Water Flow Measurement for Reversible Drum Mix Plants

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ABSTRACT:The number of liters of water that flows into the drum of a reversible drum-mix plant is calculated and displayed on site using a PLC and a water flow meter and sent to the government's website. A simple, efficient and cost-effective method for water flow measurement is devised which measures the number of counts given by the water flow meter and displays it on the PLC on site. This measurement helps the users to maintain the supply of water in the drum thus helps to maintain the integrity of their work. As the pipe size through which the water flows and the velocity of the water remains constant, the factors involving diameter of the pipe and water velocity are reduced. This system is predicted to cover majority of the reversible drum-mix plant market due to its compact and reliable nature.

KEYWORDS:Government; counts; raw value; constant parameters.

I.INTRODUCTION

As per government's new requirements, the amount of water that is mixed with concrete in a reversible drum-mix plant is to be measured and sent to their website. This paper focuses on the measurement of water flow in this system. The government's new requirement necessitates the use of a cost-effective and an efficient water flow measurement system. To make this system a PLC and a sensor is used. The program used to view and modify the water flow measurement values was designed on flexisoft software of Selec. The experiment started with taking flow measurement readings using a half inch pipe because it is the standard size of the pipe used to carry water in a reversible drum mix plant. The average of all the readings was taken to get an appropriate value of water flow. This value was fed to the Selec PLC which in turn displayed the value on a PC. The program converted the raw value to a corresponding value in liters which was the requirement of the government.

II.SELECTION OF THE APPARATUS

i.   Selec PLC Flexy panel TX4 with high speed counter

Considering that the new requirement of the government is still in an embryonic stage and the possibility of expansion of the project which could lead to measurement of more parameters, a Selec Flexypanel TX4 PLC with a high speed counter was selected which has expandable input-output ports and an HMI to display the water flow value and other information.

ii.   Flow meter JT121

The pipe size and the speed of water flow in a reversible drum-mix plant are constant. This reduces the amount of calculation required in water flow measurement to a minimum. A flow meter JT121 was used. The reason was that this particular sensor was able to measure the water in the pipes on reversible drum-mix plants accurately. Another important reason was that it is cheap and cost-effective.

The use of the above apparatus made this system simple to understand and efficient in its working rendering it very useful in a newly developed requirement.

III.CONNECTIONS

The connections of the JT 121 flow sensor with Selec flexy panel are not complicated. As Fig. 1 suggests, the red wire is for the supply of 5-12 VDC, the black wire is the output signal wire and the shield wire is the common [1]. A fuse of 3 Amp rating is connected to the supply wire for protection. The wires from the sensor are connected to the PLC as per the data manual of the PLC [2]. The wire shown between the PLC and the PC is the communication cable.

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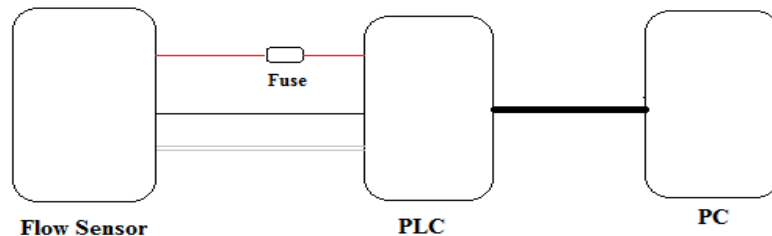
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Fig. 1 Connection Diagram of the Water Flow Measurement System

IV.PROCEDURE

The process of water flow measurement starts with taking numerous readings of the water flow. Then comes calibrating the system such that it fits the limits of the flow measurement values suggested by the government. The average of all the readings was taken to get an appropriate value. This value was then given to the PLC which read the raw value given by the sensor which was in terms of counts. This raw value was then converted into litres by using a division block in the program. And then this value was displayed on the PC as well as on the PLC.

i.   Experimental readings of the raw value.

- The sensor consists of a counter that rotates when water flows over it. This counter is immersed inside the pipe and it comes in contact with the water whenever it flows through the pipe. The counts for 1 liter of water were taken several times. As the pipe size is the same in all the reversible drum-mix plants, a pipe size on half inch diameter was used. The water flow from this pipe resulted in the counter to flow which gave counts that were close to one another. As the velocity of the water flowing through the pipe is also fixed, water for this experiment was flown with the same velocity. This rendered the need for mathematical calculations involving velocity and the pressure with which the water flows unnecessary.

- After taking numerous readings for one liter of water with a constant flow and a constant pipe size, an average value of the counts was taken. The average value of the count for all the readings came out to be 276.

ii.   Calculation of number of liters of water flow

- The count for n liters of water was taken by dividing the count that came up on the PLC by the average value- 276

- A=B/C   (1)

   Where, A- No of liters of water, B- Raw value of the count displayed on the HMI,
   C- Average value of the count for one liter of water.

- Both the raw value as well as the corresponding amount in liters was displayed.

- The Flexy soft software had Functional Block Diagrams. The program for water flow measurement included a Functional block diagram to display the raw value of the count for 'n' liters of water. This raw value was then given to a division block to get divided by the average value of the count for one liter of water which was constant. The division block gave the output in terms of litres of water that has flown through the pipe. The program also had a reset featured which was also given to the HMI.

V. RESULT

This method of water flow measurement proved to be very accurate as the number of counts given by the counter of the sensor for exactly one liter of water was found out through various readings. In addition to this, the constant nature of the pipe size and the water flow velocity reduces the uncertainties in the outcome. The number of liters of water that flows through the pipe into the drum of the reversible drum mix plants is shown on the PLC which is installed on the

site. Using vehicle tracking systems which consist of GPS and GSM modules, this data is sent to the Government's website.

VI.DRAWBACKS

This paper does not take into account the changes in the velocity of water flow, the changes in pipe diameter and the variations in the amount of water flowing through the pipe. Although the above mentioned parameters are neglected, the result is accurate since the above parameters are kept constant during the on-site work.

VI.FUTURE PROSPECTUS

The water flow measurement concept in reversible drum mix plants is new. The government's branch which has asked for this data to be provided on their website will make this a necessary item soon to maintain the integrity of the cement which is used by the contractors to build roads and bridges. This method of water flow measurement has a very good chance to become the most popular method as it is cheap and simple to understand. The installation of this system will also be very fast and efficient.

VII.CONCLUSION

Thus every time water flows through the pipe, the number of liters of water is measured and displayed on the site which helps the contractors to maintain the integrity of their work. The same data is then sent to the government's website so that it can be monitored anytime and anywhere. Hence, the project of water flow measurement was a success and is predicted to cover the majority of the reversible drum-mix plant market.

REFERENCES

[1]   JT121 flow sensor, Data manual, Vats flow meter.
[2]   Flexy panel, TX4, Data manual, Selec PLC.