



SYNERGY

Intelligence In Data Acquisition

SYNERGY IS A ...

... TRANSIENT RECORDER

Enabling precision capture and analysis. Synergy features individual 16-bit digitizers per channel. Bandwidth up to 25 MHz enables collection of the fastest power transients, engine combustion cycles, pyroshock, ballistics and material test events. Up to 128 MS of transient RAM captures the longest event or thousands of shorter segments.

... DATA RECORDER

Offering high speed, scrolling strip chart display, voice and trace annotation and integrated signal conditioning. Store and review literally months of data even at high acquisition rates.

THE PERFECT COMBINATION OF CAPABILITIES

SYNERGY KEY FEATURES

- Independent per channel high resolution digitizers with sample rates from 1 S/s to 100MS/s
- Up to 1 MS/s per channel streaming, all channels
- Remote Control, Display, and Storage
- Mix and match Input Modules
- Multiple Instrument Synchronization
- Over 100 Built-in Analysis Functions
- Full Custom Analysis Capability

THE MOST COMPLETE DATA ACQUISITION SYSTEM EVER BUILT



The **Hi-Techniques Synergy** series of Data Acquisition Systems is the ultimate choice for a wide range of mechanical, electrical, acoustic, shock and vibration measurements.

Before Synergy, research labs and test facilities were filled with a combination of different types of instruments and signal conditioners all for similar yet distinct measurement requirements. As the name implies, Synergy blends the unique capabilities of multiple instruments in an integrated, easy to use system.

... MULTI-CHANNEL DSO

Featuring multi-channel independent 16-bit digitizing up to 100 MS/s, fast updated YT and XY scope displays and a wide variety of real-time parameter measurements as well as waveform calculations.

... DATA ACQUISITION SYSTEM

Featuring high resolution data capture, high speed direct-to-disk long duration recording and signal conditioning for most popular signal types.

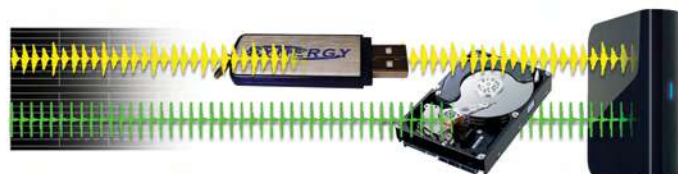
... REAL-TIME FFT ANALYZER

Including waterfall displays, octave and narrowband analysis, windowing and order analysis. Direct control from ME'scope® modal analysis software enabling setup and analysis for structural testing applications.

CONTINUOUS STREAMING TO DISK

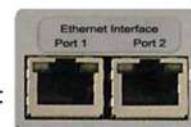
Synergy's distributed processing hardware captures data directly to a Windows® internal solid state drive or external PC via Gigabit Ethernet at speeds of up to 1 MS/s per channel. With virtually unlimited record lengths you'll never need to worry about running out of disk space. Larger capacity drives and removable RAID or USB Flash can further extend acquisition performance. Synergy can capture weeks of continuous data with annotation and storage. Data is stored directly to Windows disk, eliminating the requirement for lengthy conversion/transcription from proprietary hardware post acquisition. Other direct to disk systems can literally take hours to convert acquired data from a proprietary format to usable data.

Hi-Techniques' ClearVU technology tracks key parameters for all channels in real time, so you know in an instant if a channel goes off scale or a test lead breaks. This thumbnail statistical information is also stored in the data file to provide instant review of even multi-Gigabyte files. In addition, a summary report for immediate test validation is available at a keystroke.



Synergy's Ethernet architecture offers the advantage to stream high-speed data to an integrated PC or to a remote, networked PC or file server.

Dual integrated Ethernet switch ports allows data to be streamed through one port creating a virtual Intranet while allowing the second port to be connected to your corporate network.



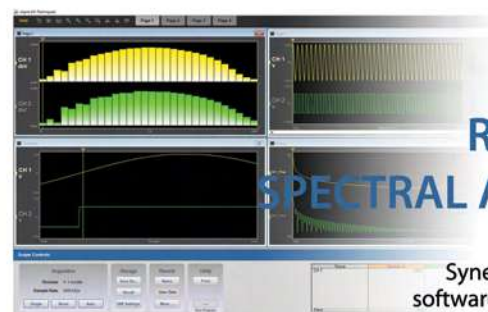
Whether connected to the internal PC or any remote PC, the software operates the same. Control, analyze, and stream directly to the host PC or to the remote PC over Gigabit Ethernet. Data stored directly to Windows based media saves time and frustration of post-test file copying.

Uncompromising Performance

Synergy's fully extensible architecture ensures data acquisition, streaming and data analysis capabilities with virtually limitless channel counts. All input modules are compatible with all mainframes. Mix and match modules and mainframes in any configuration. Multiple Synergy mainframes can be combined to create even higher simultaneous channel counts. Included software supports all Synergy mainframes and acquisition cards and allows realtime control, display and analysis from any PC on the network.

Quality By Design

Quality measurements depend on quality acquisition capabilities. All Synergy Input Amplifiers feature independent Successive Approximation (SAR) digitizers. Unlike their less expensive Sigma-Delta counterparts, SAR Digitizers ensure no overshoot or distortion as a result of the digitizing process. More information on the advantages of SAR digitizers can be found on our website.



REAL TIME SPECTRAL ANALYSIS

Synergy's hardware and software were designed for optimum performance in both the frequency and time domains. It includes dozens of spectral calculations and displays including narrowband, octave and spectral maps. The system allows selection of FFT (e.g. 4096) and decimal (e.g. 5000) sample rates and sweep lengths.

Filtering needs for a traditional FFT analyzer and scope are very distinct. The steep rolloff required for maximizing FFT performance caused considerable overshoot in Time Domain step response. In fact, competitive systems using sigma-delta techniques can overstate peak and transient measurements by over 20%! Rather than permanently compromise one mode, Synergy offers software selection of filter and frequency characteristics to best suit your varying tests.

To read more about our software selectable filtering, please visit www.hi-techniques.com/adc.html.

Mix and match modules in any configuration.

Mix and match input modules for even greater flexibility. Up to 4 modules can be installed in the Synergy P or 8 modules in the Synergy 8 and 16 modules in the Synergy Rack system.



Universal Signal Conditioning Module

Supports most signal types and can be configured channel by channel offering the ultimate in capability. No more purchasing and storage of additional modules and expensive signal conditioners.

Sample Rates High speed per channel acquisition rates to 2 MS/s.

DC Bridge Connect your strain gages, load cells, force, pressure, torque and piezo-resistive sensors with support for 1/4, 1/2 and full bridge. Autobalance, Shunt Cal and Auto Cal functions are provided at a touch.

ICP® type accel Constant-current excitation for your accelerometers, microphones and force transducers. Charge-mode sensors are also supported with small in-line charge converters.

Thermocouple Direct inputs for your thermocouples, with cold junction compensation and real-time linearization.

Voltage inputs Great versatility with wide input spans from 20 mV to 20 V direct, up to 40 KV with scope probes. All channels are differential to prevent ground loop and EMI problems.

Sensor power DC Excitation sources of 1 to 10 V provide flexibility to power bridges, MEMS sensors, DC-LVDT's, transmitters, current loops and other circuitry

Optional Signal Conditioning Breakout Interface simplifies wiring, enables ability to add external bridge completions resistors as well as providing cold junction compensation and blade type thermocouple connectors.



Basic Input Module

Offers up to 2 MS/s acquisition speeds and direct-to-disk recording at up to 1 MS/s. High impedance, differential front end supports voltage range from ± 20 mV to ± 20 V and direct connection to most oscilloscope probes and connection devices via BNC inputs.



Enhanced Universal Input Module

Intended for applications requiring long sensor leads, the EUI module adds individual channel excitation, remote sense lines, additional RF filtering and input protection to the standard Universal Input Module.



Medium Voltage Input Module

Provides a cost effective, 4-channel solution for general purpose voltage applications, offering ± 50 mV to ± 200 V ranges on isolated BNC connectors.



High Voltage Input Module

Offers up to ± 1000 V input range and 2000 V peak ch-ch isolation for high voltage and high power applications. Wide input range from ± 50 mV allows direct simultaneous connection to high voltage signals and current shunts via the 4mm safety banana jack connectors.



High Density 16-Channel Input Module

Provides 16-bit, 100 kS/s independent ADCs with full differential inputs and thermocouple support via a high density 78-pin connector. Combine multiple modules for up to 64 channels in a portable chassis or 256 channels in the larger Synergy CS chassis



High Speed Input Module

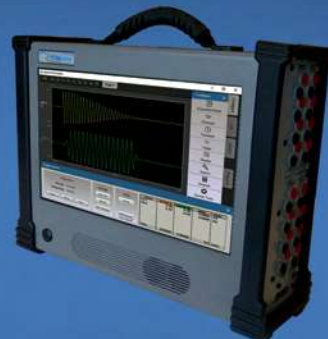
Provides four channels of 100 MS/s per channel with 16-bit digitizing. Differential, high impedance, 25 MHz amplifiers support voltage from ± 100 mV to ± 10 V full scale.

CHOOSE

the system that best meets your needs

CHOOSE

the modules that fits your testing requirements



The **Synergy P** mainframe supports up to 4 input modules capable of up to 64 channels in a portable, self-contained chassis. Mix and match input modules in any configuration or choose one of the economical bundled configurations.

FLEXIBILITY BY DESIGN

	Basic Input Module	Medium Voltage Module	High Voltage Module	High Density Module	High Speed Module	Universal & Enhanced Universal Module
						
Number of Input Channels	4	4 Isolated	4 Isolated	16	4	4 with Signal Conditioning
Types of Inputs	Differential, Single Ended Voltage	Single Ended Voltage	Single Ended Voltage, Current via Shunt	Differential, Single Ended Voltage, Thermocouple	Differential, Single Ended Voltage	Voltage, Bridge, Accelerometer, Thermocouple
Sample Rate	Up to 2 MS/s transient, 1 MS/s streaming	Up to 1 MS/s transient, 1 MS/s streaming	Up to 1 MS/s transient, 1 MS/s streaming	Up to 100 kS/s per channel	Up to 100 MS/s (4-ch mode)	Up to 2 MS/s transient, 1 MS/s streaming
Input Range	± 20 mV to ± 20 V	± 50 mV to ± 200 V	± 50 mV to ± 1000 V	± 50 mV to ± 10 V	± 100 mV to ± 10 V	± 20 mV to ± 20 V
Connector Type	BNC	BNC	4mm Safety Banana	78-pin connector, optional Breakouts	BNC	BNC or multipin, optional Breakouts

Multiple Instrument Synchronization

For higher channel counts, connect multiple systems together utilizing Synergy's master/slave architecture.

All systems are synchronized within nanoseconds and start/stop simultaneously. Data can be consolidated on a single display for comparison and analysis. System clocks can be synchronized to GPS or IRIG time using the optional time stamp interface.



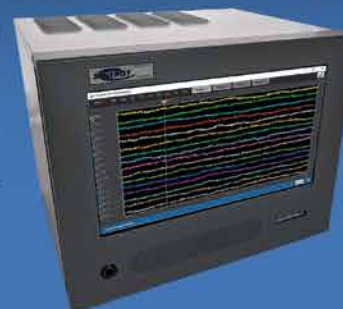
Isolated Thermocouple Module provides 16 channels of isolated thermocouple inputs of type J, K, or T.



USB Thermocouple Module provides 8 channels of support for thermocouple types J, K, R, S, T, N, E, and B, as well as RTD. Up to 4 modules can be connected to a Synergy mainframe at 1 S/s sample rate.



The **Synergy 8** supports up to eight input modules in a compact, card modular form factor capable of 32 high-speed channels or 128 using the 16-channel high density module. System can be configured with a flexible carrying handle for either field or factory use.



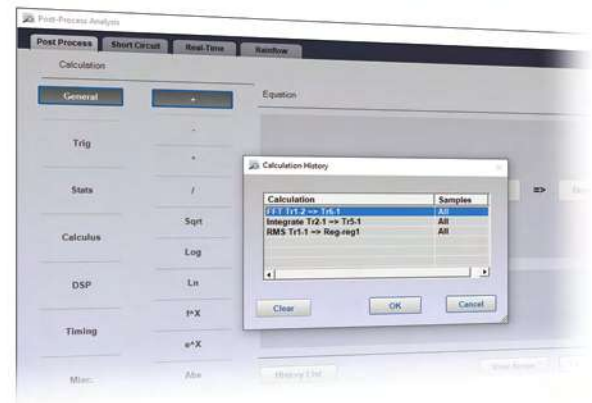
The **Synergy CS** mainframe further extends the available channel count supporting up to 16 input modules in a benchtop or rackmount configuration. The Synergy CS can be configured with or without internal display.



Over 100 Built-in Analysis Functions

The most common and useful measurements don't even require a trip to the Analysis screen.

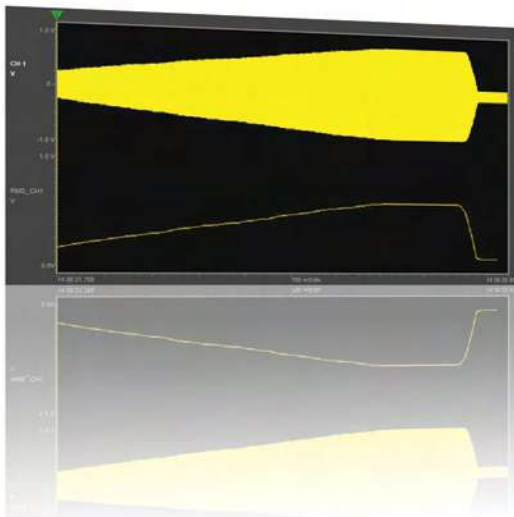
At a single keystroke, the maximum and minimum points of your waveforms are located and measured. At the touch of an icon, a Waveform Calculator instantly pops up statistics for all channels on screen such as Max, Min, RMS and Frequency. The waveforms and numeric measurements can be copied or dragged into Excel or any other Windows program.



When your analysis needs become more complicated, choose from over 100 built-in math functions including arithmetic, statistics, trigonometry, calculus, spectral and timing. Select the waveforms of interest, your measurement and the region to analyze, and a new trace or numeric result appears. Aspire™ even remembers each operation for repeat at a keystroke. With a click of the Auto-Repeat button, any sequence you perform once will be automatically updated every time you acquire new data.

Real-Time Analysis

All Synergy modules include a DSP in the data stream to provide virtual Math Channels, intelligent triggering and selectable digital filtering in real-time during recording. Not only can you record traces of True-RMS and Frequency of every channel, you can set a Trigger or Alarm output if any reading goes too high or too low, all with no need for cumbersome external dongles or expensive signal conditioners.



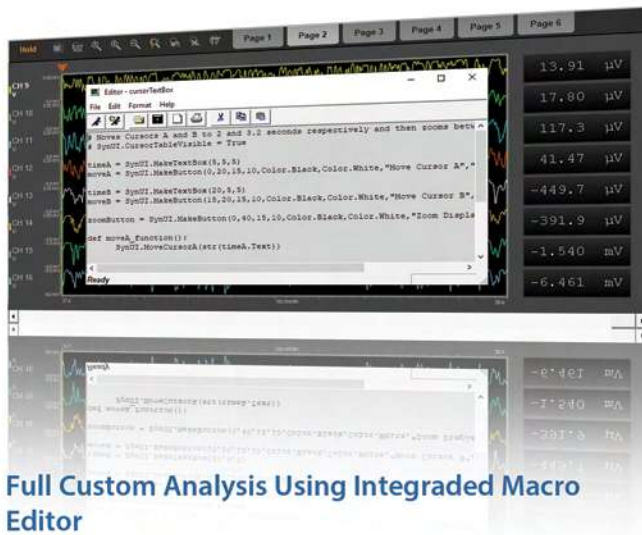
Test Cell Integration

An automated test cell typically includes a variety of instrumentation and signal generation. Synergy is equally at home as a DAQ resource in a cell environment, accepting remote commands and data transfers from a test controller over Ethernet. The controller might be a Windows PC running LabVIEW, a Mac or a Linux machine; the only requirement is an Ethernet port.



Unparalleled Analysis Capability

Your productivity depends on getting the results you need, so the Synergy Software includes a wide range of analysis and data reduction tools. Unlike lower performance PC solutions which rely solely on the PC to perform block-oriented calculations after an acquisition, we put a powerful array of DSPs directly in the data stream to enable real-time cycle-by-cycle measurements and on-the-fly data reduction. High-speed streaming data is analyzed at the full sample rate with results stored as new virtual channels or reduced to just the statistics of interest.



Full Custom Analysis Using Integrated Macro Editor

Synergy software includes a full macro editor based on the open-source Python language, which can communicate with other Windows applications and hardware. In addition to full control of Aspire™ setup, acquisition and analysis functions, Python can communicate with any other Windows applications and hardware. For example, the results of a specialized and complex calculation may be sent directly to an Excel spreadsheet, a Notepad log file, or even an analog output. Up to five user programs can be conveniently attached to buttons in the Aspire™ control panel for instant keystroke access.

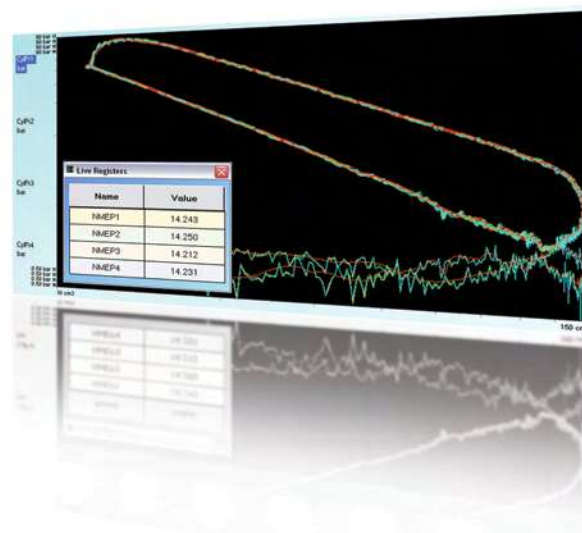
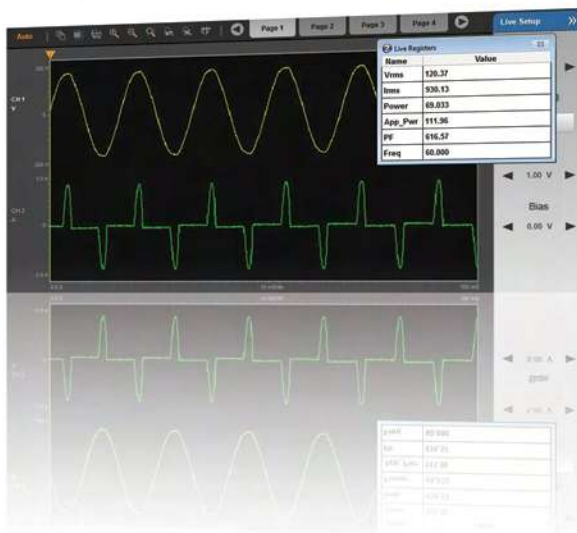


SYNERGY

Synergy Application Packs

Hi-Techniques has already created several software extensions for specialized applications. Our **Power Analyzer** package provides single-phase and three-phase power analysis, with true power, apparent power, harmonic analysis and other common measurements. With isolated input modules up to 1000 Vdc and 600 Vac, Synergy replaces a data recorder, an oscilloscope and a multi-phase power analyzer in one portable system.

Our **REvelation** internal combustion analyzer (ICA) package offers Pressure-Volume analysis for any type of piston engine from weed whackers to cargo ships. In the drive for fuel efficiency and optimal power, REvelation's ability to measure the power contribution of each cylinder in real time is indispensable.



	Synergy P	Synergy CS	Synergy 8
Mainframe			
Number of Input Slots	Accepts 4 modules (64 channels max)	Accepts 16 modules (256 channels max)	Accepts 8 modules (128 channels max)
Input Power	90-240 Vac, 47-63 Hz, 150 W max	90-240 Vac, 350 W max	90-240 Vac, 47-63 Hz, 200 W max,
Size W x H x D	42 cm x 33 cm x 16 cm (17" x 13" x 6.4")	45 cm x 36 cm x 46 cm (17.6" x 14" x 18") 8 rack units	44 cm x 22 cm x 30 cm (17.4" x 8.6" x 11.7") 5 rack units
Weight	Approx. 15 kg (32 lb.)	Approx. 32 kg (70 lb.) min, 41 kg (90 lb.) max	Approx. 16 kg (35 lb.) max
Operating Temperature	10 to 40 °C	10 to 40 °C	5 to 45 °C
Humidity	10% - 90%, non condensing	10% - 90%, non condensing	10% - 90%, non condensing
Shock	20g 11 ms half-sine, Mil-Std-810F, Procedure 1	10g 11 ms half-sine, Mil-Std-810F, Procedure 1	30g 11 ms half-sine, Mil-Std-810F, Procedure 1
Vibration	2g, 35-500 Hz, Mil-Std-810F, Procedure 1	2g, 35-500 Hz, Mil-810-F	5g, 35-500 Hz, Mil-810-F
Altitude	< 20,000 feet (6100 m)		
Interface	15.6" 1080p Touchscreen	Front Panel Start/Stop buttons, LED indicators for acquisition and network status	
PC I/O	2 USB 3.0, 2 USB2, 2 RS-232 Serial Ports, 2 DisplayPort, Audio In/Out & Mic* 2 RJ-45 Ethernet Ports, 2 PS/2 Keyboard/Mouse		

* Synergy 8 PC functions available by removing front access panel

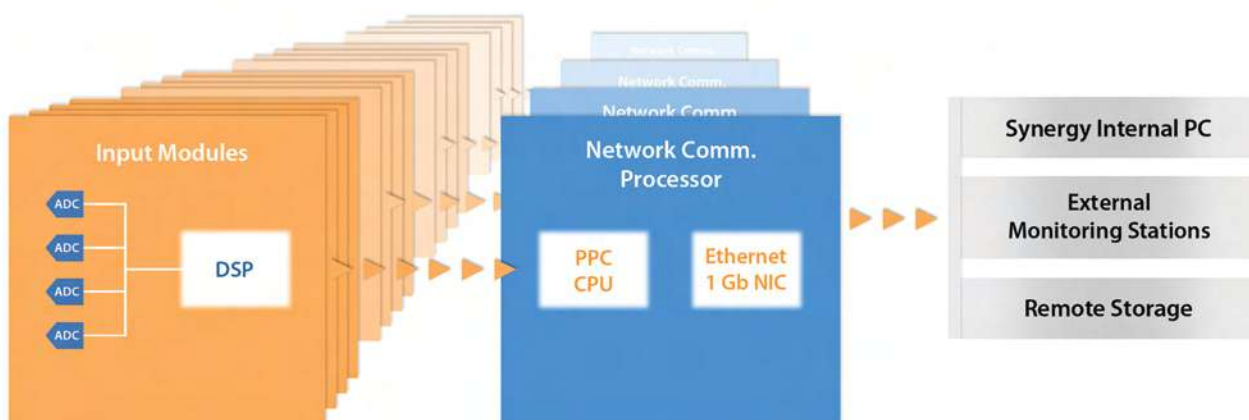
Connectivity and Control

Synergy includes a full-featured Windows PC with Gigabit Ethernet and high speed USB 3.0. Save your files to its internal SSD, to a USB flash drive, to your network, or any other medium. When you're in the office, connect any USB keyboard and mouse for convenient navigation. When you're on the plant floor, add a Wi-Fi adapter to stay in touch with your company network. With integrated PCIe card slots, USB 3.0 and our open software, system expansion possibilities (e.g., high speed video, digital data buses, ...) are unlimited. Synergy's dual video support enables independent display of multiple data sets. Control everything from the 1080p 15.6" touchscreen that supports pinch and zoom features.

Remote Control, Display and Storage from Any Network PC

Synergy's Ethernet architecture offers the advantage to stream high-speed data to an integrated PC or to a remote, networked PC or file server. Remote desktop operation allows control and realtime display even at extreme distances.

All Synergy systems include an additional software license for remote real-time control or analysis or offline analysis on a separate PC. Multiple user or site licenses are available. No software dongles or keys required.



Distributed Processing and Acquisition

The unique Synergy architecture is designed to maximize processing functions including real-time streaming and real-time math calculations. Each individual Synergy input module features its own Digital Signal Processor (DSP) directly in the data stream to perform real-time individual channel or channel-to-channel calculations as well as to perform real-time anti-alias filtering. Create up to 28 mathematically derived virtual channels per module including complex functions such as cycle-by-cycle RMS and Frequency. Real-time virtual channels can even be used as a trigger source.

Synergy's distributed processing approach also applies to streaming capabilities. Competitive systems often specify an aggregate sampling rate to disk often limited by a data processing bottleneck. Every four Input modules are connected to a Synergy Controller which pre-processes the data for the Gigabit Ethernet. Multiple Controller modules in the 16-slot Synergy CS and 8-slot Synergy 8 share the processing task to support maximum streaming to disk regardless of aggregate channel count.



Read more about the Synergy ADC architecture at www.hi-techniques.com/adc.html

Acquisition Specifications

Sample Rates	Decimal rates up to 100 MS/s to 0.5 S/s in 1, 2, 5 steps Binary rates up to 1.024 MS/s to 0.512 S/s Ext. clock up to 2 MS/s (>33K RPM at 3600 ppr)
Clock Accuracy	<50 ppm
Abs Time Accuracy	With IRIG/GPS option <1 us, PC time accuracy without
Transient Memory	64 or 128 MS per input module
Sweep length	64 samples to max transient memory in Scope mode, unlimited length in Recorder mode
Pre-Trigger	1 sample to 100% sweep length in scope mode, up to full disk in Recorder mode
Post-Trigger Delay	1 - 1E9 samples, 1 - 64K trigger events
Triggering	Any input channel, +/-dual slope with variable hysteresis; DSP-computed measurements from any channel, or External
Logical Trigger	OR of all channels, plus separate Gate input
Trigger Sequences	Up to 65,536 segments with time stamps
Signal Averaging	Up to 65,536 sweeps, selectable artifact rejection
ClearVU	Max/Min saved in real time for accurate live displays and fast review

Acquisition Modes

Recorder	80 kHz bandwidth, streaming to disk at up to 500 kS/s per channel with all channels recording. To 1 MS/s and 200 kHz bandwidth with reduced channels. In continuous mode, data can be saved to <i>Windows HD at full rate</i> or USB flash, RAID, server or other storage medium at media-dependent rates.
Scope/Transient	1 MHz to 20 MHz bandwidth, up to 100 MS/s 16-bit digitizer per channel. Single-shot or repetitive mode. High-speed transient RAM storage.
Frequency Analyzer	Real-time FFT analysis including Third Octave analysis up to 1 MHz with or without simultaneous time-domain displays.
Signal Averager	Both time-domain and frequency-domain averaging are provided to reduce noise and increase resolution.

Software Specifications

Operating System	Windows 10® 64-bit Pro
Control	Software runs on Synergy internal CPU or any networked PC
Channel Setup	Individual channel controls or spreadsheet setup
Auto Setup	Scans inputs for active signals to set range and timebase
Display Modes	Scope, stripchart, XY, FFT, Third-Octave, waterfall, zoom
Data Formats	SYN (Synergy Native Binary), Hi-Techniques DAT, several styles of single- and multi-channel ASCII, CSV, Matlab, RPC III, WFT, S3T, SIF Drag-and-drop of text or graphic data into any Windows application such as Microsoft Excel, Word, etc...

PC Options

All Synergys are equipped with a full-featured multi-core PC. Optional additions can tailor the PC functionality to your needs.

- Larger Solid State Drive
- Removable Hard Drive/Flash Drive
- Additional Memory
- Upgraded Processor
- Microsoft Office pre-installed
- Miniature keyboard for field use

Data Acquisition Options

Synergy's powerful data acquisition features can be enhanced with optional accessories.

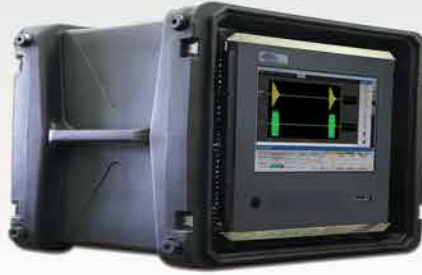
- Transient Capture up to 100 MS/s
- Extended Transient Memory
- USB Temperature Channels
- IRIG or GPS Timecode Input
- Advanced Spectral Analysis
- Alarm Output
- Master/Slave Cabling
- Breakout Cards and Cables
- Software Site Licenses
- Macro Programming
- REvelation Combustion Analysis
- Power Analysis

Accessories To Complement Your System

Cases



Hard Shipping Case for
Synergy P and 8



Shock Mounted Shipping
Case for Synergy CS



Soft Carrying Case
for Synergy P

Carts and Mounting Devices



Mobile Cart for Synergy CS
with keyboard tray and storage



VESA 100mm Mounting
Connectors allow a variety
of mounting solutions



Mobile Cart for
Synergy P

Breakout Connectors



Breakout Cable for
High Density Module



Breakout Module for
High Density Module



Breakout Module for
Enhanced Universal
Module



Breakout Module for
Universal Module
Supports Bridge Devices
and Thermocouples



EXPERIENCE TO GET THE JOB DONE

For nearly 35 years, Hi-Techniques has been a leader in high performance Data Acquisition Systems and Digital Oscilloscopes for the automotive, aerospace, power and industrial markets. Our systems are designed to offer out-of-the-box operation combining flexible hardware with user friendly software.

Please visit our website at www.hi-techniques.com for more details on these outstanding products.

Our products are backed by a network of trained professionals to ensure you get the most out of your Hi-Techniques purchase. Whether you need applications support, calibration/repair assistance or training, please visit our website to locate the representative in your area, or contact us directly at:

Hi-Techniques, Inc.
2515 Frazier Avenue
Madison, WI 53713, USA
Phone: +1.608.221.7500
Fax: +1.608.221.7509
www.hi-techniques.com