

# MEASUREMENTS ANALYSIS OF MQ-6 LPG GAS LEAK DETECTION DEVICES FOR DISTANCE FACTORS

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**Abstract — LPG (Liquified Petroleum Gas) is one of the important sources of energy. When compared with other fuels such as oil or firewood, LPG is very practical to be used for household because the material is produced from gas. But behind its practicality, it turns out that LPG gas can cause a danger if not used carefully. According to statistics, the second position of causing fire is a leaky gas cylinder that was ignited by a fire source. To overcome this problem, there a lot of research that uses special tools that can be used to detect leaks for LPG. In the design of the tool, most researchers used MQ-6 type sensors that were indeed built to utilize LPG gas. But studies on the characteristics of MQ-6 have not been done much, especially about the sensitivity of this sensor when used to detect LPG gas at a certain distance, so it needs to be researched about sensor placement. Therefore, in this study the sensitivity testing of the MQ-6 sensor was carried out. The results obtained at a distance of 10 to 30 cm, this sensor is very sensitive in detecting the presence of gas, but at a distance of 30 to 110 cm, it is less sensitive to detect presence of LPG gas because it can only support 10% of the total amount of gas in the air at a distance of 110 cm.**

*Keywords: LPG, MQ-6, gas, distance, sensitivity.*

## I. INTRODUCTION

The Liquified Petroleum Gas (LPG) conversion program that has been carried out by the Indonesian government since 2007 has increasingly shown results, which in the early days of its application, the government promoted subsidized 3 kg type LPG gas to attract consumers of the poor, until now LPG sales in East Java alone recorded the highest increase reaching 21% of the normal daily average with the equivalent of 1,5 million 3 kg tubes [1]. But with the increasing

number of LPG cylinders in circulation, new problems arise, where these types of cylinders are often complained of because they are often damaged and have fatal consequences by causing explosions or fires [2].

Based on data from the Center for Public Policy Studies (Puskepi), from 2008 to 2010 there have been 189 gas explosion cases. A total of 61 cases occurred in 2008, 50 cases in 2009, and 78 cases in 2010 [3]. Liquified Petroleum Gas (LPG) is a liquefied petroleum gas which contains a hydrocarbon mixture which is then compressed by adding pressure in order to decrease the temperature then turn into liquid [4]. In public use, it is stored in a high-pressure cylinder, so that if the cylinder leaks and exposed to a fire it can cause a fire. LPG gas that leaks can be recognized by the smell, but if the gas absorbs into the water, electricity or carpet installation, it will be difficult to detect [5].

Research on LPG gas leak detection devices has been widely studied, where most of these studies use MQ-6 gas sensors [6]. Some researchers have developed detection devices that can be monitored wirelessly [7], and there are some researchers who have also developed devices that are able to communicate with smartphones so that they can be monitored from anywhere.

But they are very little literature that examines the accuracy of the sensors used. Therefore, in this study will be observed how the accuracy of the MQ-6 sensor that used in LPG leak detection device, to measure the accuracy of the sensor with respect to the distance factor.

## II. RESEARCH METHODS

The main aspect observed in this study is the accuracy of the MQ-6 sensor due to the variable distance between the sensor and the LPG gas source. The device used in the experiment is a

device that has been developed by researchers according to the scheme shown in Figure 1.

The main function of the MQ-6 gas sensor is to detect or measure the amount of gas such as LPG and butane in an area. In this study, a MQ-6 sensor module is equipped with a Digital Pin and Analog Pin. The function of the Digital Pin as an output is to detect the presence or absence of gas in a particular area so that the output is only 1 or 0 (high or low). The detection sensitivity can be adjusted via the potentiometer on the module. So that Digital Pin can be used without the help of Arduino (microcontroller) or ADC (Analog to Digital Converter) devices. Whereas the Analog Pin has an output in the form of an analog signal (voltage) whose value changes according to the measured amount of gas concentration, thus requiring an Arduino device to translate the output value.

The circuit schematic in Figure 1 can be explained as follows, Figure 1.a is an MQ-6 sensor for detecting LPG Gas, Analog Pin sensor is connected to the Arduino ADC input (Figure 1.b), Arduino then processes the readable analog data and displays it on the screen LCD (Figure 1.c). The LCD used is the LCD with the I2C feature, so it only requires two Arduino pins to control it. For more details, the workflow of the device, can be seen in Figure 2., this is a program flowchart of the system, that starts from reading by the MQ-6 sensor, then processed to the ADC, and calculated by Arduino which is then displayed by the LCD screen in the form of a percentage number.

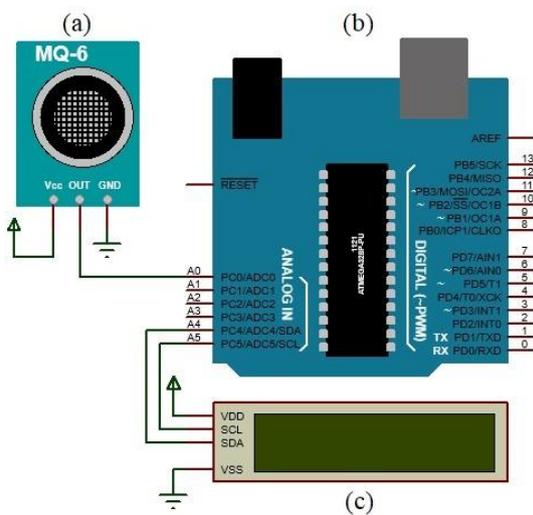


Figure 1. Schematic of the MQ-6 sensor (a) MQ-6 Sensor, (b) Arduino, (c) LCD Display



Figure 2. Flowchart of LPG measurement device

The measurement range of the MQ-6 sensor is 200-10000 ppm (parts-per-million) meaning that in an LPG gas measurement the sensor is only able to read a maximum of 10000 LPG gas molecules among one million air molecules measured. Because of that, in this study using percentage value for maximum value of ppm when it measures to facilitate the observation.

Data obtained by varying the measurement distance between the MQ-6 sensor with a gas source in the form of LPG gas cylinders. The measurement is in a kitchen measuring 6 m<sup>2</sup>, which is quite protected from the wind but still safe because it has enough air ducts.

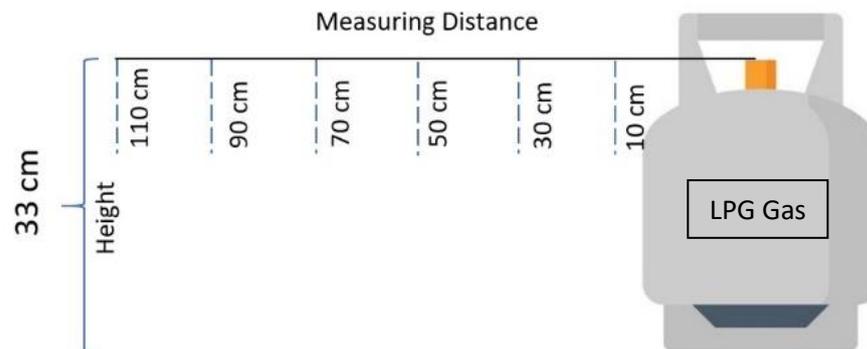


Figure 2. Measurement scheme

Measurement variations are set at distances of 10, 30, 50, 70, 90, and 110 cm from the LPG gas source. The scale of the value that is read on the device is the percentage of gas concentration that is on the device's screen. An illustration of the measurement can be seen in Figure 2., the height of the measurement is adjusted according to the height of the end of the gas cylinder outlet. Then with the same height measured one by one from a distance of 10 cm to 110 cm.

### III. RESULTS AND DISCUSSION

After conducting experiments in accordance with the method applied, obtained measurement data in accordance with Table 1. There are six data from initial measurements from 10 cm to 110 cm, the measurement results can be seen in Table 1. From the table it can be observed that the highest value is at a distance of 10 cm from the tube, by 45%. The farther the distance of the sensor, the percentage of LPG gas in the air become lower, this corresponds to the gas percentage of 10%.

Table 1. Measurement of distance variations

No.	Distance (cm)	Amount of Gas (%)
1	10	45
2	30	30
3	50	20
4	70	16
5	90	14
6	110	10

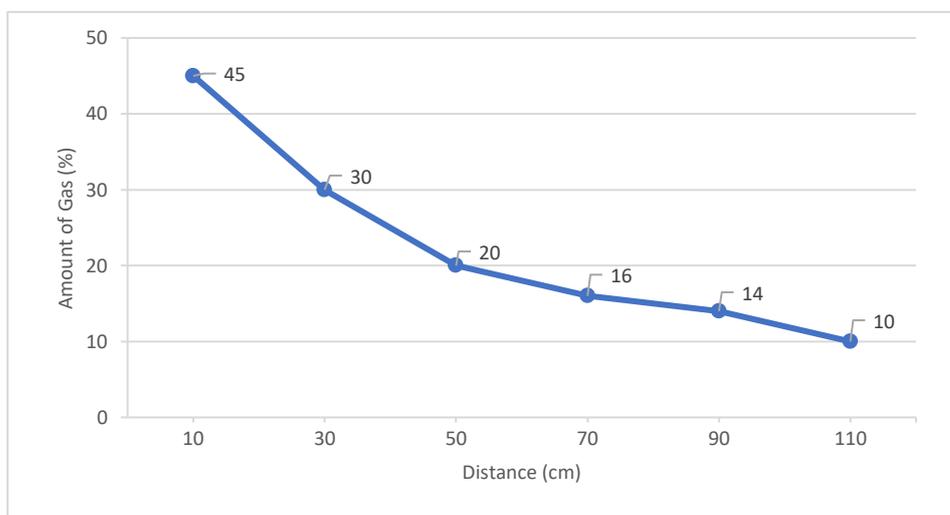


Figure 3. Measurement result of concentration  
LPG Gas due to distance

Based on the graph in Figure 3., it is seen that the reduction in LPG gas concentration is not linear with respect to the measurement distance. The farther the distance, the value of each measurement distance of gas concentration gets smaller, this is more clearly visible at a distance of 50, 70, 90, and 110 cm. At this distance the graph is getting sloping, with an average difference of about 3.3%.

With these sloping characteristics, it indicates that if the measurement distance is farther away, the sensitivity of MQ-6 in detecting the presence of LPG gas decreases, provided that the amount of gas released is fixed and the short measurement time span between variations.

All measurements use the same MQ-6 sensor, by means of the procedure preheat (heating) the device is turned on for 24 hours before the measurement process is carried out, this is done in order to obtain high sensor sensitivity.

### IV. CONCLUSION

From the results of the research that has been carried out obtained the fact that the farther the distance of measurement using a device that is built, the less sensitivity of the sensor MQ-6.

The farther the measurement distance results in the reading characteristics getting sloping or saturated with a concentration difference of about 3.3% every 20 cm.

In accordance with the results of the research conducted, it is recommended that the application

of the use of MQ-6 sensors in the LPG gas leak detection system use a detector placement distance of no more than 1 meter from the gas source, so that leak detection can run more optimally.

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