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Plc Hmi base testing machine data loger with usb excel data export

Krishna Kachhiya*
Student, Department of Electronics, Birla Vishvakarma Mahavidyalaya, Anand, Gujarat, India
krishnakachhiya25@gmail.com

***Abstract*—The PLC-HMI-based testing machine data logger is designed to acquire, process, and log real-time sensor data using a PLC analog input card. This system is developed for industrial applications requiring accurate measurement, monitoring, and data storage. The setup integrates an HMI (Human-Machine Interface) for visualization and control, while a USB-based Excel data export feature ensures efficient data management. The system incorporates four key transducers: 1. Water Flow Sensor – Measures liquid flow rate. 2. Air Flow Sensor – Monitors air velocity. 3. Differential Pressure Sensor – Detects pressure variations. 4. Pressure Sensor – Measures absolute or gauge pressure. These sensors feed data into a PLC analog input card, where the signals are processed and transmitted to the HMI for real-time display. The HMI also logs data at predefined intervals and allows users to export it in Excel format via USB for further analysis. This project enhances automation, accuracy, and efficiency by replacing traditional manual data collection methods with a real-time, digital logging solution. The implementation of scalable and modular architecture ensures flexibility for future enhancements, such as cloud-based data storage and wireless connectivity. The results demonstrate that the system effectively captures, logs, and exports data, making it an ideal solution for industrial and laboratory applications.**

***Index Terms*—Plc Hmi base testing machine data loger with usb excel data export**

I. Introduction

Industrial and laboratory environments require precise data acquisition and monitoring to ensure quality control, system optimization, and performance analysis. Traditional manual logging methods are inefficient, error-prone, and lack real-time capabilities. The need for an automated system that collects, stores, and exports real-time sensor data in an accessible format is critical for industries relying on continuous monitoring. This project aims to develop a PLC-HMI-based testing machine data logger using an analog input card with USB Excel data export to improve efficiency and accuracy in data collection (Fig 1).

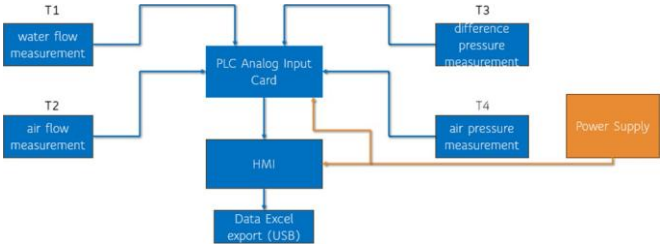

Fig. 1. Block Diagram

II. Design

- System Overview This chapter outlines the design and architecture of the PLC-HMI-based testing machine data logger. The system is designed to collect real-time data from various transducers, process it using an analog input card, and log the data onto a USB drive in Excel format via an HMI (Fig 2).

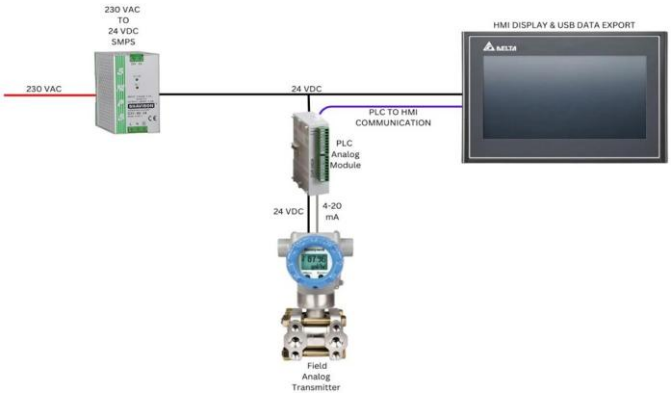

Fig. 2. Block Diagram With Photos

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- Block Diagram The system consists of the following key components: • Analog Input Card – Reads sensor data.
  • Delta HMI – Displays real-time data and handles USB Excel export. • Transducers – Measures water flow, air flow, differential pressure, and pressure. • Power Supply – Provides necessary voltage to the components. • Com- munication Interface – Ensures data exchange between HMI and analog input card.

A. Hardware Design

• Analog Input Card: Used to acquire sensor data. • Delta HMI: For user interface, real-time monitoring, and USB data export. • Power Supply: Appropriate DC/AC supply for all components (Fig 3 & 4).

SR	IO Name	Range Min	Range Max	Unit	Make
1	Diff Pressure Transmitter	0	500	mmWC	Honeywell
2	Pressure Transmitter	0	500	mmWC	Honeywell
3	Water Flow Meter	0	5	m3/h	-
4	Air Flow meter	0	850	m3/h	-

Fig. 3. Sensors and Transducers

Fig. 4. HMI Screen – Home

B. *Software Design*

The PLC is responsible for collecting actual values from the analog channel and transmitting that data to the HMI for display and data historian functionalities. The Data Logger system necessitates an HMI for display as well as data historian/data export capabilities. Accordingly, the software is designed with HMI screens that can showcase real-time values from the field and provide control options to the operator for machine operation as per requirements. The HMI comprises the following screens: 1. HOME 2. P and ID 3. VALUE 4. TREND 5. DATA LOG 6. SETTING 7. PLC SETTING

- HMI Screen – Home Home Screen will display the Name of the Project and the Supplier name with Date and Time on the Upper corner of the screen.Then Button in the bottom will help to navigate the screen like P and ID, Values, Trend, Data Log, and Setting. These buttons are typical and you can find on all the screens of the HMI.
- HMI Screen – P and ID P and ID Screen will display the Piping and Instrumentation Diagram (P and ID) of the machine with the actual values of the process parameter on the actual location. 1. Differential Pressure of the column by taking 2 difference location pressure taping. 2. Pressure of the intake Air Flow. 3. Water Flow value of the water intake. 4. Air flow value of the air intake.
- HMI Screen – Value Value Screen will display the bar Graph representation of the actual values of the process parameter with High and Low scale on the right side of the bar graph, Name of the process on the top of the graph and Engineering Unit of the process on the Bottom of the graph. High and Low Scale value can be changed through HMI Setting Page. And each color will represent the different process parameter as below (Fig 5 & 6).

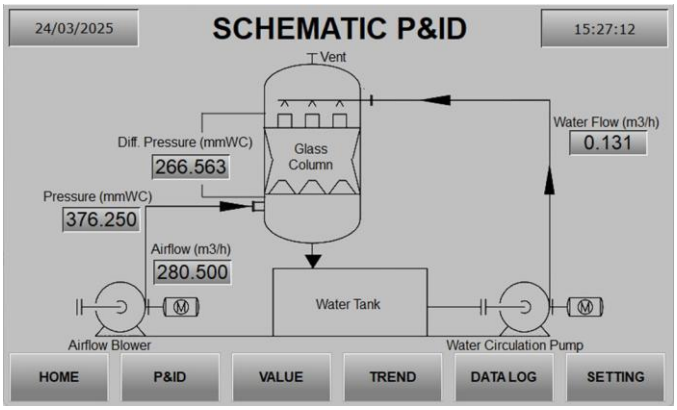

Fig. 5. HMI Screen – P and ID

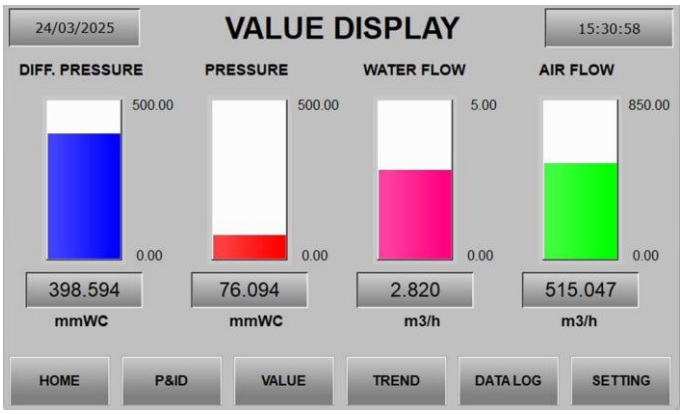

Fig. 6. HMI Screen – Value

1. Blue – Differential Pressure 2. Red – Pressure 3. Pink – Water Flow 4. Green – Air Flow

- HMI Screen – Trend Trend Screen will display the Trend of the all 4 process values combine with respect to the time. Y- axis will represent the 0-1000 Values respective for the process parameter. And X-axis will represent the time stamp of the value taken. In the bottom of Trend has button to configure the trend window to check the historical trend of the current history file. Buttons are Zoom in, Zoom Out, Zoom Reset, Slide Left, Slide Right, Slide Page Left, Slide Page Right. And each color will represent the different process parameter as below. 1. Blue – Differential Pressure (PDT) 2. Red – Pressure (PT) 3. Pink – Water Flow (WFT) 4. Green – Air Flow (AFT)
- HMI Screen – Data Log Data Loge Screen will display the tabular data of the all 4 process values with time stamp column from the current history file. Data will be captured to data history at each configured sampling time frame, this sampling time can be configured form the PLC Setting HMI Screen. Data Table will contain the Following column. 1. Sr No - Serial no of the Row of the current Sampling File. 2. Time - Time at which the data has been captured 3. Date - Date on which the data

Fig. 7. HMI Screen – Trend

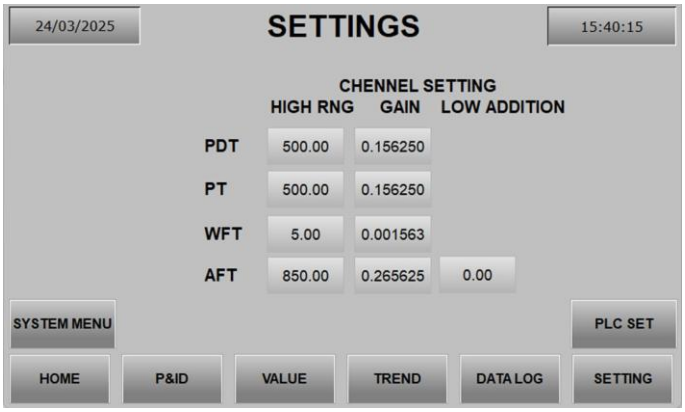

Fig. 9. HMI Screen – Setting

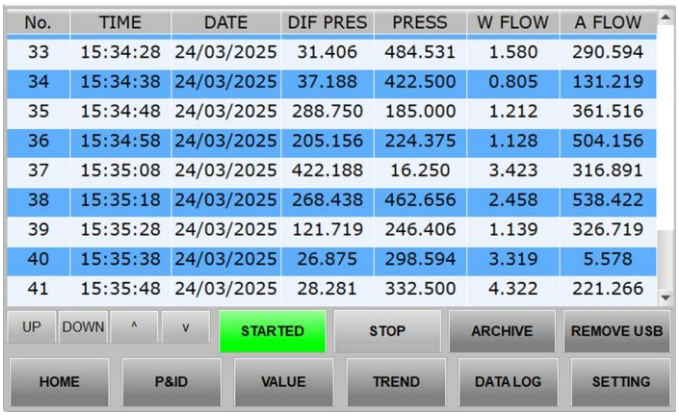

Fig. 8. HMI Screen – Data Log

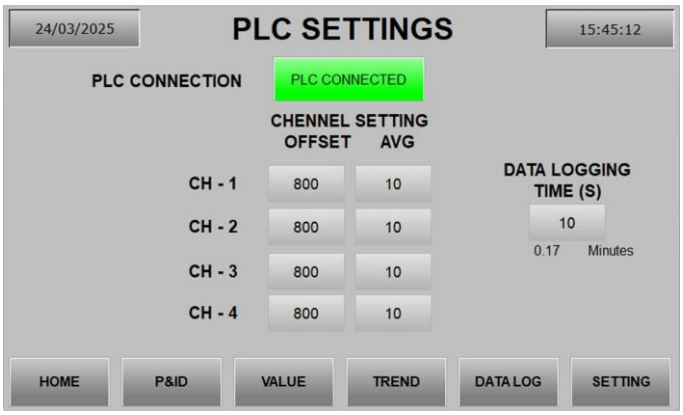

Fig. 10. HMI Screen – PLC Setting

has been captured 4. Diff Press - Differential Pressure value at the time of data Capturing. 5. Press - Pressure value at the time of data Capturing. 6. W Flow - Water Flow value at the time of data Capturing. 7. Air Flow – Air Flow value at the time of data Capturing (Fig 7 & 8). In the bottom of Tabular Data has button to configure the window to check the historical data of the current history file. Buttons are Up, Down, Page Up, Page Down, Start Data logging, Stop Data Logging, Save the current File to archive and start new file for data Logging, Remove USB. Data Logging will start only if USB Pen drive is connected to HMI Back Side.

- HMI Screen – Setting Setting Screen will allow engineer to configure the HMI Process Parameter from the HMI. PLC Paraments are as listed Below 1. Scale High Value of each Process Analog input. (Low Scale Value is conceded as default 0 value in HMI) 2. Gain Value for each Process Analog input. (This will get auto Calculated when we enter the high scale value of the Process analog input.) In the Bottom left side button is provide to go into the HMI Internal Configuration. (This configuration is changes only if recommended by the Programmer) In the Bottom Right-side button is provide to go into the PLC Setting.
- HMI Screen – PLC Setting PLC Setting Screen will allow engineer to Check and configure the PLC Parameter from the HMI. In middle of the screen a Green/Red Box will show the connection between PLC and HMI. If the PLC is connected then on Box will changes to Green Color and if the PLC is disconnected then the box is changes to Red and it is conceded as PLC Disconnected. PLC Paraments are as listed Below 1. Channel offset value of each Process Analog input. (0 Value for 0 mA and 800 value for 4 mA) 2. Current value Average parameter. To remove the unwanted spike in the process parameter. By default, set 10 Values averaging. In the Bottom right-side numeric entry is provide to set the Data History sample time in sec. Sampling time is time frame between each sample collected by the History buffer. Eg. to set the sampling time of 1 minute we need to enter 60 Sec as value. We can verify the same below in minutes counts (Fig 9 & 10).
- USB and Data Transfer to Computer System 2.5.1 USB Pen drive The Pen Drive utilized for HMI data logging must be either USB 2.0 or 3.0, equipped with high-speed data file transfer capabilities. It is advisable to format the pen drive before insertion to ensure optimal performance when used in the HMI. 2.5.2 History Data transfer to computer After completing the data logging

	TIME	DATE	DIFF PRESSURE	PRESSURE	WATER FLOW	AIR FLOW
2	18.48.29	########	7.656	75.156	0.559	365.112
3	18.48.39	########	7.5	74.688	0.506	365.378
4	18.48.49	########	7.5	75.469	0.516	365.644
5	18.48.59	########	7.5	74.375	0.552	365.378

Fig. 11. Sample Excel Data Output

process, follow the steps below to transfer the data from HMI to the computer: 1. Stop data logging by pressing the button on the HMI Data Logging Screen. 2. Once data logging is stopped, press the 'Remove USB' button on the HMI Data Logging Screen. 3. Once the USB is disconnected from the HMI, a pop-up message will indicate that the USB has been removed. 4. After receiving the confirmation, remove the USB pen drive from the HMI back panel and connect it to a computer USB port. 5. Open the pen drive and navigate to the following path on the computer: Removable Disk -¿ HMI -¿ HMI-000 -¿ History -¿ CSV 6. Inside the CSV folder, locate the 'DataLogging.csv' file. Copy this file to your desired location on the computer to access all historical data stored in the CSV file (Fig 11).

III. Results and Conclusion

A. Results and Data Acquisition Performance

•The analog input card successfully collected real-time data from the four transducers (water flow, air flow, differential pressure, and pressure). •The data was accurately displayed on the Delta HMI, with correct scaling and engineering units. •The system maintained stable and noise-free signal readings after proper calibration.

- USB Data Logging and Export • The HMI successfully stored data in an Excel file (.csv or .xls) on the USB drive. • The logging interval was user-configurable, allowing flexible data collection. • The exported Excel file was readable and contained properly formatted sensor data with timestamps

B. Conclusion

The implementation of the PLC-HMI-based testing machine data logger successfully achieved the project objectives. The system effectively: • Acquired real-time sensor data using an analog input card. • Displayed sensor readings accurately on the Delta HMI. • Logged data automatically onto a USB drive in Excel format. • Provided user control for data logging settings. • Ensured high accuracy and reliability in industrial testing applications.

This project demonstrates a cost-effective and efficient data logging solution for industries requiring continuous monitoring of flow and pressure parameters. The automated logging system eliminates manual data entry errors and improves data accessibility for analysis and decision-making.

IV. Future Improvements

To enhance the system further, the following improvements can be considered:

- Remote Data Monitoring: Integrating Wi-Fi or Ethernet for cloud-based access.
- Advanced Data Analysis: Implementing onboard graphing and trend analysis in HMI.
- Multi-Sensor Expansion: Supporting more analog input channels for additional transducers.
- Automated Report Generation: Exporting customized reports in PDF or Excel formats.

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