Test and measurement in the pov

By Clive Davis, Yokogawa Europe

The need for accurate and reliable power measurement is greater than ever before. As the demands of society and its reliance on advanced technology continue to grow, so energy consumption is increasing at a rate that is unsustainable without a significant shift to alternative energy sources - which themselves require the use of new power electronic technology in the form of high-frequency inverters.

At the same time, sectors such as the automotive industry, domestic appliances and lighting are being transformed by the use of new energy-efficient technologies where factors such as energy usage and the quality of power waveforms need to be evaluated. Moreover, these developments are taking place in an environment where governments and regulatory bodies are creating new and more stringent standards that also require compliance testing and measurement.

Measurement challenges

These challenges are being addressed by a new generation of digital power analysers (Figure 1) which offer innovative functions for with electrical power and efficiency measurements in a range of industries from inverter and drive design to alternative energy systems. A key feature of this product is the ability to make up to six power input measurements, which makes it possible to perform efficiency tests between the input and output of products such as inverters, matrix converters, motors, fans and pumps. The instrument has a power measurement bandwidth from DC and 0.1Hz to 1MHz, and basic power measurement accuracy is 0.1% of reading plus 0.05% of range.

A motor evaluation function makes it possible to measure the rotation speed, torque, and output (mechanical power) of motors from rotation sensor and torque meter signals. The input signal from the rotation sensor and torque meter can be selected from analogue signals (DC voltage) or pulse signals. In addition, A-phase, B-phase, and Z-phase input terminals make it possible to detect the rotation direction and electrical angle. For the first time in the high-precision power analyser industry, an event trigger function is incorporated to capture only a particular event. A trigger can be set for measured values that fall out of a pre-selected range, and the analyser will only

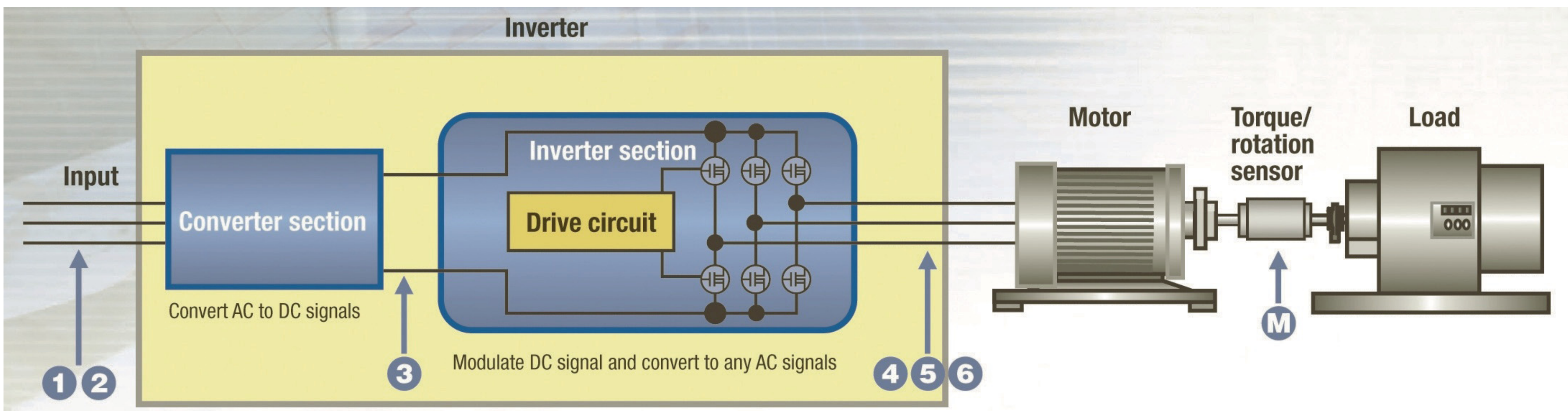

Figure 1: Electrical power and efficiency measurements feature in the new generation of power analysers

ver sector

store, print or save data that meets the trigger condition.

Harmonics

Many of today's power conversion circuits use energy-saving switching techniques which can cause highly distorted voltage or current waveforms with high harmonic content. To measure these waveforms accurately, the new analyser uses high-resolution 16-bit analogue-digital converters with a digitising rate of 2MS/s (megasamples per second). It is now possible to simultaneously measure voltage, current fundamental wave, harmonic components, and harmonic distortion factor (THD) in the harmonic measurement mode, along with the conventional voltage and current RMS values in the normal measurement mode. In addition, up to the 500th order harmonic can be measured for fundamental frequencies.

The analyser is capable of performing two-line simultaneous harmonic measurements with one unit for the first time in the industry. The ability to simultaneously measure harmonics for the input and output signals not only reduces the switching time but also makes it possible to perform simultaneous data analysis for the input and output. The dual harmonic measurement function makes it possible to simultaneously measure the harmonic content and perform harmonic analysis on two different sources, such as the input and output of an inverter, variable-speed motor drive, lighting ballast, uninterruptible power supply or similar devices. The normal power parameters and harmonic data are measured simultaneously, providing for faster and more accurate power analysis.

Applications

The ability to make multiple measurements in a single unit makes the unit ideally suited to the performance testing of multiple appliances on a production line. A single instrument can perform high-precision power evaluation on up to six items of equipment, measuring voltage, current, power, frequency, power factor, and harmonic distortion factor. An independent integration function is available for each input element to start and stop integration. Since data can be collected remotely by communicating with just a single analyser, it is easy to create the appropriate test programs.

As indicated above, power generation and conversion efficiency measurements are vital in new energy markets, including photovoltaic and wind power generation. For example, energy generated by photovoltaic cell modules and wind turbines is converted from DC to AC by a power conditioner. Furthermore, the voltage is converted by a charge control unit for the storage battery. Minimising losses in these conversion processes improves efficiency in the overall energy system. The instrument's ability to provide up to six channels of power inputs per unit makes it possible to measure the voltage, current, power, and frequency (for AC) before and after each converter, as well as converter efficiency and charging efficiency.

A new programmable digital filter function enhances the capability to remove unnecessary harmonic components and noise superimposed on signals such as from an inverter or variable-speed motor drive. This filter can be set independently for each input element, from 100Hz to 100kHz in 100Hz increments. An analogue filter is also provided for 300kHz and 1MHz filtering on each input element.

For photovoltaic power generation applications, a maximum peak power tracking measurement is available to maximise the harvested power generated by photovoltaic cells. To accomplish this, the analyser is capable of measuring voltage, current and power peak values and calculating the derived parameters.

A power integration function is also available which can be used to measure the amount of power sold or purchased in grid interconnection applications. An average active power function makes it possible to measure power consumption under conditions where the power fluctuates greatly.

A user-defined function makes it possible to compute not only the conversion efficiency but also the power loss, DC voltage and DC current ripple factors between the input and output. This is helpful in multiplying a factor or slightly changing the arithmetic expression according to the application.

YOKOGAWA EUROPE
www.epn-online.com/search?search_keyword=44530