

Read-Write Analyzer Systems 4000 Series



- All-digital parametric and spectral measurements for better yield and faster throughput
- Up to 8 Gbit/s maximum write data rate (RWA 4008 model)
- Pattern Generator with 1psec resolution of bit precompensation
- Digital Read Channel based on 8-bit ADC with up to 20 GSPS sampling rate, 6.5GHz analog bandwidth, and up to 64 GBytes of DDR3 memory
- Fast digital frequency domain measurements up to 3.2GHz
- Spectral Integral SNR test processing speed more than ten times faster comparing to analog spectrum analyzer
- PRML Chip integration using a daughter card with easy access through front panel
- Universal servo decoder supports both Guzik servo and hard drive servo formats from all major hard drive manufacturers, including DTR Chevron servo
- Built-in oscilloscope capability with four separate channels
- 3D media magnetization mapping for easier failure analysis
- Advanced digital processing includes Digital Media Scanning and Jitter / Eye Diagram measurements
- Acoustic Emission sensor and Embedded Contact sensor processing channels
- All-digital low-pass filters
- Fast PCI Express connection to the host computer

The Read Write Analyzer Systems of 4000 Series – the RWA 4004, 4006, and 4008 – are capable to operate at data rates of 4Gbit/s, 6Gbit/s, and 8Gbit/s, respectively.

The 4000 Series RWA Systems consist of two units:

- Read-Write Analyzer RWA 4000 series
- Signal Analyzer GSA 6000 series

The 4000 Series RWA Systems support UP11 preamplifier and the next generation front end cartridge/head amplifier designs on Guzik spinstands. Previous generation of head amplifiers together with UP10M (board modification 3 or 4) are also supported by RWA-4000 Systems.

The 4000 Series RWA Systems can work with Guzik spinstands, non-Guzik spinstands, and Hard Disk Drives.

All-Digital System

The 4000 Series RWA System belongs to a new generation of Guzik test systems. Read-back signal from HGA is sampled using the **high-speed A/D Converter** of GSA 6000 unit with sampling rate up to **20 GSPS** and ultra-deep memory up to **64GBytes**. This approach allows for a **direct measurement** of perpendicular magnetic recording (PMR) signal, as opposed to indirect methods based on analog peak detector approach. No analog differentiator is required. The A/D converter chipset is provided by a major oscilloscope manufacturer; therefore you can expect the same digitized signal quality as you would from high-end oscilloscopes.

RWA 4000 Read-Write Analyzer

The RWA 4000 Read-Write Analyzer incorporates the following modules:

- Pattern Generator with data rates up to **8 Gbit/s** (in RWA 4008 model), **1psec** resolution of bit precompensation
- Universal all-digital Guzik and Drive servo decoder
- Front panel accessible Chip Adapter daughter card, which supports integration of PRML channel chips.
- Programmable filter matrix of eight low-pass anti-aliasing filters with cutoff frequency up to **3.2 GHz** to provide data decimation for the data rates less than 8 GBit/s.

The spectral measurements are possible up to 3.2GHz bandwidth of RWA 4000 filter matrix. The GSA 6000 digitizer allows for up to 6.5GHz bandwidth.

The universal all-digital servo decoder seamlessly supports both Guzik servo and hard drive servo; switching between these two modes is done programmatically. The hard drive servo decoder is very flexible and supports all major hard drive manufacturer servo formats including Chevron DTR servo.

The RWA 4000 has two integrated low-frequency digitizing channels for processing of Acoustic Emission sensor and/or Embedded Contact sensor outputs.

GSA 6044 Signal Analyzer

The GSA 6044 Signal Analyzer combines outstanding signal fidelity and waveform capture with an FPGA-based hardware processing back-end. It delivers near real-time digital signal processing performance with built-in oscilloscope capability.

Noise Immunity for Parametric Measurements

Parametric measurements (amplitude, rise-fall time, asymmetry, etc) are performed using the averaged signal profile approach, when repetitive transitions of the incoming signal are averaged first, and then the parameters of the signal are measured using the averaged signal profile. This provides outstanding noise immunity and yields **1% accuracy** of measurements for the signals with signal-to-noise ratio (SNR) down to **12dB**.

High-Speed Processing

The common problem with any digital measurement is slow processing speed, which makes using the high-speed digitizers impractical for most production applications. Guzik system features FPGA-based processing, combined with high-speed Gen2 PCI-Express 8x link to PC for additional processing on Graphic-card processing units (such as NVidia GPUs). The parametric processing speed is **7GSPS**, which means it is a real-time processing for acquisition sampling rates up to 10GSPS (data occupies 70% of the track, servo takes 30%).

Fast Spectral Measurements

The spectral measurements are performed using a Fast Fourier Transform approach (**FFT**). The Fast Fourier Transform processing speed is approximately **2.5GSPS**, which means one sector of data can be processed in less than four-sector timeframe; the result is thousands of spectral lines calculated at once. In other words, you collect data at 10GSPS for 100µs, process in 400µs, and get the full signal spectrum up to 5GHz with resolution bandwidth 10kHz – 500,000 spectral lines.

Algorithm Upgrades and Flexibility

The signal is digitized and stored in a memory. This allows for processing the signal using various algorithms to produce full range of measurements, such as parametric, spectral, jitter and eye diagram, etc. The important feature of a digital system is that measurements can be developed and added in the future without any hardware modifications. New tests arrive in a form of **software/firmware upgrade**.

Fast Data Transfer to PC

The Gen2 PCI-Express 8x data link from digital read channel to PC is capable of data transfer rates up to **2.4GByte/s**. This means the data transfer will not be a bottleneck in case you develop an algorithm processing data on a PC side using a GPU or CPU.

Oscilloscope-like Signal Monitoring

While the system performs measurements, you can simultaneously **observe** acquired signal on a PC screen. GSA 6044 has four input channels – one channel is connected to RWA 4000, while three other channels can be connected to other sources for observation

purposes. You do not need an extra oscilloscope – the signal from all four channels is shown in a separate Signal Display application running in parallel with WITE32 software.

Measuring DC Components

Guzik reference MR7 headamplifier features a unique **DC-coupled** read channel. If your system includes a MR7 headamplifier, a UP10 preamplifier, and a digital read channel, you can measure DC components of the signal coming from the head and media.

Additional Tests and Measurements

The set of digital measurements available with GSA 6044 include:

- Digital parametric measurements, including pulse/slope average profile, with per-sector results
- Digital spectral measurements, including FFT and DFT, with per-sector results
- Digital media scanning with up to 16 independent defect detectors working in parallel in real time
- Jitter and Eye diagram measurements
- 3D Pulse Profile measurements for nano-scale magnetic field imaging

Channel Configurations

GSA 6044 can work in the following channel configurations:

- Four channel mode with 10 GSPS per channel sampling rate, 4GHz analog bandwidth, with 8 GByte memory per channel (upgradeable to 16 GByte).
- Two channel mode with 20 GSPS per channel sampling rate, 6.5GHz analog bandwidth, with 16 GByte memory per channel (upgradeable to 32 GByte).
- Single channel mode with 20 GSPS per channel sampling rate, 6.5GHz analog bandwidth, with 32 GByte memory per channel (upgradeable to 64 GByte).

System Integration Requirements

- RWA System 4000 Series (RWA 4000 Series and GSA 6000)
- Guzik Spinstand DTR 3000, Guzik Spinstand V2002, Canon Spinstand, or HDD
- WITE32 Revision 4.40 or greater
- Windows-based host computer with two spare PCI-Express 16x slots to accommodate Guzik PCI-Express Bridge card and processing GPU card

RWA System 4000 Series Models

RWA Model	Maximum Data Rate ¹
RWA 4004	4 Gbit/sec
RWA 4006	6 Gbit/sec
RWA 4008	8 Gbit/sec

For more information please refer to the following Guzik product bulletins:

- “*Read-Write Analyzer RWA 4000*” document P/N 02-107537,
- “*GSA 6000 Series Guzik Signal Analyzers*” document P/N 02-107547.

¹ The maximum data rate of the whole RWA/Spinstand test system is limited by the headamplifier IC.

This product is protected by the following US Patents: 6,469,862; 6,760,171; 6,785,085; 7,221,220; 7,408,495.



2443 Wyandotte Street
Mountain View, CA 94043
Phone: (650) 625-8000
Fax: (650) 625-9325
E-mail: sales@guzik.com
<http://www.guzik.com/>