DYNAMIC POWER ANALYSIS

WITH DEWETRON'S POWER ANALYZER

DEWETRON

THE MEASURABLE DIFFERENCE.

> Learn the DEWETRON way of power analysis

> New era of power analyzers

> Cycle-by-cycle analysis

> High-dynamic-range (HDR) inputs for continuous analysis

> Deeper view in the dynamic system performance

> Store every single sample for documentation

FURTHER INFORMATION?

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Figure 1: Power analyses are inevitable in the automotive sector

STATE-OF-THE-ART POWER ANALYSIS

For many years, the power measurement and analysis of AC voltage and current was considered a stationary discipline. This fundamentally changed over the past years due to the application of frequency-variable drives as well as the recognition of electric drive technology for automotives. Nowadays, it is also important to collect and verify dynamic characteristics of the drives, because many systems rarely have long stationary operating points during their measurements, but are rather dynamic.

Since „traditional" power analyzers that are available on the market are designed primarily for stationary applications, DEWETRON has developed a power analyzer which is responsive to today's flexible requirements and ready for the future demands of the market. With the high proportion of converter-fed drives in use today, it is possible to decrease the number of measuring ranges, since large peak measuring ranges are required most often, even at low power levels.

OBJECTIVE AND CONVENTIONAL SOLUTION

In today's world, electrical powertrains should be tested and evaluated in realistic environments with highly dynamic load profiles to assure the customers' measurement and analysis requirements. Traditionally, power testing, measurement and analysis are expensive and time consuming. With the improved power analysis technology, complete solutions for testing requirements become efficient and economic. Also, the very expensive testing time can be reduced to a minimum, to develop a monetary efficient solution.

<u>OUTDATED ANALYZERS CANNOT PROVIDE RELIABLE DATA FOR THE DECISION CRITERIA</u>

> No independent usage of voltage and current inputs; alternative and low common mode wiring schematics cannot be used
> Complex analog circuits (big and heavy) are not very flexible for the future requirements
> Extra analog signal path for frequency detection is required
> User must set the filter cutoff frequency before the measurement; analysis at low- and highspeed in one run can be very challenging
> No capability of capturing the whole waveform data, the engineers must use other recording equipment (scope recorder) to analyze the waveforms after the run
> Fixed calculation window size during measurement is always a compromise of resolution and dynamic
> Blind spots due to gaps in border area of the calculation window

DEWETRON'S SOLUTION

> DEWE3-PA8 with DEWETRON's software OXYGEN

> TRION3-1810M-POWER-4

> TRION-Base

> PA-IT or PA-IN current transducer series

Figure 2: Some elements of DEWETRON's power analysis equipment (ratio not proportionate)
left: DEWE2-PA7, right: DEWE3-PA8, below: current transducer

HDR (high-dynamic-range) inputs for precise measurements from a few volts up to 2000 V as well as amps up to 2000 A in combination with the according current transducer enable the user to analyze the dynamic drivetrain behavior. Beginning with load jumps and moving start-up and braking, the whole spectrum of power analysis is possible - without compromise.

Our dynamic power analyzers combined with DEWETRON's own measurement software OXYGEN, make power analysis easy and intuitive. The power analysis functionality of the OXYGEN software integrates the most advanced frequency detection algorithm available to respond to all the requirements of modern power analysis. This feature is the key to achieving precise, reliable and stable readings, even under adverse circumstances. DEWETRON continuously analyzes every single zero-crossing, and furthermore, every single fundamental period. It is our mission, to gaplessly analyze the signals for the whole truth.
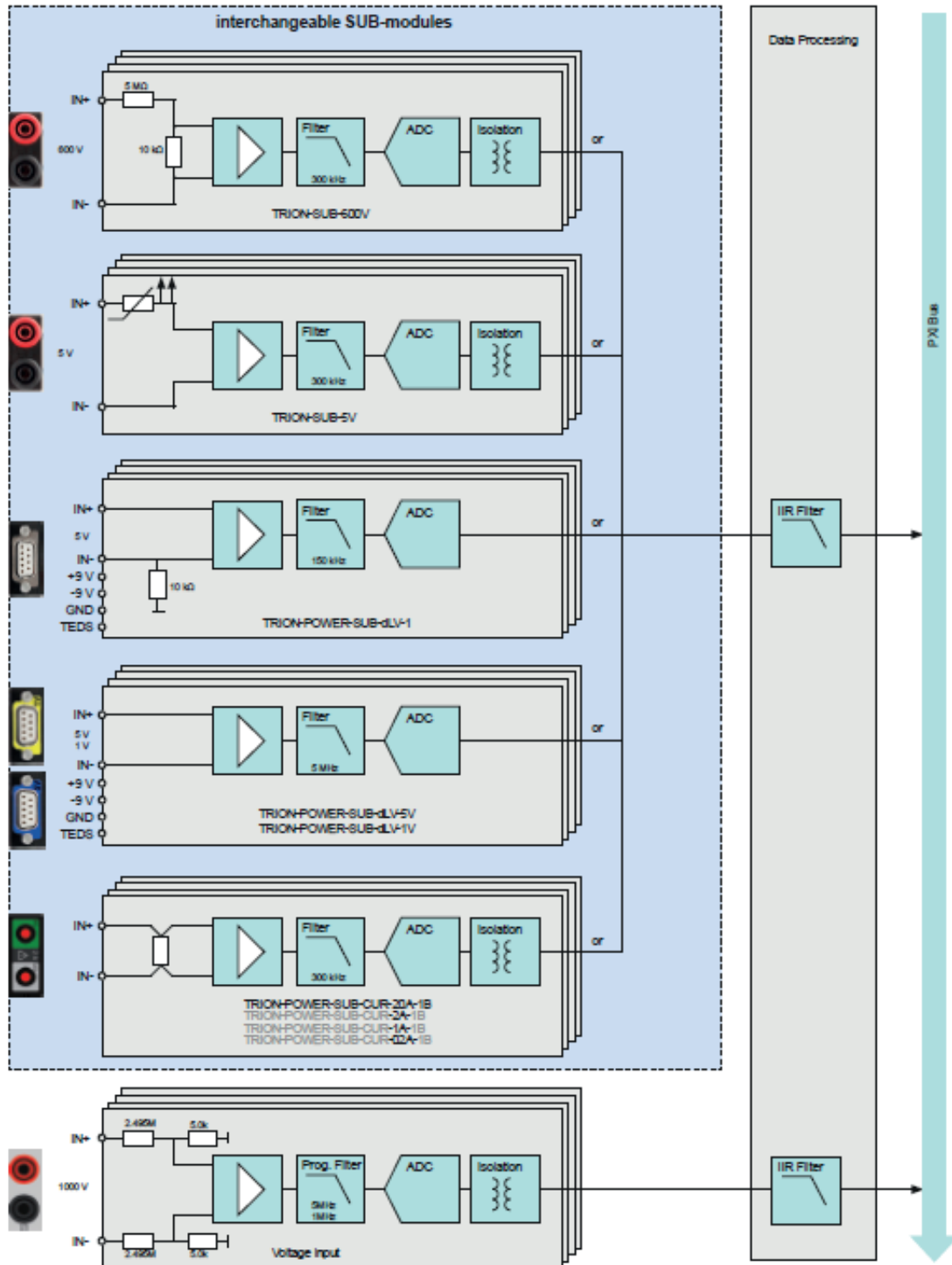
Figure 3: Base block diagram of the TRION3-1810M-POWER-4 module

> High density input module with multiple channels
> One straight forward signal path directly connected to the 18-bit ADC
> Independent voltage and current inputs for full-flexible use
> Signal filter in FPGA, continuous data stream to internal RAM and CPU
> All further operations are done in DEWETRON's measurement software OXYGEN
> Each power group has its own freely selectable synchronization source for fundamental frequency detection (further details in the next paragraph)
> Calculation of every power value (power, voltage/current RMS and fundamental) is done every single period (down to 1 ms).

THE FREQUENCY DETECTION INNOVATION

DEWETRON's intention was to develop a solution with auto-tuning capability which was easy to use for the operator and that addresses all the weak points of former solutions. The frequency detection solution is the result of collecting and analyzing information from customers and integrating those requirements into the development of the solution, which is now available for you.

> Minimum detectable frequency is 0.2 Hz (< 1 MS/s sample rate)
> Adaptive filter with delay compensation for noise suppression
> Adaptive zero-cross detector threshold avoiding multiple bounces
> Sub-sample accuracy due to interpolation
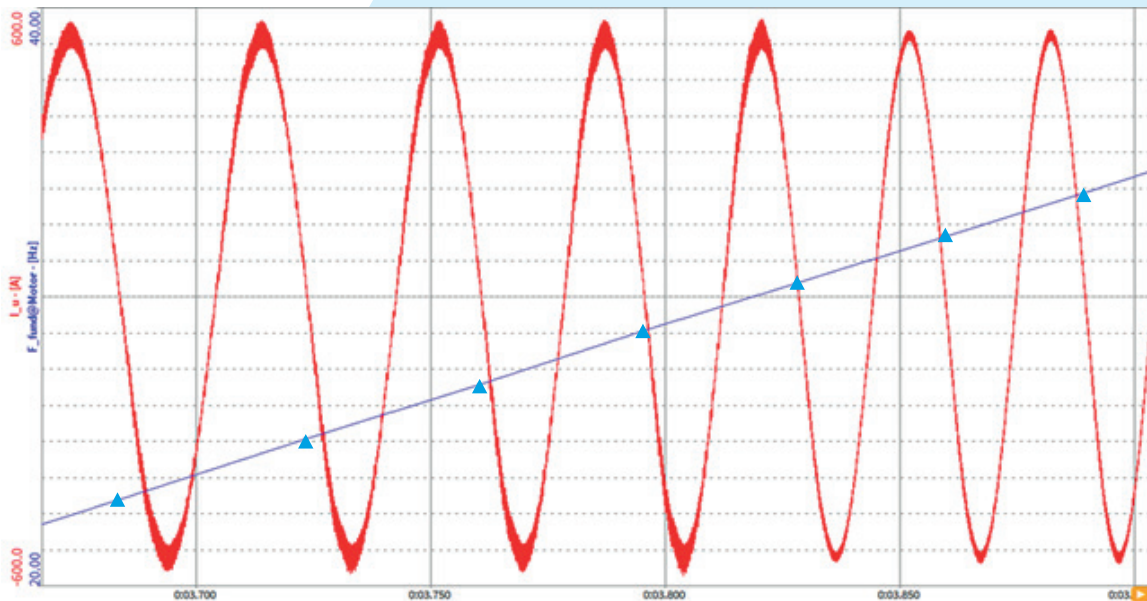> Continuous operation, with no gaps

Figure 4: Detect and visualize every single zero-crossing (period) of the fundamental

Below, you can find a selection of examples with the aim to visualize some functionalities of DEWETRON's measurement software OXYGEN:

1. Analyze vibrations of speed control with high resolution
2. Reliable frequency detection even with high noise proportion
3. Analyze the full range of your DUT with a single shot

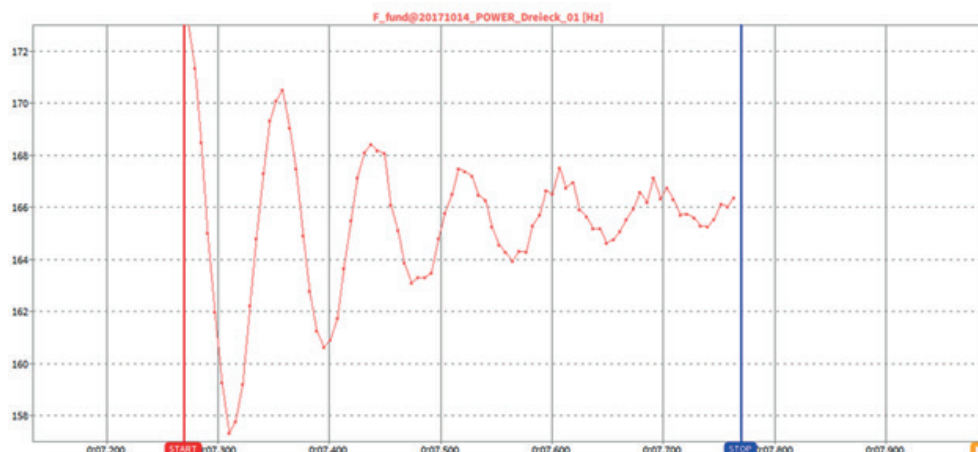### EXAMPLE 1: ANALYZE VIBRATIONS OF SPEED CONTROL WITH HIGH RESOLUTION

Figure 5: Fundamental frequency trace of a load step, vibrations of 10 Hz can be clearly detected
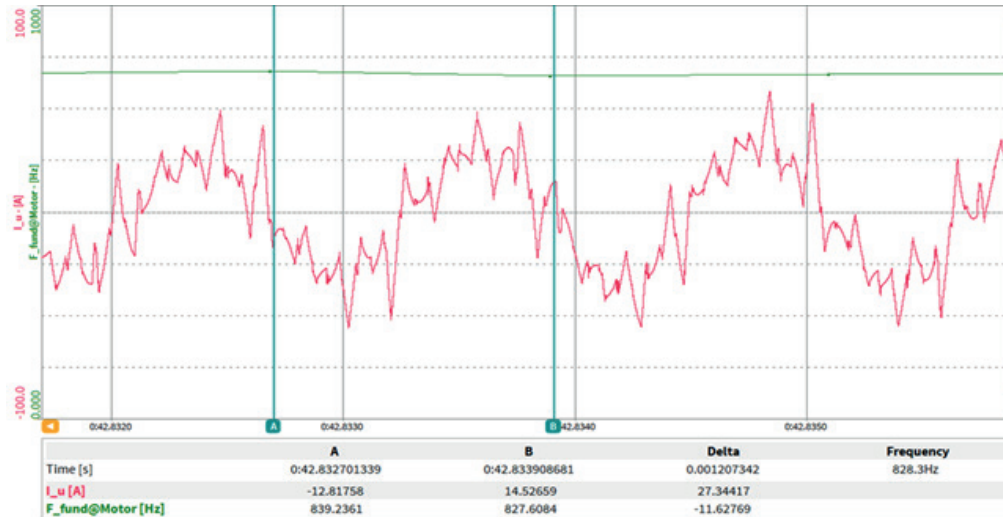
EXAMPLE 2: RELIABLE FREQUENCY DETECTION EVEN WITH HIGH NOISE PROPORTION

Figure 6: Fundamental frequency/period detection with highly distorted waveform
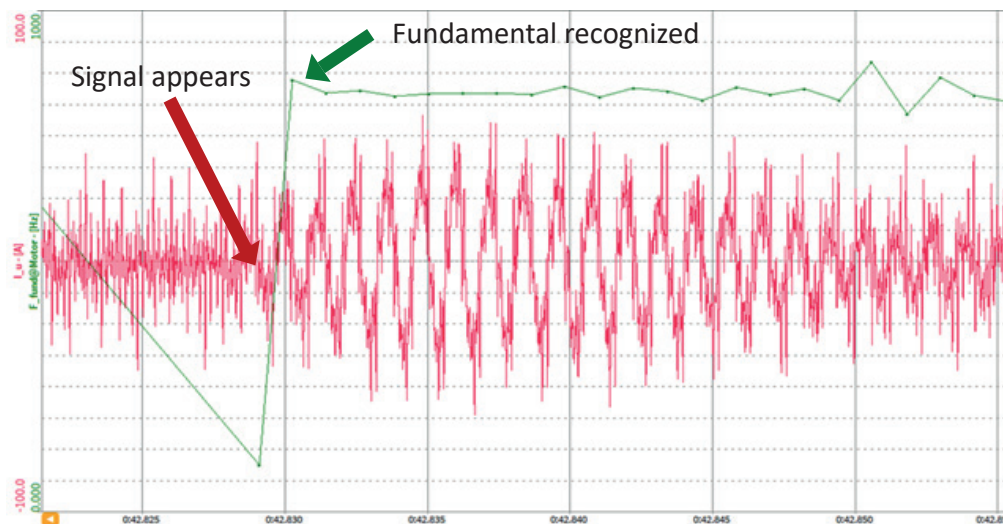

Figure 7: The fast reaction time guarantees reliable results from the first detected fundamental period
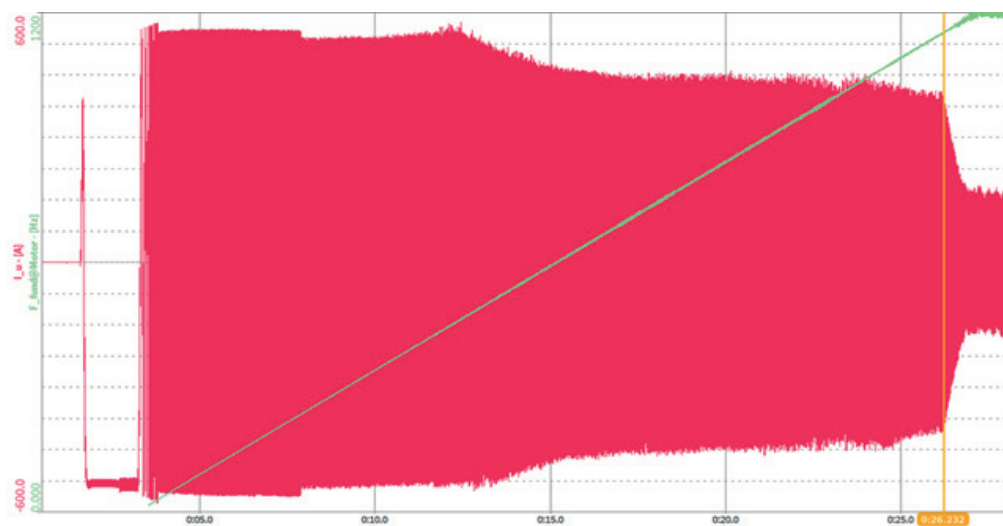
EXAMPLE 3: ANALYZE THE FULL RANGE OF YOUR DUT WITH A SINGLE SHOT

Figure 8: The high range of fundamental frequency detection allows analysis of the DUT with a single shot
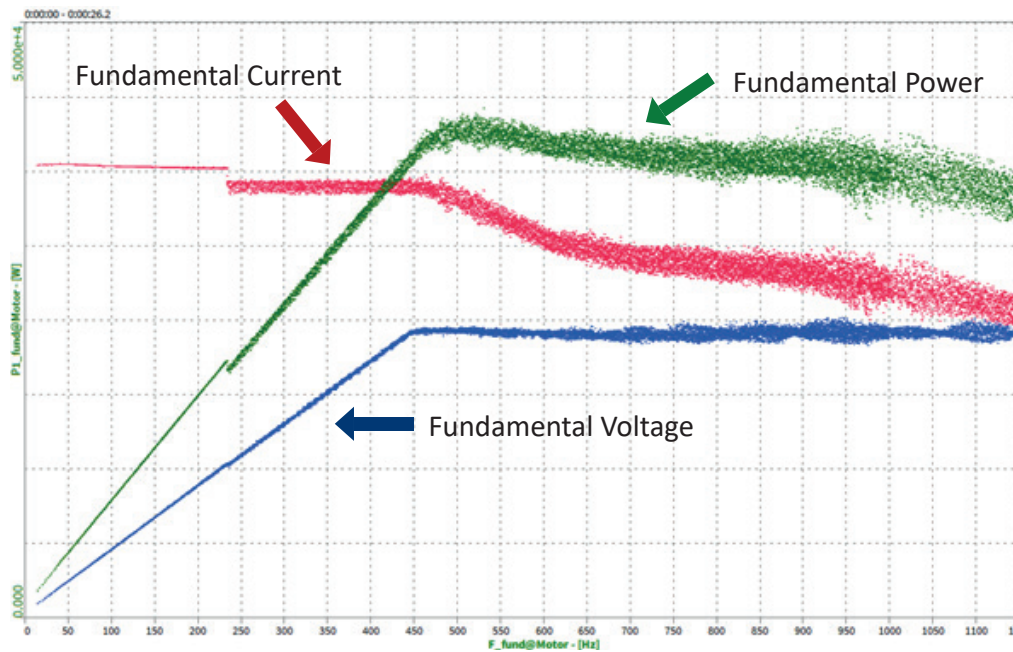
Figure 9: Visualize the control characteristics of a motor run-up, recognize changes in control strategies

For more information about DEWETRON's power analyzer, other systems for power analysis and measurement software OXYGEN, please visit us on our website www.DEWETRON.com. To see OXYGEN in action, watch the video tutorials we provide in our academy section.

THE EXPERT

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Michael Oberhofer is the R&D manager and technical expert for power analysis at DEWETRON. He received his master's degree in electrical engineering with a focus on energy technology from the Graz University of Technology.

Michael started his career at DEWETRON as an application engineer and sales consultant for electrical power analysis. In 2015, he became responsible for the technical product development, the definition of power analyzers and the software production backlog. Since 2019, he is DEWETRON's R&D manager and he therefore takes responsibility for the entire product development process including hardware as well as software.

FURTHER QUESTIONS? **CONTACT THE AUTHOR:**
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