AFG3000 Arbitrary/Function Generator Aids Experiment Design and Execution in Education

Solution Summary	
Challenge	Fudan University, one of the leading universities in China, was struggling with existing equipment that required an oscilloscope to visualize modulated waveforms output by a signal source. Moreover, the sources were difficult to use, resulting in poor productivity.
Solution	To assist students with experiment design and execution, Fudan University sought a powerful, easy to use and cost effective signal source that did not require an oscilloscope to get a graphical representation of the signal being generated. Fudan University tested the AFG3000 against their requirements and found it to be an excellent match for student use.
Benefits	A graphical representation of modulated waveforms can now be observed before output, which is extremely helpful for applying the correct signals as part of an experiment. The intuitive user interface greatly eases instrument operation, improving efficiency and results.

The Information Teaching and Experiment Center of Fudan University is a higher education institution that consists of eight teaching and experiment labs including basic circuitry, modern measurement methods, HF circuitry, biomedical electronics, the teaching of EDA software use, electrical engineering, general purpose labs open to regular undergraduate students, and specialty labs for postgraduate students. The center delivers programs including experiments for basic electronic circuitry for all technical platforms across the university including electronics experiments for undergraduate students of the Institute of Information Science and experiments for postgraduate students of the Department of Electronic Engineering. Equipped with first class equipment and staffed with an experienced teaching team, the experiment center is actively engaged in innovative teaching methods.

College education provides basic quality and training of students to prepare them for positions in industry. The goal is for students to be equipped with a sound theoretical foundation, and have the ability to identify, define and solve problems. Conducting experiments is a critical part of the curriculum to help cultivate the student's desire to learn and understand. By conducting experiments, students enhance their mastery of knowledge and distill deeper understanding through the application of theoretical knowledge, thus improving their foundation for scientific research in the future. A key factor for successful execution of an experiment is the choice of instruments in the design.

A challenge often encountered by Fudan University has been the fleeting output of signals. More often than not, signals would disappear completely from the oscilloscope display before students saw them and knew what had happened. This made the overall teaching process both difficult and tedious since modulated waveforms can often only be observed with an oscilloscope after the output of signals. In addition, to measure the frequency response of a system, the usual method is to continuously adjust frequency and amplitude of the output signal on the signal source and then observe the output signal of the system with an oscilloscope.

"To improve the experiment design and execution process and the quality of results, Fudan University selected the Tektronix AFG3000 series arbitrary/function generators," said Yu Cheng-fang, Professor, Electronic Information Teaching and Experiment Center, Fudan University, China. "We have been deeply impressed by the high performance and convenient operation of Tektronix instruments and this especially applies to the AFG3000. The AFG3000 provides a significant improvement in performance compared to other sources and produces 12 types of standard signals we need for our curriculum including sine wave, triangle wave, square wave and pulse wave. Moreover, the width, rising edge and falling edge of pulse waves can all be programmed. The substantial capabilities of this instrument and its ease-of-use are a real asset for our students and greatly assist them while executing their experiments."

In addition to the display of the specific parameters of the waveform, the AFG3000 graphically displays the output waveform. “With only a glimpse, we are now able to easily see different types of parameters on the display,” said professor Yu. “This enables professors and students to see both detailed parametric value as well as gain an overall graphical appreciation of the waveform shape before even connecting the AFG3000 to a device under test or oscilloscope. This results is a great improvement of our productivity and effectiveness.”

Convenient, intuitive and easy-to-operate

“Many existing instruments have a common shortcoming: they are difficult to operate - hard to learn and easy to forget,” said professor Yu. “Students who only occasionally use arbitrary/function generators have to learn how to operate them each time. The difficulty of operation of these instruments impedes teaching and conducting the experiments and often has a negative impact on the results.” With a large 5.6” LCD display, and an intuitive UI, the AFG3000 has greatly simplified the operation process. “The AFG3000 series are as intuitive and as easy to understand as the Tektronix TDS1000/TDS2000 oscilloscopes,” said professor Yu. “The excellent user interface of the AFG3000 helps students concentrate on problems in the experiment itself instead of spending a lot of time to set-up and control the instrument. As a result, teaching can focus more on content and less on equipment explanations and students are able to gain greater insight from their experiments.”

To assist with operation, AFG3000 arbitrary/function generators have a menu-editing mode for editing of output signals. The professor added, “the user interface on the AFG3000 enables us to perform parameter control for most frequently used waveforms through simplified screen menus in combination with a number of shortcuts. We are able to accomplish settings for even the most complicated modulated signals through fast operation on the front panel.”

Additionally with the supplied ArbExpress software, students are able to create and edit waveforms on a PC. Professor Yu added, “with the ArbExpress software, we are now able to directly create and edit waveforms on a PC. This further simplifies the use of AFG3000. The software is also capable of seamless conversion of data collected by Tektronix oscilloscopes.” Additionally, ArbExpress provides the capability of importing MatLab files, thus eliminating the difficult process of conversion and correction. “The useful ArbExpress software complements the AFG3000,” said professor Yu.

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- Professor Yu Cheng-fang
Electronic Information Teaching and Experiment Center, Fudan University, China

Versatility and wide area of application

In terms of signal modulation, the AFG3000 provides both internal and external modulations including AM, FM, PM and FSK, enabling the instrument to play a more significant role. The modulated signals are especially important in experiments for fields such as communications. The graphic display capability of its screen enables students to see a graphical representation of the baseband modulating signal and the modulated carrier. During the process of waveform editing, students are able not only to perform some practical experiments with the output signal generated by the instrument, but also to understand the realistic data of the edited waveform. This AFG3000 capability is extremely helpful to ensuring that the right signal is applied during an experiment. Previously, such modulated waveforms could only be observed with an oscilloscope after signal output.

Tektronix has added sweep capability to the AFG3000 arbitrary/function generator for its output signals and it is possible to output a signal with constant frequency variation within a specified frequency range. It is very convenient to use such a signal to measure the frequency response of a system. “With the sweep capability of AFG3000, all we need to do is to edit and produce a sweep signal with continuous frequency change on the front panel, apply the signal to the system under test, and then use an oscilloscope to measure output of the system under test.”

Professor Yu concluded: “The AFG3000 is a high performance signal source that has an excellent display and extensive applications. The instruments will find broad application in institutions of higher learning as they are powerful yet easy to use and therefore perfect for lab experiments. They are also economical; by adding the AFG3000 to our lab environments, we have been able to replace several different instruments. The AFG3000 help to provide an effective test environment for students to learn state-of-the-art measurement theories and for the faculty to carry out teaching through experiments. The AFG3000 have provided great value to the students and faculty of Fudan University.”