

ABSTRAK

KINERJA RANGKAIAN *AMPLIFIER* DALAM MENINGKATKAN SENSITIVITAS *ELECTRIC FIELD MILL* PADA SISTEM *MONITORING* MEDAN LISTRIK ATMOSFER

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Kinerja Rangkaian *Amplifier* Dalam Meningkatkan Sensitivitas *Electric Field Mill*
pada Sistem *Monitoring* Medan Listrik Atmosfer

(2026 : xvii + 55 Halaman + 23 Gambar + 14 Tabel + Lampiran)

Penelitian ini bertujuan untuk meningkatkan sensitivitas *Electric Field Mill* (EFM) pada sistem *monitoring* medan listrik atmosfer menggunakan rangkaian *amplifier* berbasis IC LM358. Sinyal keluaran EFM yang memiliki amplitudo kecil memerlukan pengkondisian sinyal agar dapat diproses secara optimal oleh mikrokontroler ESP32-S3. Metode penelitian meliputi perancangan, realisasi, dan pengujian rangkaian *amplifier* terhadap parameter tegangan keluaran, gain, linearitas, *bandwidth*, dan *Signal-to-Noise Ratio* (SNR). Hasil pengujian menunjukkan bahwa rangkaian *amplifier* mampu meningkatkan tegangan keluaran EFM dari 82,88–89,50 mV menjadi 1,662–1,685 V dengan nilai penguatan rata-rata sebesar 19,98 kali. Pengujian linearitas menunjukkan hubungan yang linear dan stabil antara tegangan masukan dan keluaran, sedangkan pengujian *bandwidth* menghasilkan nilai 735,29 Hz. Nilai SNR rata-rata sebesar 86,45 dB menunjukkan bahwa sinyal hasil penguatan memiliki kualitas yang sangat baik dengan pengaruh *noise* yang rendah. Berdasarkan hasil tersebut, rangkaian *amplifier* LM358 yang dipadukan dengan RC *Low-Pass Filter* berhasil meningkatkan sensitivitas dan kualitas sinyal *Electric Field Mill* sehingga mendukung sistem *monitoring* medan listrik atmosfer yang lebih akurat, stabil, dan andal.

Kata Kunci : *Electric Field Mill*, LM358, Medan Listrik Atmosfer, ESP32-S3, *Signal to Noise Ratio*.

ABSTRACT

PERFORMANCE OF THE AMPLIFIER CIRCUIT IN INCREASING THE SENSITIVITY OF THE ELECTRIC FIELD MILL IN THE ATMOSPHERIC ELECTRIC FIELD MONITORING SYSTEM

Scientific paper in the form of Final Project, June 21, 2026

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Performance of The Amplifier Circuit in Increasing The Sensitivity of The Electric Field Mill in The Atmospheric Electric Field Monitoring System

(2026 : xvii + 55 Pages + 23 Pictures + 14 Tables + Attachment)

This study aims to enhance the sensitivity of an Electric Field Mill (EFM) within an atmospheric electric field monitoring system by utilizing an amplifier circuit based on the LM358 IC. The low-amplitude output signal from the EFM requires signal conditioning to ensure optimal processing by the ESP32-S3 microcontroller. The research methodology encompasses the design, implementation, and testing of the amplifier circuit, evaluating parameters such as output voltage, gain, linearity, bandwidth, and Signal-to-Noise Ratio (SNR). Test results demonstrate that the amplifier circuit successfully boosts the EFM output voltage from a range of 82.88–89.50 mV to 1.662–1.685 V, achieving an average gain of 19.98. Linearity testing reveals a stable, linear relationship between input and output voltages, while bandwidth testing yields a value of 735.29 Hz. An average SNR of 86.45 dB indicates that the amplified signal is of excellent quality with minimal noise interference. Consequently, the LM358 amplifier circuit, integrated with an RC low-pass filter, effectively improves the sensitivity and signal quality of the Electric Field Mill, thereby supporting a more accurate, stable, and reliable atmospheric electric field monitoring system.

Keywords : *Electric Field Mill, LM358, Atmospheric Electric Field, ESP32-S3, Signal-to-Noise Ratio.*