

# Spider-80SG V2 Hardware Specifications



The Spider-80SG is a high precision, general purpose data acquisition device featuring strain gage capability.

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## SPIDER-80SG INTRODUCTION

The Spider-80SG V2 is a high precision, general purpose data acquisition device featuring IEPE, strain gage and MEMS capabilities. The Spider-80SG can acquire data from IEPE and MEMS accelerometers, bridge-based sensors like load cells, strain measurements from strain gauges and many other physical quantities and general-purpose sensors. The Spider-80SG is built on the proven outstanding performance and reliability of Crystal Instruments' DSP-based hardware platform, making it an ideal data acquisition system for the automotive, aviation, aerospace, electronics and military industries. It features the same form factor as the 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.

Spider-80SG front-ends have breakout boxes with BNC connectors to interface either directly to a sensor lead wire or through the BNC cable which is ideal for shock, vibration, acoustic, or general purpose measurements. Each Spider-80SG 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. One output channel provides various signal output waveforms that are synchronized with the input sampling rate.

Spider-80SG is equipped with a 24-bit sigma-delta analog to digital converter (ADC) per channel to ensure highly accurate measurements with any type of sensor. Together with the user-configurable parameters, accuracy is ensured over a wide range of measurements.

Multiple Spider front-ends can combine to form a single high channel system. Users can arrange the Spider system with various Spider front-ends and network switches to form different configurations. With multiple Spider-SG front-ends, a Spider system can have up to 64 input channels and chain up to hundreds of channels, all sampled simultaneously. Users can configure up to 1024 input channels for a Spider-80SG 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.

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 subjected to network speed limitations.

### Terminology

Maximum and minimum specifications characterize the warranted performance of the instrument within the recommended calibration interval and under the stated operating conditions. These specifications are guaranteed by design.

Typical specifications are met by the instrument within the recommended calibration interval according to the specified operating conditions. These measurements are taken during the production verification of the finalized engineering prototype. The performance of the instrument is not warranted.

All performance specifications are typical unless otherwise noted. These specifications are valid within the full operating temperature range. The accuracy of specifications are valid within  $\pm 5$  °C after calibrating the unit unless otherwise noted.

### Performance

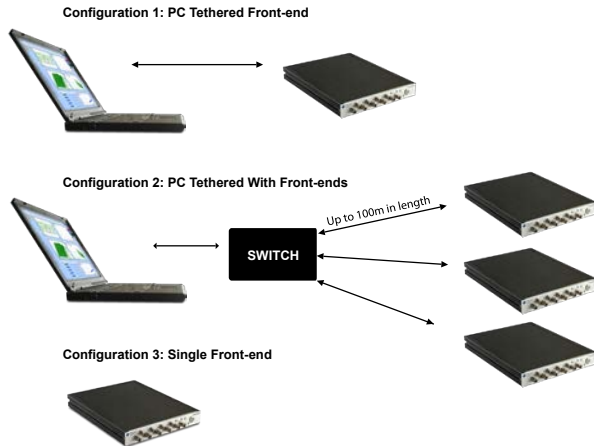
The Spider product line performance is the best-in-class with the highest dynamic range of any similar product. With patented technology, each measurement channel can detect signals as small as 6  $\mu$ V and as large as  $\pm 20$  V. Proprietary hardware technology delivers more than 160 dBFS dynamic 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/output and real-time processing. The Spider-80SG 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 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 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 connect together to create 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 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.

## **IEPE Power and DC Excitation**

The Spider-80SG is equipped with dual excitation modes. There is an option for Precision DC Excitation Voltage of  $\pm 2.5V$  or  $\pm 5V$  that can be used to excite a strain gage or a strain gage-based sensor and to accurately measure the minute change in resistance. Alternatively, the Spider-80SG can act as 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.

Depending on the input mode the Spider-80SG can also output IEPE power to interface with IEPE sensors. With the power to choose between various input modes, DC excitation and power supply, a single module can simultaneously interface with an IEPE accelerometer, strain gage, and load cell as well as a MEMS sensor.

## **Remote Sensing**

The Spider-80SG has been tested to work on sensors up to 1000 ft away from the analyzer using the remote sensing feature. An 18AWG 5 conductor cable was used to measure the excitation voltage using remote sensing and changes in output voltage, resulting in the error measured at 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 simultaneously read and record general purpose measurements while performing a vibration control test.

## **Spider-80SG Features Overview**

- 8 voltage / strain gage / general purpose inputs
- 24-bit ADC channel
- Supports multiple measurement quantities
- Supports a variety of IEPE, MEMS, strain gages, load cells, pressure transducers, torque sensors, Accelerometers and geophones, conditioned LVDTs
- 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  $\pm 2.5V$  and  $\pm 5V$
- 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 FRONT-END SPECIFICATIONS (S80SG – P08)**

### **Measurement Channel Specifications**

- **Input Channels:** 8 channels per front-end
- **Maximum Input Channels:** 1024
- **Connector Type:** 14-pin LEMO
- **Coupling:** DC Differential, AC Differential, bridge-based sensors, in-line charge convertors and IEPE (ICP®)
- **Excitation Voltage/Power Supply:** 2.5V, 5V, 10V
- **AC Coupling Cutoff Freq. @ -3dB:** 0.375 Hz
- **Input Impedance:** 1 M $\Omega$
- **A/D Resolution:** 24-bit
- **Input Protection Voltage:**  $\pm 40V$

- **Input Range:**  $\pm 10$  mV,  $\pm 100$  mV,  $\pm 10$  V
- **Sampling Rate per Channel:** 0.48 Hz to 102.4 kHz, with 54 stages
- **Maximum Useful Bandwidth:** 46% of sampling rate
- **Crosstalk:** less than -100 dB
- **Frequency Accuracy:**  $\pm 25$  ppm (typically  $\pm 0.025$  Hz margin at 1 kHz)
- **Amplitude Accuracy:** 0.1% typical
- **Amplitude Accuracy (Extended Cable Length):** Less than 1.5% (up to 10 kHz), cable length up to 1000 ft (18 AWG)
- **Noise Floor:** 0.5  $\mu$ V/V (10 mV Range)
- **DC Drift:** 1.5  $\mu$ V/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
- **THD:** -90 dBFS (DC to 1 kHz)
- **Amplitude Channel Match:**  $< 0.1$  dB
- **Phase Channel Match:** better than 0.3 degrees up to 20 kHz
- **Common Mode Range:** 100% input range
- **Shunt Calibration:** Internal 100 k $\Omega$  (0.05%, 10 ppm/oC)
- **Excitation Sense:** local sensing and remote sensing

### Strain Gage Functions:

- **120 $\Omega$ , 350 $\Omega$  Quarter Bridges (Type I,II, 3 – Wire Quarter Bridge)**
- **Half bridge (Type I,II)**
- **Full bridge (Type I,II)**
- **Bridge Completion:** 120  $\Omega$  - 0.05%, 5 ppm/oC, 350  $\Omega$ : 0.1%, 25 ppm/oC
- **Back Half Resistor:** 120  $\Omega$  - 0.05%, 5 ppm/oC, 350  $\Omega$ : 0.1%, 25 ppm/oC
- **Excitation Voltage for Strain Gauge:**  $\pm 2.5$  V,  $\pm 5$  V
- **Current:** 30 mA max/channel
- **Zero Suppression/Auto Balancing/Offset Nulling**
- **Power Supply (excitation voltage for other kind of sensors):** 2.5 V, 5 V, 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
- **Maximum Output Sampling Rate:** 102.4 kHz,

synchronized with input channels

- **Dynamic Range:** 120 dB
- **Output Impedance:** 50  $\Omega$
- **Maximum Output Current:** 25 mA
- **Sine Amplitude Accuracy:**
  - $\pm 0.2$  dB at 1 kHz for 200  $\mu$ V to 10 V
  - $\pm 1.0$  dB at 1 kHz for 10  $\mu$ V to 200  $\mu$ V
- **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, pink 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:**  $\pm 10$  V

### Isolated Digital Input and Output

Total 4 bits digital channels that can be configurable by the software to either input or output type.

- **Connector:** 9-pin female D-SUB
- **External Circuit Power Supply:** 12 VDC ( $\pm 10\%$ )
- **Internal Power:** 12 VDC 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:** 2
- **Input Resistance:** 6.1 k $\Omega$
- **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:** 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  $\mu$ s

- **Fall Time:** 50  $\mu$ s

### 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-80SG 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)

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### SPIDER-80SG ACCESSORIES



#### Travel Cases

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

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