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Automation and Calibration for Discrete Transducer: A Survey

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Abstract - ***This paper basically is on closed loop testing for discrete transducer. The close loop system determines the stable response of the testing parameters. The discrete transducer can measure all electrical quantities both AC and DC, such as current, voltage, power, frequency, resistance and so on. The transducer coverts the input signal into proportional DC signal that is independent of load an electrically isolated. AC power is measured using principle of TDM system. An analog DC signal is converted into a pulse output, for example to indicate the energy consumption. In this CALMET is the main part. It is basically used for calibration related 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: *Closed loop system, Current transducers, Voltage transducers, CALMET.*

1. 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 (e.g., speed or torque of the motor), 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 is an initialism for Proportional-Integral-Derivative, referring to the three terms operating on the error signal to produce a control signal. If u(t) is the control signal sent to the system, y(t) is the measured

output and r(t) is the desired output, and tracking error. For practical PID controllers, a pure differentiator is neither physically realisable 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. 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. The 2553 can be remotely programmed and controlled using an optional General Purpose Interface Bus (GP-IB) that meets the IEEE 488 Standard. 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 finally in Section 4 conclusions was made.

2. DISCRETE TRANSDUCERS USING CLOSED LOOP SYSTEM

Discrete transducers such as voltage or current transducer measure a wide range of electrical parameters and generat 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,

1. Closed Loop System
2. Need of System
3. Previous System
4. Prototype Model

2.1 Closed Loop System

In a closed-loop control system, lets see the example data from a sensor monitoring the speed of a moving car (the system output) enters a controller which continuously reduces the quantity representing the speed from the reference quantity representing the speed which we need. This difference is called as the error i.e. the throttle (the control). The result is to match the car's speed to the reference speed (maintain the desired system output). Now, when the car has to go on some hill, so the difference between the input (the sensed speed) and the reference continuously shows the throttle position. We have to set some reference, when the sensed speed drops below that the throttle opens, and engine power increases, speeding up the vehicle. In this way, the controller dynamically counteracts changes to the car's speed. The main idea of these closed loop systems is the feedback loop, the controller which interns affects the system output and given feedback to the controller.

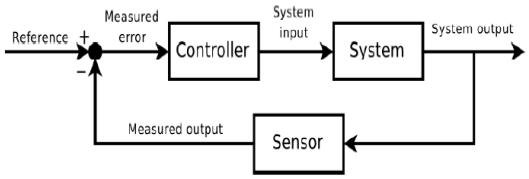

Figure-1 Basic Feedback Loop System

Closed-loop controllers have the following advantages over open-loop controllers:

- disturbance rejection
- guaranteed performance even with model uncertainties, when the model structure does not match perfectly the real process and the model parameters are not exact
- unstable processes can be stabilized using this process
- Sensitivity is reduced when variations in parameter is observed
- Reference tracking performance can be improved

In some systems, closed-loop and open-loop control are used simultaneously. In few systems, the open-loop control system is termed as feedforward and which further improve reference tracking performance.

2. 2 Need of System

The system basically is closed loop testing for discrete transducer. The close loop system determines the stable response of the testing parameters. The discrete transducer can measure all electrical quantities both AC and DC, such as current, voltage, power, frequency, resistance and so on. The transducer coverts the input signal into proportional DC signal that is independent of load an electrically isolated. AC power is measured using principle of TDM (time division multiplexing) system. An analogue DC signal is converted into a pulse output, for example to indicate the energy consumption. The automation of any system is today's requirement.

2.3 Previous System

The previous system "The closed loop system for transducer" was using the calibrator called YOKOGAWA 2553 which is 1ϕ supply. The 2553 is an ultra-stable, high-resolution DC voltage and current source which delivers output voltages from 1 mV to 12 V, and output currents from 0.1 mA to 120 mA at an accuracy of ± 0.02%.
Previous system is the closed loop system for transducer was been used. In this system the calibrator called YOKOGAWA 2553 which is 1ϕ supply. The 2553 is an ultra-stable, high-resolution DC voltage and current source which delivers output voltages from 1 mV to 12 V, and output currents from 0.1 mA to 120 mA at an accuracy of ± 0.02%. In this system using 2553 calibrator the accuracy was 0.08% and was used for single phase medium range. The previous system which we saw was not fully automated. Its working is just so simple but less accurate. Here in our new proposed system adaptor is being placed so that if any fluctuations on voltage or current occurs then adaptor will not affect the rest circuitry. a computerized software programming is not done in this system so manual work increases and due to tha human error occurs. The system is not automated so it is not easily replaceable. In this system a manual datalog is been maintained, so typographical mistakes can occur. Due to this a whole system could not work properly.

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

2.4 Prototype Model

In this paper CALMET is the main part. It is basically used for calibration related 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 system. Converting one electrical parameter to another electrical parameter or one electrical parameter to the same one is called as transducer. Here if we consider current as the parameter, then if input applied is 1A our output is 20 mA and if input is 0 means nothing applied output for our system by default is 4mA.

Here in this system we have considered only 4 and 20 mA because standard system for electrical measurements which goes to PLC, SCADA or different system is with respective of 4-20 mA or 0-20 mA form. The function is that if its output is 1 A transducer should sense and according to that transducer should generate an output. So for that different circuits a placed inside transducer, different potentiometer 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. It is called as linearity. Means, according to input our output changes. Basically it will get input as 1A and it will create some output which is not valid at the beginning, such as 25 mA or 16 mA. So we will set first potentiometer value to 4 mA. The second potentiometer which might be showing something 3.9 mA we will change it to 4 mA. This is basic function of transducer.

3. SYSTEM DEVELOPMENT

In this paper CALMET is the main part. It is basically used for calibration related as given input. Calibrator is used for adjusting, checking, and verification of electrical instrument characterised 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 system. Converting one electrical parameter to another electrical parameter or one electrical parameter to the same one is called as transducer. Here if we consider current as the parameter, then if input applied is 1A our output is 20 mA and if input is 0 means nothing applied output for our system by default is 4mA.

3.1 Block Diagram

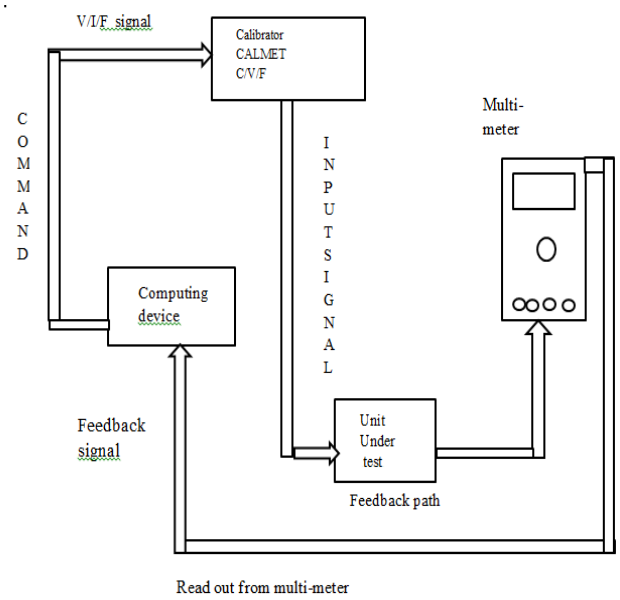

Figure-3 Block diagram

3.2 Working

The above shown is the block diagram of "Automation for calibration and testing of discrete transducer". Now in this paper the potentiometer which is set manually this procedure of previous system remains same. We have to manually set this potentiometer means once we will set it to 4 mA. If an operator is sitting on the machine to set value so if value is 4 mA then its ok. We can fill the value to the computer. If the value is set as 3.9 mA then mistake occurs or if wrong input is set to transducer instead of setting it to 1 A i.e..have given 5 A and output is calibrated according to that so mistake is been occurred. Here typographical mistakes can occur or if we interpret something wrong if its accuracy is +-0.5%. If the value is 4 mA then the value is 3.95 & 4.05. So to avoid such mistakes we are using automation. Here the input is fed to unit under test (UUT) that is the E15 transducer.

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

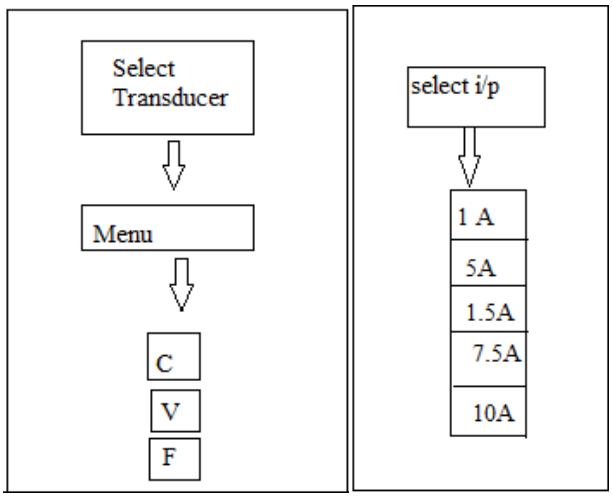

Figure-4 Drop Box

As many times the operator will set the pot, at the same time output will flash on multi meter and accordingly output will be flash on computer and then on multi meter. At that moment in computer as per our coding comparison will be done. There is some program written on backend i.e. as per input voltage what output and same for the current. Computing device will display message and giving command to CALMET (source) Accordingly its output will be actuated gives to transducer.

CONCLUSION

This system shown above "automation and calibration of discrete transducer". The closed loop system determines the stable response of testing parameter. The discrete transducer can measure both AC and DC electrical current as well as voltage. The transducer converts the input signall into proportional DC signal that is independent of load. Previously the close loop system for discrete transducer is been used but by using simple calibrator namely "yokogawa" , but now we are going to use "calmet C101F". It is AC & DC voltage and current calibrator having range of 100A AC range. In this we are using Auxiliary supply of 230V- AC. Its input is 0 to 5 A and output 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.

- The system is closed loop system so error are minimized then the open loop system. Due to close loop ,system has few advantages. Performance unstable processes can be stabilized. Parameter variation and reduction in sensitivity leads to improvement in reference tracking.
- The computing device is used, so that data can be saved for future analysis. The datalog of any system is must for keeping records.
- The automation in system has made system flexible. The manual error like 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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