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Troubleshooting the P0108 DTC Fault in Suzuki XL7 Engines

Muhammad Andre

Department of Automotive Engineering Study Program, Politeknik Piksi Ganesha Indonesia, Indonesia, 54311

andrerainism@gmail.com

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Abstract

This study aims to describe the analysis of the causes of problems in the engine of Suzuki XL7 with Diagnostic Trouble Code P0108. The analysis was conducted to identify the causes of this problem in the engine. This study used a quantitative descriptive approach, evaluating engine data through scan tool, multimeter, and vacuum gauge testing. The testing procedure included engine preparation, instrument calibration, and the execution of diagnostics in accordance with established standard procedures. The research results indicate that the cause of the problem lies in the internal circuit of the MAP (manifold absolute pressure) sensor, with an O.L. (open-loop) measurement result, indicating no connection. This result was obtained by analysing the connections within the entire internal circuit of the MAP sensor. Overall, this study provides empirical information regarding the functioning of the MAP sensor in relation to the engine performance of the Suzuki XL7 following measurement analysis conducted in accordance with applicable procedures.

Keywords*: MAP sensor, Troubleshooting, Diagnostic Trouble Code*

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan analisa penyebab masalah pada mesin kendaraan Suzuki XL7 dengan *Diagnostic Trouble Code* P0108. Analisa dilakukan untuk mengetahui penyebab munculnya permasalahan ini pada mesin. Metode penelitian yang digunakan adalah pendekatan deskriptif kuantitatif melalui pengujian menggunakan *scan tool, multimeter*, dan *vacuum gauge*. Prosedur pengujian meliputi persiapan mesin, kalibrasi alat, serta pelaksanaan diagnosis sesuai dengan standar operasional yang telah ditetapkan Hasil penelitian menunjukkan bahwa penyebab masalah berasal dari sirkuit internal sensor *manifold absolute pressure* (MAP) dengan hasil pengukuran *open line (O.L.)* atau tidak terdapat kontinuitas. Hasil tersebut didapatkan dengan menganalisa hubungan seluruh sirkuit internal pada sensor MAP. Secara keseluruhan, penelitian ini memberikan informasi empiris mengenai cara kerja sensor MAP terhadap performas mesin kendaraan Suzuki XL7 setelah dilakukan analisa pengukuran berdasarkan prosedur yang berlaku.

Kata-kata kunci*: Sensor MAP, Pemecahan Masalah; Diagnostic Trouble Code*

1. Introduction

In 1971, vehicles began to use a simpler type of electronic control unit in their engines [1]. Despite the major advancements in modern technology, internal combustion engines still operate with a relatively low level of efficiency [2]. Modern vehicle engines generally utilise technology comprising a variety of controllers and sensors. Consequently, all engine functions operate as intended through communication between these various controllers and sensors. Vehicular sensors and biosensors have become integral to modern automotive technology, driving advancements in vehicle safety, performance optimization, and driver well-being [3]. Vehicle sensors actively monitor engines, fuel consumption, and emissions while also aiding and protecting everyone on board [4]. However, the more complex vehicle technology becomes, the deeper our understanding must be from its core functions and operations to issue diagnosis. As electrical and electronic systems become increasingly complex and fundamental to the workings of modern vehicles, understanding these systems is essential for automotive technicians [5].

For currently modern vehicles, most faults can generally be identified using a scan tool with the OBD2 (On-Board Diagnostics 2) system. OBD2 technology is the standard for diagnosing various vehicle systems managed by electronic control units (ECUs) [6]. And from other paper said the analysis revealed that OBD II technology remains highly effective in diagnosing faults across core automotive subsystem [7]. Each of these issues is identified by a code known as a DTC (Diagnostic Trouble Code). This option allows you to read DTC definitions within the highlighted system. If multiple faults are detected, the scan tool will display a list of options to view the different types of DTCs or freeze frames [8]. Effective troubleshooting in modern automotive systems requires mechanics to employ advanced diagnostic skills. This involves retrieving Diagnostic Trouble Codes (DTCs) and utilizing a scan tool to interface with the vehicle's on-board computer. Through this process, technicians can access the OBD-II system to review fault history, determine whether a code is pending, current, or permanent, and execute diagnostics by strictly following the repair manual [9]. This study, the author will diagnose a problem with the engine relating to Trouble Code P0108.

Trouble Code P0108 indicates an issue with the engine's air intake system. More specifically, this issue relates to the MAP sensor, its circuitry and the ECM. The Manifold Absolute Pressure (MAP) sensor measures intake manifold pressure in an internal combustion engine [10]. The Engine Management System (EMS) consists of the Engine Control Module

(ECM) and various electrical and electronic components, such as sensors, actuators, and relays [11]. This study therefore focuses on how to draw accurate conclusions in order to identify the root causes of these issues. While real-world test suites often contain both passing and failing tests, they rarely include closely matched pairs of passing and failing test cases that can provide useful information about the root cause [12]. Naturally, the process of diagnosing these issues must be carried out in accordance with applicable standards.

2. Method

This study employs a troubleshooting method to identify the root cause of the issue. Troubleshooting is a form of problem-solving frequently applied to the maintenance of failed products or system processes [13]. To implement this troubleshooting method, the research flowchart is presented in Figure 1.

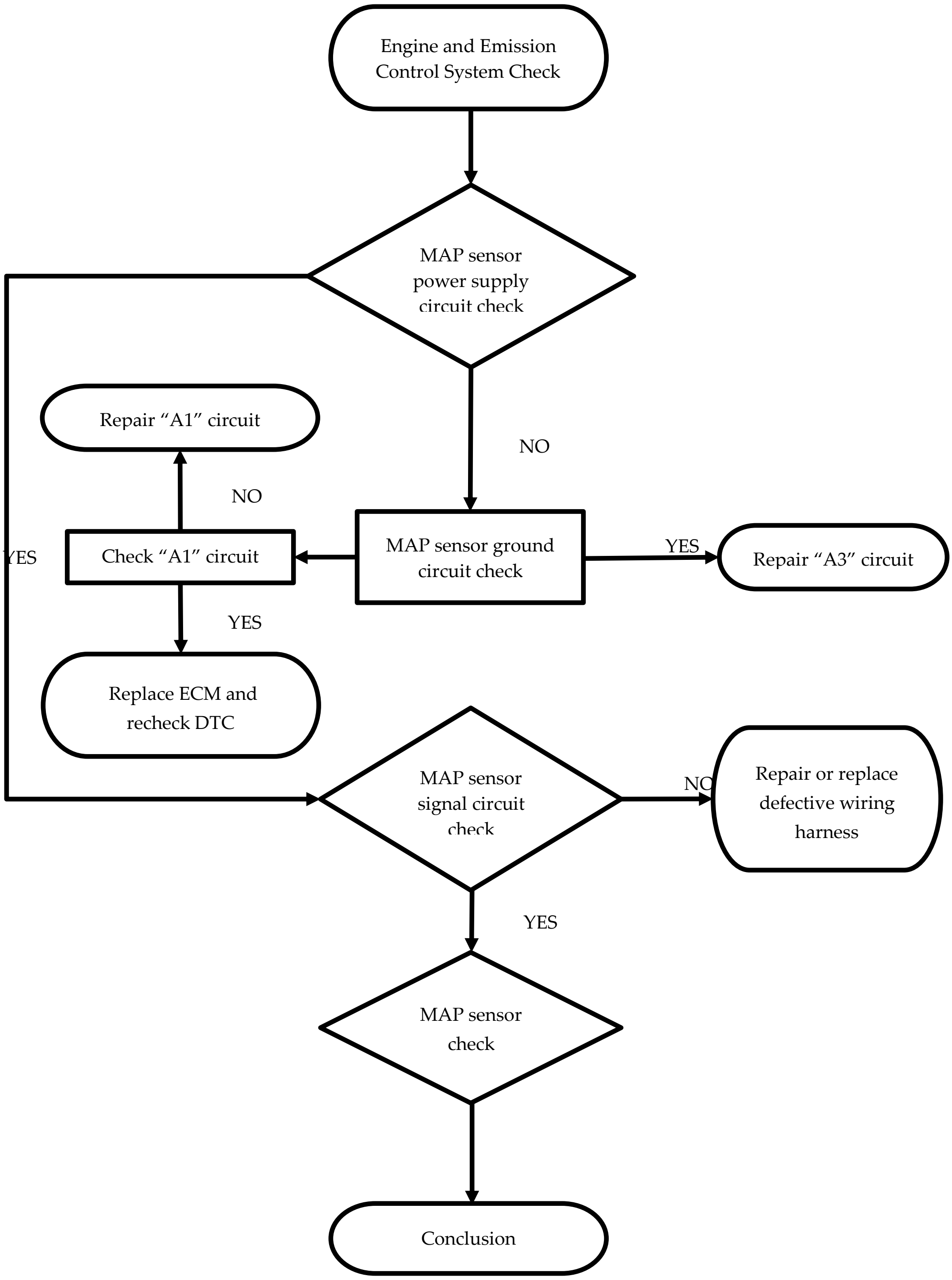

Figure 1. Research flowchart

3. The Results and Discussion

3.1 Result

3.1.1 The detected DTC is P0108 with a current status as shown in Figure 2.

FF	System	DTC	DTC Name	Status
1	Engine	P0108	Manifold Absolute Pressure / Barometric Pressure Circuit High	Current

Figure 2. The detected DTC

3.1.2 Engine conditions with the following abnormal parameters for engine system as shown in Table 1.

Table 1. Abnormal Parameters for Engine System

No	Parameter	Value (unit)	Condition	Specification (approx)
1	Manifold Absolute Pressure	124 kPa	Engine idle speed after warming up	20-55 kPa
2	Short Term Fuel Trim	23,44 %	Engine idle speed after warming up	-20-20 %
3	Long Term Fuel Trim	39,84 %	Engine idle speed after warming up	-20-20 %
4	Total Fuel Trim	73,44 %	Engine idle speed after warming up	-30-30 %

3.2 Discussion

3.2.1 MAP Sensor Power Supply Circuit Check

The measurement results are in accordance with the specifications; the MAP sensor power supply is approximately 5 V, as shown in Figure 3.

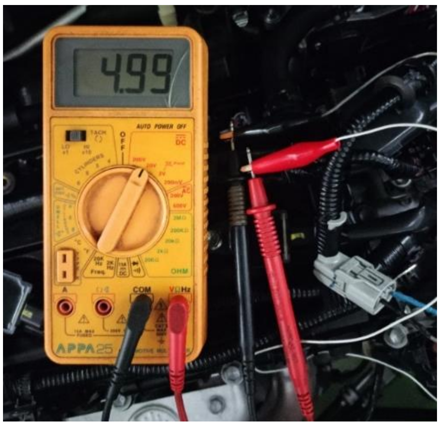

Figure 3. MAP Sensor Power Supply Voltage

3.2.2 MAP Sensor Signal Circuit Check

3.2.2.1 Circuit A2 resistance result 0.6 Ω as shown in Figure 4.

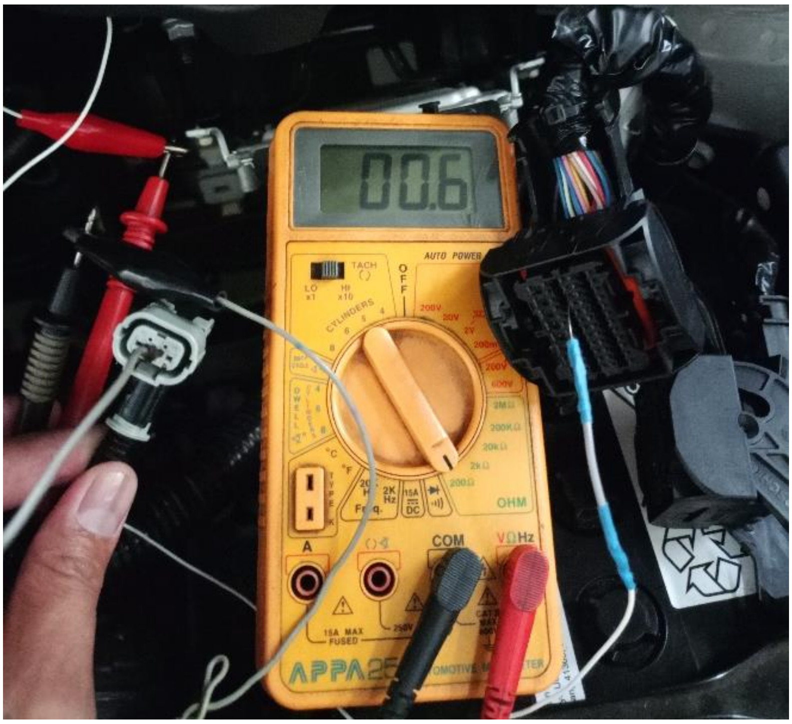

Figure 4. Circuit A2 Resistance

3.2.2.2 Circuit A2 resistance with ground O.L as shown in Figure 5.

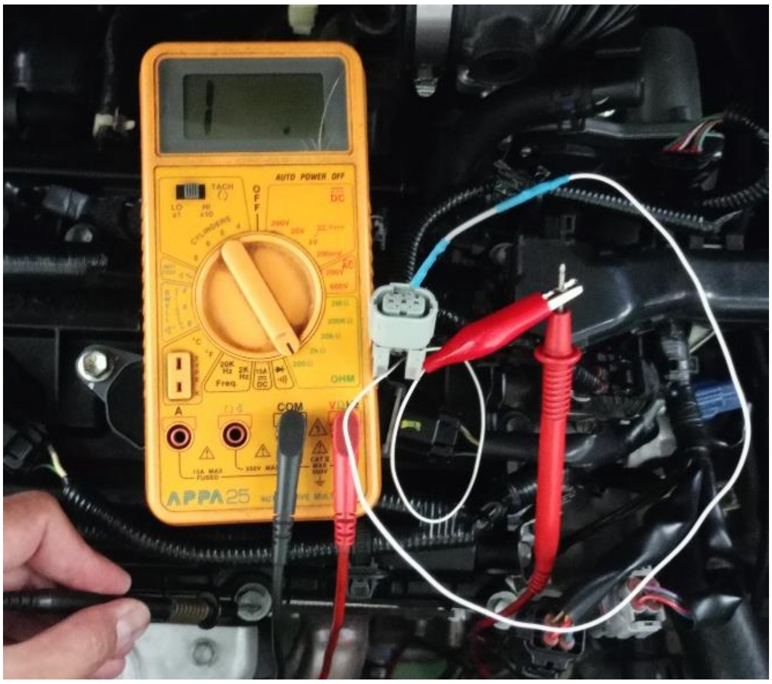

Figure 5. Circuit A2 Resistance With Ground

3.2.2.3 Circuit A2 resistance with other circuit is O.L, as shown in Figure 6.

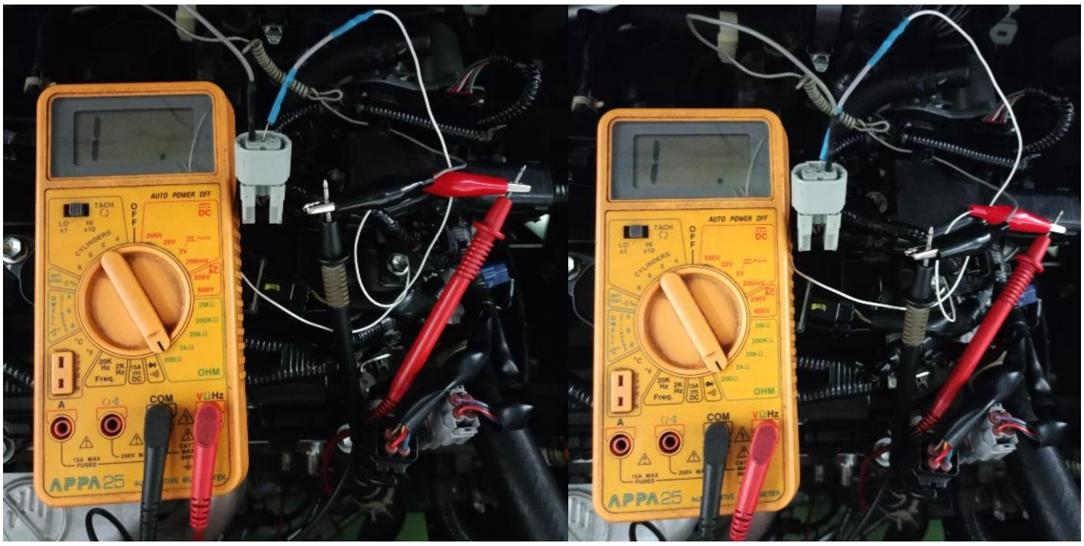

Figure 6. Circuit A2 resistance with other circuit

3.2.2.4 Circuit A2 Voltage as Shown in Figure 7.

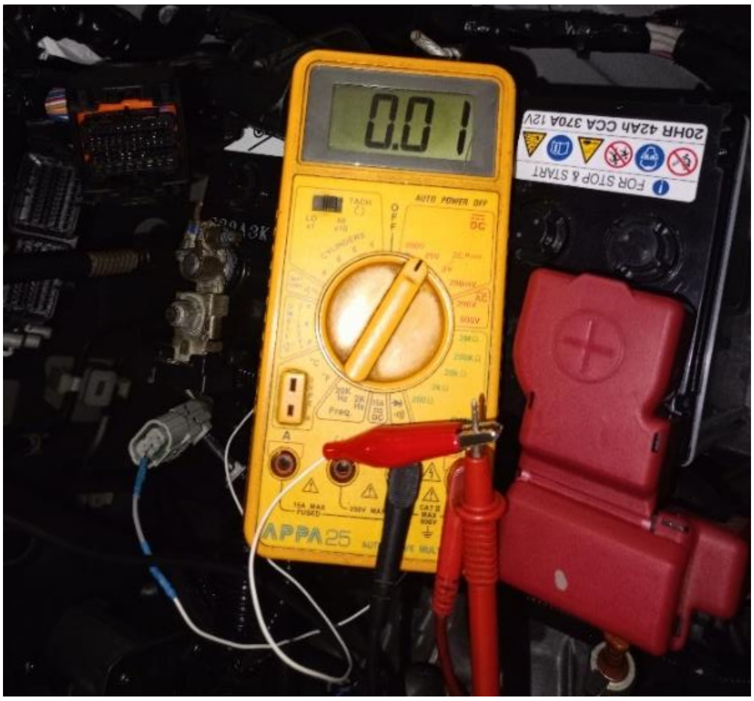

Figure 7. Circuit A2 voltage

3.2.3 MAP Sensor Performance Check

Measuring result of MAP sensor is 4,61 Volt and not suitable with specification as shown in Figure 8.

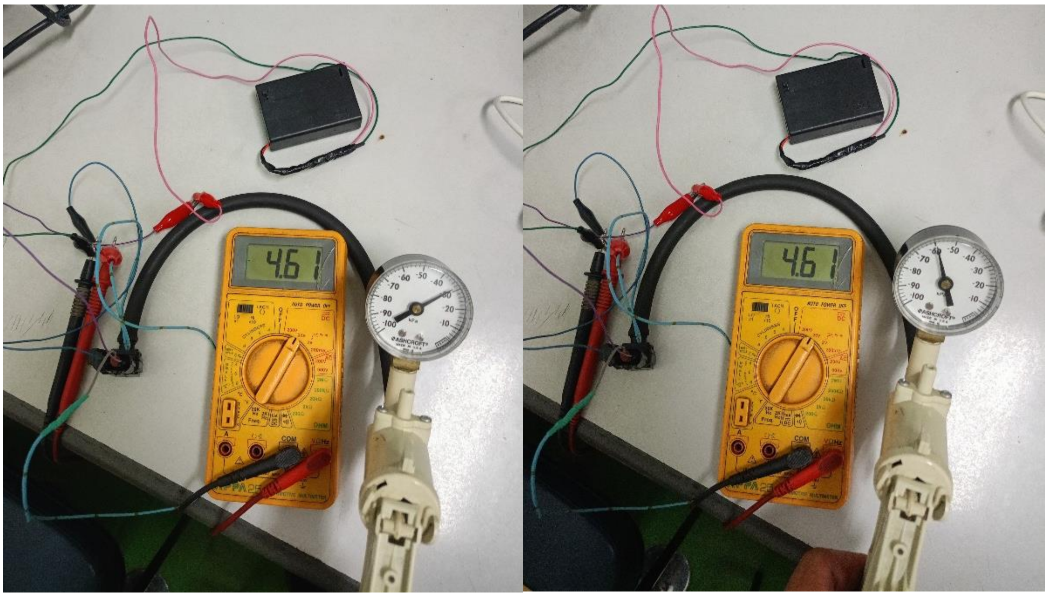

Figure 8. MAP sensor performance check

3.3 Analysis

3.3.1 MAP internal circuit measurement

As the results of the MAP sensor performance check revealed that it is not suitable with the specification. The final analysis is required, need to check the internal circuit of the MAP sensor. Continuity measurements are frequently conducted during the troubleshooting process to verify the integrity of the electrical lines [14] .A continuity tester is used to determine the presence of an electrical path between two points in a circuit [15]. Check the internal circuit by referring to Figure 9.

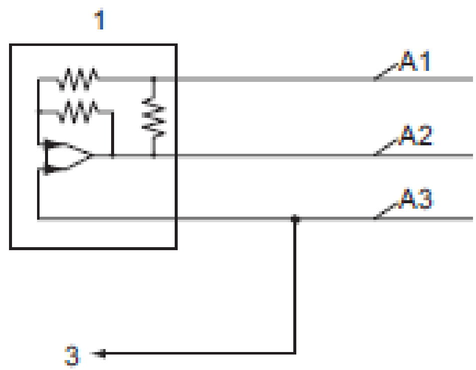

Figure 9. MAP Circuit Diagram

The results of the final inspection of the internal MAP circuit connections shows that there are no connections to A3.

3.3.2 A1 and A2 connection as shown in Figure 10.

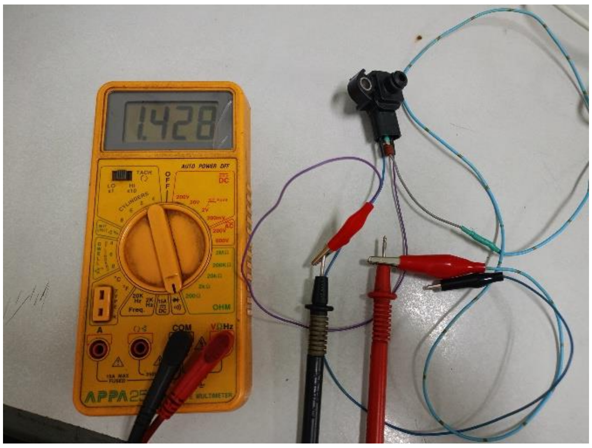

Figure 10. A1 and A2 connection

3.3.3 A1 and A3 connection as shown in Figure 11.

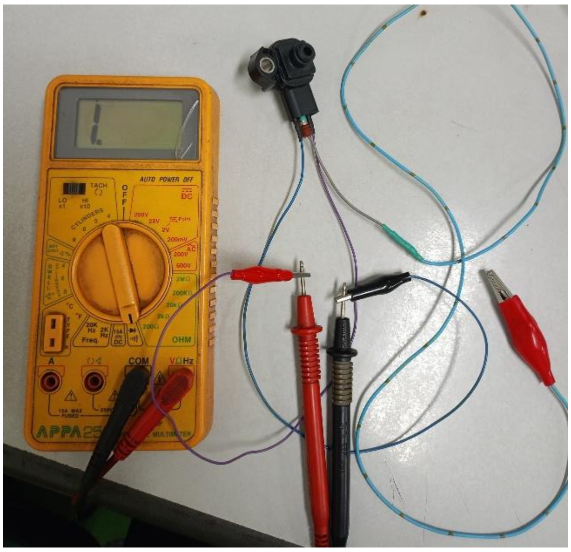

Figure 11. A1 and A3 connection

3.3.4 A2 and A3 connection as shown as in Figure 12.

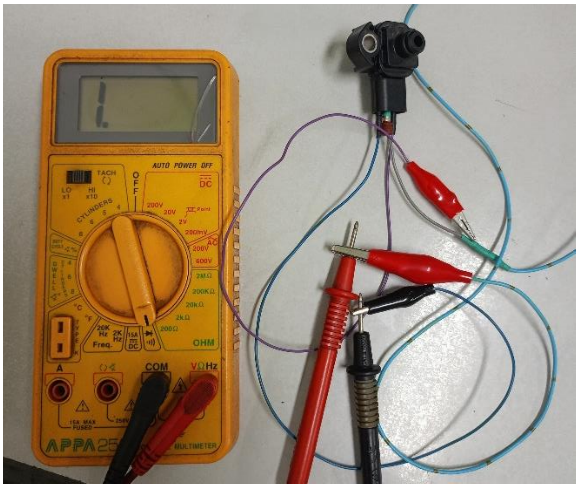

Figure 12. A2 and A3 connection

3.3.5 Causal part

The measurements taken at each stage of the troubleshooting method were carried out successfully without any issues. The results of the measurements and inspections comply with the specified standards, as shown in Table 2.

Tabel 2. The results of the measurements.

No	Parameter	Value (unit)	Specification	Analysis
1	MAP circuit power supply	4,99 Volt	Approx 5 Volt	Good
2	MAP sensor signal circuit			
	a. A2 circuit resistance	0,6 Ω	≤ 1 Ω	Good
	b. A2 circuit resistance with ground	O.L	O.L	Good
	c. A2 circuit resistance with other circuit in MAP connector	O.L	O.L	Good
	d. A2 circuit voltage (IG ON)	0 Volt	Approx 0 Volt	Good
3	MAP sensor performance			
	a. Negative pressure (–30 kPa)	Approx 4,61 Volt	Approx 2,9 Volt	Bad
	b. Negative pressure (-60 kPa)	Approx 4,61 Volt	Approx 1,7 Volt	Bad
4	Internal circuit MAP connection			
	a. A1 and A2	Connected	Connected	Bad
	b. A2 and A3	O.L	Connected	Bad
	c. A1 and A3	O.L	Connected	Bad

The results show that neither circuit (A1 nor A2) is not connected to A3 as a ground circuit. According to the reference in Figure 9. MAP Circuit Diagram, these circuits should be connected. It can therefore be concluded that there is a fault within the MAP circuit, namely that the internal circuit of the MAP sensor is open as shown in Figure 13. marked with a red X.

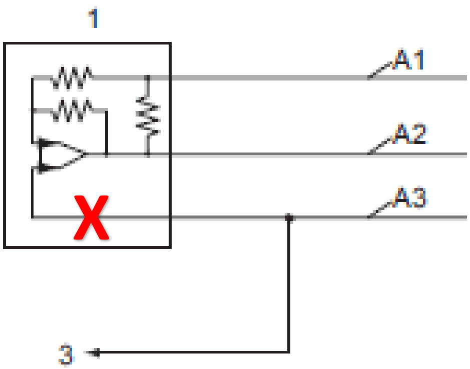

Figure 13. Internal circuit of the MAP sensor is open

4. Conclusion

This study investigates the underlying causes of engine malfunctions in the Suzuki XL7 associated with Diagnostic Trouble Code (DTC) P0108. Employing a quantitative descriptive approach, the research evaluated engine data utilizing a scan tool, a multimeter, and a vacuum gauge. The diagnostic process involved thorough engine preparation, instrument calibration, and strict adherence to standard testing procedures. The findings reveal that the malfunction stems from the internal circuit of the Manifold Absolute Pressure (MAP) sensor, which exhibited an open-loop (O.L.) reading, signifying a disconnected circuit. Ultimately, this research offers empirical insights into MAP sensor functionality and its impact on the engine performance of the Suzuki XL7 based on standardized measurement analysis.

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