Pengembangan sistem kalibrasi aliran fluida rendah menggunakan Metode Volumetri = Development of volumetric micro flow calibration system using Volumetric Method

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Abstrak

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Jaminan mutu atas keakuratan alat ukur di bidang kesehatan merupakan kebutuhan yang mutlak diperlukan pada masa ini. Salah satu alat yang perlu dikalibrasi adalah infusion pump analyser. Alat ini berfungsi menguji pompa infus yang bekerja pada aliran rendah, yang digunakan di rumah sakit apakah masih layak pakai atau tidak. Sebagai peralatan uji, infusion pump analyser harus terkalibrasi untuk menjamin keakuratan hasil pengujiannya. Pada penelitian ini akan dikembangan sistem kalibrasi yang beroperasi pada laju aliran rendah. Sistem terdiri dari aktuator linear yang menggerakan siringe dari gelas kaca. Aktuator linear terdiri dari ulir bola, linear guide way, rangkaian roda gigi yang terhubung ke motor d.c. Kecepatan motor d.c. dikendalikan oleh FPGA dengan menggunakan metode pulse width modulation. FPGA juga digunakan untuk membaca keluaran rotary encoder yang terhubung ke poros roda gigi untuk memantau kecepatan aktuator. Untuk mengkarakterisasi sistem, pertama osilator FPGA dikalibrasi terhadap universal counter untuk menvalidasi pengukuran waktunya. Kemudian aktuator dikalibrasi menggunakan kaliper untuk menverifikasi pergerakan linearnya. Dalam proses ini diamati efek dinamis dari faktor kalibrasi enkoder, yang membawa kepada penentuan kecepatan intrinsik dari sistem. Dengan menggunakan kecepatan intrinsik dan faktor alat, maka volume dan laju alir yang dibangkitkan oleh sistem dapat ditentukan. Selanjutnya sistem diuji secara gravimetri berdasarkan ISO/FDIS 8655-1, dan didapatkan hasil ketidakpastian pengukuran yang tidak memenuhi syarat. Setelah melakukan penyelidikan lanjut dengan simulasi pada perhitungan pengukuran, didapatkan bahwa kapasistas silinder perlu diperbesar agar ketidakpastian pengukuran yang dibutuhkan dapat dicapai.
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ABSTRACT
Quality assurance of the accuracyof measuring instruments in the health industry is necessary. One of the instruments that need to be calibrated is Infusion pump analyzer. This instruments is used to test infusion pumps used in hospital at low flow rate. As test equipment, infusion pump analyzer must be calibrated to ensure the accuracy of test results. In this study, a low flow rate calibration system is developed. The system consist of linear actuator to move a glass syringe. The linear actuator consist a linear ball screw, linear guide way, and gear box connected to d.c. motor. The motor controlled by FPGA using pulse width modulation method. FPGA also use to read rotary encoder that connected to gearbox shaft to monitor actuator speed. To characterized the system, first the FPGA oscilator is calibrated to universal counter to validated the time measurement. Then the actuator is

calibrated using caliper to verify its linear movement. In this porocess a dynamic efect of encoder meter factor are discovered. This dynamic effect lead to determining intrinsic speed of the system. The intrinsic speed together with meter factor are used to determine volume and flowrate generated by the system. The system then tested using gravimetric method base up on ISO/FDIS 8655-1 and the result of measurement uncertainty is not satisfying. After further investigation using simulation on measurement calculation, it is found that the capacity of syringe should be increased to achieve required uncertainty., Quality assurance of the accuracyof measuring instruments in the health industry is
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