis of Abnormality and Conclusion

Main transformer #1 and 5043 circuit breaker (DL2) are carried out in a substation (the primary system is connected by 3/2, as is shown in Fig. 1).

During the protection inspection, it was found that phase B and C of 5043 circuit breaker were normal, while phase A could not realize the protection and opening, and its opening time was obviously behind the phase B and C.

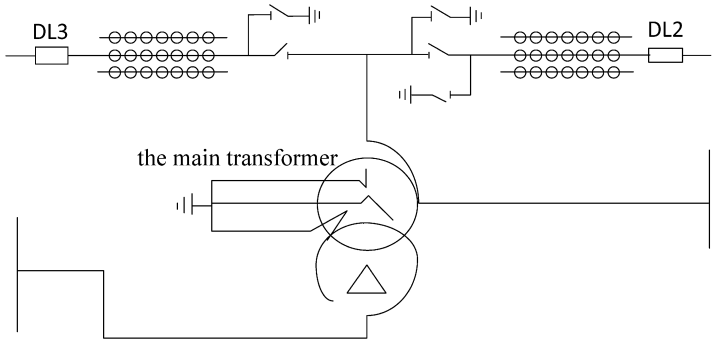

Figure 1. Simplified Substation Primary system.

Through analysis, phase A protection trip circuit was discovered a problem, but the monitoring background did not report the "control circuit break line" signal. Aiming at this problem, the author carried on an analysis.

Analyze the phase A trip circuit of CZX-22R2 controlbox [3] of RCS-921 protective screen: first measure the 4D123 terminal (as shown in Fig. 2), which is with negative charge; Close the 5043 circuit breaker and short-circuit the phase A trip circuit terminals of terminals 4D1 and 4D126 with the test line. The phase A trip light is off, the light of phase B and phase C trip is on, and the phase A, B and C all trip, but the phase A trip time delay is longer than the phase B and C (about 0.5s).

After removing the trip cable from the 4D123 terminal to the circuit breaker mechanism on the protection screen, it is found that the trip cable is not live and the inner side of the 4D123 terminal is negatively charged. Because 5043 circuit breaker is the main transformer side circuit breaker #1, it operates in reclosing "out of service" mode, the circuit breaker protection does not charge after closing the circuit breaker, and the CTT contact between terminals 3D121, 3D119 and 3D122 works, so the circuit breaker of phase B and C trips when short-circuiting terminals of phase A trip circuit (4D1, 4D126) with the test wire. At the same time, B, C phase trip keeps relay (TBIJB, TBIJC) operate, trip is lighten; phase A trip circuit is blocked, the trip keeps relay (TBIJA) not to operate, and the phase A trip light is not on.

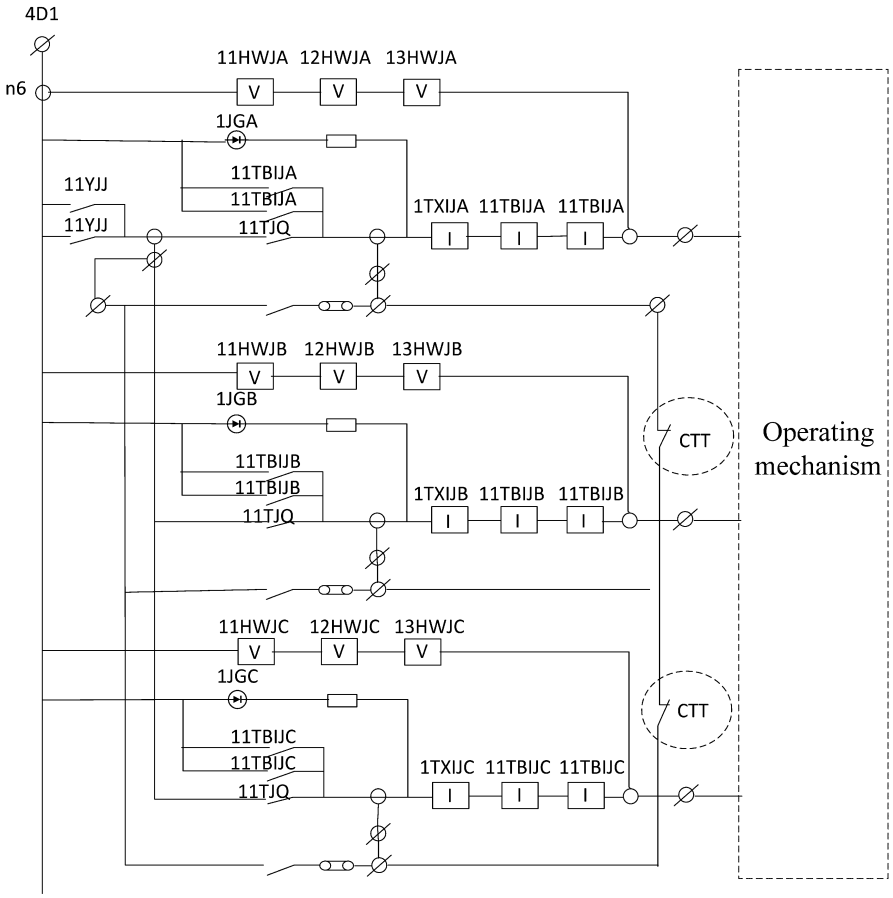

Figure 2. CZX-22R2 controlbox principle diagram.

After confirming that the trip circuit of phase A is blocked, the potential of the trip circuit in the mechanism box of phase A of the circuit breaker is measured (as shown in Fig. 3), and it is found that the terminal X3:105 is negatively charged, while X1:A630 is not charged. It is initially suspected that the "7 and 8" contacts of S4 (" remote/local "handle) in Fig. 3 are blocked, that is, the connection between X1:A630 and X3:105 is blocked. When phase A trips, the positive potential of X1:A630 cannot reach the trip coil through X3:105, so that phase A cannot break. When the #1 main transformer fails to trip, because phase A cannot trip at a distance, it can only be protected by the inconsistency of phase A body.

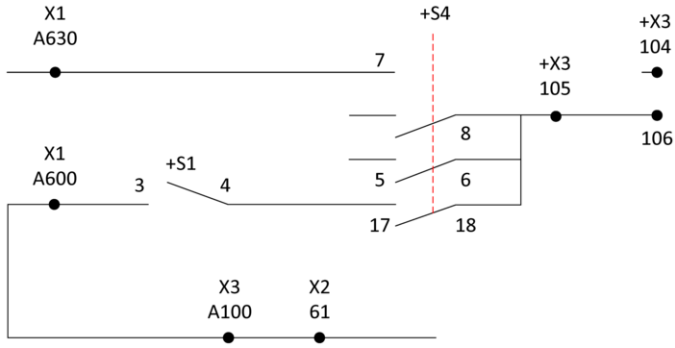

Figure 3. Phase A mechanism principle diagram.

In the above case, when the system short-circuit fault occurs, if the fault current is very large, it may cause 5043 circuit breaker failure protection action [4] before the A-phase jump, which leads to the differential protection action, and then expands the scope of the accident. By replacing another pair of contacts on the S4 handle, the fault is eliminated and the trip circuit returns to normal.

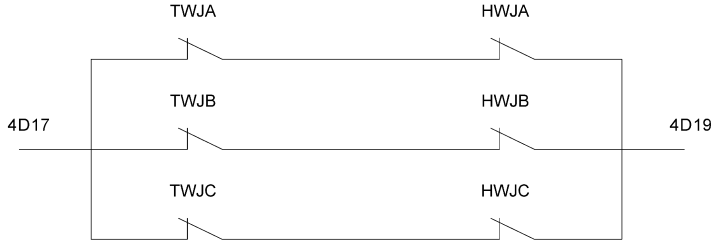

Figure 4. Control circuit broken telesignalisation wiring diagram.

When protection personnel check background SOE packets, they do not find the notice of “control circuit disconnection” of circuit breaker protection. View the control circuit disconnection signal wiring diagram (as shown in Fig. 4) for reference. TWJA and HWJA are not in action at the same time. When the circuit breaker is in the closing position, TWJA does not operate, and HWJA should also not operate when the phase A trip circuit is unavailable. At this time, "Control circuit disconnection" should be reported. By analyzing the CTT contact action among 3D121, 3D119 and 3D122 terminal blocks (as shown in Fig. 2), the negative charge of the phase B and C trip circuit is connected to terminal 4D123 through the CTT contact, causing HWJA action. Therefore, the "Control circuit disconnection" signal does not work. It can be seen that in the case of hard CTT contact and existing control circuit wiring, the "control circuit disconnection" signal wiring mode as shown in Fig. 4 is not scientific.

The analysis of this anomaly leads to the following conclusions:

(1) phase A trip circuit is unavailable due to the damage of +S4 handle auxiliary contact.

(2) RCS-921 device reclosing handle in the "stop" position, CTT contact operates, phase A circuit breaker by the body inconsistent protection trips (inconsistent action time 0.5s).

(3) Due to the CTT contact action, the negative electricity of B and C phase trip circuit is connected to the 4D123 terminal through the CTT contact, resulting in HWJA action, so the signal of "control circuit disconnection" does not act.

3. Solution

In view of the above situation, the protection personnel comes up with an improved solution for the realization method of communication triple trip. The improved logical block diagram is shown in Fig. 5. the external trip circuit passes through the trip contact, there is a problem in the circuit connection of the access circuit breaker controlbox.

This scheme removes the hard CTT contacts among terminal blocks 3D121, 3D119 and 3D122 shown in Fig. 2, and is realized by the soft CTT of the RCS-921 device through logical identification. That is, when the circuit breaker protection receives the single-phase trip of other protection devices, if the circuit breaker protection does not charge, the circuit breaker protection will switch to three-phase. In this way, there will be no hard CTT contact between three-phase trip circuits, and the trip circuit will be clearer, and there will be no such circumstances as "control circuit break" signal cannot be correctly reported.

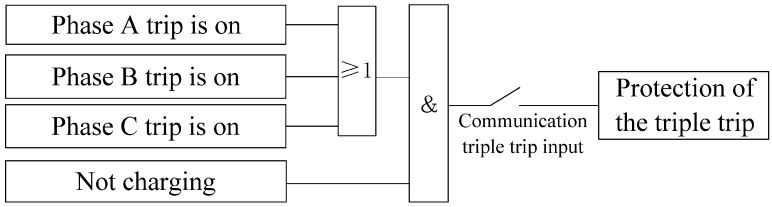

Figure 5. Improved CTT logic diagram.

4. Conclusion

Circuit breaker protection CTT can be implemented in many ways, but inappropriate circuit design not only increases the complexity of circuit, causing the consequence that certain signals can't display properly, it also increases the difficulty of the control circuit fault analysis. So a scientific way of CTT implementation is quite important for circuit breaker protection circuit, and it is necessary for the relay protection personnel to pay attention to this.

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