CALIBRATION OF 1-PHASE AND 3-PHASE ENERGY METER USING PID CONTROLLER

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Abstract - Calibration of Energy meter plays important role in distribution systems from consumer point of view. Several conventional methods like Standard energy meter, comparing energy with standard power measuring equipments leaves some of the considerable errors in calibration techniques. This noval method of calibration of energy meter based on arduino for measurement of true energy is effective and more accurate as compared to conventional methods. The results have been verified with numerical analysis methods and also with standard meter method.

***Key Words*:** Smart Energy meter, Calibration of Energy meter, Error detection.

1.INTRODUCTION

The meter which is used for measuring the energy utilizes by the electric load is known as the energy meter. The energy is the total power consumed and utilized by the load at a particular interval of time. It is used in domestic and industrial AC circuit for measuring the power consumption. The meter is less expensive and accurate. The calibration of energy meter may become inaccurate during its vigorous use due to various reasons. It is necessary to calibrate the meter to determine the amount of error. The current and voltages are held constant during the test. The numbers of revolutions made by the test are recorded. The time taken is also measured. Energy recorded by meter under test = RX / KX kWh. Energy computed from the readings of the indicating instrument = kW × t Where RX = number of revolutions made by disc of meter under test.

2. METHODOLOGY

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The objectives of the research work are as below-

1. To determine the accuracy of energy meter under the test .
2. To establish the reliability of the energy meter
3. To reduce the testing time of energy meter

3. DESIGN ASPECTS

3.1 Testing Principle

The schematic diagram of field test on digital energy meter based on digital reference energy meter is shown in Fig.1. The reference meter [3] receives the IEC 61850 protocol data sent by the field merging unit to calculate the precise electric energy and output the high frequency standard electric energy pulse.

Higher performance is required of digital reference meter than digital meter including higher accuracy of complex load energy measurement and field reliability, standard electric energy pulse output which can respond accurately to the real-time changes of field dynamic load. However, in the field testing, the actual operating environment of digital energy meter challenges.

The performance improvement of digital reference meter, mainly revealed in the following aspects-

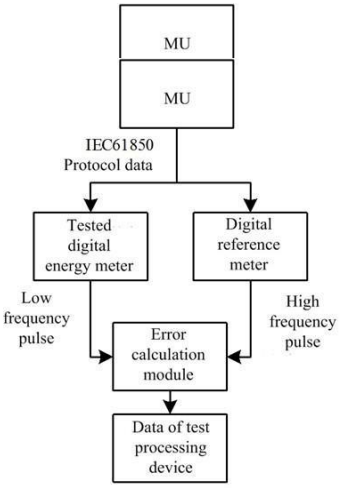

Fig.1 IEC 61850 protocol data flow

3.2 Limits of sampling frequency

In the process of energy metering, the digital energy meter accumulates the energy value by sampling time interval. The main error between the power output by the fixed pulse and the actual power is the pulse counting overflow error, the value of which is the ratio of the three- phase energy accumulated instantaneously at sampling interval to the total energy metered.

The frequency of the front-end sampling system of digital energy meters is usually 4 kHz, which restricts the overflow error of the electric energy pulse output by the reference meter when receiving the sampled data. Therefore, the accuracy and time of testing are limited even when improving the frequency of electric energy pulse output by the reference meter. Considering the limits above, the uncertainty of the reference meter is hardly 1/5 of the tested digital energy meter (Class 0.2S).

3.3 Restrictions of processing time and algorithm

Differently from the sampling system of normal electrical energy meters, digital energy meter receives sampling data through IEC61850 protocol. Therefore, the digital reference meter has to receive the data of the interface, analyse the protocol and calculate the power in 250μs while ensuring the accuracy of energy metering and the time of the high frequency pulse outputting.

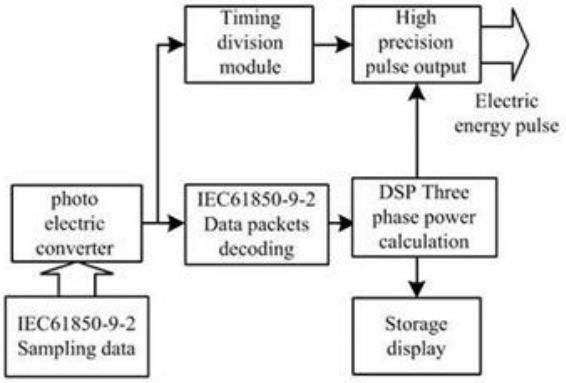

Fig. 2 Diagram of structure of the digital reference meter

In this device, the high-precision decoding and conversion of IEC 61850 protocol sampling data from optical fibre signal to electrical signal is completed in the photoelectric conversion module. The sampled data packets are analysed and the effective sampled data for high precision real-time power calculation are extracted in the data receiving and decoding module. High frequency pulse is output by high precision frequency division technology in the timing & frequency-dividing module. The power storage display module the historical power is accumulated and renovated on display at regular intervals.

3.4 Sequence Diagram

Energy meter calibration is a process required to determine and reduce the error when the energy is measured. The errors in the energy meter can be caused by different sources like voltage transformers, current transformers errors due to phase angle, crystal oscillators, etc. Energy meters need to be calibrated for use in Measurement and Verification (M&V) projects. This project presents a low-cost meter data calibration technique using a relatively high accuracy energy meter as a calibrator. Calibration is achieved by combining three processes:

1. Sense
2. Process
3. Switching

Fig. 3 Sequence diagram

Measurements are then compared to the standard values to verify the method. Energy meters have specified characteristic constants, which give information about the number of pulses per hour. For single phase energy meter the standard pulses are 3200 and 6400 and for three phase 450,800,1200,1600. In single phase 3200 pulses considered as LT and 6400 pulses is considered as HT. And also, in three phase 450,800 pulses considered as LT and 1200,1600 pulses considered as HT.

3.5 Activity Diagram

Below fig. 4 shows block diagram or activity diagram of proposed method.

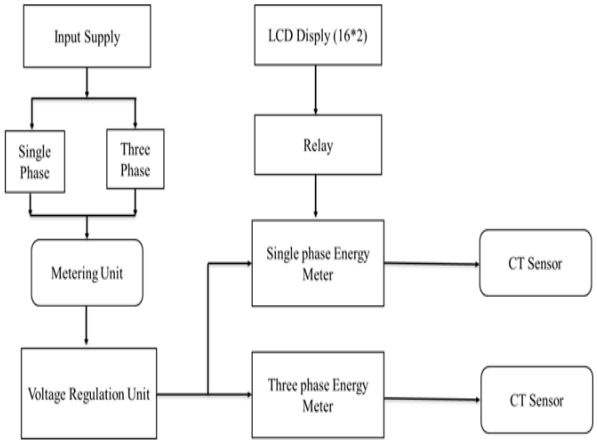

Fig. 4 Block diagram of proposed method

4. EXPERIMENTAL RESULTS

All old meter testing method are gone and seen the MSEB side and check the old meter fault checking system and observe.

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Order the all equipment under observation my group and study of this projectis hardly no any complete.

5. CONCLUSION

Energy meter which can control the usage of electricity on consumer said to avoid wastage of power. Prepaid energy meter is a concept to minimize the electricity theft with a cost-efficient manner. The users are not bound to pay excesses amount of money, users have to pay according to their requirement. Prepaid energy meter is more reliable and user friendly. This prepaid remote energy meter proves to be a boon in the power sector. It controls the usage of electricity on consumer said to avoid wastage of power. It helps to the country revenue by stopping current theft and punishing the dishonest customers. However, their design has to meet certain prepaid standards and regulations. The only concern is the security and privacy of data as theyare prone to cyber-attack. However, the use of GSM in this particular system provides numerous advantages over methods that have been previously used. Data transmission is charged at standards SMS rates; thus, the charges are not based on the duration of data transmission. The cost efficient of readings. Developed system also gives information about daily, monthly and yearly power usage. Details regarding daily power consumption will help consumer to manage their power usage. This developed system is reliable and secure as only authorized person can access the system.

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