

INTISARI

Sistem hidrolik pada alat berat modern seperti *Dozer* Komatsu D155A-6 sangat bergantung pada kinerja komponen aktuator seperti *proportional solenoid*. Proses diagnosis dan pengujian fungsional komponen ini seringkali memerlukan prosedur yang rumit dan tidak efisien. Penelitian ini bertujuan untuk membuat dan menguji sebuah alat uji portabel bernama *Proportional Solenoid Tester* berbasis *microcontroller* ESP32. Metode yang digunakan adalah pembuatan sistem elektronik yang mengintegrasikan *microcontroller* sebagai penghasil sinyal *PWM* (*Pulse Width Modulation*), modul *MOSFET* IRLZ44N sebagai *driver* untuk mengendalikan catu daya 24V, sensor INA219 untuk mengukur arus dan tegangan secara *real-time*, serta potensiometer yang berfungsi untuk memasukkan presentase *PWM* dan layar LCD 20x4 sebagai antarmuka pengguna. Pengujian fungsional dilakukan dengan memberikan variasi *duty cycle PWM* pada rentang 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100% dengan lima kali pengulangan pada setiap titik untuk memastikan validitas data. Hasil pengujian menunjukkan bahwa alat mampu menghasilkan sinyal *PWM* yang stabil dan mengukur respon arus solenoid secara akurat, di mana nilai arus terukur berbanding lurus dengan persentase *duty cycle* yang diberikan. *Proportional Solenoid Tester* yang telah dibuat berfungsi sesuai dengan perancangan dan dapat menjadi solusi yang efektif, praktis, serta portabel untuk melakukan diagnosis kinerja *proportional solenoid* di lapangan.

Kata Kunci: *Proportional Solenoid*, Alat Uji, ESP32, *PWM*, Sensor INA219.

ABSTRACT

The hydraulic system in modern heavy equipment such as the Komatsu D155A-6 Dozer is highly dependent on the performance of actuator components such as proportional solenoids. The process of diagnosing and functionally testing these components often requires complicated and inefficient procedures. This study aims to develop and test a portable testing device called the Proportional Solenoid Tester based on the ESP32 microcontroller. The method used is the creation of an electronic system that integrates a microcontroller as a PWM (Pulse Width Modulation) signal generator; an IRLZ44N MOSFET module as a driver to control the 24V power supply, an INA219 sensor to measure current and voltage in real-time, a potentiometer to input the PWM percentage, and a 20x4 LCD screen as the user interface. Functional testing was conducted by applying variations in the PWM duty cycle within the range of 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100%, with five repetitions at each point to ensure data validity. The test results showed that the device was capable of generating a stable PWM signal and accurately measuring the solenoid current response, where the measured current value was directly proportional to the given duty cycle percentage. The Proportional Solenoid Tester that was created functioned according to the design and could be an effective, practical, and portable solution for diagnosing proportional solenoid performance in the field.

Keywords: *Proportional Solenoid, Tester Tool, ESP32, PWM, INA219 Sensor.*