

Field Flow Meter Simulator Kit

¹Salil Kulkarni, ²Shriya Gadekar, ³Dr. D.R.Shende

¹B.E.Scholar, Department of Instrumentation, AISSMS's IOIT, Pune

²B.E.Scholar, Department of Instrumentation, AISSMS's IOIT, Pune

³Prof. Department of Instrumentation, AISSMS's IOIT, Pune

Abstract-The determination of flow meter status and its functioning is of great importance when accurate flow measurements are required. The output current from the flow transmitter needs to be monitored as it drives the control of process and its parameters. Our project consists of a device which simulates and tests measurement signals. It determines the deviation from true reading by testing of the given flow meter at hand. The transmitter of flow meter generates a current signal at the output in a standardized range of 4 to 20 milli-amperes. This signal will be tested with respect to the simulator output voltage signal given as input to the flowmeter. The difference in the true and actual readings will indicate the accuracy of measurement of the given flow meter. Pulsed output signal and communication signal with RS485 protocol are other signals that will be tested. On field testing and simulation is the prime feature of this device and has an advantage as it is integrated for different signal inputs. When we take Indian context into consideration, such device is not used widely but bringing it to market will change the working standards in Indian measurement and control industry.

Keywords: Flow meter testing, Simulation, Communication testing, Pulse signal detection, Microcontroller.

I. INTRODUCTION

The determination of flow meter status and its functioning is of great importance in process plants when accurate flow measurements are required. The output current from the flow transmitter needs to be monitored as it drives the control of process and its parameters. The device we have produced simulates measurement current signals. It determines the deviation from true reading by testing of the given flow meter at hand. Pulsed output signal and communication signal with RS485 protocol are other signals that will be tested. This device can be carried to the field for testing and simulation and has an advantage as it is integrated for different signal inputs.

II. SYSTEM MODEL

The purpose of this project is to develop an on field Flowmeter Simulation device. Flowmeter simulators are used to verify the correctness or soundness of a flowmeter.

This project is used to conduct simulation of flowmeter for given output signals. If the simulation reveals that adjustments need to be made, the flowmeter needs to be calibrated either online or in factory.

In the context hardware engineering, a flowmeter simulator refers to an environment in which the flowmeter

in operation is tested with the aid of hardware tools. Special feature is designed for easy and handy operation of device on 5 V DC, which is provided by rechargeable battery pack.

Kit consists of current measurement port, RS 485 communication port, pulse signal port, rechargeable battery pack, charger . This machine has operator based control System. It has Push Buttons, 16x2 LCD Display etc. Kit shall check indications for measurement output signal, pulse output signal, communication output signal of Flow meter.

III. PREVIOUS WORK

Earlier service of flow meter included removing of the flow meter from the process line and testing it at a different location. With change in technology, handheld devices which were highly efficient were introduced which could be carried to the field and be used to check the flow meter.



Fig.(1) Proline fieldcheck

Flow simulation system Proline fieldcheck[1] is one of the products of Endress+Hauser (E+H) which is used only for their product named Proline which is a field flow meter. The figures above show the fieldcheck device by (E+H).

Devices like Proline fieldcheck are used in other countries in the US and Europe. According to Indian context, these devices are new and will play a major role in measurement and instrumentation industry. The device we have made will be merely functioning like Fieldcheck but with the specifications and materials all different based on suitability for different flow meters used, as fieldcheck is used only for their Proline mass flow meter.

IV. PROPOSED METHODOLOGY

The transmitter of flow meter generates a current signal(simulation process[2]) at the output in a standardized range of 4 to 20 milli-amperes. This signal will be compared to the simulator output current signal. The difference in the readings will indicate the accuracy of measurement of the given flow meter. The controller used in this device is Arduino [3] that is At mega 328P. The pulsed output signal which are totaliser pulses will be detected and counted by this device, indicating its pulse output response. RS485 protocol based communication is another feature that indicates that the measurement device is communicating correctly or not. Instuctables[4] based on interfacing the display and keys are used for working on the backend of this project.

Flow simulator separate hardware is used to to simulate voltage output from transmitter whenever there is no flow of liquid present through the pipeline. The simulator voltage output is given to transmitter input in that case.

Actual System Working

1. The device detects 3 signals namely-
 - a) Standard current output
 - b) Communication signal (here based on RS485 technology)[5]
 - c) Pulse output of flow meter.
2. It measures the actual value of current signal and displays it on the LCD.
3. It detects the pulse signal and communication signal and displays their status on the LCD.
4. The device works on rechargeable battery pack.
5. There are 4 physical keys and a 16x2 LCD screen provided for the communication between the device and operator.
6. For easy operation, the size of the device is moderate.
7. Flow simulator output voltage is given as input to transmitter for actual flow simulation during no flow condition.

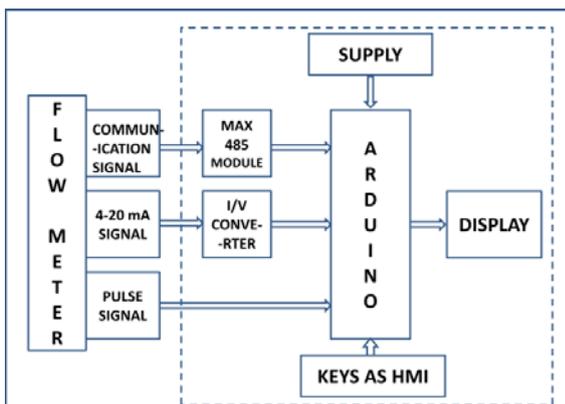


Fig.(2) Field flow meter Simulator kit internal diagram

V. SIMULATION/EXPERIMENTAL RESULTS

The obtained result at the end of this project is a handheld device which allows field simulation of flow meters on the basis of

1. Standard current output
2. Communication signal (here RS485)
3. Pulse output of flow meter

The simulator device works properly on the field and can be used for testing by the help of simulation. The LCD display that we are using indicates the status of signals coming from the flow meter. Hence on field testing support, followed up by required actions to be taken by maker of the device.

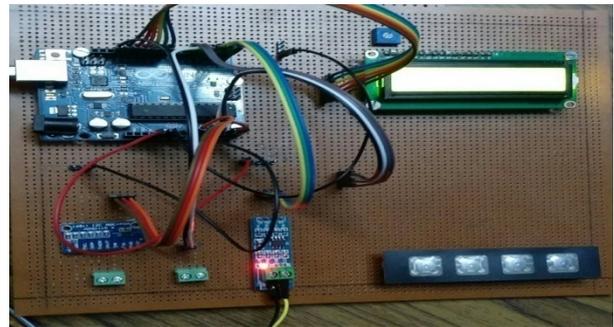


Fig.(3)Actual implemented system

VI. CONCLUSION

The determination of flowmeter status by checking it's output signal values is critical and needed to maintain the correct process flow. As earlier the whole flowmeter had to be temporarily removed and brought to the testing and manufacturer's base, this device makes the operator's job easy. The field flow meter simulator helps troubleshooting and validation of flow meter in the field itself. It checks status of flow meter by checking 3 output signals namely - Standard current output, Communication signal (here RS485), Pulse output signal and displays their status on the display LCD, as a part of human interface.

The major advantage is that testing of different signals leads to integration in the performance of device. Rechargeable battery pack and handheld device size allows easy , efficient and integrated on the spot simulation process. The device is hard, enough and can sustain through ingresses, which makes it suitable to industry standard.

Thus using this device, field simulation and testing is easily possible and this takes automation in maintenance to a whole new level.

VII. FUTURE SCOPES

The device is presently being used for testing and simulation purpose, further it can be used as a calibration device too by implementing span and live zero adjustment.

The device can further be connected to internet and can be used as IoT enabled device and can be used to obtain and draw flowmeter response graphs on the device as well as on a nearby client system. Based on user requirement, the device can be configured to a touch screen based and weatherproof system too. Different protocols can be implemented just like Modbus that we have implemented now.

VIII. ACKNOWLEDGEMENT

Thanks to Adept Fluidyne Pvt. Ltd.[6] for sponsoring this project to us. Their products include electromagnetic flow meter which generates 3 types of signals that will be tested using this simulation kit. The guidance of Mr. Vinayak Gadre and clarity of his comments has helped us make this a suitable and useful product for their company as well as the market.

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