SPIDER SERIE

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SPIDER-20 & SPIDER-20E
HARDWARE SPECIFICATIONS (v1.31)

INTRODUCTION

The Spider-20 is a compact yet powerful digital data recorder and dynamic signal analyzer. It provides four 24-bit precise high-fidelity input channels, and a unique software-selectable tachometer-input/signal-source output channel (all using conventional BNC connectors). Each input is individually programmable to accept AC or DC voltage or output from an IEPE (ICP) sensor with built-in electronics.

The Spider-20 is a diminutive 5 5/16 x 45/16 x 15/16 inch tool weighing only 18 ounces. It has only three push-button controls and five LED status indicators. This little powerhouse can run over 6 hours on its internal rechargeable battery which can be replaced in field with a backup battery. It can also record data on its built-in 4GB flash memory at the simple push of a button.

The Spider-20 communicates with the world through its built-in Wi-Fi interface. Use your iPad to setup/view or record time histories. An iPad can also be used to perform spectrum analysis, measure frequency response, and perform coherence functions. Link the Spider-20 to your laptop or tablet running Windows and enjoy the full repertoire of functionality provided by our EDM (Engineering Data Management) software, including 1/nth Octave acoustic functions, Order Tracking for rotating machinery, Shock Response Spectra for drop testing, or Digital Filtering for special purpose analysis.

Transfer measured data to a truly massive storage space using the EDM Cloud server. EDM can be used to program your Spider-20 to perform a custom measurement or measurement sequence at the touch of its START button, making it an unintimidating and user-friendly tool. No computer, tablet or phone is required; just use your thumb and your Spider-20 operating in Black Box mode. Use our flexible Automated Schedule and Limiting software to turn the Spider-20 into an intelligent unattended monitor capable of responding to data conditions or networked instructions, notifying you of significant conditions via e-mail.

The Spider-20E is the Ethernet version of the Spider-20. The Spider-20E communicates with the world through an Ethernet interface. It requires an additional wireless router to communicate with an iPad.

The Spider-20 is the perfect solution to many applications including:

Machinery Diagnosis
Four inputs and a tachometer channel are the perfect size for many machinery monitoring tasks. Simultaneously measure two perpendicular proximity probes or horizontal and vertical bearing cap accelerations at both ends of a machine. Record this along with a 1/rev tachometer during startups and shutdowns to plot waterfalls and Campbell diagrams identifying resonances, critical speeds and unusual forcing functions. Use the same signal inputs to balance the machine. Place accelerometers on either side of a coupling to aid alignment.

Machine/Process Monitoring
Load a custom monitoring program employing our Automated Schedule and Limiting software and leave your Spider-20 to monitor speed and four dynamic inputs. Upon detecting an alarm-level limit (in the time or frequency domain), it can send you an email reporting the finding and make an immediate recording for more detailed analysis. For longer stays, leave the accessory AC power unit plugged in. This allows Spider-20 to draw power (6 Watts, maximum) from any 100 to 240 VAC (50/60 Hz) power line. Alternatively, you can provide a battery backup of 15 VDC (±10%) for more remote applications.

Modal Analysis
Four signal inputs allow you to measure a force and three accelerations. Use a fixed tri-axial accelerometer or up to 3 separate reference accelerometers and a force-transduced hammer to perform impulse studies (with redundant measurements). Alternatively, turn on the output channel and let the Spider drive a shaker with random noise while you rove a tri-axial around the structure, measuring 3 degrees of response freedom at a time. Switch the shaker drive to a sinewave at a detected resonance frequency to do a quick hand-and-ear mode shape analysis on the spot.

Acoustic Studies
Add an ICP microphone and your iPad or iPhone becomes a fully functioning sound level meter. Add 3 more and it becomes a multi-channel, multi-function sound level recorder and analyzer. Use it with an intensity probe for noise source localization. Take the Spider-20 on the road or in the air to record interior noise signatures during full-spectrum vehicle operation. Make and monitor pass-by measurements from the vehicle. Validate all of your recordings in-place on your tablet or laptop before returning to base.

Vehicle Dynamics
Record speed and four DC-coupled accelerometers to fully document chassis handling characteristics. Record any combination of acceleration, displacement, strain and sound to characterize annoying operational periods. Monitor engine and driveline vibration on your remote screen during road tests, whether you are the driver, a passenger or a standing observer.

Temporary Monitor
Let's face it – sometimes things just go wrong and we don't know why. This can happen in the factory or at a remote installation and occurs even with brand new products. The problem may be sonic or something shaking or breaking. The mission is always the same – find out what's causing the problem and correct it. A few simple measurements made over the course of a day or a week may provide the necessary clue to solve this annoying

mystery. The Spider-20 is ideal for such “detective work”. Through EDM it has a very flexible measurement repertoire and the ability to take various actions based upon instantaneous data conditions and other (networked) stimuli. The Spider-20 is small, silent, draws little power, and is inexpensive to replace. It’s the right kind of instrument to lock down in an unexpected place for an exploratory “look-and-see”.

A standard shipping package will include a Spider-20 unit with batteries installed, a pair of backup batteries, a battery charger, one 3ft BNC cable, an AC power adapter, CD for software, and the calibration certificate.

HARDWARE SPECIFICATIONS

Analog Input Channels

- Input Channels: 4
- Connector Type: isolated BNC
- Coupling: AC, DC, IEPE (ICP®)
- IEPE DC offset Voltage and Current: 21 V at 4.2 mA
- Input Type: Single-ended
- Input Range: ±0.1V, ±1V, ±10V
- Input Impedance: 500 kΩ
- Input Protection Voltage: ±40 Vpk
- AC Coupling: analog high-pass filter, -3 dB @ 0.3 Hz and -0.1 dB @ 0.7 Hz
- A/D Resolutions: 24 bit
- Anti-Aliasing Filter: analog anti-aliasing low-pass filters in addition to sigma-delta converters
- Digital Filter: high-pass and low-pass filters (user programmable)
- Input Dynamic Range: 100 dBFS
- Sampling Rate: 0.48 Hz to 102.4 kHz, with 54 stages
- Maximum Useful Bandwidth: 46.08 kHz
- THD: -90 dB (DC to 1 kHz)
- Amplitude Channel Match (1 kHz, 1V input): 0.02 dB
- Channel Phase Match: better than ±1.0 degree, up to 20 kHz
- Crosstalk: less than -100 dB
- Frequency Accuracy: ±250 ppm (typically ±0.25Hz margin at 1 kHz)
- Amplitude Accuracy (1 kHz, 1V input): 0.1% or better

Tachometer Input Channel

- Tachometer Input Channel: 1
- Connector Type: isolated BNC (shared with the Analog Output)
- Configuration: Tachometer or Output function selected by software
- Signal Type: analog or digital pulse train
- Input Range: ±10V
- Pulses/Revolution (N): 1
- Pulse Frequency Range: 0.05 – 5,000 Hz)
- Shaft RPM Range: 3/N – 300,000/N RPM

Analog Output Channel

- Output Channels: 1
- Connector Type: isolated BNC (shared with Tachometer Input)
- Configuration: Output or Tachometer function selected by software
- Output Waveform: sine, triangle, square, white random noise, DC, chirp, swept sine, arbitrary
- Output Range: ± 10 Volts
- D/A Resolution: 24 bit
- Sampling Rate: up to 102.4 kHz, synchronized with input channels
- Output Dynamic Range: 100 dB
- Maximum Output Current: 25 mA
- Sine Amplitude Accuracy: ±1% (0.34 dB) at 1 kHz for 0.1 Vpk to 5 Vpk
- Anti-Imaging Filter: 160 dB/octave

DC Power Input

- Connector Type: 5.5mm Jack connector (on rear panel)
- Voltage: 15 VDC (±10%)

Ground Connector (GND)

- Connector Type: 4.0mm Jack, not standard (on rear panel)

Control Buttons

- Power: top panel alternate action ON/OFF pushbutton
- Start: top panel push button initiates recording (or programmed function)
- Stop: top panel push button terminates recording (or programmed function)
- Reset: rear panel pin-switch

Indicating LEDs

- Power: steady red when the unit is ON, off otherwise
- Start/Stop: flashes green when recording or process has been started, off when stopped
- Battery: 50% < charge < 100% - steady green
- 15% < charge < 50% - steady yellow
- charge < 15% - flashing yellow
- charge = 0% - off
- Wi-Fi: green when Wi-Fi is connected, off otherwise
- Charging: green when battery is being charged, off otherwise

Network Communication

- Spider-20:
- Type: Built-in Wi-Fi router
- Compliance: IEEE 802.11b/g/n; 2.4 GHz band 802
- Transmit range: ~ 10 meters
- Spider-20E:
- Ethernet: 100Base-T, RJ45 female connector

Power Specifications

- Power Supply: interchangeable battery with DC charger interface
- Battery Hours: 6 hours or longer in full operation
- Charging Power: AC adaptor accepts 100 to 240 VAC (50/60 Hz), DC power 15 V (±10%)
- Power Consumption: less than 6W

Environmental Specifications

- Enclosure: 135mm x 109mm x 32.5mm
- Weight: 0.56kg
- On-Board Flash Memory: 4GB
- Internal Clock: maintains date and time
- Cooling: no cooling fan required
- Safety Standards: electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001
- Operating Temperature: -10 °C to +55 °C
- Storage Temperature: -20 °C to +70 °C
- Shock: 50 g’s, 315 in/sec, tested at 6 sides, non-operational test
- Shock: 50g, 7ms width, operational test
- Vibration: 5 – 500 Hz, 0.3 g, tested at 3 sides, operational test
- Vibration: 5 – 500 Hz, 2.42 g, tested at 3 sides, non-operational test

- Operating System Support: Windows 7 or higher
- Operating System Type: 32-bit or 64-bit
- Minimum Processor Speed: 1.5GHz Dual-Core x86
- Minimum RAM: 4 GB
- Minimum Free Space: 10 GB
- Solid Particle and Liquid Ingress Protection: IP 53

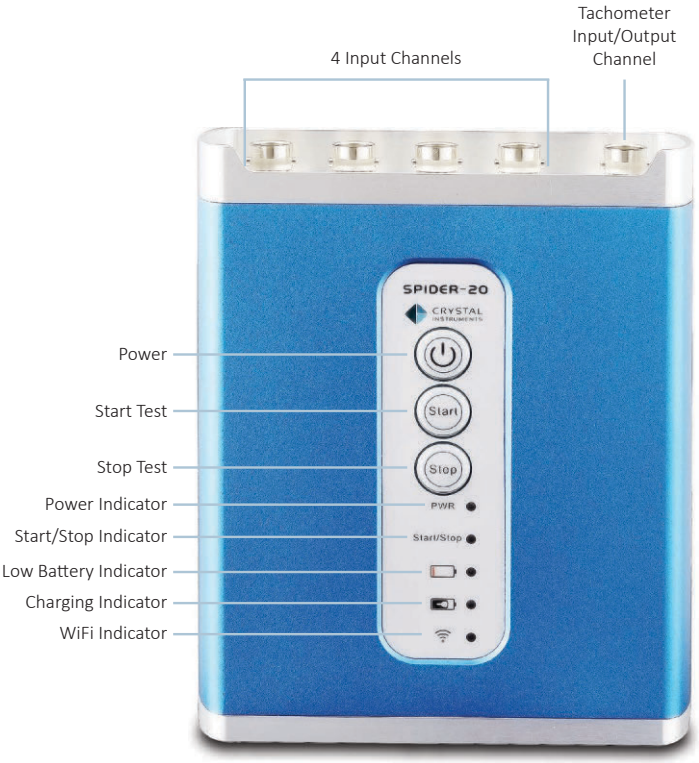
SUPPORTED SOFTWARE APPLICATIONS

EDM Dynamic Signal Analyzer DSA Mode Software (PC-based)

- Entry-level FFT Spectral Analysis (DSA-10-C04)
- FFT Spectral Analysis (DSA-10-C08)
- Octave Analysis and Sound Level Meters (SLM) (DSA-11-C08)
- Real-time Order Tracking and Order Analysis (DSA-12-C08)
- Swept Sine Analysis (DSA-13-C08)
- Real-time Sine Reduction (DSA-14-C08)
- Time Waveform Recording (DSA-20-C08)
- Automated Schedule and Limiting Test (DSA-24-C08)
- Real-time Digital Filters (DSA-25-C08)
- Shock Response Spectrum (SRS) Analysis (DSA-27-C08)
- Spider System Calibration Software (Spider-CAL)

EDM App - DSA mode in iOS (DSA-37) (iPad-based)

- FFT Spectral Analysis



SPIDER-80SG
HARDWARE SPECIFICATIONS (v6.1)

INTRODUCTION

The Spider-80SG is a high precision, general purpose data acquisition device featuring strain gage functionality. This device can be used in a variety of physical and measurement tests. The Spider-80SG can acquire data from a strain gage or a wide range of measurement quantities. A variety of general purpose and strain gage based sensors are supported. The Spider-80SG is built on the proven outstanding performance and reliability of Crystal Instruments' DSP-based hardware platform. It features the same form factor as other Spider-80X front-ends from Crystal Instruments and can be configured into one measurement system with excellent compatibility and scalability. This gives the Spider-80SG capabilities to reliably acquire data from multiple sensors and for multiple measurement quantities simultaneously.

The Spider-80SG front-end connects to the network switch of a PC using an Ethernet connection. When used with a strain gage, it measures the strain based on arriving signals, measuring the changes in resistance when the strain gauge is stretched or compressed. It can also be used to measure Force, Torque, Pressure, Acceleration, Velocity and Displacement. The Spider-80SG can be configured to output an excitation voltage to power up the sensors and measure a range of measurement quantities.

Pluggable front-ends provide the system with maximum flexibility of analog channel configuration, making it ideal for a range of measurement tests under various circumstances. The modular design allows configurations with 8 input channels of isolated analog inputs and one analog output.

With Crystal Instruments' unique Ethernet based time synchronization technology, multiple Spider-80SG front-ends can be chained together to construct a system with higher number of input channels.

Each Spider-80SG front-end has its own mass storage media that houses the operating software and stores measurement data. This truly distributed system guarantees data recording at full speed without being subject to network speed limitations.

Dual Modes of Excitation

The Spider-80SG is equipped with dual excitation modes. There is an option for Precision Excitation Voltage of ± 2.5V or ± 5V that can be used to excite a strain gage or a strain gage based sensor and measure the minute change in resistance accurately. It is also equipped with a user configurable DC power supply of 2.5V, 5V and 10V which can be used as an excitation voltage for a wide variety of sensors.

Remote Sensing

The Spider-80SG has been tested to work on strain gages up

to 1000 ft away from the analyzer using the remote sensing feature. Using an 18AWG 5 conductor cable to measure the excitation voltage using remote sensing and changes in output voltage, the error was measured to be less than 1.5% for up to signal frequencies of 10 KHz.

Use with Vibration Controller

The Spider-80SG's compatibility allows it to be chained together with Spider–80X front-end(s), extending the capabilities of the Spider-80SG to read and record general purpose measurements simultaneously while performing a vibration control test.

High Performance Hardware Capability

Since all the processing and data recording is executed locally inside the Spider-80SG, the front-end can be located far from the host PC and closer to the test article. This flexibility in location prevents the measurement results from being affected by the network connection limitations and other environmental errors. This decentralized and distributed structure greatly reduces the noise and electrical interference in the system. One PC can monitor and control multiple Spider-80SG front-ends over the network. With wireless network routers, the PC can easily connect to the Spider-80SG remotely via Wi-Fi.

Multiple Front-ends and Time Synchronization

The Spider-80SG is built on IEEE 1588 time synchronization technology. The Spider-80SG front-ends on the same network can be synchronized with up to 50 ns accuracy, which guarantees ±1 degree cross channel phase match up to 20 kHz. With such unique technology and high-speed Ethernet data transfer capability, the distributed components on the network truly act as one integrated system.

Black Box Mode: Run without PC

The Spider-80SG can operate in Black Box mode, which allows the measurements to take place without a PC. In this mode, a PC is used only to configure the Spider-80SG system before the system starts operating and to download data after the test is

complete. During the test, the system can operate according to a preset schedule or is controlled from a variety of external devices, such as a tablet or iPad.

Spider-80SG Features Overview
- 8 strain gage / general purpose inputs
- 24-bit ADC channel
- Supports multiple measurement quantities
- Supports a variety of Strain Gages, Load Cells, Pressure transducers, Torque sensors, Accelerometers and Geophones
- User selectable excitation voltage
- User configurable synchronized sampling rate
- Remote sensing: Measures strain accurately from up to 1000 ft cable length with up to 10 KHz frequency.
- Precision Excitation Voltage of ±2.5V and ±5V
- Power supply voltage of 2.5V, 5V and 10V for sensor excitation
- Shunt calibration
- Offset nulling for any measurement quantity
- Multiple trigger modes
- Compact, portable design
- Expandable using multiple front-ends

SPIDER-80SG HARDWARE SPECIFICATIONS

Measurement Channel Specifications
- Input Channels: 8 channels per front-end, expandable to 256 channels in a system
- Connector Type: 7-pin LEMO
- Coupling: DC Differential, AC Differential
- Excitation Voltage / Power Supply: 2.5V, 5V, 10V
- AC Coupling Cutoff Freq. @ -3dB: 0.375Hz
- Input Type: Differential
- Input Impedance: 1M Ω
- A/D Resolution: 24 bit
- Input Protection Voltage: +/-40Vpk
- Input Range: ±10mV, ±100mV, ±10V
- Sampling Rate per Channel: 0.48 Hz to 102.4 kHz, with 54 stages
- Maximum Useful Bandwidth: 46% of sampling rate
- Crosstalk: less than -130 dB
- Frequency Accuracy: better than 1/100,000
- Amplitude Accuracy: 0.1% typical
- Amplitude Accuracy (Extended Cable Length): Less than 1.5% (up to 10 KHz), cable length up to 1000 ft (18AWG)
- Noise Floor: 0.5 µV/V (10mV Range)
- DC Drift: 1.5 µV/V in 48 Hours
- Anti-Aliasing Filter: analog anti-aliasing filters
- Max Sampling rate: 102.4 kHz
- Digital Filter: digital high-pass and low-pass filters
- Total THD + Noise: -90dBfs (DC to 1 kHz)
- Amplitude Channel Match: 0.1dB
- Phase Channel Match: better than 0.3 degrees up to 20 kHz
- Common Mode Range: 100% input range
- Common Mode Rejection: better than 85 dB
- Shunt Calibration: Internal 100K Ω (0.1%, 25 ppm/c)
- Excitation Sense: local sensing and remote sensing

Strain Gage Functions:
- 120Ω, 350Ω Quarter Bridges (Type I,II, 3 – Wire Quarter Bridge)
- Half bridge (Type I,II)
- Full bridge (Type I,II)

Bridge Completion:
- 120 Ω / 350 Ω: 0.1%, 25 ppm/c
- Back Half resistor: 120 Ω/350 Ω, 0.1% 25 ppm/c

Bridge Completion:
- 120 Ω: 0.1%, 25 ppm/c
- Back Half resistor: 120 Ω/120 Ω, 0.1% 25 ppm/c

Excitation Voltage for Strain Gauge
- ±2.5V, ±5V
- Current: 30mA max/channel

Zero Suppression/Auto Balancing/Offset Nulling

Power Supply (Excitation Voltage for other kind of sensors): 2.5V, 5V, 10 V

Output Channel Specifications
- Channels: 1 output channel per front-end
- Configuration: Output for voltage calibration
- Connector Type: 2-pin LEMO
- D/A Resolution: 24 bit
- Max Output Frequency: 46 kHz
- Dynamic Range: 100 dB
- Output Impedance: 50 Ω
- Maximum Output Current: 25 mA
- Sine Amplitude Accuracy: ±1% (0.34 dB) for 0.1 to 5 Vpk, at 1 kHz
- Anti-Imaging Filtering: 160 dB/oct digital plus analog filters
- Digital Filter: high-pass and low-pass digital filters
- Source Waveforms: sine, triangle, square, white noise, DC, chirp, swept sine, arbitrary waveform
- Arbitrary Waveform Size Limit: 16,000 points typical. Special configuration allows up to 128,000 points.
- Output Range: ± 10 Volts

Isolated Digital Input and Output
- Connector: 25-pin female D-SUB
- External Circuit Power Supply: 3.3 – 12 VDC (±10%)
- Internal Power: 12 VDC 400 mA
- Maximum Allowable Distance of Signal Extension: 50 meters

Inputs
- Input Format: opto-isolated input (compatible with current-sink output)
- Number of Channels: 4
- Input Resistance: 6.1 kΩ
- Input On Current: 2.0 mA or more
- Input Off Current: 0.16 mA or less
- Interrupt: 8 input signals are arranged into a single interrupt output signal. An interrupt is generated either at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).

Outputs
- Output Format: opto-isolated input (current sink output)
- Number of Channels: 4
- Output Rating: output voltage 12 VDC max, output current 100 mA per channel max
- Residual Voltage with Output On: 1.0 V or less (Output current < 100 mA)
- Pulse Width: 47 ms
- Rise Time: 250 µs
- Fall Time: 50 µs

High Speed Data Port interfacing to Spider-NAS

- Connector Type: 5-pin LEMO
- Maximum distance of cable: 2 meters
- Data Transfer Speed: Higher than 819.2 K Sample/second

System Specifications

- On-Board Memory: 4 GB non-volatile flash memory, 32 MB DRAM
- Power Management: active and sleep mode
- Ethernet: 100Base-T, RJ45 female connector supports connection to PC or network switch
- Internal Clock: maintains date and time
- System Disaster Recovery: dedicated reset pin. Watch-dog based recovery can be enabled.
- Cooling: no cooling fan required

Network Protocols and IEEE 1588 Time Synchronization

Multiple Spider front-ends are synchronized through IEEE 1588 protocol. The synchronization accuracy is better than ±50 ns with a certified network switch. The data acquired by all the measurement channels will be synchronized. The phase match between channels across different Spider-Strain front-ends is within 1.0 degree at 20 kHz.

- IPv4 Protocol Stack: ICMP, IP, UDP, TCP, IGMP
- IPv4 Configuration: manual or via DHCP
- IEEE 1588v2 Protocol: PTP Ordinary clock, with both E2E and P2P synchronization supported and hardware level time-stamp for PTP event messages

Power Specifications

- Power Supply: external DC power
- External DC Power: AC adaptor accepts 100 to 240 VAC (50/60 Hz), DC power 15 V (±10%)/3 A
- Power Consumption: less than 15 watts

Environmental and General Specifications

Enclosure: sealed metal box, electrical safety compliant, rugged metal design, shock proof with integrated protective holster and internal EMI shielding.

- Size : 240 x 35 x 310 mm (w x h x l)
- Weight: 1.87 kg
- Electromagnetic Compatibility and Sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001
- Operating Temperature:-10 to +55 °C
- Storage Temperature -20 to +70 °C
- Shock: 50 g's, 315 in/sec, tested at 6 sides, non-operational test
- Vibration: 5 - 500 Hz, 0.3 gRMS, tested at 3 sides, operational test
- Vibration: 5 - 500 Hz, 2.42 gRMS, tested at 3 sides, non-operational test

Compatible Measurement Quantities and Suggested Sensors

Multiple sensors of various measurement quantities are supported with the Spider-80SG. The following list gives an overview of measurement quantities with sample sensors that are supported. The actual list of compatible sensors contains much more than specified here.

- Acceleration – Dytran 7603B, 7503, 7523A2, Endevco 7264C, Kistler Type 8395A, DTS 6DX PRO Series
- Force – Omega LCM 901, Futek FFP350
- Torque – Omega TQ-130 Series, Futek TDD400, Futek TRS300, Futek TAT200, TAT420
- Pressure – Omega PX309 series, Measurement Spec EB100, Futek PMP927
- Angular Velocity – DTS ARS Pro-300, ARS Pro-1500, ARS Pro-8K, ARS Pro-18k
- Displacement – Omega E2E-3DC Series
- Magnetic Field – Analog Devices AD22151
- Sound Pressure – InvenSense ICS40618
- Strain – Configurable as Quarter, Half or Full Bridge

Hardware/Software Compatibility Specifications

The Spider-80SG can be used with the following devices:

1. Spider-80X
2. Spider-81
3. Spider-NAS
4. Spider-HUB

Modes of Operation:

1. Standalone mode as a General Purpose Data acquisition device
2. In conjunction with Spider-80X for General purpose Data Acquisition
3. In conjunction with Spider-80X for general data acquisition during vibration control.

For further software specifications related to the Spider-80SG, please refer to the EDM DSA or EDM VCS specification documents by Crystal Instruments.

SPIDER-80X
HARDWARE SPECIFICATIONS (v6.1)

INTRODUCTION

The Spider-80X is a highly modular, truly distributed, scalable dynamic measurement system introduced by Crystal Instruments. It is ideal for a wide range of operations including vibration testing and machine condition monitoring for industries such as automotive, aviation, aerospace, electronics and military. The Spider-80X excels in industries that demand quick and accurate data recording in addition to real-time signal processing.

Multiple Spider front-ends can be combined to form a single high channel system. The Spider system can be arranged with various Spider front-ends and network switches to form different configurations. With multiple Spider-80X front-ends, a Spider system can have up to 64 input channels in a chassis and be chained up to hundreds of channels, with all channels sampled simultaneously. The maximum number of input channels for a Spider-80X system is 512. Multiple Spider front-ends are accurately synchronized through the IEEE 1588v2 protocol, ensuring all measurement channels are on the same time base. Accurate time synchronization results in excellent phase match in the frequency domain between all channels, either on the same Spider front-end or across different front-ends. Channel phase match, even between separate Spider front-ends, is within 1.0 degree at 20 kHz which is suitable for high quality structural and acoustics applications requiring cross channel measurement.

Spider-80X front-ends have voltage, IEPE, and optional charge types of input, which are ideal for shock, vibration, acoustic, or general purpose voltage measurements. Each Spider-80X front-end is equipped with 8 input channels and can accurately measure and record both dynamic and static signals. The mass flash memory can record 8 channels of streaming signals simultaneously at up to 102.4 kHz while computing real-time time and frequency based functions. Two output channels provide various signal output waveforms that are synchronized with the input sampling rate. Two tachometers sharing the connectors with outputs allow the system to measure the rotating pulse signals and conduct order tracking.

The Spider-80X front-ends can be controlled by a host PC or can operate in Black Box mode where a preprogrammed schedule is uploaded to the unit and started manually or based on event triggers. The ability to use any front-end in Black Box mode or in a distributed network system means that the user can place front-ends close to the measurement object, minimizing cable length and decreasing setup time.

The Spider-80X DSA front-end, Spider-80SG strain gage front-end, Spider-NAS storage device and Spider-HUB network switch all have the same physical form factor.

Performance

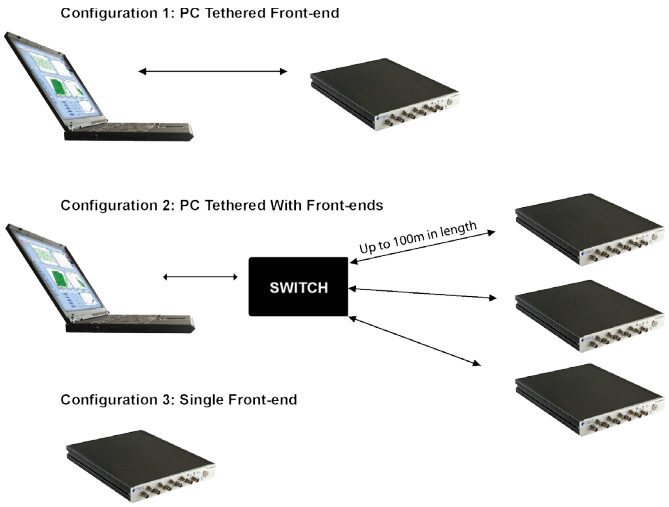
The Spider product line performance is the best in class with the highest dynamic range of any similar product. With patented technology, each measurement channel can detect signals as small as 6 µV and as large as ±20 V. Proprietary hardware technology delivers more than 150 dBFS dynamic range. The extremely high dynamic range eliminates the need for multiple front-end gain settings.

A high-speed floating point DSP manages the data input/output and real-time processing. The Spider-80X is also configured with RAM and onboard flash memory for mass data storage. Special thermal and low power design eliminates the need for a cooling fan.

Typical System Configurations

The Spider hardware platform supports two different software working modes: Black Box mode and PC Tethered mode. When the Spider front-end runs in Black Box mode, the preset projects can be executed based on a user-defined schedule. In PC Tethered mode, the PC is used as a control terminal to access the Spider through an Ethernet network. The Spider can be switched between the two modes. The PC Tethered mode is ideal for applications such as structural testing in a laboratory environment, while Black Box mode is ideal for remote monitoring.

The following figure illustrates some of the different configurations that are possible with the Spider system:



Configuration 1: PC Tethered with One Spider Front-End
One Spider front-end can be directly connected to a PC or to a LAN network through Ethernet. No switch is needed. The PC is used as a control and monitoring terminal via Crystal Instruments' EDM software.

Configuration 2: PC Tethered with Multiple Spider Front-Ends
Multiple Spider front-ends can be connected to make a high channel count system. Multiple switches, such as the SpiderHUB, can be used in cascade to extend the number of front-ends. The PC is used as a control and monitoring terminal via Crystal Instruments' EDM software.

Configuration 3: Black Box Mode with One Spider Front-End
This is the same as Configuration 1 except that the PC is not required during run time. A PC is required to install the Spider Black Box engine to the Spider front-end so it can run without a PC. The PC is only used to configure the Spider and download data files.

Input Channel Specifications
- Input Channels Installed per Front-end: 8
- Connector Type: BNC
- TEDS: IEEE 1451.4 compliant
- Coupling: AC, DC, IEPE (ICP®), and optional Charge (S80X-P44)
- IEPE DC offset Volt and Current: 4.2 mA at 21 V
- Input Type: Differential or Single-Ended
- Input Range: ±20 Vpk
- Input Impedance: 1 MΩ for differential; 500 kΩ for single-end
- Input Protection Voltage: ±220V (For hardware version 7.6.x)
- AC Coupling: analog high-pass filter at 0.3 Hz @ (-3 dB) and 0.7 Hz @ (-0.1 dB)
- A/D Resolutions: 2 x 24-bit (patented dual A/D technology per input channel)
- Anti-Aliasing Filter: analog anti-aliasing filters plus digital decimation technique
- Digital Filter: high-pass filters (user programmable)
- Dynamic Range: 150 dBFS
- Sampling Rate: 0.48 Hz to 102.4 kHz, with 54 stages
- Maximum Bandwidth: 46.08 kHz
- THD: -95 dB (SV sine, DC to 1kHz)
- Amplitude Channel Match (1 kHz, 1V input): 0.02 dB
- Channel Phase Match: < ±1.0 degree up to 20 kHz
- Crosstalk: less than -100 dB
- Frequency Accuracy: 0.00025%
- Common Mode Range: ±20 Vpk
- Amplitude Accuracy (1 kHz, 1V input): ± 0.1%

Tachometer Input Specifications
- Number of Tachometers: 2
- Connector type: BNC
- Configuration: Software configures the port as either output or tacho input
- Input Voltage Range of Rotating Pulses: zero to +/-10Vpk
- Maximum RPM: 300,000

Tacho channel 1 can be used for both pulse counting and order tracking measurement. Tacho channel 2, with 50MHz ultra-high counter resolution, is only used for pulse counting.

Output Channel Specifications
- Channels: 1 or 2 channels
- Connector Type: BNC
- D/A Resolution: 24-bits
- Max Output Frequency: 46 kHz
- Dynamic Range: 100 dB
- Output Impedance: 50 Ω
- Maximum Output Current: 250 mA (HW 7.4 and earlier: 25mA)
- Amplitude Accuracy (1 kHz, 1Vrms) : ±0.2%
- Anti-Imaging Filtering: 160 dB/oct digital plus analog filters
- Source Waveforms: sine, triangle, square, white noise, DC, chirp, swept sine, arbitrary waveform
- Arbitrary Waveform Size Limit: 16,000 points typical. Special configuration allows up to 128,000 points.
- Output Range: ± 10 Volts

Isolated Digital Input and Output
- Connector: 25-pin female D-SUB
- External Circuit Power Supply: 3.3 – 12 VDC (±10%)
- Internal Power: 12 VDC 400 mA
- Maximum Allowable Distance of Signal Extension: 50 meters

Inputs
- Input Format: opto-isolated input (compatible with current-sink output)
- Number of Channels: 4
- Input Resistance: 6.1 kΩ
- Input On Current: 2.0 mA or more
- Input Off Current: 0.16 mA or less
- Interrupt: 8 input signals are arranged into a single interrupt output signal. An interrupt is generated either at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).

Outputs
- Output Format: opto-isolated input (current sink output)
- Number of Channels: 4
- Output Rating: output voltage 12 VDC max, output current 100 mA per channel max
- Residual Voltage with Output On: 1.0 V or less (Output current < 100 mA)
- Pulse Width: 47 ms
- Rise Time: 250 µs
- Fall Time: 50 µs

High Speed Data Port interfacing to Spider-NAS
- Connector Type: 5-pin LEMO
- Maximum Distance of Cable: 2 meters
- Typical Aggregate Data Transfer Speed: Higher than 819.2 K Sample/second

System Specifications
- Total Memory: 4 GB flash memory used for system and data storage
- Total RAM: 32 MB
- Ethernet: 100Base-T, RJ45 female connector
- Serial Port: RS-485

LED Indicators
- RUN/STOP Status Indicator: run light green, stop lightless
- Flash Capacity Status Indicator: less than 60% green, between 60% and 90% yellow, between 90% and 100%, red.
- Power Indicator: power on/off
- LAN Indicator: communication active/inactive

Software Options
- The Spider-80X is compatible with all VCS or DSA software options from Crystal Instruments.

Network Protocols and IEEE 1588 Time Synchronization
Multiple Spider front-ends are synchronized through the IEEE 1588v2 protocol. The synchronization accuracy is better than ±100 ns when a specified network switch is used. The data acquired by all the measurement channels will be on the same time base. Phase match between channels across different Spider front-ends is within 1.0 degree at 20 kHz.

- IPv4 Protocol Stack: ICMP, IP, UDP, TCP, IGMP
- IPv4 Based Applications: DHCP Client
- IEEE 1588v2 Protocol: PTP ordinary clock, both E2E and P2P synchronization supported, hardware level timestamp for PTP event messages
- Time Synchronization Accuracy Between Front-Ends: ±100 ns or better (multiple Spider-80X front-ends connected by the Spider-HUB network switch)

Power Specifications (S80X-A11)
- Power Supply: 100 – 240 VAC (50/60 Hz), 12-22 V_{DC}
- Power Consumption: less than 12 Watts
- S80X-A11NA: power supply with LEMO adapter (North America)
- S80X-A11EU: power supply with LEMO adapter (Europe)
- S80X-A11UK: power supply with LEMO adapter (UK)

Environmental and General Specifications
- Enclosure: rugged sealed metal box, electrical safety compliant, and internal EMI shielding
- Dimensions: 240 x 35 x 310 mm (w x h x l)
- Weight: 2 kg
- Safety Standard: electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001
- Operational Temperature: -10 °C to +55 °C
- Storage Temperature: -20 °C to +70 °C
- Shock: 50 g's, 315 in/sec, tested at 6 sides, non-operational test
- Vibration: 5 – 500 Hz, 0.3 grms, tested at 3 sides, operational test
- Vibration: 5 – 500 Hz, 2.42 grms, tested at 3 sides, non-operational test

5 Slot and 8 Slot Enclosures (S80X-A35)
Description
Enclosure supports 5 or 8 Spider-80X front-ends (40 to 64 channels) and includes AC power supply, Ethernet switch, and cooling fans. The Spider-HUB network switch is included and is installed at the factory. Spider-NAS may be included when the proper option is purchased.

Specification
- Enclosure: metal box
- Available Slots: 5 or 8, depending on selection
- Power Supply: AC adaptor accepts 100 to 240 VAC (50/60 Hz)
- Fan Operation: turns on or off by a switch
- Dimension: 5-slot: 343 x 310 x 407 mm (w x h x l) (measured off the silver front cover, which is wider than the body)
- Dimension: 8-slot: 470 x 310 x 407 mm (w x h x l) (measured off the silver front cover, which is wider than the body)
- Weight : 8-slot with all front-ends installed : 80lb
  5-slot with all front-ends installed : 55lb
- Power consumption:
  8-slot with all front-ends installed: 100W
  5-slot with all front-ends installed: 70W

Configurations
- S80X-A35-5: 5-slot enclosure including power supply for up to 5 Spider-80X front-ends and a built-in Spider-HUB network switch. Shipping case is included.
- S80X-A35-5N: 5-slot enclosure including power supply for up to 5 Spider-80X front-ends and a built-in Spider-HUB network switch. Includes a built-in Spider-NAS storage device. Shipping case is included.
- S80X-A35-8: 8-slot enclosure including power supply for up to 5 Spider-80X front-ends and a built-in Spider-HUB network switch. Shipping case is included.
- S80X-A35-8N: 5-slot enclosure including power supply for up to 5 Spider-80X front-ends and a built-in Spider-HUB network switch. Includes a built-in Spider-NAS storage device. Shipping case is included.

Spider-80X Battery (Spider-BATTERY)

Specifications
- Enclosure: rugged sealed metal box, electrical safety compliant, and internal EMI shielding
- Size: 240 x 35 x 310 mm (w x h x l)
- Weight: 2.72 kg
- Battery: 194Wh (13.5Ah/14.4V)

(continued on next page)

Spider-80X Accessories

Travel Cases

- S80X-A45: ruggedized travel case (single system)
- S80X-A45-5: ruggedized travel case (5-slot system)
- S80X-A45-8: ruggedized travel case (8-slot system)

SPIDER-80Xi
HARDWARE SPECIFICATIONS (v1.1)

INTRODUCTION

The Spider-80Xi is a compact version of Spider-80X. The mechanical design of Spider-80Xi eliminated the enclosure of each modular card inside of chassis. Light weighted, it is ideal for the applications that the portability and size are critical to the usage while exchangeability of cards are not required.

Spider-80Xi system comes with two different chassis, one that can host up to 64 input channels, one up to 32 input channels. Multiple chassis can be chained up to hundreds of channels, all sampled simultaneously. Multiple Spider-80Xi front-ends are accurately synchronized through the IEEE 1588v2 protocol, making sure all measurement channels are on the same time base. Accurate time synchronization results in excellent phase match in the frequency domain between all channels, either on the same Spider front-end or across different front-ends. Channel phase match, even between separate Spider front-ends, is within 1.0 degree at 20 kHz which is suitable for high quality structural and acoustics applications requiring cross channel measurement.

The Spider-80Xi system with the 64 channel chassis is power by AC power, 100 to 240 VAC . The Spider-80Xi system with the 32 channel chassis is power by the DC power, 10V to 22V. The latter can be easily used together with an external battery pack. With Spider-Battery, a special model of battery CI developed, the 32 channel Spider-80Xi can run up to 4 hours without interruption.

Spider-80Xi front-ends have voltage, IEPE, which are ideal for shock, vibration, acoustic, or general purpose voltage measurements. The Spider product line performance is the best in class with the highest dynamic range of any similar product. With patented technology, each measurement channel can detect signals as small as 6 µV and as large as ±20 V. Proprietary hardware technology delivers more than 150 dBFS dynamic range. The extremely high dynamic range eliminates the need for multiple front-end gain settings.

Spider-80Xi can operate in Black Box mode which allows it to acquire data without a PC. In this mode, a PC is used only to configure the system before the test and then to download the data after the test is complete. During the test, the front-end can be operated according to a preset schedule or from a variety of external devices, such a Wi-Fi enabled PDA or iPad.

Spider-80Xi is equipped with powerful and flexible data acquisition functions. Continuous time data recording and spectral analysis can be initiated by many events including user operation, pre-set run schedule, alarm limit trigger, input trigger or digital input trigger. A high-performance removable 2.5-inch hard disk is used as a storage media inside Spider-80Xi. The default capacity of hard disk is 250GB. When recorded, data will be written in the NTFS file format. Data is extracted from

the hard disk using Crystal Instruments PC software to transfer data to the PC, or the hard disk can be physically removed and connected to another PC.

Input Channel Specifications

Number of Input Channels per chassis: 16, 24, 32, 48 or 64 when ordered with S80Xi-A35-8N, the 8 slot chassis; 16, 24, 32 when ordered with S80Xi-A35-4N, the 4 slot chassis. This is only factory configurable.

- Connector Type: BNC
- TEDS: IEEE 1451.4 compliant
- Coupling: AC, DC, IEPE (ICP®)
- IEPE DC offset Volt and Current: 4.2 mA at 21 V
- Input Type: Differential or Single-Ended
- Input Range: ±20 Vpk
- Input Impedance: 1 MΩ for differential; 500 kΩ for single-end
- Input Protection Voltage: ±40V
- AC Coupling: analog high-pass filter at 0.3 Hz @ (-3 dB) and 0.7 Hz @ (-0.1 dB)
- A/D Resolutions: 2 x 24-bit (patented dual A/D technology per input channel)
- Anti-Aliasing Filter: analog anti-aliasing filters plus digital decimation technique
- Digital Filter: high-pass filters (user programmable)
- Dynamic Range: 150 dBFS
- Sampling Rate: 0.48 Hz to 102.4 kHz, with 54 stages
- Maximum Bandwidth: 46.08 kHz
- THD: -95 dB (SV sine, DC to 1kHz)
- Amplitude Channel Match (1 kHz, 1V input): 0.02 dB
- Channel Phase Match: < ±1.0 degree up to 20 kHz
- Crosstalk: less than -100 dB
- Frequency Accuracy: 0.00025%
- Common Mode Range: ±20 Vpk
- Common Mode Rejection: better than 70 dB (typical)
- Amplitude Accuracy (kHz, 1V input): ± 0.1%
- LED indicator: displays the status of each channel in red or green

Tachometer Input Specifications

- Number of Tachometers: 2

- Connector type: BNC
- Configuration: Software configures the port as either output or tacho input
- Input Voltage Range of Rotating Pulses: zero to +/-10Vpk
- Maximum RPM: 300,000

Tacho channel 1 can be used for both pulse counting and order tracking measurement. Tacho channel 2 is with 50MHz ultra-high counter resolution, is only used for pulse counting.

Output Channel Specifications
- Channels: 2 channels
- Connector Type: BNC
- D/A Resolution: 24-bits
- Max Output Frequency: 46 kHz
- Dynamic Range: 100 dB
- Output Impedance: 50 Ω
- Maximum Output Current: 250 mA
- Amplitude Accuracy (1 kHz, 1Vrms) : ±0.2%
- Anti-Imaging Filtering: 160 dB/oct digital plus analog filters
- Source Waveforms: sine, triangle, square, white noise, DC, chirp, swept sine, arbitrary waveform
- Arbitrary Waveform Size Limit: 16,000 points typical. Special configuration allows up to 128,000 points.
- Output Range: ± 10 Volts

Isolated Digital Input and Output
Total 4 bits digital channels that can be configurable by the software to either input or output type.

- Connector: 9pin female D-SUB
- External Circuit Power Supply: 12 V_{DC} (±10%)
- Internal Power: 12 V_{DC} 400 mA
- Maximum Allowable Distance of Signal Extension: 50 meters

Digital Inputs
- Input Format: opto-isolated input (compatible with current-sink output)
- Number of Channels: 4 channel maximum
- Input Resistance: 6.1 kΩ
- Input On Current: 2.0 mA or more
- Input Off Current: 0.16 mA or less
- Interrupt: 8 input signals are arranged into a single interrupt output signal. An interrupt is generated either at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).

Digital Outputs
- Output Format: opto-isolated input (current sink output)
- Number of Channels: 4 channel maximum
- Output Rating: output voltage 12 VDC max, output current 100 mA per channel max
- Residual Voltage with Output On: 1.0 V or less (Output current < 100 mA)
- Pulse Width: 47 ms
- Rise Time: 250 µs
- Fall Time: 50 µs

Mass Storage
A high-performance removable Serial ATA (SATA) 2.5-inch hard disk is used as storage media. When recorded, data will be written in NTFS file format. Data is extracted from the Spider-NAS using Crystal Instruments software to transfer data to the PC. Alternatively, the SATA hard disk can be physically removed and connected to extract data to the PC.

When it is shipped, a solid state hard-drive with a capacity of 250GB is installed internally. The solid state drive performs very well in the high shock and vibration environment. A special error-checking algorithm developed by Crystal Instruments detects and avoids any errors that may occur in the data transfer and storage.

Time Synchronization
Through the Ethernet connection, multiple Spider-80Xi front-ends can be synchronized through the IEEE 1588v2 protocol. The synchronization accuracy is better than ±100 ns when a specified network switch is used. The data acquired by all the measurement channels will be on the same time base. Phase match between channels across different Spider front-ends is within 1.0 degree at 20 kHz.

Environmental and General Specifications
- Ethernet: 100Base-T Ethernet. RJ 45 connector
- Hard Buttons: Power, Fan On/Off, Start measurement, Stop measurement
- Cooling Fan: Manually controlled
- Grounding: Connect to common ground of power amplifier to reduce ground-loop interference. Connector Type: 0.166 inch (4.23 mm) jack connector for standard 0.166 inch banana plug
- Safety Standard: electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001
- Operational Temperature: -10 °C to +55 °C
- Storage Temperature: -20 °C to +70 °C
- Shock: 50 g's, 315 in/sec, tested at 6 sides, non-operational test
- Vibration: 5 – 500 Hz, 0.3 grms, tested at 3 sides, operational test
- Vibration: 5 – 500 Hz, 2.42 grms, tested at 3 sides, non-operational test

8 slot chassis (S80Xi-A35-8N)
- Enclosure: rugged sealed metal box, electrical safety compliant, and internal EMI shielding
- Power Supply: 100 – 240 VAC (47 – 440 Hz),
- Power Consumption: less than 90W when 64 channels configured
- Size: 274 X 259 X 298 mm (W x H x L)
- Total Weight: 10.4 kg when 64 channels configured

4 slot chassis (S80Xi-A35-4N)
- Enclosure: rugged sealed metal box, electrical safety compliant, and internal EMI shielding
- Power Supply: DC input, 10 VDC to 18 VDC
- Power Consumption: less than 50W when 32 channels configured
- Size: 194 X 259 X 298 mm (W x H x L)
- Total Weight: 7 kg when 32 channels configured
- Battery hours: 4 hours with Spider-Battery applied

ORDERING INFORMATION

Software Configuration

The Spider-80Xi is fully compatible with all EDM VCS or DSA software options that are developed for Spider-80X.

PC Requirements for EDM Software

- Operating System Support: Windows 7 or higher
- Operating System Type: 32-bit or 64-bit
- Minimum Processor Speed: 1.5GHz Dual-Core x86
- Minimum RAM: 4 GB
- Minimum Free Space: 10 GB

Hardware Part Numbers

Part Number	Short Description
S80Xi-P08	Spider-80Xi Front-end card: Eight Inputs
S80Xi-A35-4N	4-slot chassis with Switch and NAS
S80Xi-A35-8N	8-slot chassis with Switch and NAS

CRYSTAL INSTRUMENTS

SPIDER-81
HARDWARE SPECIFICATIONS (v7.7)

WWW.CRYSTALINSTRUMENTS.COM

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APPLICABLE HARDWARE VERSION

This document applies to hardware version 7.6x of the Spider-81 and Spider-81B. Hardware with version 7.3 or lower may have reduced functions and/or performance.

INTRODUCTION

The Spider-81 series is a highly modular, distributed, scalable vibration control system developed by Crystal Instruments. It represents the fourth generation of vibration control systems with advanced technology unavailable in the current generation.

DSP Centralized Architecture

Unlike traditional controllers that rely heavily on an external computer for real-time operations, the Spider-81 is the first controller that directly integrates time-synchronized Ethernet connectivity with embedded DSP technology. This greatly increases the control performance, system reliability, and failure protection of the controller. It also allows a large number of channels to be configured without sacrificing system performance.

Latest Hardware Design

The Spider-81 hardware modules have voltage, charge, and IEPE inputs which are ideal for shock, vibration, and acoustic measurement or general purpose voltage measurement. The internal flash memory stores test configuration data for controlling up to hundreds of channels simultaneously and stores real-time analysis data. Multiple output channels provide various signal output waveforms that are synchronized with the input sampling rate. A bright LCD displays testing status information. Ten monitoring connections on each unit are used to read signals of analog input and output. The front panel has intuitive buttons. There is a built-in isolated digital I/O to interface with other hardware.

Simple Network Connection

Ethernet connectivity allows the Spider-81 to be located far from the host PC. This distributed structure greatly reduces noise and electrical interference in the system. One PC monitors and controls multiple controllers over the network. Since the control processing and data recording are executed locally inside the controller, the network connection does not affect control reliability. With wireless network routers, a PC connects easily to the Spider-81 remotely via Wi-Fi.

Time Synchronization between Multiple Hardware Modules

The Spider-81 is built on IEEE 1588 PTP time synchronization technology (PTP-Precision Time Protocol). Spider-81 modules on the same network can be synchronized with up to 100 ns accuracy, which guarantees ±1 degree cross channel phase match up to 20 kHz. With such unique technology and high-speed Ethernet data transfer, the distributed components on the network truly act as one integrated system.

Black Box Mode: Operate without PC

The Spider-81 in Black Box mode enables operation without a PC. In this mode, a PC is used only to configure the control system before the system starts operation and to download data after the test is completed. During the test, the controller operates according to a preset schedule or from a connected iPad. Black Box mode is included with every Spider-81/81B.

For hardware with version 5.8 and lower, up to 4 tests are uploaded and stored on each module. For hardware with version 7.3 and higher, up to 8 tests are uploaded and stored on each module.

On-Board LCD Display

Each Spider-81 is equipped with a bright front-panel LCD that displays system status and test information. Real-time status such as control RMS or sweeping frequency is instantly viewed on the LCD.

Designed for High Reliability

The Spider-81 is the very first vibration control system designed for fail-safe operation even in the event of network or power loss. Advanced safety routines allow sensor failures to be detected within milliseconds. All Spider-81 hardware passes strict environmental tests including EMI, temperature, drop shock, sine and random vibration. The system is built to withstand the rigors of the testing environment with long-lasting durability. The unique floating ground design reduces ground loop problems typically found in testing laboratories. A power-backup circuitry based on super-capacitor is installed to prevent the unexpected power loss.

Designed for High Accuracy

Using a patented dual parallel A/D design, the Spider-81 is the first vibration control system that achieves 160 dBFS input dynamic range. Each measurement channel can detect signals as small as 6 μV and as large as 20 V. This design completely eliminates the need for the input range or gain settings found on traditional controllers.

Designed for High Control Performance

By using enhanced control algorithms and a simplified DSP architecture, the feedback loop time of Sine and Random control are all greatly reduced. A reduced control loop time gives much better capability for resonance search and dwell or control for a structure with high Q resonances. It also provides faster responses for better safety protection.

Ease of Use

The Spider-81 software is further improved at the user interface level. More graphical guidance, wizards, and tools are available to simplify setup. The interface has been reformatted to be more intuitive. Event-Action Rules, Abort-Sensitivity, and numerous other new concepts are introduced in the software to simplify operation. Keyword searching through a large number of tests is easy.

ASAM-ODS Data and File Model

ASAM is an international organization supported by more than 150 companies in the test and measurement industry. The Spider-81 is fully compliant with the ASAM-ODS data and file model. With ASAM-ODS, the engineering unit, user control, testing article description, and data exchange of the Spider-81 are all governed by the ASAM standard. The Spider-81 data is read by the software of LMS, Bruel & Kjaer, BBM, and many other providers.

Integrated with Dynamic Signal Analysis and Data Recording

The Spider-81 is integrated with general signal analysis functions including time stream recording, transient capture, FFT, auto power spectra, and transfer function analysis. Multiple Spider-81 modules work together to form one integrated system. Long waveform data recording is a built-in function.

iPad Control

The iPad app is available from the Apple App Store. The software runs on the iPad and accesses the Spider-81 hardware

when operating in Black Box mode. The iPad app enables users to access preloaded tests to run and control when they are mobile but within the range of the wireless network. Display window can show one or multiple signals. The user can print or email screen shots. For hardware versions 7.x and higher, up to 8 tests can be uploaded to the hardware for selection while running the iPad app.

Spider-81B, the Basic Version
The Spider-81B is designed to meet the requirements of basic vibration testing applications. It has 4 inputs, 1 output, and 4 pairs of digital I/O. Available software includes Random, Sine, Shock, and RSTD testing bundles.

The Spider-81B does not have an LCD display, cannot be extended to more than one module, and have less DIO ports than the Spider-81.

HARDWARE SPECIFICATIONS

Analog Input Channels

- **Input Channels per Spider-81 Front-End:** 4,6, 8
- **Max Input Channels per Spider-81 System:** 192
- **Input Channels per Spider-81B:** 2 , 4
- **Connector Type:** isolated BNC
- **TEDS:** IEEE 1451.4 compliant
- **Coupling:** AC Voltage, DC Voltage, Charge, or IEPE (ICP®)
- **IEPE DC Offset Voltage and Current:** 21 V at 4.2 mA
- **Charge Input:** 1,000 pC and 10,000 pC
- **Input Range:** ±20 Vpk
- **Input Impedance:** 1MΩ for differential and 500 kΩ for single-end
- **Input Protection Voltage:** ±220V (For hardware version 7.6.x)
- **AC Coupling:** analog high-pass filter, -3 dB @ 0.3 Hz and -0.1 dB @ 0.7 Hz
- **A/D Resolutions:** 2 x 24-bit (per input channel)
- **Anti-Aliasing Filter:** analog anti-aliasing low-pass filters in addition to sigma-delta converters
- **Digital Filter:** high-pass and low-pass filters (user programmable)
- **Input Dynamic Range:** 160 dBFS
- **Sampling Rate:** 0.48 Hz to 102.4 kHz, with 54 stages
- **Maximum Useful Bandwidth:** 46.08 kHz
- **THD:** -95 dBfs (DC to 1 kHz)
- **Amplitude Channel Match (1 kHz, 1V input):** 0.02 dB
- **Channel Phase Match:** better than ±1.0 degree, up to 20 kHz
- **Crosstalk:** less than -100 dB
- **Frequency Accuracy:** ±250 ppm (typically ±0.25Hz margin at 1 kHz)
- **Common Mode Range:** ±20 Vpk
- **Amplitude Accuracy (1 kHz, 1V input):** ± 0.1%

Analog Output Channels

- **Spider-81 Output Channels:** 2 (Additional 2 outputs reserved for future expansion)
- **Spider-81B Output Channels:** 1
- **Connector Type:** isolated BNC
- **D/A Resolution:** 24 bit
- **Sampling Rate:** up to 102.4 kHz per channel, synchronized with input channels
- **Output Dynamic Range:** 100 dB
- **Maximum Output Current:** 250 mA (HW 7.4 and earlier: 25mA)
- **Amplitude Accuracy (1 kHz,1Vrms):** ±0.2%
- **Anti-Imaging Filter:** 160 dB/oct digital and analog filters
- **Digital Filters:** high-pass and low-pass digital filters
- **Output Range:** ± 10 Volts
- **Frequency Accuracy:** ±250 ppm (typically ±0.25Hz margin at 1 kHz)

Isolated Digital Input and Output

- **Connector:** 25-pin female D-SUB
- **External Circuit Power Supply:** 3.3 – 12 VDC (±10%)
- **Internal Power:** 12 VDC 400 mA (For Spider-81B, only V7.5.x provide internal power)
- **Maximum Allowable Distance of Signal Extension:** 50 meters
- *Inputs*
  - **Input Format:** opto-isolated input (compatible with current-sink output)
  - **Spider-81 Channels:** 8
  - **Spider-81B Channels:** 4
  - **Input Resistance:** 6.1 kΩ
  - **Input On Current:** 2.0 mA or more
  - **Input Off Current:** 0.16 mA or less
  - **Interrupt:** 8 input signals are arranged into a single interrupt output signal. An interrupt is generated either at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).
- *Outputs*
  - **Output Format:** opto-isolated input (current sink output)
  - **Spider-81 Channels:** 8
  - **Spider-81B Channels:** 4
  - **Output Rating:** output voltage 12 VDC max, output current 100 mA per channel max
  - **Residual Voltage with Output On:** 1.0 V or less (Output current < 100 mA)
  - **Pulse Width:** 47 ms
  - **Rise Time:** 250 µs
  - **Fall Time:** 50 µs

High Speed Data Port interfacing to Spider-NAS
Not available on Spider-81B

- **Connector Type:** 5-pin LEMO
- **Maximum Distance of Cable:** 2 meters
- **Data Transfer Speed:** Higher than 819.2ksample/second.

Data saved in 32-bit single precision floating point. (Data from all input channels can be streamed to the Spider-NAS at rate of 102.4kHz per channel)

Front Panel LCD Display
Not available on Spider-81B

- **Display Area:** 115.05 x 28.65 mm
- **Color:** blue-green
- **Technology:** VFD, 8 level brightness, font size user customizable
- **LCD Control Buttons:** five buttons: left, right, up, down and enter

Ground Connection
- **Purpose:** connect to common ground of power amplifier to reduce ground-loop interference
- **Connector Type:** 0.166 inch (4.23 mm) jack connector for standard 0.166 inch banana plug

System Specifications
- **On-Board Memory:** 4 GB non-volatile flash memory, 32 MB DRAM
- **Ethernet:** 100Base-T, RJ45 female connector
- **Internal Clock:** maintains date and time
- **Cooling:** no cooling fan required

Network Protocols and IEEE 1588 Time Synchronization
Multiple Spider-81 front-ends are synchronized through the IEEE 1588 protocol. The synchronization accuracy is better than ±100 ns when using a certified network switch, such as the Spider-HUB. Data acquired by all the measurement channels will be synchronized and the phase match across different Spider modules is within 1.0 degree of 20 kHz.

- **IPv4 Protocol Stack:** ICMP, IP, UDP, TCP, IGMP
- **IPv4 Configuration:** manual or via DHCP
- **IEEE 1588v2 Protocol:** PTP ordinary clock, with both E2E and P2P synchronization supported and hardware level timestamp for PTP event messages. Not available on Spider-81B
- **Time Sync Accuracy for Sampling Clocks Between Front-ends:** ±100 ns or better (Multiple Spider-81 front-ends connected by specified switch)

Power Specifications
- **Power Supply:** external DC power
- **External DC Power:** AC adaptor accepts 100 to 240 VAC (50/60 Hz), DC power 15 V (±10%)/3A
- **Power Consumption:** less than 18 watts

Environmental and General Specifications
- **Enclosure:** metal box compliant with CE electrical safety and EMI shielding standards
- **Spider-81 Dimension:** 440 x 66 x 330 mm (W x H x D)
- **Spider-81B Dimension:** 220 x 66 x 276 mm (W x H x D)
- **Weight:**
  - **Spider-81:** 4.8kg
  - **Spider-81B:** 2.56kg
- **Safety Standards:** electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001
- **Operating Temperature:** -10 °C to +55 °C
- **Storage Temperature:** -20 °C to +70 °C
- **Shock:** 50 g's, 315 in/sec, tested at 6 sides, non-operational test
- **Vibration:** 5 – 500 Hz, 0.3 g, tested at 3 sides, operational test
- **Vibration:** 5 – 500 Hz, 2.42 g, tested at 3 sides, non-operational test

APPENDIX 1: SPIDER SERIES COMPARISON

	Spider-81	Spider-81B	Spider-80X	Spider-80Xi
Number of Inputs	8 per module expandable to 512	2, 4 not-expandable	8 per module expandable to 512	8 per module expandable to 512
Number of Outputs	4	1	2	2
Input Mode	Charge TEDS IEPE Voltage	Charge TEDS IEPE Voltage	Charge (external) TEDS IEPE Voltage	Charge (external) TEDS IEPE Voltage
Digital I/O	8 in/out, isolated	4 in/out, isolated	4 in/out, isolated	4 in/out, isolated
Front Panel LCD	Yes	No	No	No
High Speed Data Port	Yes	No	Yes	Yes
Analog Monitor Channels	Yes	No	No	No
Notes	Flagship product for VCS line. Input protection up to 220V. Equipped with Stop/Start button	Economical solution	Target at all VCS, Modal and DSA application. Modular at box level.	Compact version of Spider-80X. Target at all VCS, Modal and DSA application. Modular at PCB board level.

APPENDIX 2: TYPICAL SYSTEM CONFIGURATIONS

The Spider hardware platform can operate in two working modes: Black Box and PC Tethered mode. When Spider runs in Black Box mode, preset projects are executed based on a user defined schedule. In PC tethered mode, the PC is used as a control terminal to access the Spider through an Ethernet network. The Spider can switch between the two modes during tests. The PC Tethered mode is ideal for applications such as structural testing in a laboratory environment. The Black Box mode is ideal for remote monitoring. The connection between your PC and LAN is either wired or wireless.

PC Tethered with One Spider Front-End

One Spider-81 is directly connected to a PC or to a LAN network through Ethernet. No switch is needed. The PC is used as a control and monitoring terminal via the EDM software.

PC Tethered with Multiple Spider Front-Ends

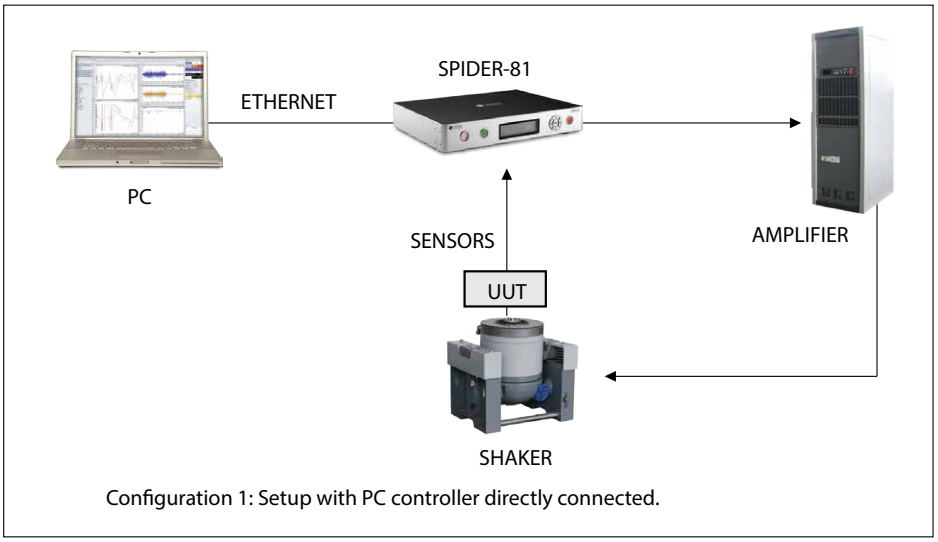
Multiple Spider modules are connected to form a high channel count system. Multiple switches are cascaded to extend the number of modules. For example, to make a 64 channel system, a Spider-81 and 7 Spider-80X's can be used. The PC is used as a control and monitoring terminal via the EDM software.

Black Box Mode with One Spider Front-End

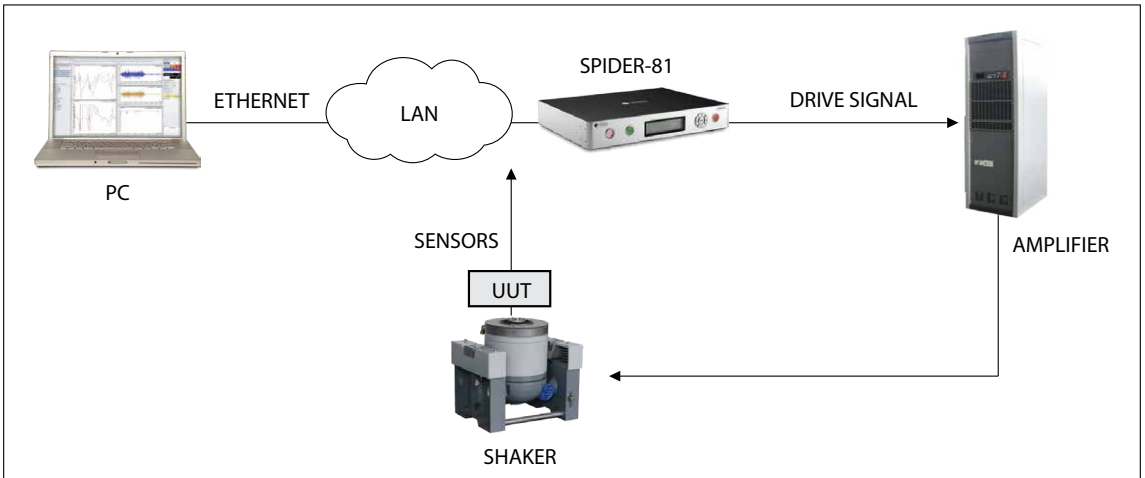
This is the same as Configuration 1 except that the PC is not required during run time. A PC is required to install the Spider Black Box engine to the Spider module, and is used to configure the Spider and to download data files.

The following figures illustrate some of the many configurations that are possible with the Spider system.

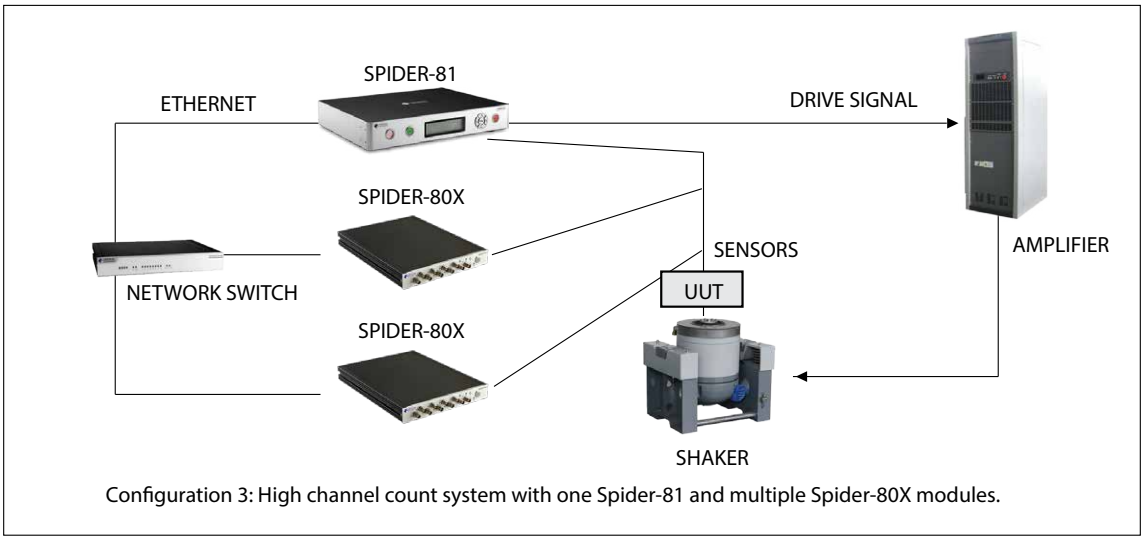
(see next page.)



Configuration 1: Setup with PC controller directly connected.



Configuration 2: Spider VCS controlled remotely through a LAN. The network can be wired or wireless.



Configuration 3: High channel count system with one Spider-81 and multiple Spider-80X modules.

SPIDER-81
HARDWARE SPECIFICATIONS (v6.0)

APPLICABLE HARDWARE VERSION

This document applies to hardware version 7.4 of the Spider-81 and Spider-81B. Hardware with version 7.3 or lower may have reduced functions and/or performance.

INTRODUCTION

This document applies to hardware version 7.4 of the Spider-81 and Spider-81B. Hardware with version 7.3 or lower may have reduced functions and/or performance.

The Spider-81 series is a highly modular, distributed, scalable vibration control system developed by Crystal Instruments. It represents the fourth generation of vibration control systems with advanced technology unavailable in the current generation.

DSP Centralized Architecture

Unlike traditional controllers that rely heavily on an external computer for real-time operations, the Spider-81 is the first controller that directly integrates time-synchronized Ethernet connectivity with embedded DSP technology. This greatly increases the control performance, system reliability, and failure protection of the controller. It also allows a large number of channels to be configured without sacrificing system performance.

Latest Hardware Design

The Spider-81 hardware front-ends have voltage, charge, and IEPE inputs which are ideal for shock, vibration, and acoustic measurement or general purpose voltage measurement. The internal flash memory stores test configuration data for controlling up to hundreds of channels simultaneously and stores real-time analysis data. Multiple output channels provide various signal output waveforms that are synchronized with the input sampling rate. A bright LCD displays testing status information. Ten monitoring connections on each unit are used to read signals of analog input and output. The front panel has intuitive buttons. There is a built-in isolated digital I/O to interface with other hardware.

Simple Network Connection

Ethernet connectivity allows the Spider-81 to be located far from the host PC. This distributed structure greatly reduces noise and electrical interference in the system. One PC monitors and controls multiple controllers over the network. Since the control processing and data recording are executed locally inside the controller, the network connection does not affect control reliability. With wireless network routers, a PC connects easily to the Spider-81 remotely via Wi-Fi.

Time Synchronization between Multiple Hardware Front-ends

The Spider-81 is built on IEEE 1588 PTP time synchronization technology (PTP-Precision Time Protocol). Spider-81 front-ends on the same network can be synchronized with up to 100 ns accuracy, which guarantees ±1 degree cross channel phase

match up to 20 kHz. With such unique technology and high-speed Ethernet data transfer, the distributed components on the network truly act as one integrated system.

Black Box Mode: Operate without PC

The Spider-81 in Black Box mode enables operation without a PC. In this mode, a PC is used only to configure the control system before the system starts operation and to download data after the test is completed. During the test, the controller operates according to a preset schedule or from a connected iPad. Black Box mode is included with every Spider-81 and Spider-81B.
For hardware with version 5.8 and lower, up to 4 tests are uploaded and stored on each front-end. For hardware with version 7.3 and higher, up to 8 tests are uploaded and stored on each front-end.

On-Board LCD Display

Each Spider-81 is equipped with a bright LCD front-panel that displays system status and test information. Real-time status such as control RMS or sweeping frequency is instantly viewed on the LCD.

Designed for High Reliability

The Spider-81 is the very first vibration control system designed for fail-safe operation even in the event of network or power loss. Advanced safety routines allow sensor failures to be detected within milliseconds. All Spider-81 hardware passes strict environmental tests including EMI, temperature, drop shock, sine and random vibration. The system is built to withstand the rigors of the testing environment with long-lasting durability. The unique floating ground design reduces ground loop problems typically found in testing laboratories. A power-backup circuitry based on super-capacitor is installed to prevent the unexpected power loss.

Designed for High Accuracy

Using a patented dual parallel A/D design, the Spider-81 is the first vibration control system that achieves 150 dBFS input dynamic range. Each measurement channel can detect signals as small as 6 μV and as large as 20 V. This design completely eliminates the need for the input range or gain settings found on traditional controllers.

Designed for High Control Performance
By using enhanced control algorithms and a simplified DSP architecture, the feedback loop time of Sine and Random control are all greatly reduced. A reduced control loop time gives much better capability for resonance search and dwell or control for a structure with high Q resonances. It also provides faster responses for better safety protection.

Ease of Use
The Spider-81 software is further improved at the user interface level. More graphical guidance, wizards, and tools are available to simplify setup. The interface has been reformatted to be more intuitive. Event-Action Rules, Abort-Sensitivity, and numerous other new concepts are introduced in the software to simplify operation. Keyword searching through a large number of tests is easy.

ASAM-ODS Data and File Model
ASAM is an international organization supported by more than 150 companies in the test and measurement industry. The Spider-81 is fully compliant with the ASAM-ODS data and file model. With ASAM-ODS, the engineering unit, user control, testing article description, and data exchange of the Spider-81 are all governed by the ASAM standard. The Spider-81 data is read by the software of LMS, Bruel & Kjaer, BBM, and many other providers.

Integrated with Dynamic Signal Analysis and Data Recording
The Spider-81 is integrated with general signal analysis functions including time stream recording, transient capture, FFT, auto power spectra, and transfer function analysis. Multiple Spider-81 front-ends work together to form one integrated system. Long waveform data recording is a built-in function.

iPad Control
The iPad app is available from the Apple App Store. The software runs on the iPad and accesses the Spider-81 hardware when operating in Black Box mode. The iPad app enables users to access preloaded tests to run and control when they are mobile but within the range of the wireless network. The display window can show one or multiple signals. The user can print or email screen shots. For hardware versions 7.x and higher, up to 8 tests can be uploaded to the hardware for selection while running the iPad app.

Spider-81B, the Basic Version
The Spider-81B is designed to meet the requirements of basic vibration testing applications. It has 4 inputs, 1 output, and 4 pairs of digital I/O. Available software includes Random, Sine, Shock, and RSTD testing bundles.

The Spider-81B does not have an LCD display, cannot be extended to more than one front-end, and has less DIO ports than the Spider-81.

HARDWARE SPECIFICATIONS

Analog Input Channels
- Input Channels per Spider-81 Front-End: 4,6, 8
- Max Input Channels per Spider-81 System: 256
- Input Channels per Spider-81B: 2, 4
- Connector Type: isolated BNC
- TEDS: IEEE 1451.4 compliant
- Coupling: AC Voltage, DC Voltage, Charge, or IEPE (ICP®)
- IEPE DC Offset Voltage and Current: 21 V at 4.2 mA
- Charge Input: 10,000 pC and 49,000 pC
- Input Range: ±20 Vpk
- Input Impedance: 1MΩ for differential and 500 kΩ for single-end
- Input Protection Voltage: ±40 Vpk
- AC Coupling: analog high-pass filter, -3 dB @ 0.3 Hz and -0.1 dB @ 0.7 Hz
- A/D Resolutions: 2 x 24-bit (per input channel)
- Anti-Aliasing Filter: analog anti-aliasing low-pass filters in addition to sigma-delta converters
- Digital Filter: high-pass and low-pass filters (user programmable)
- Input Dynamic Range: 150 dBFS
- Sampling Rate: 0.48 Hz to 102.4 kHz, with 54 stages
- Maximum Useful Bandwidth: 46.08 kHz
- THD: -95 dBfs (DC to 1 kHz)
- Amplitude Channel Match(1 kHz, 1V input): 0.02 dB
- Channel Phase Match: better than ±1.0 degree, up to 20 kHz
- Crosstalk: less than -100 dB
- Frequency Accuracy: ±250 ppm (typically ±0.25Hz margin at 1 kHz)
- Common Mode Range: ±20 Vpk
- Amplitude Accuracy (1 kHz, 1V input): ± 0.1%

Analog Output Channels
- Spider-81 Output Channels: 2 (Additional 2 outputs reserved for future expansion)
- Spider-81B Output Channels: 1
- Connector Type: isolated BNC
- D/A Resolution: 24 bit
- Sampling Rate: up to 102.4 kHz per channel, synchronized with input channels
- Output Dynamic Range: 100 dB
- Maximum Output Current: 250 mA (HW 7.4 and earlier: 25mA)
- Amplitude Accuracy(1 kHz,1Vrms): ±0.2%
- Anti-Imaging Filter: 160 dB/oct digital and analog filters
- Digital Filters: high-pass and low-pass digital filters
- Output Range: ± 10 Volts
- Frequency Accuracy: ±250 ppm (typically ±0.25Hz margin at 1 kHz)

Isolated Digital Input and Output
- Connector: 25-pin female D-SUB
- External Circuit Power Supply: 3.3 – 12 VDC (±10%)
- Internal Power: 12 VDC 400 mA (For Spider-81B, only V7.5.x provide internal power)
- Maximum Allowable Distance of Signal Extension: 50 meters

Inputs
- Input Format: opto-isolated input (compatible with current-sink output)
- Spider-81 Channels: 8
- Spider-81B Channels: 4
- Input Resistance: 6.1 kΩ
- Input On Current: 2.0 mA or more
- Input Off Current: 0.16 mA or less
- Interrupt: 8 input signals are arranged into a single interrupt output signal. An interrupt is generated either at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).

Outputs
- Output Format: opto-isolated input (current sink output)
- Spider-81 Channels: 8

System Specifications
- Spider-81B Channels: 4
- Output Rating: output voltage 12 VDC max, output current 100 mA per channel max
- Residual Voltage with Output On: 1.0 V or less (Output current < 100 mA)
- Pulse Width: 47 ms
- Rise Time: 250 µs
- Fall Time: 50 µs

Analog Monitoring Channels
Not available on Spider-81B
- Purpose: voltage replication of each input and output channel
- Number of Channels: 10 (8 analog inputs, 2 analog outputs.)
- Connector Type: 25-pin female D-SUB
- Monitoring Magnitude: 50% of input channel
- Output Format: single-ended
- Output Rating: 10 VDC max, 25 mA per channel max

High Speed Data Port interfacing to Spider-NAS
- Not available on Spider-81B
- Connector Type: 5-pin LEMO
- Maximum distance of cable: 2 meters
- Data Transfer Speed: Higher than 819.2ksample/second. Data saved in 32-bit single precision floating point. (Data from all input channels can be streamed to the Spider-NAS at rate of 102.4kHz per channel)

Front Panel LCD Display
- Not available on Spider-81B
- Display Area: 115.05 x 28.65 mm
- Color: blue-green
- Technology: VFD, 8 level brightness, font size user customizable
- LCD Control Buttons: five buttons: left, right, up, down and enter

Ground Connection
- Purpose: connect to common ground of power amplifier to reduce ground-loop interference
- Connector Type: 0.166 inch (4.23 mm) jack connector for standard 0.166 inch banana plug

System Specifications
- On-Board Memory: 4 GB non-volatile flash memory, 32 MB DRAM
- Ethernet: 100Base-T, RJ45 female connector
- Internal Clock: maintains date and time
- Cooling: no cooling fan required

Network Protocols and IEEE 1588 Time Synchronization
Multiple Spider-81 front-ends are synchronized through the IEEE 1588 protocol. The synchronization accuracy is better than ±100 ns when using a certified network switch, such as the Spider-HUB. Data acquired by all the measurement channels will be synchronized and the phase match across different Spider modules is within 1.0 degree of 20 kHz.

- IPv4 Protocol Stack: ICMP, IP, UDP, TCP, IGMP
- IPv4 Configuration: manual or via DHCP
- IEEE 1588v2 Protocol: PTP ordinary clock, with both E2E and P2P synchronization supported and hardware level timestamp for PTP event messages. Not available on Spider-81B
- Time Sync Accuracy for sampling clocks between modules: ±100 ns or better (Multiple Spider-81 modules connected by specified switch)

Power Specifications
- Power Supply: external DC power
- External DC Power: AC adaptor accepts 100 to 240 VAC (50/60 Hz), DC power 15 V (±10%)/3A
- Backup Super Capacitor: 8 seconds for emergency shutdown
- Power Consumption: less than 18 watts

Environmental and General Specifications
- Enclosure: metal box compliant with CE electrical safety and EMI shielding standards
- Spider-81 Dimension: 440 x 66 x 330 mm (W x H x D)
- Spider-81B Dimension: 220 x 66 x 276 mm (W x H x D)
- Weight: 4.2 kg
- Safety Standards: electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001
- Operating Temperature: -10 °C to +55 °C
- Storage Temperature: -20 °C to +70 °C
- Shock: 50 g's, 315 in/sec, tested at 6 sides, non-operational test
- Vibration: 5 – 500 Hz, 0.3 g, tested at 3 sides, operational test
- Vibration: 5 – 500 Hz, 2.42 g, tested at 3 sides, non-operational test

APPENDIX 1: SPIDER-81 SERIES COMPARISON				
	Spider-81	**Spider-80X**	**Spider-81B**	**Spider-81C**
Number of Inputs	8 expandable to 256	8 expandable to 512	2, 4 not-expandable	2 not-expandable
Number of Outputs	4	2	1	1
Input Mode	Charge TEDS IEPE AC-Differential DC-Differential AC-Single End DC-Single End	Charge (optional) TEDS IEPE AC-Differential DC-Differential AC-Single End DC-Single End	Charge (optional) TEDS IEPE AC-Differential DC-Differential AC-Single End DC-Single End	Charge TEDS IEPE AC-Differential DC-Differential AC-Single End DC-Single End
Digital I/O	8 in/out, isolated	4 in/out, isolated	4 in/out, isolated	4 in/out, isolated
Backup Power Capacitor	Yes	Yes	Yes	Yes
Available Software Bundles	Silver, Gold	Silver, Gold	Bronze, Silver, Gold	EDM App
Front Panel LCD	Yes	No	No	No
High Speed Data Port	Yes	Yes	No	No
Analog Monitor Channels	Yes	No	No	No
Built-in Wi-Fi router	No	No	No	Yes

APPENDIX 2: TYPICAL SYSTEM CONFIGURATIONS

The Spider hardware platform can operate in two working modes: Black Box and PC Tethered mode. When the Spider runs in Black Box mode, preset projects are executed based on a user defined schedule. In PC tethered mode, the PC is used as a control terminal to access the Spider through an Ethernet network. The Spider can switch between the two modes during tests. The PC Tethered mode is ideal for applications such as structural testing in a laboratory environment. The Black Box mode is ideal for remote monitoring. The connection between your PC and LAN is either wired or wireless.

PC Tethered with One Spider Front-End

One Spider-81 is directly connected to a PC or to a LAN network through Ethernet. No switch is needed. The PC is used as a control and monitoring terminal via the EDM software.

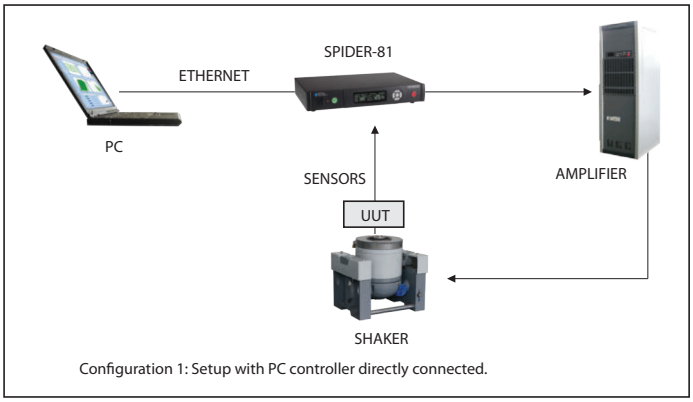
PC Tethered with Multiple Spider Front-Ends

Multiple Spider front-ends are connected to form a high channel count system. Multiple switches are cascaded to extend the number of front-ends. For example, to make a 64 channel system, a Spider-81 and 7 Spider-80X's are used. The PC is used as a control and monitoring terminal via the EDM software.

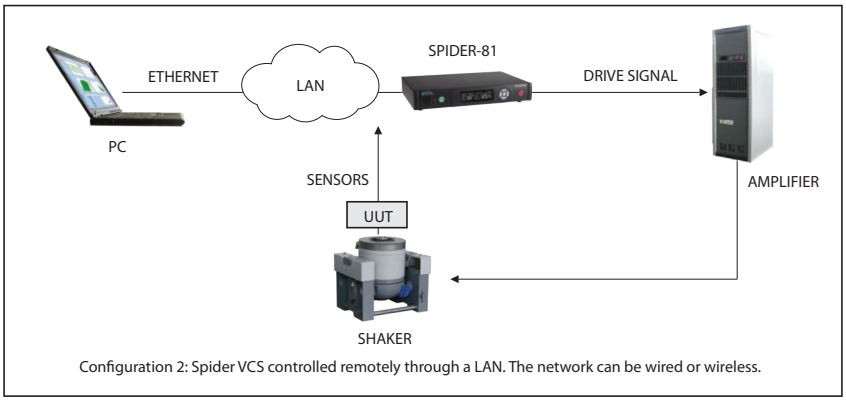
Black Box Mode with One Spider Front-End

This is the same as Configuration 1 except that the PC is not required during run time. A PC is required to install the Spider Black Box engine to the Spider module, and is used to configure the Spider and to download data files.

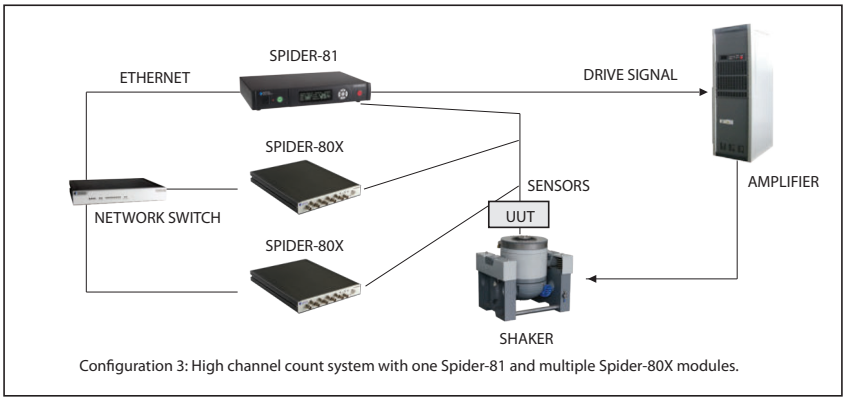
The figures below illustrate some of the many configurations that are possible with the Spider system.



Configuration 1: Setup with PC controller directly connected.



Configuration 2: Spider VCS controlled remotely through a LAN. The network can be wired or wireless.



Configuration 3: High channel count system with one Spider-81 and multiple Spider-80X modules.

SPIDER-100 CONTROLLER
HARDWARE SPECIFICATIONS (v1.1)

The Spider-100 is an integrated chamber system designed for environmental testing. Temperature, humidity and vibration are controlled at extreme accuracy to simulate the actual physical environment.

The Spider-100 controller is a key element of the chamber system. This document defines the hardware specifications of the Spider-100 controller.

HARDWARE SPECIFICATIONS

Analog Input Channels (for vibration measurement)

- Input Channels: 4 (can be expanded to 8)
- Connector Type: isolated BNC
- Coupling: AC Voltage, DC Voltage, Charge, or IEPE (ICP®)
- IEPE DC offset Voltage and Current: 22 V at 4.7 mA
- Charge Input: 49000pC and 10000pC
- Input Range: ±20 Vpk
- Input Impedance: 500 kΩ
- Input Protection Voltage: ±40 Vpk
- AC Coupling: analog high-pass filter, -3 dB @ 0.3 Hz and -0.1 dB @ 0.7 Hz
- A/D Resolutions: 2 x 24-bit (per input channel)
- Anti-Aliasing Filter: analog anti-aliasing low-pass filters in addition to sigma-delta converters
- Digital Filter: high-pass and low-pass filters (user programmable)
- Input Dynamic Range: 150 dBFS
- Sampling Rate: 0.48 Hz to 102.4 kHz, with 54 stages
- Maximum Useful Bandwidth: 46.08 kHz
- Total THD + Noise: -95 dBfs (DC to 1 kHz)
- Amplitude Channel Match: 0.1 dB
- Channel Phase Match: better than ±1.0 degree, up to 20 kHz
- Crosstalk: less than -100 dB
- Frequency Accuracy: 0.00025%
- Common Mode Range: ±10 Vpk
- Amplitude Accuracy: 0.5%

Analog Output Channels (to control the electro-dynamic shaker)

- Output Channels: 2
- Connector Type: isolated BNC
- D/A Resolution: 24 bit
- Sampling Rate: up to 102.4 kHz per channel, synchronized with input channels
- Output Dynamic Range: 100 dB
- Maximum Output Current: 25 mA
- Sine Amplitude Accuracy: ±1% (0.34 dB) at 1 kHz for 0.1 Vpk to 5 Vpk
- Anti-Imaging Filter: 160 dB/oct digital and analog filters
- Digital Filters: high-pass and low-pass digital filters
- Output Range: ± 10 Volts

Isolated Digital Input and Output

- Connector: Two 25-pin female D-SUB
- External Circuit Power Supply: 24VDC (±10%)
- Maximum Allowable Distance of Signal Extension: 50 meters

Inputs

- Input Format: Opto-isolated input (compatible with current-sink output)
- Channels: 24
- Input Resistance: 6.1 kΩ
- Input On Current: 2.0 mA or more
- Input Off Current: 0.16 mA or less

Outputs

- Output Format: opto-isolated input (current sink output)
- Channels: 8
- Output Rating: output voltage 24 VDC max, output current 100 mA per channel max
- Residual Voltage with Output On: 1.0 V or less (Output current < 100 mA)

Temperature Input Channel

- Number of Channels: 8
- Connector Type: Three pins Screwed Terminal
- Input Type: three wire RTD/ K type thermocouple
- Input Range: RTD: -200C ---+850C; K type thermocouple: -200C -- +1250C
- Accuracy: RTD: +/-0.2C; Thermocouple: +/-0.5
- Maximum Sampling Rate: 2 kHz

Relay Control Channel

- Number of Channels: 30
- Connector Type: 37 pins D-SUB (part # 5745784-4)
- Output Type: TTL +3.3V compatible control signals and internal +DC3.3V/1.5A power

4-20mA Analog Input

- Number of Channels: 10
- Connector Type: 2 Pins Screwed Terminal
- Input Type: 4-20mA
- ADC Resolution: 16bit
- Maximum Sampling Rate: 833Hz
- Accuracy: 1mV offset error, 0.01% gain error

4-20mA Analog Output

- Number of Channels: 8
- Connector Type: 4 pins Screwed Terminal
- Output Type: 4-20mA
- DAC Resolution: 16 bits
- Accuracy: 1%
- DC24V/50mA for every channel

RS485 Interface #1: for Touch Screen Control

RS485 Interface #2: for Digital Amplifier Control

External Emergency Abort Button

On-board Master/Slave Switch

High Speed Data Port interfacing to Spider-NAS (Optional)

- Number of Port: 1
- Connector Type: 5-pin LEMO
- Maximum Distance of Cable: 2 meters
- Theoretical Physical Data Transfer Speed: 480 Mbits/second
- Data Transfer Speed: Higher than 819.2ksample/second. Data saved in 32-bit single precision floating point. (Data from all input channels can be streamed to Spider-NAS)

System Specifications

- On-Board Memory: 4 GB non-volatile flash memory, 32 MB DRAM
- Ethernet: 100Base-T, RJ45 female connector
- Internal Clock: maintains date and time
- Cooling: no cooling fan required

Power Specifications

- Power Supply: external DC power
- External DC Power: AC adaptor accepts 100 to 240 VAC (50/60 Hz), DC power 15 V (±10%)/3A
- Power Consumption: 25 watts

Environmental and General Specifications

- Enclosure: metal box compliant with CE electrical safety and EMI shielding standards.
- Spider-100 Controller Dimension: 440mm(L) x 320mm(W) x 90mm (H)
- Weight: (to be announced)
- Safety Standards: electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001
- Operating Temperature: -10 °C to +55 °C
- Storage Temperature: -20 °C to +70 °C
- Shock: 50 g's, 315 in/sec, tested at 6 sides, non-operational test
- Vibration: 5 – 500 Hz, 0.3 g, tested at 3 sides, operational test
- Vibration: 5 – 500 Hz, 2.42 g, tested at 3 sides, non-operational test