INNOVATIVE APPROACH FOR AUTOMATION AND CALIBRATION OF ELECTRONIC TRANSDUCER

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ABSTRACT

This paper basically is on testing for discrete transducer basically current and voltage transducer. The stable response of the testing parameters is determined by The close loop system . AC and DC both are electrical quantities can be measured by the discrete transducer, such as current, voltage, power, frequency, resistance and so on. The input signal are converted into proportional DC signal using transducer that is independent of load an electrically isolated. The principle of TDM system is used for measuring AC power. A DC (analog) signal is converted into a pulse signal output, for example to indicate the energy consumption. In this CALMET 2150 is the main part, It is basically used for calibration as given input. Calibrator is used for adjusting, checking, and verification of electrical instrument characterized by high accuracy, high output power, light weight and small dimensions. CALMET is having another feature that standard interface RS232C enables connecting calibrator to computer and switched on to the automatic measurement systems.

Key Words: CALMET, Closed Loop System, Current Transducers, Voltage Transducers.

I INTRODUCTION

The open-loop controller has few disadvantage, control theory introduces feedback. A closed-loop controller uses feedback to control states or outputs of a dynamical system. Its name comes from the information path in the system: process inputs (e.g., voltage applied to an electric motor) have an effect on the process outputs which is measured with sensors and processed by the controller; the result (the control signal) is "feedback" as input to the process, closing the loop [1]. The PID controller is probably the most-used feedback control design. PID (Proportional-Integral-Derivative), a control signal produced by referring to the three terms operating on the error signal. For the system u(t) is the control signal given, y(t) is the measuring output value and r(t) is the desired output, and tracking error. Practically PID controllers, a pure differentiator is neither physically realizable nor desirable [2]. A sampling current ratio measurement system has been developed, tested, and validated for the accurate complex ratio measurement of ac current transducers[3]. Control theory has also been used to decipher the neural mechanism that directs cognitive states[4].

In this calibrator DC voltage and current is calibrated, this system has only one output at a time. Output voltage and current are set using three dials on the front panel [5]. Settings are controlled by digital signals passing through photo couplers and microprocessors, and are displayed on a red 5-digit LED [6]. The 2553 also features the five most commonly used TC ranges conforming to ANSI, DIN or JIS standard for calibrating and testing thermocouple thermometers or related devices. C or responding emf outputs are available by selecting the relevant range and setting the temperature in °C [7]. The 2553 can be remotely programmed and controlled using an optional General Purpose Interface Bus (GP-IB) that meets the IEEE 488 Standard [8]. This enables the 2553 to be interfaced easily with other instruments and to be applied in a fully automatic calibration or test system.

The further sections in this paper are as follows, Section 2 includes Discrete Transducers in Closed Loop System , Section 3 includes the working block diagram of systems and in Section 4 Results of following system and finally Section 5 conclusions was made.

II DISCRETE TRANSDUCERS USING CLOSED LOOP SYSTEM

Discrete transducers such as voltage or current transducer measure a wide range of electrical parameters and generate output signals suitable for interfacing with instruments and control system.

Transducers can be current or voltage transducers used. Transducers have one or two outputs, and each type being available for different output configuration and auxiliary supply input. All outputs that are being used are galvanically isolated. Discrete transducers are used in control panels, instrumentation systems, electrical distribution panels.

It is also used in electrical transmission system and generators, in SCADA system. The system mainly consist of four sections those are listed as below,

- Need of System
- Previous System
- Prototype Model

2.1Need of System

Basically the system is closed loop testing for current and voltage transducer. The stable response of the testing parameters determines the close loop system. All electrical quantities both AC and DC can be measured by the discrete transducer, such as current, voltage, power, frequency, resistance and so on. The input signal is converted into proportional DC signal using transducers that is independent of load an electrically isolated. Using principle of TDM (time division multiplexing) system AC power is measured. DC(analog) signal is converted into a pulse output, i.e. to indication of total energy consumption. The automation in any system is today's requirement.

2.2 Previous System

The previous model based system "The closed loop system for transducer" was developed using the calibrator called YOKOGAWA 2553 which is 1? supply. The YOKOGAWA 2553 is an ultra-stable, high-resolution DC

voltage and current source which gives output voltages from 1 mV to 12 V, and whose output currents lies between 0.1 mA to 120 mA at an accuracy of ± 0.02%.

Previous system model was the closed loop system for transducer using YOKOGAWA model was being used. The calibrator called YOKOGAWA 2553 was used at 1? supply. model was not fully automated. The working is simple but less accurate. Here in new evolving model adaptor is used The 2553 is a system with good stability, great resolution DC voltage and current source which gives output voltages between 1 mV to 12 V, and output currents between 0.1 mA to 120 mA and its accuracy ± 0.02%. In this system using 2553 calibrator the accuracy for model was 0.08% and was used for single phase medium range systems. The previous system so that if any fluctuations in voltage or current occurs in circuitry then because of adaptor circuit will not damage. A programming is not implemented in this system so manual work increases and due to the human error occurs. This system is not fully automated so it cannot be easily replaceable. In this system a manual data log is been maintained, so typing mistakes can occur. Due to this a whole system could not work properly.

Figure-2 The closed loop system for transducer using YOKOGAWA Calibrator

2.3 Prototype Model

In this CALMET 2150 is the main part, It is basically used for calibration as given input. Calibrator is used for adjusting, checking, and verification of electrical instrument characterized by high accuracy, high output power, light weight and small dimensions. CALMET is having the feature of enabling interfacing with computer using RS232C for measuring value automatically Transducers are defined as converting one electrical parameter to another electrical parameter or one electrical parameter to the same one. Here if we consider current as the parameter, then applied input to the system is 1A then output is 20 mA and if input is 0 means no input applied output to our system so by default output is 4mA.

Here in this system we have considered only 4 mA and 20 mA because standard system for measurements for PLC, SCADA or different system with respective of 4-20 mA or 0-20 mA form. If its output is 1 A transducer should sense and according to that transducer should generate an output. So for that different models placed

inside different transducer, different pot are placed as such we can co-ordinate between input and output depend on the circuit designed. We have to set potentiometer and establishing fixed relation between input and output, this process is called as linearity. That means output varies according to input. Initially input is given as 1 A and some random output which is not valid at the beginning, such as 25 mA or 16 mA. Initially we will set potentiometer to 4 mA. The next potentiometer will be showing value as 3.9 mA we have to change it to 4 mA. This is the basic function of transducer to follow.

III SYSTEM DEVELOPMENT

Few advancement in previous system is done in this case. Previous system model was the closed loop system for transducer using YOKOGAWA model was being used. The calibrator called YOKOGAWA 2553 was used at 1? supply. In this system using 2553 calibrator the accuracy for model was 0.08% and was used for single phase medium range systems. A programming is not implemented in this system so manual work increases and due to the human error occurs. This system is not fully automated so it cannot be easily replaceable. In this system a manual data log is been maintained, so typing mistakes can occur. Due to this a whole system could not work properly. The previous system so that if any fluctuations in voltage or current occurs in circuitry then because of adaptor circuit will not damage. This prototype model is automated and calibrated well.

3.1 Block Diagram

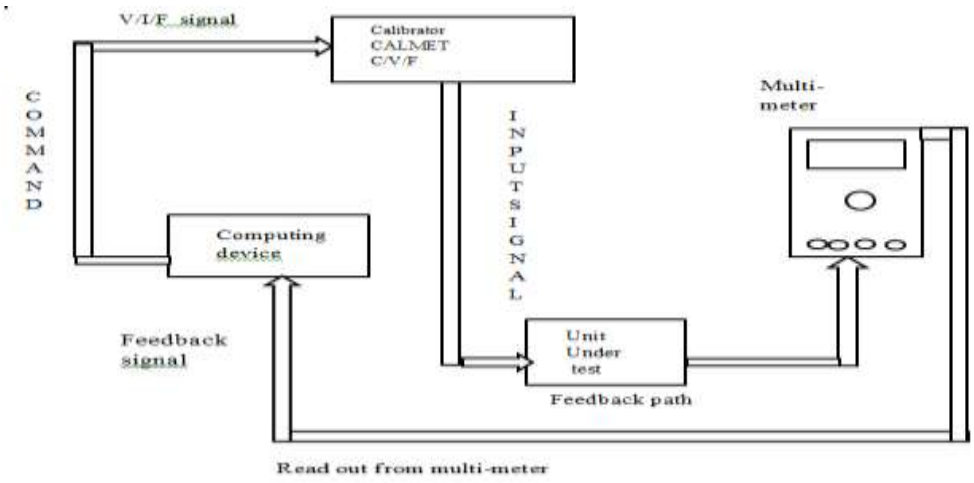

Figure-3 Block diagram

3.2 Working

The figure shows the block diagram of "Automation for calibration and testing for the transducer". Now in this new system the sequential procedure of setting potentiometer manually is done first. Initially the value of potentiometer is set to 4 mA. If the value is predefined to 4 mA then its ok otherwise operator on machine have t set have to set the value. We can feed this value in computer. If the value being is already set to 3.9 mA then the

error will occurs or if incorrect input is fed to transducer instead of setting it to 1 A i.e. given 5 A and output is calibrated according to that so mistake is been occurred. Here some of the typing mistakes can occur or if we interpret something wrong. If the value is 4 mA and its accuracy is +/-0.5% then the final value comes as 3.95 mA and 4.05 mA. Therefore to avoid such kind errors or mistakes, automation should be done. Here the input is given to unit under test (UUT) that is the E15 transducer.

The front end window of the software will be shown as follows:

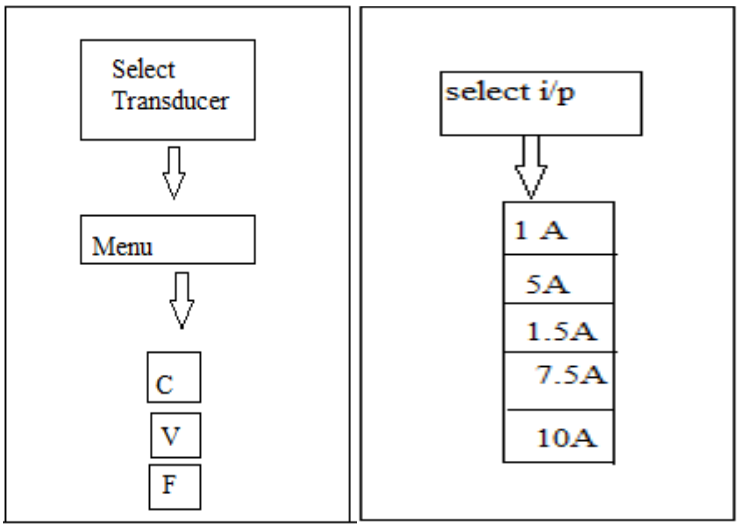

Figure-4 Drop Box

As many times the operator will set the potentiometer, that many time output will flash on multi meter and accordingly the output will be generated on computer and then on multi meter. As per our coding comparison will be done. At the backend some C++ program is written, i.e. as per input voltage output is changed and same for the current. Computing device will compute and display message and giving command to our source i.e. CALMET and According to that output will be actuated gives to transducer.

IV RESULTS

The results are based on the working model shown above.

The specified output shown here are 4, 8, 12, 16 and 20 mA.But the observed outputs which we first saw are nearly equal to 3.9995 for first value, but for our system accuracy is 0.5% so we can adjust our output by minimizing error. After minimizing error observed output is 4.0081 mA, this output is within our limit and satisfies our accuracy terms. This follows for all other values and observe the final output.

The below result is of voltage transducer:

Parameter	Input Value (V)	Aux. Supply (V)	Loa Res. (Ω)	Specified Output (mA)	Observed Output (mA)	Observed Error (%)	Tolerance +/-(%)
0%	0	110	375	4.0000	4.0081	0.0506	+/-0.5
25%	27.5	110	375	8.0000	8.0056	0.0350	+/-0.5
50%	55	110	375	12.0000	12.0062	0.0387	+/-0.5
75%	82.5	110	375	16.0000	16.0080	0.0500	+/-0.5
100%	110	110	375	20.0000	20.0171	0.1069	+/-0.5
Load Influence	110	110	0	20.0171	20.0184	0.001	+/-0.05
	110	110	375	20.0171	20.0159	-0.0075	+/-0.05
Aux. Influence	110	72.25	375	20.0171	20.0142	-0.0181	+/-0.05
	110	305.9	375	20.0171	20.0137	-0.0212	+/-0.05

Table 1: Result of Voltage Transducer

The below result is of current transducer.

Parameter	Input Value (A)	Aux. Supply (V)	Loa Res. (Ω)	Specified Output (mA)	Observed Output (mA)	Observed Error (%)	Tolerance +/-(%)
0%	0	110	375	4.0000	4.0082	0.0513	+/-0.5
25%	0.25	110	375	8.0000	8.0103	0.0644	+/-0.5
50%	0.5	110	375	12.0000	12.0129	0.0806	+/-0.5
75%	0.75	110	375	16.0000	16.0127	0.0794	+/-0.5
100%	1	110	375	20.0000	20.0156	0.0975	+/-0.5
Load Influence	1	110	0	20.0156	20.0142	0.0088	+/-0.05
	1	110	375	20.0156	20.0127	-0.0181	+/-0.05
Aux. Influence	1	72.25	375	20.0156	20.0129	-0.0169	+/-0.05
	1	305.9	375	20.0156	20.0139	-0.0106	+/-0.05

Table 2: Result of Current Transducer

V CONCLUSION

This system shown above "Implementation of automation and calibration for discrete transducer". The closed loop system that shows of testing parameter is shown by the testing of the stable response. All electrical quantities both AC and DC can be measured by the discrete transducer, such as current, voltage, power, frequency, resistance and so on. The input signal is converted into proportional DC signal using transducers that is independent of load an electrically isolated. The input signal is converted into proportional DC signal which is independent of load this does the transducer. The previous model based system "The closed loop system for transducer" was developed using the calibrator called YOKOGAWA 2553 which is 1? supply, but now we are going to use "calmet C101F". It is AC as well as DC voltage and current calibrator with range of 100 A AC range. Auxiliary supply is been used here that of 230V- AC. The input value to the system is 0 to 5 A and output is 4to 20mA. The maximum resistance is Rmax is 750Ω.

Here new and advanced method are been implemented practically. The system is automated using few advancement which is practically usable.

- This system is closed loop system so error are reduced then the open loop system. Unstable processes can be stabilized using closed loop system. Reduced sensitivity to parameter variations and reference tracking is improved.
- The data can be saved for future analysis using computing device. The data log is used for keeping records.
- System is flexible because of automation. Typographical mistakes can be avoided.
- The system is easily replaceable with the previous system. In this system we are using programming in C++ language, so it can be modified and changed as per requirement. The software can easily be upgraded as new version is launched.

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