Oefenopgaven EE1320 Meettechniek – college 7: Meetinstrumenten II[1]

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Regtien opgave 20.3, 20.4, 20.5, 14.1, 14.2, 14.3

A frequency counter with a 7-digit display and an internal reference frequency at 1 MHz is used for the measurement of an input signal with a frequency at about 480 MHz.

3.4 Calculate the setting of the frequency divider, to result in a gate period that gives optimum use of the available resolution.

In the practical implementation of this instrument the counters and display driver circuits are integrated on a single chip with a maximum input clock frequency of 100 MHz. A pre-scaler is used for the division of the input signal frequency by factor 10 before applying this frequency to the clock input of the counter.

3.5 Calculate also for this configuration the setting of the frequency divider, to result in a gate period that gives optimum use of the available resolution.

An instrument for the measurement of time is equipped with a 6-digit display and an internal reference oscillator at f_{osc}= 1 MHz. The clock frequency of the counter is controllable in power of 10 using an internal frequency divider (f_{ck}= 10^{-i} Hz with $-1 \leq i \leq 6$). The internal reference oscillator is paced in a furnace with temperature controlled by a thermostat, which enables the stabilising of the operating temperature at 80±2 °C.

The oscillator is calibrated once every year with calibration inaccuracy $\Delta f_{osc}/f_{osc}= 10^{-7}$. Temperature drift amounts to: $\partial f_{osc}/\partial T$= 0.2 Hz/°C. Ageing amounts to: $\partial f_{osc}/\partial t$= 0.1 Hz/month.

3.6 Determine the best-obtainable resolution in case the user is unaware of the exact date of the last calibration.

3.7 Determine the inaccuracy of the measurement in case the user is unaware of the exact date of the last calibration.

[1] De weergegeven opgaven die niet uit Regtien komen zijn afkomstig uit R.F. Wolffenbuttel, “Measurement of Electrical and Non-electrical quantities”, editie 2010.