

RINGKASAN

PERANCANGAN DAN IMPLEMENTASI KONTROL DIGITAL BERBASIS PLC DAN HMI PADA *RETROFITTING* MESIN EPS SHAPE MOLDING (1996) UNTUK OPTIMALISASI PRODUKSI *POLYFOAM*

Bagja Hanifan Hilmana

Penelitian ini dilatarbelakangi oleh tingginya *downtime* dan keterbatasan kinerja mesin EPS Shape Molding (1996) yang masih mengandalkan sistem kontrol konvensional *electromechanical*. Permasalahan utama meliputi kesulitan pengaturan parameter produksi, ketersediaan suku cadang, serta inkonsistensi kualitas *polyfoam*. Tujuan penelitian ialah merancang dan mengimplementasikan sistem kontrol digital berbasis PLC Omron NX1P2 dan HMI Weintek MT8102iP untuk meningkatkan efisiensi, keandalan, dan kualitas produksi.

Metode yang digunakan mencakup perancangan ulang *electrical wiring diagram*, pemrograman *ladder logic* di Sysmac Studio, dan pembuatan antarmuka operator menggunakan EasyBuilder Pro. Implementasi meliputi penggantian *hardware* lama, *rewiring*, instalasi PLC-HMI, serta pengujian konektivitas, fungsi operasi manual, dan mode operasi auto. Evaluasi performa menggunakan analisis rekam data produksi pra dan pasca retrofit dengan standar *Overall Equipment Effectiveness* (OEE).

Hasil menunjukkan peningkatan laju produksi dari 0,644 menjadi 0,694 produk baik per menit, penurunan total waktu *breakdown* dari 660 menjadi 555 menit dalam tiga bulan, serta kenaikan OEE hingga mendekati 100 % (*Quality* > 99 %, *Availability* hingga 99,81 %, *Performance* > 100 %). Produktivitas operator bertambah dari rata-rata 38 unit/jam menjadi 42,75 unit/jam. Kesimpulannya, penerapan sistem kontrol digital signifikan memperbaiki efisiensi operasional, stabilitas proses, dan konsistensi kualitas *polyfoam*, sekaligus memperpanjang usia pakai mesin tanpa modifikasi struktural besar.

Kata kunci : Sistem Kontrol Digital, *Retrofitting* Mesin Industri, Optimalisasi Proses Produksi, PLC Omron NX1P2, HMI Weintek MT8102iP

SUMMARY

DESIGN AND IMPLEMENTATION OF A DIGITAL CONTROL BASED ON PLC AND HMI FOR RETROFITTING THE EPS SHAPE MOLDING MACHINE (1996) TO OPTIMIZE POLYFOAM PRODUCTION

Bagja Hanifan Hilmana

This study was motivated by the high downtime and limited Performance of the EPS Shape Molding machine (1996), which still relies on a conventional electromechanical control system. The main problems include difficulties in setting production parameters, Availability of spare parts, and inconsistency in the quality of polyfoam. The objective of this study is to design and implement a digital control system based on Omron NX1P2 PLC and Weintek MT8102iP HMI to improve production efficiency, reliability, and quality.

The methods used include redesigning the electrical wiring diagram, programming ladder logic in Sysmac Studio, and creating an operator interface using EasyBuilder Pro. The implementation involved replacing old hardware, rewiring, installing the PLC-HMI, and testing connectivity, as well as manual and automatic operation modes. Performance evaluation was conducted using production data analysis before and after the retrofit, with the Overall Equipment Effectiveness (OEE) standard as a benchmark.

Results showed an increase in production rate from 0.644 to 0.694 good products per minute, a reduction in total breakdown time from 660 to 555 minutes over three months, and an increase in OEE to nearly 100% (Quality > 99%, Availability up to 99.81%, Performance > 100%). Operator productivity increased from an average of 38 units per hour to 42.75 units per hour. In conclusion, the implementation of the digital control system has significantly improved operational efficiency, process stability, and quality consistency of polyfoam while extending the machine's service life without requiring major structural modifications.

Keywords : Digital Control Systems, Retrofitting Industrial Machines, Production Process Optimization, Omron NX1P2 PLC, Weintek MT8102iP HMI