

## Search for a wave generator at VITO

VITO's research program "Smart Systems for Intelligent Energy Networks" focuses on the coupling of decentralized and renewable energies to existing energy networks. To support this research, VITO has built up smart grid testing infrastructure with an extensive range of measuring instruments. In order to extend its facilities, VITO has been screening the market for an arbitrary wave generator to test linear and nonlinear loads under balanced and unbalanced load operating conditions emulating a grid distorted by harmonics. Their ideal solution was not just a wave generator "black-box" but rather a platform that could act as voltage source and be versatile enough to also serve in their ongoing research programs.

## PM90F40C as wave generator

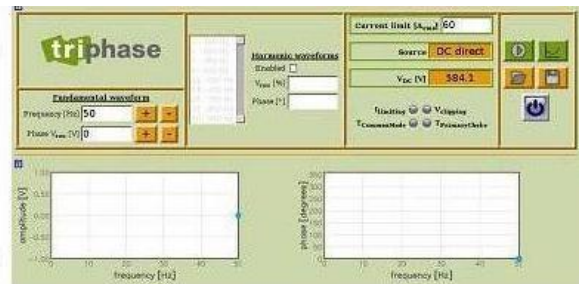
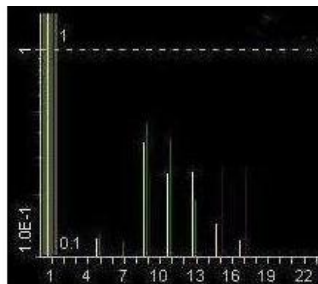
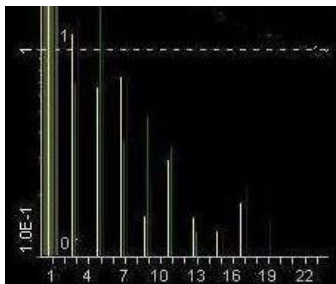
The only bidder that could offer such an open wave generator platform was Triphase. Indeed, their PM90F40C standard power module comes as a natural solution for a 90kVA 3 phase 4 wire voltage source. It comes with all relevant measurements and interfaces included and it is easy to install and use. The waveform generator was implemented using standard Triphase libraries thereby shortcutting the time from conceptual simulation to hardware implementation. Additional harmonic analysis and compensation algorithms were developed to meet the stringent demands. A web based graphical user interface was developed for user-friendliness.



PM90F40C Power Module

### Wave generator specifications:

Supply voltage $V_{AC,in} / V_{DC,in}$	→	230 ... 480 Vrms / 50-60 Hz 300 ... 750 VDC
Output voltage $V_{AC,out}$	→	0 ... 230 Vrms
Output current $I_{AC,out}$ (per leg)	→	130 Arms
Programmable frequency	→	10-100 Hz



Left & Middle: Wave generation with unbalanced load without and with harmonic compensation. Right: Graphical User Interface

## PM90F40C as an open research and development platform

The Triphase PM90F40C power module can also be used for research on active filters and front ends and AC current sources. Additionally, the existing cabinet can be connected to a PM90F03C power module with 3 DC/DC conversion interfaces which is ideally suited for interfacing batteries and photovoltaic panels. Alternatively, it can be also be connected to a PM90M30 module thereby combining a motor drive and an active front-end which is suited for four-quadrant motor control or for the control of doubly-fed induction generators. The flexibility of the PM90 modules in combination with the user-friendly engineering environment will help VITO in meeting its smart grid research objectives.

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