一种带开关量的开口式电流互感器的应用

Application of open type current transformer with switching

摘 要：介绍了开口式电流互感器在改造项目中的应用，以及带开关量的开口式电流互感器的作用，和常规开口互感器对比的优势，并结合工程实例分析。

Abstract：Introduces the application of open type current transformer in the renovation project, as well as the role of open type current transformer with switching quantity, and the advantages of comparison with conventional open type current transformer, and analyzes with engineering examples.

关键词 低压配电系统 开关量 开口式 电流互感器 防窃电 工作原理

Keywords low voltage distribution system, switching, open type current transformer, anti-theft, working principle

1. 引言 Introduction

随着我国电力工业中城网及农网的改造，以及低压配电系统的自动化程度不断提高，开口式电流互感器作为低压配电系统中的一种重要电气元件，在电网改造中的作用越来越明显，已被广泛地应用于测量、计量、继电保护、系统监测、接地保护和各种电力系统分析之中。

With the transformation of urban and agricultural networks in China's power industry and the increasing automation of low-voltage distribution systems, open type current transformers, as an important electrical component in low-voltage distribution systems, have become more and more obvious in the transformation of power grids and have been widely used in measurement, metering, relay protection, system monitoring, grounding protection and various power system analysis.

但是，目前市场上的开口式低压互感器在安装的时候可能会出现卡扣没卡紧导致铁芯没有完全闭合；或者在运行过程中，互感器外壳受到很大应力作用，外壳铰链断裂，导致上下铁芯不闭合，影响互感器精度或者没有电流输出。带开关量的开口式电流互感器能够有效的向仪表或者后台反馈上述情况，在电力监控项目上有广阔的运用前景。

However, the open type low-voltage transformers on the market at present may be installed with snaps that are not tightened to cause the core to be not completely closed; or during operation, the transformer shell is subjected to great stress and the shell hinge breaks, resulting in the upper

and lower cores not being closed, affecting the accuracy of the transformer or no current output. The open type current transformer with switch can effectively feedback the above situation to the instrument or the background, and has a broad application prospect in power monitoring projects.

2. 电流互感器工作原理 Working principle of current transformer

开口低压电流互感器的工作原理如图 1 所示，开口电流互感器的一次绕组串联在被测线路中，I_1 为线路电流即电流互感器的一次电流，N_1 为电流互感器的一次匝数，I_2 电流互感器二次电流，N2 为电流互感器的二次匝数，Z_{2e} 为二次回路设备及连接导线阻抗。当一次电流从电流互感器 P1 端流进，P2 端出，在二次 Z_{2e} 接通的情况下，由电磁感应原理，电流互感器二次绕组有电流 I_2 从 S1 流过，经 Z_{2e} 至 S_2，形成闭合回路。由此可得电流在理想状态下 I1×N1=I2×N2，所以有 $I_1/I_2=N_1/N_2=K$，K 为电流互感器的变比。但是由于开口式电流互感器的铁芯切开后，使铁芯的性能下将的比较厉害，所以必须将互感器的铁芯截面积加大，而且提高安匝数，将 I1×N1=I2×N2≥100AN。

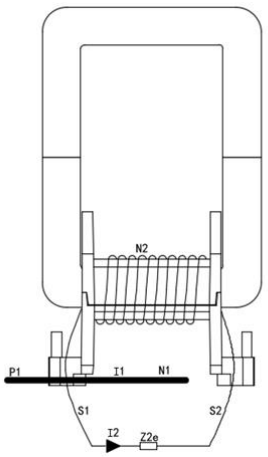

Figure 1

The working principle of the open-ended low-voltage current transformer is shown in Figure 1. The primary winding of the open-ended current transformer is connected in series with the line under test, I1 is the line current, that is, the primary current of the current transformer, and N1 is the primary turns of the current transformer. I2 is the secondary current of the current transformer, N2 is the secondary turns of the current transformer, and Z2e is the impedance of the secondary circuit equipment and connecting wires. When the primary current flows in from the P1 end of the current transformer, and the P2 end goes out, in the case that the secondary Z2e is turned on, according to the principle of electromagnetic induction, the secondary winding of the current transformer has a current I2 flowing from S1, through Z2e to S2, form a closed loop. It can be obtained that the current is I1×N1=I2×N2 in the ideal state, so there is I1/I2=N1/N2=K, and K is the transformation ratio of the current transformer. However, after the iron core of the open current transformer is cut, the performance of the iron core will be worse, so the cross-sectional area of the iron core of the transformer must be increased, and the number of ampere turns must be increased, and I1×N1=I2 ×N2≥100AN.

另外，该互感器上的开关量开关，当互感器卡扣没卡好或是互感器老化导致壳体破裂，开关按钮弹起，常闭变常开，信号终止传输，互感器无信号输出；当互感器卡扣正常是，开关状态为常闭，互感器正常工作。

In addition, the transformer on the switch, when the transformer snap did not card or the transformer aging caused by the rupture of the shell, the switch button pops up, normally closed to normally open, the signal termination transmission, the transformer no signal output; when the transformer snap is normal, the switch state is normally closed, the transformer works normally.

3. 开口式电流互感器 Open type current transformer

开口式电流互感器主要应用于工业中城网、农网改造项目。特点是安装方便，无需拆除一次母线，亦可带电操作。但是，目前市场上的低压开口式互感器存在以下缺点：

Open type current transformers are mainly used in industrial city network and agricultural network renovation projects. Features are easy to install, no need to remove the primary busbar, and can also be operated with electricity. However, the current low-voltage open type transformers on the market have the following drawbacks.

（1）市场上的开口式电流互感器在安装的时候可能会出现卡扣没卡紧或是铁芯没有闭合，在运行过程中会出现互感器脱落或者断开的风险；

(1) Open type current transformer on the market may not be installed when the clasp is not tight or the core is not closed, the risk of the transformer falling off or disconnected during operation.

（2）开口式电流互感器在安装后如果被人为二次打开后，会出现无信号等问题。

针对上述不足，AKH-0.66/K-SW 系列电流互感器，可以解决上述问题。此互感器外形美观，安装维护方便简洁。如图 2 所示，该互感器具备以下几个优点：

Open type current transformer will have no signal and other problems if it is artificially opened twice after installation.

AKH-0.66/K-SW series current transformer can solve the above problems. This transformer has a beautiful appearance and is easy and simple to install and maintain. As shown in Figure 2, the transformer has the following advantages.

（1）AKH-0.66/K-SW 系列电流互感器，安装时无需将电断开，可以带电操作，闭合直接使用即可现场安装简便，减少人力成本；

AKH-0.66/K-SW series current transformer, installation without disconnecting the electricity, you can operate with electricity, close the direct use of the site installation is simple, reducing labor costs.

（2）AKH-0.66/K-SW 系列电流互感器，在该模块有 4 根引线，两根传输电流信号，两根传输开关量信号；

AKH-0.66/K-SW series current transformer, there are

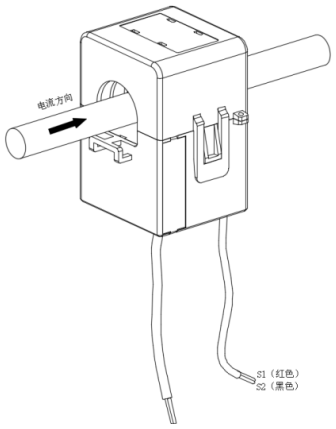

Figure2

four leads in the module, two to transmit the current signal, two to transmit the switching signal.

（3）AKH-0.66/K-SW 系列电流互感器，当卡扣没卡好或是互感器老化导致壳体破裂，上下壳体弹开，铁芯接触不良，卡在互感器下壳体的开关凸起按钮就会向上弹出，开关断开，开关量信号终止传输，起到提示开口式低压互感器停止工作的作用。

AKH-0.66/K-SW series current transformers, when the buckle is not locked or the transformer is aging, the casing is broken, the upper and lower casings pop open, the iron core is in poor contact, and the switch stuck on the lower casing of the transformer protrudes The button will pop up, the switch will be disconnected, and the switching signal will terminate the transmission, which will prompt the open-type low-voltage transformer to stop working.

（4）AKH-0.66/K-SW 系列电流互感器，上下壳体带有铅封孔，一旦安装完毕立即进行铅封。

AKH-0.66/K-SW series current transformer, the upper and lower shells with lead seal holes, once the installation is completed immediately lead seal.

4. 参数对照表 **Parameter comparison table**

型 号	额定电流比	准确度等级	穿心匝数	穿孔尺寸（mm）
		0.5 级		
K-SW-Φ16	100A/20mA	10Ω	1	Φ16
K-SW-Φ24	400A/100mA	10Ω	1	Φ24
K-SW-Φ36	600A/100mA	10Ω	1	Φ24

Model	Rated current ratio	Accuracy class	Straight-through turns	Through size (mm)
		Class 0.5		
K-SW-Φ16	100A/20mA	10Ω	1	Φ16
K-SW-Φ24	400A/100mA	10Ω	1	Φ24
K-SW-Φ36	600A/100mA	10Ω	1	Φ24

4. 结束语 Conclusion

AKH-0.66/K-SW 系列电流互感器的出现，具备异常打开报警、停上电事件上报等功能，同时也为企业降低了人力物力成本，由于市场巨大，一旦形成生产能力，也可带动其他行业的飞速发展。

The emergence of AKH-0.66/K-SW series current transformer, with abnormal open alarm, stop on the power event reporting and other functions, but also for the enterprise to reduce the cost of human and material resources, due to the huge market, once the formation of production capacity, but also can drive the rapid development of other industries.