

HIGHER TECHNICAL INSTITUTE

ELECTRICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

COMPUTERIZED SIGNAL
GENERATOR

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ANDREAS KEKKOU

1998

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SUMMARY

COMPUTERIZED SIGNAL GENERATOR

WRITTEN AND CONSTRUCTED BY: ANDREAS KEKKOU
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The purpose of this project is to design, construct and test a signal generator and interface it to an IBM PC, and to develop relevant software to control the signal generator.

Terms and conditions

1. The signal generator can either be based on a complex IC or on simple D/A converter.
2. The interface can either be through the Centronics connector or through a PC interface card.
3. The control software can in one of the following languages: Visual Basic, Pascal or Assembly.

Design a computerized signal generator is not easy since a safe link between the PC and the construction is required. The insertion card must be carefully construct since any fault on it may be caused the internal 5V supply voltage of the computer to break down with all the costly consequences for the PC.

Also design and manipulate any trigonometric function (sine wave, square wave, and triangular wave) circuit pose a significant design challenge because they represent a constantly controlled linear oscillator.

INTRODUCTION

There is no electrical laboratory without a signal generator. Signal generators are very helpful equipment for electrical engineers since trigonometric functions are required in a number of diverse areas, including audio testing, calibration equipment, transducer drivers and power conditioning.

Almost all function generators consist of a variable-frequency, rectangular wave oscillator that provides a number of switch-selected frequency ranges. Its output is applied to an integrator which converts the rectangular waves into triangular ones. Finally, the triangular waves are converted to sine waves by soft clipping with a diode. This type of signal generator has a considerable total harmonic distortion since the sine wave is made up from a diode clipper, which is very sensitive to temperature changes.

The presented generator is an exception since it is based on a PC and all of its functions are controlled through software. It uses the ML2038 IC, which is a programmable sine wave generator and generates perfect sine wave signals. The ML2038 uses direct synthesis and has been designed to generate sinusoidal signals in conjunction with a digital control. Using this technique, the total harmonic distortion is reduced, since the perfect sine wave is converted first into square wave and then into a triangular one.

Moreover the fact that it is based on a PC makes it easier to control and friendlier to the user.

Generating signals using the signal generator presented here is straightforward: simply write the requested frequency in the User Defined Output Frequency box and select the desirable function from the function

field. Then by clicking on the button Output Enable the requested frequency appears at the output.

The resolution of the generator is 1.52 Hz, which is also the minimum frequency. Therefore, the output frequency and the requested frequency are very close to each other, something very difficult to achieve in the most analogue generators.

The maximum frequency of the signal generator is 100 kHz, and it can be upgraded up to 400 kHz by replacing the crystal that controls the maximum frequency of the ML2038, and by making some additional changes to the values of the components (capacitors and resistors) in the analogue section of the generator.