



eDrive Power Analyzer Family

BEST IN CLASS ACCURACY FOR ANALYZING ELECTRIC DRIVE SYSTEMS



A complete solution ...

SENSORS

Current

HBM offers world class zero flux current transducers with highest accuracy and bandwidth. The full aluminium body ensures perfect EMC immunity critical in inverter



connection cables and power supply, a range from 50 A to 1200 A and bandwidths from 400 kHz to 1 MHz.

Voltage

For different voltage levels, HBM offers different solutions. Certified connection cables with high CAT rating, or HV probes with a unique safety concept to allow high accuracy measurements up to 5 kV rms. For even higher voltages, the isolated digitizers allow safe measurements to virtually any voltage level, be it 10 kV or 10 MV.

Torque and Speed

HBM torque sensors are the standard in the market not only for outstanding accuracy, but also for the unique



Flexrange capabilities, the optional speed measurement systems and the high bandwidth to observe torque ripple. When seamlessly integrated in the eDrive solution, unmatched accuracy in both electrical and mechanical measurements is achieved.

POWER ANALYZER

Power Analyzer Card

The GN310B power analyzer card offers the best accuracy, the highest input range and the best safety class on the market. Combine as many cards as you need as computing power is fully scalable due to onboard DSPs. Digital cycle detection allows true dynamic power calculation needed for run up tests or WLTP drive cycles.

Mainframes

Select a mainframe with the appropriate number of slots, stand-alone or with integrated PC. Combine mainframes to increase your system size.

PC integrated systems are best for bench top and portable use; tethered systems are optimized for rack and test rig integration.



Options for NVH, Temperatures, and CAN bus

Expandability is a key feature of the HBM solution. You want to add accelerometers or temp channels to correlate with other measurements? No problem, just select the proper card. Or add a scope card with 250 MS/s into the power analyzer. CAN FD and EtherCAT interfaces are available as well.

PERCEPTION SOFTWARE

ePower suite

Dedicated Windows® software allows basic power measurements out of the box. Scope, FFT and Phazor displays are available to gain



more insights. And user programmable formulas in real time or post process analysis branch out for drive calibration or reverse engineering.

KNOW HOW

Training, Engineering Services and Consultancy

Be it product training, classroom style introduction to electrical testing or advanced analysis, or having an HBM expert on site to help improve measurement uncertainty or NVH behaviour: be assured HBM offers you all these services from its world class staff of electrical drive experts. We not only sell products; we can help you to maximize the return of investment by guiding you through all stages of electric motor

testing.





... for electrical and mechanical signals



The HBM eDrive Power Analyzers cover the entire measurement chain from high-precision sensors to powerful instruments and intuitive software. And they simultaneously acquire electrical signals like voltage and current, mechanical signals like torque, speed, temperatures or vibration and bus signals like CAN based control commands or test rig parameters. They help engineers to analyze their drive better, faster and more accurately than ever before.

- Highest power accuracy 0.015% reading + 0.02% range
 - Sample rate of 2 MS/s with 1 MHz bandwidth (per channel)
 - Voltage inputs up to +/- 1500 V, with 1000 V CAT IV safety
 - Programmable input ranges and AUTO-Range to minimize measurement uncertainty
 - Packages from 3 to 9 power channels, expandable to 51
 - Up to 12 torque / speed frequency-inputs with exceptional accuracy of 0.004%
 - Real time power calculation with **transparent formulas**, and unlimited user defined computations
 - Digital cycle detection for accurate power measurements in dynamic load changes like WLTP drive cycles
 - Optional inputs for temperatures, accelerometers, microphones, CAN bus and more
 - Continuous raw data storage at full sample rate for analysis and review
 - Flexible recording modes with triggers to store results only, raw data or both
 - Powerful analysis like fundamentals, space vectors, dq0 transformation, torque ripple, harmonics, back EMF and much more
 - Easy test rig integration using TTL, CAN, EtherCAT, or software API

Seven different packages

SELECT THE MAINFRAME WHICH BEST MEETS YOUR REQUIREMENTS:

- "i" mainframes feature an integrated PC and are best for portable use or when an instrument-type Power Analyzer is desired.
- "t" mainframes are connected to a PC but can work stand alone as well. They are best for test rig integration, in-car use or if an existing PC is used.

All systems come standard with Perception Enterprise ePower suite, a built-in SSD, an artificial star adapter and a signal splitter to connect torque/speed sensors.

Overall specifications

- Board modular mainframe
- Mix Power Analyzer cards and other inputs for temperature, acceleration or CAN FD
- Continuous, full sample rate streaming
- 100 MB/s to PC
- 200 / 350 MB/s to internal SSD
- 500 GB or 1 TB SSD
- Real time result transfer via API, CAN FD or EtherCAT
- Remote control via API, TTL or CAN FD
- Stand alone operation without PC/Perception



PRECONFIGURED EDRIVE POWER ANALYZERS

| | | | | | 6 | | |
|--------------------------|--|--------------|----------------|-----------------------|--------------|---------------------------------|----------------------------|
| | BERRE | | (E) | | | | |
| Description | PC-tethered Power Analyzer | | | | | Instrument-style Power Analyzer | |
| Part number | 1-EDRV-3P-2T | 1-EDRV-6P-2T | 1-EDRV-6P-4T | 1-EDRV-9P-4T | 1-EDRV-6P-7T | 1-EDRV-6P-3I | 1-EDRV-6P-7I |
| Mainframe | GEN2tB | GEN2tB | GEN4tB | GEN4tB | GEN7tA | GEN3iA | GEN7iA |
| # of power channels | 3 | 6 | 6 | 9 | 6 | 6 | 6 |
| Max # of power channels | 6 | 6 | 12 | 12 | 21 | 9 | 21 |
| Software | ePower suite ePower suite
running on external PC running on built-in PC | | | | | er suite
built-in PC | |
| Base power accuracy | 0.015 % of reading + 0.02 % of range | | | | | | |
| Integrated Windows PC | x | x | x | x | x | Intel i3, 4 GB,
17" TFT | Intel i5, 8 GB,
17" TFT |
| SSD capacity | 500 GB | 500 GB | 500 GB / 1 TB | 500 GB / 1 TB | 960 GB RAID | 480 GB (in PC) | 960 GB (in PC) |
| Streaming rate | 200 MB/s | 200 MB/s | 350 / 200 MB/s | 350 / 200 MB/s | 350 MB/s | 200 MB/s | 350 MB/s |
| Open slots for expansion | 1 | - | 2 | 1 | 5 | 1 | 5 |
| Sample rate / channel | 2 MS/s | | | | | | |
| Torque / speed inputs | 2+2 | 4+4 | 4+4 | 6+6 | 4+4 | 4+4 | 6+6 |
| System integration | Good | Good | Best | Best | Best | Limited, slow | |
| EtherCat output option | x | x | ✓ | ✓ | \checkmark | x | x |
| CAN FD option | √ | √ | ✓ | ✓ | \checkmark | x | x |
| GEN DAQ hardware API | ~ | √ | ✓ | ✓ | \checkmark | limited,
read only | limited,
read only |
| Perception API | ✓ | √ | ✓ | \checkmark | \checkmark | ✓ | ✓ |

Note: More detailed specifications can be found in the datasheets of the individual mainframes

GN310B Power Analyzer Card

ACCURATE AND DYNAMIC POWER MEASUREMENTS

The GN310B card is the base of all systems and plug & play with all mainframes, as plain Power Analyzer or paired with mechanical input cards as power and NVH data recorder. Unmatched accuracy and a hardware-based concept enable unlimited scalability, dynamic power measurement and real time streaming to SSD. Best in class accuracy for both electrical and mechanical power measurements and highest overvoltage categories allowing worry free use at levels up to 1500 V.

Overall specifications

- 3 power channels, base accuracy 0.015% reading + 0.02% range
- 4 frequency inputs for torque and speed, accuracy better than 0.004%
- Scalable, hardware-based power calculations: RMS, P, Q, S, η , λ , $\cos\varphi$, α , β -vectors, for full signal or fundamentals only
- Results per half cycle with 2000 results/s maximum
- Unlimited user formulas with over 70 operators
- 2 MS/s sampling rate per channel with 18-bit resolution
- Digital cycle detectors for dynamic power measurement
- Cycle based recording for accelerated motor mapping

Voltage input specifications

- 5 ranges ± 50 V, ± 100 V, ± 500 V, ± 1000 V, ± 1500 V, AUTO
- Bandwidth > 1 MHz
- Highest overvoltage category on the market: 1500 V DC, 1000 V CAT IV

Current input specifications

- 7 ranges ± 0.075 A, ± 0.15 A, ± 0.3 A, ± 0.6 A, ± 1.0 A, ± 1.2 A, ± 2.0 A, AUTO
- Bandwidth > 1 MHz
- 2 built-in burden resistors 100 mΩ, 330 mΩ
- Switchable to voltage for current clamps, 9 ranges ± 50 mV to ± 20 V

Power accuracy

| For 0.5 < PF ≤ 1 | Reading error | Range error | Measurement
Uncertainty Contribution |
|------------------|---------------|-------------|---|
| DC | 0.015 % | 0.02 % | 0.015 % |
| 100 Hz | 0.019 % | 0.02 % | 0.016 % |
| 10 kHz | 0.415 % | 0.02 % | 0.25 % |
| 100 kHz | 1.015 % | 0.02 % | 0.59 % |

Torque accuracy

- Direct frequency input
- Accuracy 5 360 kHz (T12/T40B range):
 - With 500 values/s: <0.004%
 - With 50 values/s: <0.0005%
- "DualTorque" computation delivers both high accuracy torque for efficiency and high dynamic torque for torque ripple analysis

Speed accuracy

- Direct frequency input with quadrature encoder and direction
- Reference pulse input for angle measurement
- Accuracy > 60 rpm (T40B with 1024 pulses/rev):
 - With 500 values/s: < 0.004%
 - With 50 values/s: < 0.0005%

Note: The Measurement Uncertainty Contribution here is achieved according to GUM guidelines at reference conditions and full scale. More detailed specifications can be found in the GN310B Power Analyzer datasheet

Each GN310B Power

inputs

Analyzer card features

three power channels and two torque/speed

Perception ePower suite

SET UP YOUR POWER ANALYZER AND USE POWERFUL DISPLAYS TO UNDERSTAND YOUR DRIVE





The Perception ePower software allows to operate the power analyzer with just a few mouseclicks. And it also turns the device into a scope, an FFT analyzer and into a DAQ for raw data. With the ability to analyze in real time with predefined and user defined formulas, to re-analyze in post process for verification and certification, and to transfer the data into other packages like Matlab or LabVIEW. And the multi monitoring capabilities allow you to show all of this information on as many monitors as your PC supports.

Analysis and display features

- 1 Space vectors in time and xy domain to understand modulation
- 2 Multiple efficiency maps for motor / inverter / drive in real time
- 3 Vectorscope for amplitudes and phases in 3ph systems
- 4 Live scope displays for raw data
- 5 User definable system maps to automatically generate formulas and displays for complex configurations like hybrid drives
- 6 Meters can be freely configured and arranged



Advanced analysis

GAIN INSIGHTS IN YOUR DRIVE WITH TRACEABLE RESULTS

With recorded data and more than 100 analysis functions to create your own formulas, you can learn more about your machine and inverter than ever before. Show computed results live as scope traces so you can get intuition to your signals while doing power analysis. Batch processing allows you to reanalyze your test with the recorded data saving you the time and effort of redoing a test.

Analysis examples

- dq0 transformation
- Torque ripple
- Cogging torque
- Back EMF
- Motor parameter testing
- Modulation method evaluation
- CAN correlation

- Electromechanical testing
- NVH
- Dynamic power and transient torque
- Flux calculation and flux maps
- Airgap torque
- Range determination and drive cycles
- Calibration







dq0 calculations allow you to validate models. These signals are calculated in real time and can be viewed as a scope trace with CAN, torque, or any other signal.

To maximize the efficiency of an electric motor it needs to be tuned for its real world and **dynamic drive cycle**. Recorded data and accurate power measurements on the half cycle allow engineers to analyze real world **dynamic power**.

Engineers go to great lengths to analyze torque ripple, but it is simple to look at torque ripple and dynamic torque with the HBM DualTorque system. It allows you to look at high accuracy torque for power and full bandwidth torque for ripple analysis at the same time.

Options and Accessories

EVERYTHING YOU NEED TO GET STARTED AND TO EXPAND YOUR SYSTEM



FOR MORE INFORMATION, PLEASE SEE

electric power testing

www.hbm.com/ElectricPowerTesting

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