Spider-80X V2 Hardware Specifications



A highly modular, truly distributed, scalable dynamic measurement system introduced by Crystal Instruments.

Featuring the following capabilities:

- 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.
- Modular system with identical physical form factor as Spider-80X DSA front-end, Spider-80SG, Spider-NAS, and Spider-HUB.
- Operates in Black Box mode (without connected computer) for flexibible system configurations.
- Multiple Spider front-ends are accurately synchronized through the IEEE 1588v2 protocol.

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HARDWARE SPECIFICATIONS

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 industries including vibration testing and machine condition monitoring in 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. A Spider system can have up to 64 input channels and chain together to form systems with up to hundreds of channels, all sampled simultaneously. Users can configure up to 1024 input channels for a Spider-80X system.

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 512 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 rotating pulse signals and conduct order tracking.

The Spider-80X front-ends can be controlled by a host computer or run in Black Box mode according to a preprogrammed schedule that 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 dynamic signal analyzer (DSA) module, Spider-80SG strain gage module, Spider-NAS storage module, and Spider-HUB network switch all have identical physical form factors.

Performance

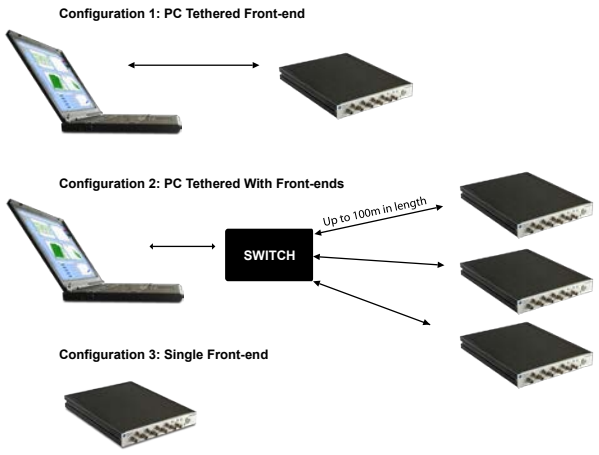
The Spider product line performance is the best in class with the highest dynamic range of any similar product. Patented technology allows each measurement channel to detect signals as small as 6 μV and as large as ±20 V. Proprietary hardware technology delivers more than 160 dBFS dynamic range. The extremely high dynamic range eliminates the need for multiple front-end gain settings.

A high-speed floating point DSP manages the data input, data output, and real-time processing. RAM and onboard flash memory is provided 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 computer 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 figure below 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 computer or to a LAN network through Ethernet. No switch is needed. The computer serves as a control and monitoring terminal using 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 Spider-HUB, can be used in cascade to extend the number of front-ends. The computer serves as a control and monitoring terminal using Crystal Instruments' EDM software.

Configuration 3: Black Box Mode with One Spider Front-End
This is the same as Configuration 1 except that the computer is not required during run time. A computer is required to install the Spider Black Box engine into the Spider front-end. The computer is only used to configure the Spider and download data files.

Input Channel Specifications

- **Input channels:** 8 channels per front-end
- **Max input channels:** 1024
- **Connector type:** BNC
- **TEDS:** IEEE 1451.4 compliant
- **Coupling:** AC, DC, IEPE (ICP®)
- **IEPE power:** 4.2 mA at 21 V
- **Input type:** Differential or Single-End
- **Input range selection:** Auto, ±20 V, ±5 V, ±0.2 V
- **Input impedance:** 444 kΩ for Differential; 222 kΩ for Single-End
- **Input protection voltage:** ±220 V
- **AC coupling:** analog high-pass filter (-3 dB @ 0.375 Hz; -0.1 dB @ 2.45 Hz)
- **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:** 160 dBFS
- **Sampling rate:** 0.48 Hz to 512 kHz, with 61 stages
- **Maximum bandwidth:** 230.4 kHz
- **Continuous data recording speed:** up to 512 kHz/channel
- **THD:**
  - -98 dB at 1 kHz, 5 V (-12 dBFS)
  - -87 dB at 1 kHz, 17.83 V (-1 dBFS)
- **Amplitude accuracy (1 kHz, 1 V):** ±0.04 dB
- **Amplitude channel match (1 kHz, 1 V):** < 0.04 dB
- **Channel phase match:** better than ±1.0 degree, up to 20 kHz
- **Crosstalk:** less than -100 dB
- **Frequency accuracy:** ±25 ppm (typically ±0.025 Hz margin at 1 kHz)
- **Common mode range:** ±20 V
- **Common mode rejection:** better than 70 dB (typical)
- **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 ±10 V
- **Sampling rate:** up to 512 kHz, synchronized with input channels
- **Maximum RPM:** 300,000
  - Tacho channel 1 can be used for both pulse counting and order tracking measurement.
  - Tacho channel 2 has 50 MHz ultra-high counter resolution and is only used for pulse counting.

Output Channel Specifications

- **Channels:** 2 channels
- **Connector type:** BNC
- **D/A resolution:** 24-bits
- **Maximum output sampling rate:** 102.4 kHz, synchronized with input channels
- **Dynamic range:** 120 dB
- **Output impedance:** 50 Ω
- **Maximum output current:** 250 mA
- **Amplitude accuracy:**
  - ±0.05 dB at 1 kHz for 200 µV to 10 V
  - ±0.5 dB at 1 kHz for 10 µV to 200 µV
- **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 V

Isolated Digital Input and Output

- **Connector:** 9-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)
- **Max number of channels:** 2
- **Input resistance:** 6.1 kΩ
- **Input on current:** 2.0 mA or more
- **Input off current:** 0.16 mA or less
- **Interrupt:** 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)
- **Max number of channels:** 2
- **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 kSamples/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 = no light
- **Flash capacity status indicator:**
  - less than 60% is green
  - between 60% and 90% is yellow
  - between 90% and 100% is red
- **Power indicator:** power on/off
- **LAN indicator:** communication active/inactive

Software Options

The Spider-80X is compatible with all vibration control system (VCS) or dynamic signal analyzer (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 Spider-HUB network switch)

Power Specifications (S80X-A11)

- **Power supply:** 100 – 240 VAC (50/60 Hz), 15 VDC (±10%)
- **Power consumption:** less than 15 W
- **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

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:** 194 Wh (13.5 Ah/14.4 V)



Spider-80X Accessories

Travel Cases

- **S80X-A45:** ruggedized travel case (single system)



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