10 + 1 Reasons to Choose a Yokogawa Power Analyzer

What is a Power Analyzer?

Power analyzers and power meters measure electrical power in devices that generate, transform, or consume electricity. Since they offer the accuracy, frequency ranges, and functions necessary to meet industry test and measurement standards, they have been used for decades in electrical product testing applications. More than simply watt meters, these instruments make true power measurements using matched voltage and current input circuits. They are able to make power measurements in single-phase, three-phase/three-wire, and three-phase/four-wire circuits.

In order to provide the best solution for a broad range of applications while staying within budget, power analyzer and power meter portfolios feature a variety of measurement accuracies, frequency bandwidths, and prices. High-end power analyzers offer measurement accuracy as good as ±0.01% of reading. Depending on the model, the specified power measurement frequency can range from DC to 1 MHz.

Some power analyzers offer harmonic measurement functions. The best instruments are able to characterize harmonic data and total harmonic distortion (THD) simultaneously with normal power measurements. This enables the highest efficiency in the testing process and, in some instruments, allows compliance testing to IEC 61000-3-2 or IEC 62301. However, please beware that the ability to perform a Fast Fourier Transform (FFT) does not necessarily mean that an instrument complies with IEC harmonic measurement requirements.

This application note discusses the top 10 reasons, plus one, to select a Yokogawa power analyzer.

1 Modular architecture

Test configurations can change. The number of poles in a motor, phases of a power system, and accuracy for each input could vary. To provide the best configuration for the job at hand, Yokogawa's WT power analyzer line uses a modular architecture that supports up to seven user swappable, reconfigurable input elements.* Using a single instrument instead of many considerably reduces test set-up time as well as costs of purchase and maintenance.

Figure 1. The WT5000 Precision Power Analyzer allows up to seven user swappable elements

*Please note that not all Yokogawa WT models are user swappable.

2 Synchronize multiple chassis for large multi-phase systems

Up to four Yokogawa power analyzers can be synchronized with one primary unit and three satellite units to offer scale for both power and motor measurement channels. Plus, the WTViewerE software supports such large systems.

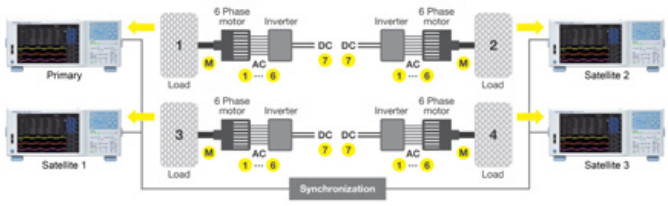

Figure 2. The WT5000 can synchronize up to four systems with one primary and three satellite units, with access to 28 input elements for electrical power measurements and up to 16 motor evaluation functions.

3 Multiple speed and torque inputs

Measure more than just electrical parameters. Some Yokogawa power analyzers feature a motor evaluation function to enable measurements of rotational speed and direction, synchronous speed, slip, torque, mechanical power, electrical angle, and motor efficiency. These inputs accept analog or pulse outputs from torque sensors and pulse outputs from rotation sensors. Models with eight inputs can measure two motors when the rotation direction and the electrical angle are needed. However, a simple setting in the motor configuration menu allows a single analyzer to take synchronous measurements from up to four torque and rotation sensors. This allows users to determine the overall efficiency from four wheel drive vehicles.

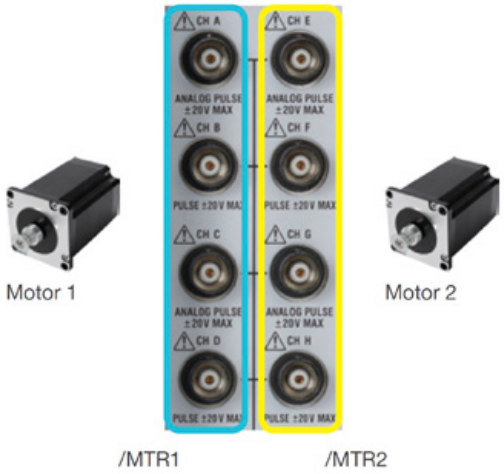

Figure 3. A single WT5000 configured for simultaneous, synchronized measurements from 2 motors to determine torque, rotation speed, direction and electrical angles of A/B and Z phases.

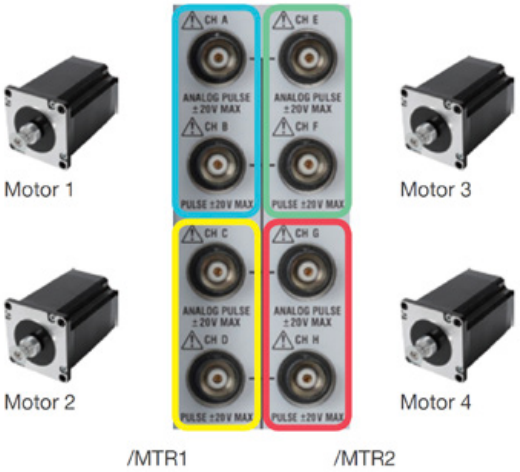

Figure 4. A single WT5000 configured for simultaneous synchronized measurements from 4 torque and rotation sensors to determine overall efficiency of 4 motors.

4 Advanced filtering

In addition to low pass frequency filters and line filters, Yokogawa power analyzers feature advanced filtering capabilities that provide unprecedented control to analyze even difficult waveforms with precision:

- A synchronization source filter allows the user to select any point of the synchronization source signal instead of synchronizing to zero crossings.
- An enhanced frequency filter allows users to simultaneously measure fundamental and switching frequencies without influencing any other parameter.
- Supported by a high frequency anti-aliasing filter, digital parallel path filters for normal and harmonic measurements ensure accuracy without aliasing in wide band and harmonic measurements. Users can limit the number of harmonic orders to eliminate attenuation in low bandwidth measurements.

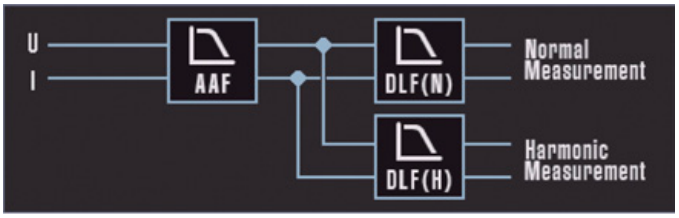

Figure 5. Synchronization source filter provides options for a low pass and high pass filter.

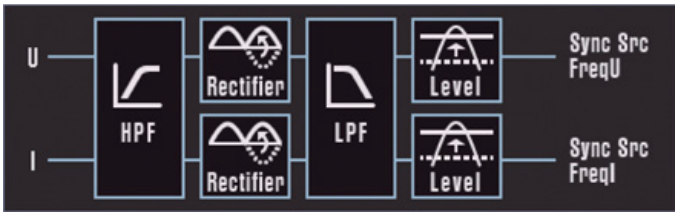

Figure 6. Filters can apply anti-alias filters and digital line filters on normal measurements and harmonic measurements.

5 IEC harmonic compliance

Select models of Yokogawa power analyzers provide solutions for verifying product efficiency and compliance to IEC harmonic and flicker standards. Compliant standards include:

Harmonic

IEC 61000-3-2: Ed3.0 (2005), Ed3.0 A2 (2009), Ed4.0 (2014)

EN61000-3-2: 2006, 2009, 2014

IEC 61000-3-12: Ed1.0 (2004), Ed2.0 (2011)

EN 61000-3-12: 2005, 2011

IEC 61000-4-7: Ed1.0 (1991), Ed2.0 (2002), Ed2.0 A1 (2008)

EN 61000-4-7: 1993, 2002, 2009

JIS C61000-3-2: 2011

JIS C61000-4-7: 2007

Voltage fluctuation/flicker

IEC 61000-3-3: Ed2.0 (2008), Ed3.0 (2013)

EN 61000-3-3: 2008, 2013

IEC 61000-3-11: Ed 1.0 (2000)

EN 61000-3-11: 2000

IEC 61000-4-15: Ed1.1 (2003), Ed2.0 (2010)

EN 61000-4-15: 1998, 2003, 2011

6 Guaranteed industry-leading accuracy

Yokogawa offers the world's most accurate precision power analyzers, with leading power accuracy of +/- 0.03%. Yokogawa's accuracy specifications are guaranteed up to the full bandwidth of the instrument, and also guaranteed from 1% to 130% of the selected voltage and current ranges. The accuracy specifications cover voltage, current, power, and harmonics. The WT power analyzer line features up to 18-bit ADC sampling at up to 10 MS/s.

DC	±(0.02% of reading + 0.05% of range)
0.1 Hz ≤ f < 10 Hz	±(0.08% of reading + 0.1% of range)
10 Hz ≤ f < 30 Hz	±(0.08% of reading + 0.1% of range)
30 Hz ≤ f < 45 Hz	±(0.05% of reading + 0.05% of range)
45 Hz ≤ f ≤ 66 Hz	±(0.01% of reading + 0.02% of range)
66 Hz < f ≤ 1 kHz	±(0.05% of reading + 0.05% of range)
1 kHz < f ≤ 10 kHz	±(0.15% of reading + 0.1% of range) Add 0.01% × f of reading (lower than 10 V range)
10 kHz < f ≤ 50 kHz	±(0.3% of reading + 0.2% of range)
50 kHz < f ≤ 100 kHz	±(0.7% of reading + 0.3% of range)
100 kHz < f ≤ 200 kHz	±{(0.008 × f)% of reading + 1% of range}
200 kHz < f ≤ 500 kHz	±{(0.008 × f)% of reading + 1% of range}
500 kHz < f ≤ 1 MHz	±{(0.048 × f – 20)% of reading + 1% of range}

Figure 7. Yokogawa publishes guaranteed voltage, current, power, and harmonics to the full bandwidth of the instrument, not just at DC.

7 Custom triggers and computations

Define and use event triggers and custom computations per application requirements. The event trigger function allows users to set limits to capture readings that fall within or outside a specified range of power, current, or other parameters. Users can also define and use up to 20 different expressions for custom calculations. Data that meets the trigger conditions can be stored, printed, or saved to a USB memory device.

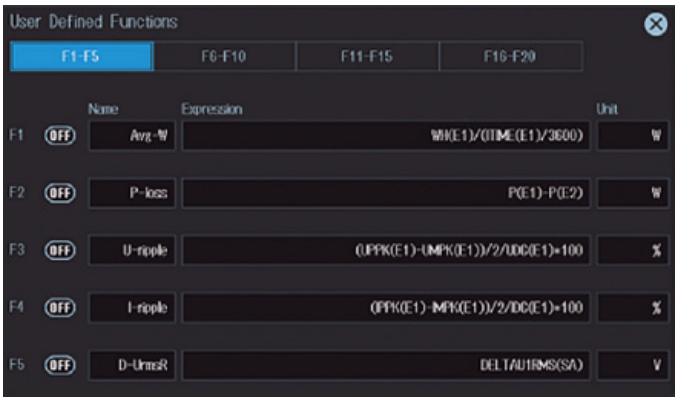

Figure 8. Up to 20 different expressions can be customized on the WT5000.

8 Up to seven input channels

Yokogawa power analyzers can measure up to seven different power phases at 10 MS/s (18 bits). The high resolution, 10.1 inch WXGA display allows split screen viewing of up to seven waveforms. The ability to display up to 12 pages of diverse measurement parameters makes it ideal for efficiency tests of inverter driven motors, renewable energy technologies, and traction applications like pumps, fans, and electric vehicles.

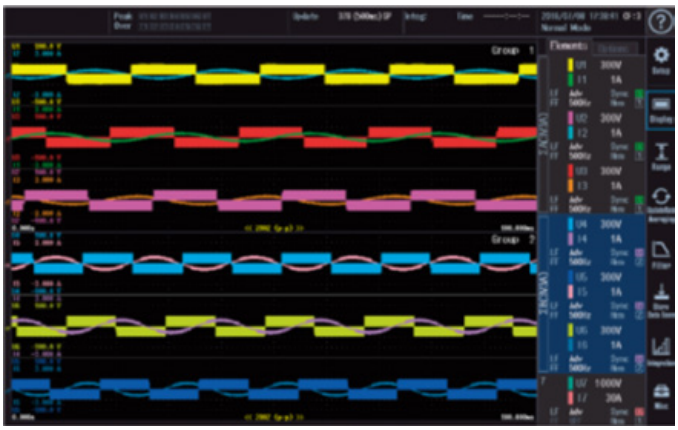

Figure 9. Easily display up to seven input waveforms, including current and voltage.

9 Precision current sensing

The coaxial construction of current shunts in the Yokogawa input elements ensures low resistance, low inductance, low impact on phase shift and minimal heat dissipation. Heat flow pathways are optimized in the shunts and across the instrument to ensure even distribution and minimum effect on resistance.

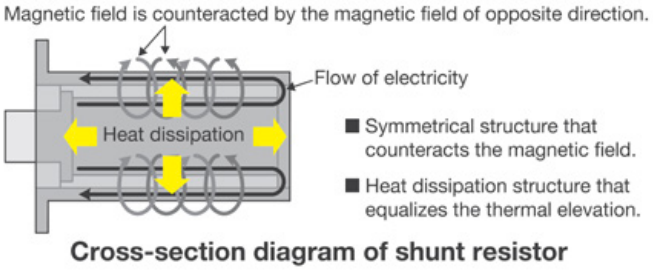

Figure 10. Heat flow pathways are optimized in the shunts and across the instrument to ensure even distribution and minimum effect on resistance.

10 Noise and isolation

Yokogawa's isoPRO™ technology ensures fast data transmission (max. 10 MS/s) and industry leading isolation to the input elements. It is designed particularly for energy-saving applications at high levels in terms of voltage, current, and frequency. Special shielding and optical transmission protect against noise and crosstalk. Noise flow routes are optimized for minimum effect on the measurement circuitry.

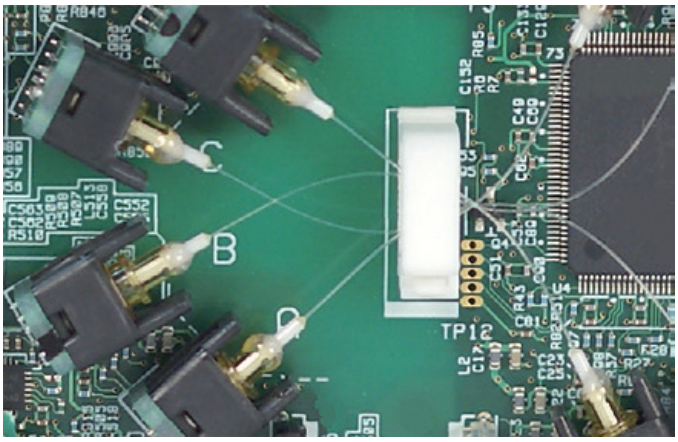

Figure 11. Optical isolation protects against noise and crosstalk.

+1 The importance of calibration

No measurement is ever “correct.” There is always an unknown, finite, non-zero difference between a measured value and the corresponding “true” value. In other words, a user can never be 100% sure that an instrument is operating within its specified tolerance limits. Regular accredited calibration is a method for gaining quantifiable confidence in a measurement system by comparing the instrument’s performance to a standard of known accuracy. It is also advisable to calibrate not only the measuring instrument but also the extended measurement setup including sensors, cables, shunts, and other devices that are part of a test bench.

Without an ISO 17025 accredited power calibration, there is no guarantee that the measurements on an ISO 9001 certificate are correct. Depending on age and quality, a measurement instrument could drift out of specification due to temperature, humidity, oxidation, loading, or other reasons and may need to be “adjusted” to bring it back within specifications.

The guaranteed accuracy and precision of Yokogawa’s instruments in North America results from our ISO 17025 accredited calibration laboratory that is located in our Newnan, Georgia facility. Since we can process calibrations in less than ten business days, users benefit from fast turnaround and domestic shipping. Yokogawa also offers a “Gold Plan” including up to five years calibration and expedited service levels in a convenient, single purchase.

Yokogawa’s global network of 114 companies spans 62 countries. Founded in 1915, the US $3.7 billion company engages in cutting-edge research and innovation. Yokogawa is active in the industrial automation and control (IA), test and measurement, and aviation and other businesses segments.

Yokogawa has been developing measurement solutions for 100 years, consistently finding new ways to give R&D teams the tools they need to gain the best insights from their measurement strategies. The company has pioneered accurate power measurement throughout its history and is the market leader in digital power analyzers.

Yokogawa instruments are renowned for maintaining high levels of precision and for continuing to deliver value for far longer than the typical shelf-life of such equipment. Yokogawa believes that precise and effective measurement lies at the heart of successful innovation - and has focused its own R&D on providing the tools that researchers and engineers need to address challenges great and small.

Yokogawa takes pride in its reputation for quality, both in the products it delivers - often adding new features in response to specific client requests - and the level of service and advice provided to clients, helping to devise measurement strategies for even the most challenging environments.

Meet the Precision Makers at
tmi.yokogawa.com