

# Novel Detection Method of High Voltage Power Metering Circuit Fault based on Electric Energy Meter Phase and Voltage Transformer

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## **Abstract**

*The basic structure of the electromagnetic induction type voltage transformer is the core and primary, secondary winding. Characteristics of capacity are small and relatively constant. This paper introduces the application of electric energy meter, including two kinds of three-phase electric energy meter (three-phase two elements and three element phase) and non reactive energy meter. In this paper, the high voltage electric energy metering system of fault conditions is analyzed. The paper presents novel method of high voltage power metering circuit fault detection based on Electric energy meter phase and voltage transformer. The voltage circuit fault that electric energy meter pressure loss, less pressure fault detection method is analyzed.*

**Keywords:** *Voltage transformer; Fault detection; High voltage power metering; Electric energy meter phase*

## **1. Introduction**

Electric energy meter voltage loop disconnect cause inaccurate measurement, this failure may be naturally occurring, may also be caused by. Artificial cut off voltage circuit can make the electric energy meter less or no, it can reduce the production cost, and the operation is very convenient.

Here the fault on the nature of the situation is not too much explanation, detection method and the proposed, as long as there is this kind of faults can be detected, has nothing to do with the fault reasons.

The working principle of high voltage of voltage transformer in the measurement of alternating current, in order to safety measure in parallel between the ground and a transformer (connected to the input end of the transformer), the output terminal of the transformer is connected to the voltage meter, because the input coil is greater than the number of turns out the turn number of coil, so the output voltage is less than the input voltage, the voltage transformer is a step-down transformer.

Electric energy meter is a metering user electric energy meter, according to use can be divided into single-phase, three-phase and special purpose electric energy meter (including standard electric energy meter, multi rate watt hour meter, Prepaid energy meter and multi function watt hour meter and so on), according to the measured electric energy into power energy meter and non reactive energy meter.

The working principle of voltage transformer equivalent circuit transformer, 2 sides to swing, in the two sides access voltmeter to measure the voltage (can be multiple parallel voltmeter). The two sides can not short circuit of voltage transformer. The working principle of current transformer to transformer short-circuit 2 side, used for variable flow, in the two side access current meter to measure the current (series multiple current sheet). The two sides is not current transformer circuit. The voltmeter is equivalent to a voltage transformer load

(impedance) measuring device [1]. The current meter is equivalent to the current transformer (small load impedance measurement device).

The high voltage power metering system used by the voltage transformer (PT) and current transformer (CT) three-phase three wire connection mode, the mode for connection is complicated, very easy because of natural or man-made the lines are wrong, especially some power users deliberately change connection to electrical energy meter or less at the purpose of electricity. Some measurement failure was caused by the wrong wiring of electric energy meter (natural or artificial) caused by many methods, wrong wiring of electric energy meter, the main vector diagram, power meter, phase meter method. These discriminate method not only need the phase meter, ammeter, voltage meter, phase meter, measuring tools, and the process is complicated, and often can not judge the wrong wiring of it. The paper presents novel method of high voltage power metering circuit fault detection based on Electric energy meter phase and voltage transformer.

## 2. Using Voltage Transformer to High Voltage Power Metering Fault Detection

The electrical department to analyze such as current transformer short circuit one or two times or two times the interphone short circuit current transformer and current transformer polarity reversal, one or two phase voltage circuit breaker fault electric energy meter by measuring loss, but not given these fault detection. Therefore, this kind of fault and detection is one of the focuses of this paper.

The voltage transformer is a voltage conversion device. It will be the high voltage to the low voltage, low value to reflect the change of pressure value. Therefore, through the voltage transformer can be directly used in ordinary electrical instrument for voltage measurement.

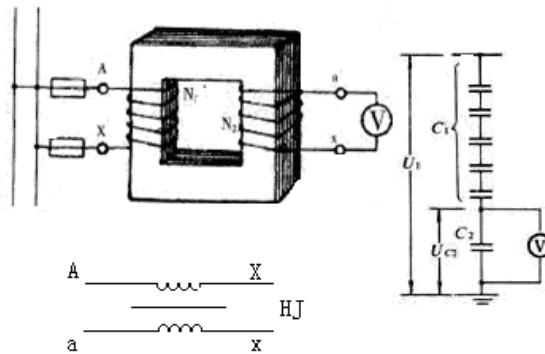
The voltage transformer is also called instrument transformer, a voltage transformation device; 2, voltage transformer capacity is very small, usually only tens to hundreds of voltammeter; 3, voltage transformer secondary side voltage is the voltage, not by the two load impact, and in most cases the load is constant; 4, two lateral load is the main instrument, relay coils, their impedance is large, the current through the little [2]. If the infinite period increased two times and two times the load, voltage will decrease, caused by measurement error increases; 5, voltage transformer to indirectly measure voltage, can accurately reflect the high pressure side of the value, to guarantee the accuracy of measurement, as is shown by equation(1).

$$\begin{cases} u_A + u_B + u_C = 0 \\ \dot{U}_A + \dot{U}_B + \dot{U}_C = 0 \end{cases} \quad (1)$$

Voltage transformer (VT) structure and the equivalent of a step-down transformer, there are two points difference between it and the transformer: one is the phase ratio before and after voltage transformer to transform voltage transformation and has strict requirements, and the step-down transformer is not high on these requirements; two is the transmission of information was measured, i.e. size and the phase voltage; the latter is mainly used for the transmission of electrical energy or impedance transformation.

Voltage transformer secondary side two may not work due to short circuit, voltage transformer secondary side one or two are working in parallel mode, such as short circuit, short circuit current will produce large, there may be burned transformer, and even affect the safe operation of a circuit. Therefore, the one or two voltage transformer side must be installed for short circuit protection fuse.

A secondary winding of electromagnetic voltage transformer is connected to the high voltage power line, the two winding is connected with the measuring instrument, therefore, a number of turns of the secondary winding is far more than. The structure of single voltage transformer and symbol is in the diagram in Figure 1. Based on Figure 1 capacitive divider voltage transformer voltage divider in the capacitance of the circuit is shown in it.



**Figure 1. The Structure and Capacitance of the Circuit of Single Voltage Transformer and Symbol.**

The working principle of transformer and the transformer of the same, all is the use of the principle of electromagnetic induction to work. The role of the transformer's voltage voltage transforms a class to another class of the same frequency, it can only achieve voltage transformation, can not realize the power transformation [3]. The transformer consists of voltage transformer and current transformer device. Voltage transformer is the role of supply measuring instrument, relay, and voltage, so as to reflect the various operations of an electrical system.

The measuring instrument, relay, two electrical system and an electrical system, to ensure that personnel and two times the safety equipment, the low voltage and high voltage conversion a the electrical system into the agreed standard value (100 V, 100/1.732 V, 100/3 V). The effect of power transformer and the voltage transformer's role is basically the same, the difference is the current transformer is the current transform an electrical system into a standard 5 or 1 to electrical supply, current coil measuring instrument.

In the electrical measurement, measuring instruments are sometimes unable to be measured directly measuring voltage or current, and then need to transform the voltage or current, then the measurement. Transformer has such a transformation. Transformer has the transformation function also has the following advantages: due to the structural transformation and isolation transformer, and good insulation performance, can ensure the measuring instrument and testing the safety of personnel.

Electromagnetic induction type voltage transformer and its working principle and basic structure of transformer is the same, is the core and primary, secondary winding. Characteristics of capacity are small and relatively constant, normal operation when close to the idle state. Impedance voltage transformer itself is very small, once the side short circuit, current will increase sharply and burning coil. Therefore, voltage transformer primary side is connected with a fuse, side reliable grounding, so original, side insulation damage, side of high potential caused personal and equipment accident.

Transformer adopts standard output range unified: such as voltage transformer,. Current transformer, *etc.*. In order to make tens of volts to hundreds of thousands of volts of voltage, tens of Ma to vie current through transformer, instrument measuring for the unification of the simple several, greatly reducing the production and use of the instrument; when the power line failure, over voltage and over current, the transformer core tends to saturation, the output is not proportional to increase, can protect the measuring instrument, the two device. Therefore, measurement of transformer is widely used in electric power system.

Accuracy of voltage transformer in the specified conditions of use, in accordance with the JJG312-1994 "measurement voltage transformer verification regulation", the accuracy rating voltage transformer can be divided into: 0.001, 0.002, 0.005, 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, each class of accuracy on the error also different [4]. Rated voltage ratio rated secondary voltage and rated voltage two times, as in equation (2).

$$K_{nm} = U_{1n}/U_{2n} = N_1/N_2 \quad (2)$$

Where K is the Voltage transformer rated transformation ratio, U is a number of turn's ratio, and time is proportional to the number of turns, and the two turns is inversely proportional to it.

Impedance Reactance is Compensation capacitor. YH has two secondary winding, the first secondary winding can be connected with a compensation capacitor Ck for measuring instruments; second secondary winding can be connected with a damping resistor Rd, in order to prevent the resonance over voltage caused by VT.

Coupling capacitor voltage transformer and communication are in electric power system combination, to simplify the system, reducing the cost. At this time, it is also required to meet the requirements of the communication operation [5]. The two circuits is not short circuit voltage transformer, otherwise it will cause the coil burnout, in order to prevent short circuit caused by the two ends of the main circuit interference, plus air switch K1. C1 is normally closed, U1 trip, protection device will display the PT disconnection alarm, as shown in equation (3).

$$U_{C2} = \frac{C_1}{C_1 + C_2} U_1 \quad (3)$$

Voltage transformer is the transformer output voltage and input voltage multiplied by the ratio of the two vector difference, so the error ratio difference and phase difference (angle). Error: equivalent to two times the actual voltage and a voltage of a side of a voltage difference ratio. Angle difference: two times with a reduced voltage phase angle difference between voltages. Thus the synthesis error of transformer can be expressed as the following formula (4).

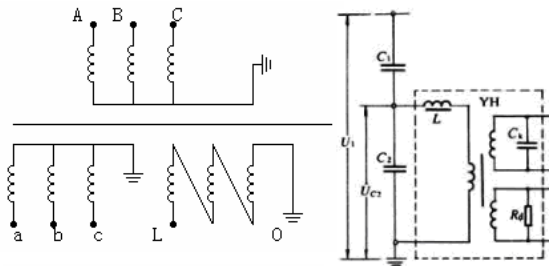
$$\varepsilon = f + j\delta \quad (4)$$

Where f is measuring voltage transformer, j is generally made of single-phase double coil structure, the primary side voltage is the voltage to be measured (such as electric power system, single phase line voltage) can be used; also can use the two to form a V-V shape for three-phase use. Voltage transformer used in laboratory is often the primary multi tap, in order to meet the needs of different voltage measurement. For the protection of grounding also comes with a third coil voltage transformer, called the three coil voltage transformer. The third coil three-phase connected into an open triangle.

Inductive proximity switch is composed of three parts: the oscillator, a switch circuit and an amplifying output circuit. The oscillator generates an alternating magnetic field. When the metal objects close to the magnetic field, and reaches the induction distance, eddy currents are generated in the metal target, leading to oscillatory decay, and stop the vibration. Change oscillator and oscillation stop by after class amplifying circuit processing and conversion into switching signals, triggering drive control device, so as to achieve the purpose of detection and non - contact.

Y/Y0 connection is a three column three-phase voltage transformer, also can use three single-phase voltage mutual inductor three-phase voltage transformer groups [6]. This connection method used for high-voltage three-phase system for small current grounding, is generally two times side neutral wire, connected into a Y/Y0 connection. The disadvantage of this method is: when the two load imbalance, may cause large errors; in order to prevent the high pressure side of the single-phase grounding fault, the neutral point grounding pressure is not allowed, so can not measure the voltage to the ground.

Because the voltage of neutral point grounding, it can reduce the level of insulation, and reduces the cost; voltage transformer winding is connected to the phase voltage design, it can measure line voltage, but also can measure the phase voltage. In addition, open triangular grounding the auxiliary winding of the two side added, can constitute a zero sequence voltage filter for relay protection *etc.*. When the Y0/y0 connection method is for small current grounding system and it is the three-phase voltage transformer of three-phase five core structure, as shown in Figure 2. In order to overcome this drawback, in electromagnetic voltage transformer YH a charged capacitor is connected in parallel with the C2 resistance, capacitor divider voltage transformer (Figure 2).



**Figure 2. Voltage Transformer of Three-Phase Five Core Structure.**

In a synchronous circuit in the B grounding system, the non direct ground neutral system, single phase grounding, neutral point displacement, cannot be synchronized with the phase voltage, must be synchronized voltage line [7]. As the step point on both sides for the B phase, one phase of the public, reducing the number of synchronous switch (such as the use of comprehensive protection, the wiring is simple, simple synchronous connection). The neutral grounded system, two phase voltage available auxiliary winding of synchronous.

Measuring voltage transformer are generally made of single-phase double coil structure, the primary side voltage is the voltage to be measured (such as power system, single phase line voltage) can be used, also can use two connected into a V-V shape using three-phase. Voltage transformer used in laboratory is often the primary multi tap, in order to meet the needs of different voltage measurement. For the protection of the ground with a third coil voltage transformer, called the three coil voltage transformer. The third phase of the coil is connected into an open triangle.

In this connection the one or two side by the neutral wire, it can measure line voltage, but also can measure the phase voltage [8]. In addition, the two side opening auxiliary winding river can be used for monitoring insulation purposes. For measuring and protective class two. The main technical requirements of the former is necessary to ensure accuracy; there are some special requirements on the latter may, as demand has third windings, with zero flux and iron core.

The main types of failure of high voltage power metering system, according to the fault reason can be divided into: 1). The fault table error wiring caused by three-phase electric energy; 2). By the voltage transformer and current transformer wiring disconnection caused by failure; 3). The fault caused by the current transformer one or two short circuit or electric current transformer two phase to phase short circuit.

In the B grounding system, the neutral point to be installed breakdown insurance, the part increases, normal when breakdown breakdown insurance ground, will enable the B phase winding short circuit. When either A, C two phase grounding, constitute the two secondary winding phase to phase short circuit, two phase fuse. In the neutral point grounding system, the corresponding problem without B grounding, wiring is simple. According to the analysis, for the non direct ground neutral system is not installed, the distance and zero sequence directional protection, B is to protect the minimal impact on beneficial, synchronous circuit,

the voltage transformer secondary side two by B is an ideal method. For the neutral grounded system, strict protection, neutral grounding is beneficial to improve the reliability of protection, as is shown by equation (5) and it is phase voltage synchronous circuit by auxiliary winding, so the two winding voltage transformer with neutral grounding mode is superior.

$$\text{Var}[X] = E[(X - \mu_x)(X - \mu_x)^T] = C_x \quad (5)$$

Where,  $\text{Var}[X]$  is structure, principle and connection of voltage transformer and power transformer are the same, the difference is the voltage transformer capacity is small, usually only tens or hundreds of VA, two load voltage meter and relay coil, is basically constant high impedance. No-load operation and its working state close to power transformer. The high voltage winding of high voltage transformer, in parallel with a circuit system, a two voltage  $U_2$  and a voltage proportional to the value, a voltage. A rated voltage of  $U_{1N}$ , much the same with rated voltage of power grid, two times of rated voltage  $U_{2N}$ , usually 100V, 100/V, 100/3V. The voltage transformer winding one or two times rated voltage ratio, called the rated transformation ratio of voltage transformer  $K_N$ .

Impedance Reactance Compensation capacitor and YH has two secondary winding, the first winding can be connected with a compensation capacitor  $C_k$  for measuring instrument; second secondary winding can be connected with the damping resistor  $R_d$ , in order to prevent the resonance overvoltage caused by. Coupling capacitor type voltage transformer and power line carrier communication system used in combination, to simplify the system, reduce the cost. At the same time, it is also required to meet the requirements of telecommunication operation.

The primary winding of voltage transformer is connected in parallel with a circuit, and the power transformer, two sides can not be short circuited, otherwise it will produce very large short circuit current, burning voltage transformer. Similarly, in order to prevent the breakdown of high, low-voltage winding, high voltage is to the secondary circuit two harm, must be two secondary winding, iron core and shell of voltage transformer grounding.

### 3. High Voltage Power Metering Circuit Fault Detection by Electric Energy Meter Phase

Single phase electric energy meter is mainly used for 220V single-phase AC in the electric energy measurement. Single-phase electric energy meter is the most frequently used induction three flux integrating single-phase electric energy meter (Mechanical) and the electronic pulse mechanical measurement meter (electronic form) two. The mechanical watch is the most common use of the most modern applications, electrical energy measuring instrument, which is characterized by simple structure, large rotating torque, and reliable work. It mainly consists of driving device, the rotating element, brake components, bearings, a counter and an adjusting device.

Three-phase two element power two current coil and a voltage coil with two tables, three-phase and three components of electric energy meter current coil with three and three coil voltage, generates an alternating magnetic flux of the two coil, through the aluminum plate, two from a certain angle in the space, the time difference of one phase, resulting in into the magnetic field, the aluminum plate by the same force and move into the direction of the magnetic field [9]. Aluminum plate in the rotation, cutting the magnetic field of a permanent magnet to generate a braking torque, the torque increase with the rotational speed and the increase of the aluminum plate, aluminum plate rotation speed and the measured power is proportional to, so as to achieve the purpose of accurate measurement of electric energy.

Three-phase electric energy meter a drive shaft and two driving element and brake components used two or three single phase, the character wheel reflects the total electric three-phase load the consumption of energy.

Power system, power grid to provide electricity for two parts: one-way conversion into other energy of active electric energy and used for the electromagnetic energy exchange

wattless power. Wattless power flow is in the power system not only take up the grid, generator output, and cause the voltage change, power loss. Therefore, as is shown by equation (6), where  $X(k|k)$  is power users from non power size must be checked and power transmission grid absorption measurement, no power is inevitable.

$$\begin{aligned} \lim_{P(k|k-1) \rightarrow 0} X(k|k) &= X(k|k-1) + 0 \times (z_k - H X(k|k-1)) \\ &= X(k|k-1) \end{aligned} \quad (6)$$

Electronic electric energy meter is a measuring instrument model, is the application of analog digital conversion and pulse digital technology as the foundation. To be measured by the analog-to-digital converter is converted to a continuous pulse, then the mechanical counter and display the measurement results [10]. Electronic table has many advantages, such as high accuracy, no rotating element, a longer life expectancy, anti-theft performance is good, but also suitable for telemetry.

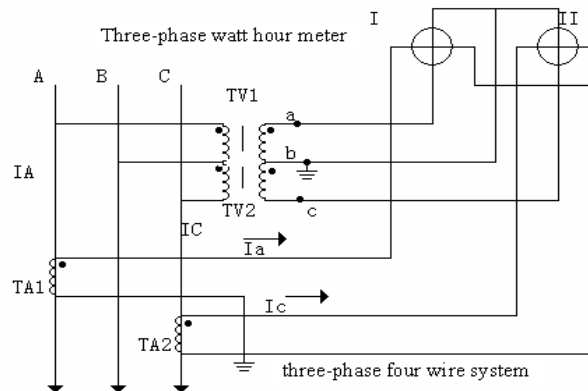
The product of electric energy meter electricity depends on three factors and the time of voltage, current, power factor. Therefore, changes in any one of the three elements can be caused by electric energy meter turn slow, stop or even reverse, causing measurement fault. In addition, the meter itself mechanical or electronic properties change, expand the error measurement system can also cause measurement fault [11]. What is more private pull chaos, without the electrical behavior, this is entirely man-made fault, as is shown by equation (7).

$$Z = \sum_{x \in \Omega_i} \begin{bmatrix} \frac{\partial I}{\partial x} \\ \frac{\partial I}{\partial y} \end{bmatrix} \cdot \begin{bmatrix} \frac{\partial I}{\partial x} & \frac{\partial I}{\partial y} \end{bmatrix} = \sum_{x \in \Omega_i} \begin{bmatrix} g_x^2 & g_x \cdot g_y \\ g_x \cdot g_y & g_y^2 \end{bmatrix} \quad (7)$$

Where,  $Z$  and  $I$  are to judge transformer circuit wiring error (TV and TA ratio measurement, TV and TA one or two polarity test, voltage and current test of symmetry and so on) as the first layer identification content, the electric energy meter common MIS wiring discrimination as the second layer of identifying content hierarchical identification method. After the first layer identification can be put on more than 4000 kinds of three-phase three wire connection mode of electrical energy meter is reduced to 48 common, thus speeding up the electricity recognition process table error connection, reduce the recognition software development workload, reduce development cost, improve work efficiency, enhance the recognition process definition.

Detection of transformer a ratio is added between the high voltage electric power metering systems P, Q points (TB4), the standard resistance in the two sides of the detection of transformers, so the measurement of the impedance between the P, Q points to the two ends of the resistance voltage standard. Effect of the grid voltage, the voltage between two points is the detection signal with load change and faults.

Three-phase watt hour meter three-phase three wire and three-phase four wire system two. High power three-phase load is balanced, the three-phase three wire connection. As shown in Figure 3.



**Figure 3. Three-Phase and Two Components of Electric Energy Metering Wiring Diagram.**

This paper first introduces the composition of the power system and the importance of high pressure measurement; secondly introduces the voltage transformer, current transformer two transform device structure, work principle, error and the three-phase electrical energy measurement of connection mode; finally introduces the application of electric energy meter, including two kinds of three-phase electric energy meter (phase two element and three element phase) and non reactive energy meter, highlighting the common faults in three-phase electric energy meter.

#### **4. Novel Method of High Voltage Power Metering Circuit Fault Detection based on Electric Energy Meter Phase and VT**

Metering failure caused by error voltage wiring. If a disconnected is caused by the loss of pressure; virtual connection and a phase voltage terminal, cause under voltage, resulting in electric energy meter less or no. Current fault: measurement failure caused by error current loop wiring. Such as short circuit or open circuit CT two side, one side, the current can not flow meter; virtual ground current terminal, so that the current flowing into the electric energy meter is reduced [12].

The electric energy metering system is error measurement failure. This failure is usually caused by man-made, the purpose is to steal. The specific methods such as private buildings meter, changing the performance of internal mechanical structure with damage meters, as is shown by equation(8), where X is meters, K can change the meter installation conditions; the magnetic field or the harmonic interference and other means to expand the electric energy metering system error.

$$X'_2 = K_U^2 X_2, \quad r'_b = K_U^2 r_b, \quad X'_b = K_U^2 X_b \quad (8)$$

Electric energy metering and correct measurement of high voltage power metering system in power more and more today is particularly important. Form the two wires of the system consists of a voltage transformer, current transformer, three-phase electric energy meter and connecting them, any of its part of the failure are not for the user of electricity meter right even the whole measurement system paralysis, this is absolutely not allowed. Therefore research on measuring system fault and detection method is required.

Measuring system of this method commonly is used in remote meter reading. If the collector used to support the automatic detection of loss of pressure, this method can be applied. Collector based on three phase voltage of electric energy meter, automatic detection of the presence of a phase voltage is lower than the rated voltage of the electric energy meter, and at least one phase current is greater than the rated current (due to the load current transformer no-load and rated current, here the margin), if this happens, with equation(9),



where,  $B(t)$  is the recorder the counting times of pressure loss and pressure loss of time, and  $R(H)$  is the records as the pressure loss events into the pressure loss record [13].

$$\left\{ \begin{array}{l} B(0) = b_0 \\ B(t) - B(0) = \frac{1}{\Gamma(H + 1/2)} \left\{ \int_{-\infty}^0 [(t-s)^{H-\frac{1}{2}} - (-s)^{H-\frac{1}{2}}] dB(s) + \int_0^t |t-s|^{H-\frac{1}{2}} dB(s) \right\} \end{array} \right. \quad (9)$$

Meaning: when any criterion of electric energy meter is lower than the rated voltage and phase voltage, three-phase current, at least one phase current higher than the rated current (standard is given to the transformer no-load current and rated current, and give the margin), but that a failure has occurred.

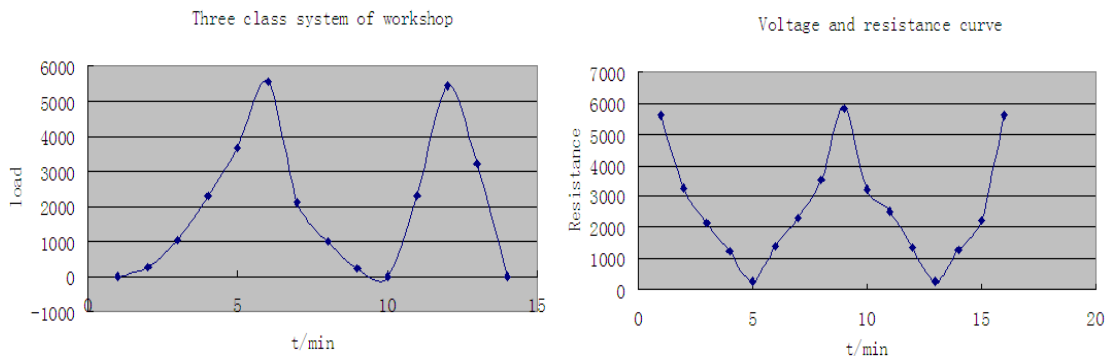
The V/V method is widely used in neutral point ungrounded or grounded by arc suppression coil and the high-voltage three-phase system, especially the three-phase system. Because it can not only save a voltage transformer can meet the three phase active, reactive power meter and three-phase power meter for line voltage. Coil voltage meter is connected to the two sides of the A, B and C, B. The disadvantage of this method is: can not measure the phase voltage; do not intervene in the monitoring system of the insulation condition of the voltage meter; the total output capacity is only 10 times the capacity of two sets.

That is to say, any phase voltage is lower than sixty percent of the rated voltage, it is possible because the voltage loop voltage may also be due to power outages caused by, and with at least one phase current is higher than the rated current of the conditions, ruled out because of the blackout caused under voltage may, it can determine the incidence of under voltage fault, as is shown by equation (10).

$$U'_2 = K_1 U_2 \quad I'_2 = K_1 I_2 \quad r'_2 = r_2 / K_1^2 \quad (10)$$

Where,  $U$  is the user only disconnect the A phase voltage or disconnect the B phase voltage,  $K$  is one LM339 two for high level, through the door after low level. So simply disconnect A, output voltage C phase in a phase does not affect the B phase voltage disconnect fault judging circuit. If the user also cut off the electric energy meter any two-phase three-phase voltage in the input circuit, output is high, that the occurrence of the three-phase voltage is disconnected fault, as is shown by Figure(4).

Finally, the three class system of workshop as the load, the actual load curves is usually irregular curve, but for the sake of simplicity, describe the load curve of the factory, as shown in Figure 4. In the sine curve plus the last constant for more practical, because the factory has little load is zero, always need some lighting or some necessary power. In order to simulate the convenient and considering the actual situation can be set to detect transformer ratio.



**Figure 4. The Three Class System Load Curve and Impedance Curve of Voltage Port Network Diagram**

In the user's normal electricity situation, the figure of  $A_v$ , voltage of  $B_v$  should be 200V. Figure 4 5NCM optocoupler isolation effect, in addition to outside, but also to the level

conversion function, consisting of a voltage divider circuit, a reference voltage through the voltage divider, an output voltage with a reference voltage is compared, 5623 of the value of selected is appropriate, can make the circuit voltage at both ends of the situation the users normal electricity under the higher value, the comparator output to a low level LM559.

The essence of this method is using double measurement loop (or analog comparison circuit) to determine whether the wrong wiring. Specifically, in the loop in series with or incorporated into the special detection circuit of electric quantity collection information, compared with the power information of electric energy meter, if the result is not consistent with the judge for the wrong wiring. Although this method can quickly reflect user wiring error occurred at a time, and it is for the power supply department to take timely measures to reduce losses, expenses. But the power sector is found only in the post fault, then measuring circuit, and there are a series of defects.

Single meter threshold logic detection: according to the same electrical energy measurement data obtained (phase voltage, phase current, power factor and power added) to judge whether a measurement faults, according to fault caused by different ways, using different methods. These methods include the voltage threshold detection, current threshold detection and phase type threshold detection. Here only discuss the detection method of voltage threshold is the under voltage threshold detection.

## 5. Summary

The paper presents novel method of high voltage power metering circuit fault detection based on Electric energy meter phase and voltage transformer. Voltage transformer type many, according to the number of windings are divided into two kinds of double winding and the three winding, three winding voltage transformer in addition to the one or two secondary winding and a group of two times for the auxiliary winding insulation monitoring and zero sequence circuit. By phase is divided into single and three phase type, rated voltage of 35kV and above voltage transformer are made for single phase type. According to the installation site is divided into indoor and outdoor type, 35kV and below made more indoor type. According to the insulation and cooling methods can be divided into dry type, cast type, oil immersed and inflatable, dry (impregnated glue) has the advantages of simple structure, no fire and explosion danger, but the insulation strength is low, indoor device only applies to the following 6kV.

With electric energy automatic tracking compensation error of measuring multi table; reasonably accurate measurement of nonlinear load electronic meter can fundamental; accurate measurement, simple low power load electric electronic slope can India Pavilion electric energy meter; electronic multifunctional visual electric energy meter. Accurate measurement of nonlinear load and reasonable application of electronic fundamental electric energy meter can measure the urgent need, because now nonlinear power user electric energy meter results depending on the nonlinear load consumption of fundamental and harmonic power algebra and. Users in addition to its own consumption part of the harmonic is feed into the grid harmonic component, but this part of harmonic and fundamental power flow in the opposite direction, the electric energy metering of electric energy is the fundamental energy deducts this part of harmonic energy, measurement value is less than the fundamental wave energy.

Electrical energy table fault current circuit fault is the high voltage power metering systems often occur, and there are many kinds of fault types. In the third chapter has discussed the current transformer one or two short circuit, a fault detection model, and proved the validity of the simulation model of fault detection.

## References

- [1] J.C. Li, "Research of guarding against the theft of electricity", *Country Electrification*, vol.12, no.9, (1999), pp.42-44.
- [2] B. Li, "Small Current Grounding Fault Detection Based on Wavelet Packet Transform Deposition", *JCIT*, vol. 8, no. 4, (2013), pp. 182 – 190.
- [3] S. Chattopadhyay, "Designing Energy Meters With the PIC16F873A", *MICrochip Techonlogy Inc*, (2005), pp.1-18.
- [4] W. Zhang, X. Liu, R. Qi and Y. Jiang, "Improved Locally Linear Embedding Based Method for Nonlinear System Fault Detection", *IJACT*, vol. 5, no. 1, (2013), pp. 515 – 523.
- [5] Bashir, Zidan and EI-Hawarv, "Short term load forecasting by using wavelet neural network", *M.E Canadian Conference on Electrical and Computer Engineering*, 1May 7-May, (2000).
- [6] G. Srogers and J. Edwards, "An introduction to wireless technology", Beijing: Publishing of tsinghua, (2005).
- [7] J. Feng, J. Yu, and J.J. Chen, "A Low Voltage Cell Crushing System Based on MEMS Technology", *IJACT*, vol. 5, no. 3, (2013), pp. 71 ~ 78.
- [8] I. Erakovic, D. Rakic, V. Lapcevic, S. Marjjanovic and M. Djonovic, "A system for remote meter reading and load management", *Ninth International Conference On Meter And Tariffs For Energy Supply*, *IEEE CONFERENCE PUBLICATIONS*, vol.462, (1999),pp.196-199.
- [9] Y. Luo, X. Duan, M. Zhang and E. Dong, "Research on the Electronic Transformer Applied in IEC 61850-9-2 Process Bus", *IJACT*, vol. 4, no. 13, (2012), pp. 217 - 224.
- [10] S. Ltoral, J.M. Quero and L.G. Franquelo, "Reactive power and enery measurement in frequency domain using random pulse arithmatic", *IEE Proceedings Science, Measurement And Technology*. vol.148, no.2, (2001), pp.63-67.
- [11] H. G. Lee, Y. Choi and J.H. Shin, "Spatio-Temporal Mining for Power Load Forecasting in GIS-AMR Load Analysis Model", *IJIPM*, vol. 2, no. 1, (2011), pp. 57 - 66.
- [12] K.-H. Kim, H.-Sun and Y.-C. Kang, "Short-time forecasting for special days in anomalous load conditions using neural networks and fuzzy inference method", *IEEE Transactions on Power System*. vol.15, no.2, (2000), pp.559-565.
- [13] T.-Y. Zheng and Y.-C. Kang, "Development of a compensating algorithm for an iron-cored measurement CT using flux-magnetizing current curves and voltage-core loss current curves", *RNIS*, Vol. 4, (2009), pp. 12 -18.

