Spider-80Xi/SGi/Ti Hardware Specifications

Featuring the following capabilities:

- Spider-80Xi: measures shock, vibration, acoustic, or general purpose voltage measurements
- Spider-80SGi: measures Strain, Strain gage based sensors, MEMS sensors, IEPE sensors, DC based sensors or general purpose voltage measurement
- Spider-80Ti: measures temperature
- 32 and 64 channel chassis systems

A compact, ultra-portable chassis that can host a combination of Spider-80Xi, Spider-80SGi and Spider-80Ti front-ends.

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CRYSTAL INSTRUMENTS

Introduction

The Spider-80Xi system is a compact, ultra-portable chassis that can host a combination of Spider-80Xi, Spider-80SGi and Spider-80Ti front-ends. The system facilitates measurements of acceleration (Spider-80Xi) and strain in addition to a wide range of measurements quantities (Spider-80SGi), and temperature (Spider-80Ti). The size efficient design of the Spider-80Xi chassis eliminates individual enclosures for each modular card to minimize overall dimensions. Light weighted, it is ideal for the applications where portability and size are critical to the operation while exchangeability of cards are not required.

The Spider-80Xi system offers two different chassis configurations: a 64-channel configuration and a 32-channel configuration. Each front-end card consists of 8 channels. Users can combine front-end cards from the Spider-80Xi, Spider-80SGi or Spider-80Ti systems to form a synchronized high channel count system with several types of inputs.

Multiple chassis can chain together to form a system with up to 1024 channels, all sampled simultaneously. 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.

The Spider-80Xi system with the 64-channel chassis is powered by AC power, 100 to 240 VAC. The Spider-80Xi system with the 32-channel chassis is powered by DC power, 12 – 30 VDC. The latter can be easily used together with an external battery pack. The combination of Crystal Instruments specially developed Spider-Battery and the 32-channel Spider-80Xi chassis allows operations for up to 4 hours without interruption.

The input channels of Spider-80Xi front-ends are equipped with IEPE power source to power IEPE sensors in addition to the standard voltage input which makes it ideal for shock, vibration, acoustic, or general purpose voltage measurements. Spider-80SGi front-ends are designed for measuring strain using precision excitation and other general purpose measurement quantities using a customizable power supply. The recently introduced Spider-80Ti adds a temperature measurement capability to the Spider-80Xi system. 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.

The Spider-80Xi system 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.

The Spider-80Xi system 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 the storage media inside Spider-80Xi. The default capacity of hard disk is 250 GB. When recorded, the data will be written in the NTFS file format. Data is extracted from the hard disk using Crystal Instruments EDM software to transfer data to the PC. Users can also physically remove the hard disk and connect it to the PC to extract data.

Spider-80Xi Front-end Specifications

Input Channel Specifications

- *Number of Input Channels per Chassis*: 16, 24, 32, 48, 56 or 64 when ordered with S80Xi-A35-8N; This is only factory configurable.
- *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-Ended
- *Input Range*: ±20 Vpk
- *Input Impedance*: 1 MΩ for differential; 500 kΩ for single-end
- *Input Protection Voltage*: ±220V
- *AC Coupling*: analog high-pass filter at 0.375 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*: 160 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*: ±250 ppm (typically ±0.25Hz margin at 1 kHz)
- *Common Mode Range*: ±20 Vpk
- *Common Mode Rejection*: better than 70 dB (typical)
- *Amplitude Accuracy (1 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 50 MHz 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

Spider-80SGi Front-end Specifications

Measurement Channel Specifications

- *Input Channels*: 8 channels per front-end
- *Connector Type*: 7-pin LEMO
- *Coupling*: DC Differential, AC Differential and IEPE (ICP®)
- *Excitation Voltage / Power Supply*: 2.5V, 5V, 10V
- *AC Coupling Cutoff Freq. @ -3dB*: 0.375 Hz
- *Input Impedance*: 1M Ω
- *A/D Resolution*: 24 bit
- *Input Protection Voltage*: +/-40Vpk
- *Input Range*: ±10mV, ±100mV, ±1V , ±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
- *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 - 0.05%, 5 ppm/ oC, 350 Ω: 0.1%, 25 ppm/oC
- *Back Half Resistor*: 120 Ω - 0.05%, 5 ppm/ oC, 350 Ω: 0.1%, 25 ppm/ oC
- *Excitation Voltage for Strain Gauge*: ±2.5V, ±5V
- *Current*: 30mA max/channel
- *Zero Suppression/Auto Balancing/Offset Nulling*
- *Power Supply* (Excitation Voltage for other 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

Spider-80Ti Front-end Specifications

Temperature Input Channel

- *Number of Input Channels*: 16 channels per front-end
- *Connector Type*: Three pins Screwed Terminal
- *Input Type*: Three wire RTD/ K type thermocouple
- *Input Range*: RTD: -200C ---+850C; K type thermocouple: -200C -- +1250C
- *Sensor Accuracy*: RTD: +/-0.2C; Thermocouple: +/-0.5 C
- *Maximum Sampling Rate*: 256 Hz

Spider-80Xi System Specifications

Input Channels

- *Number of Input Channels per Chassis*: 16, 24, 32, 48,56 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.
- *Maximum Number of Input Channels in a Complete System*: 1024

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 (±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 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*: 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

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 250 GB storage capacity 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

Multiple Spider-80Xi front-ends can be synchronized using an Ethernet connection through the IEEE 1588v2 protocol. The synchronization accuracy is better than ±100 ns when the Spider-HUB 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
- *Digital Input and Output*: 2 digital inputs and 2 digital outputs
- *Hard Buttons*: Power, Fan On/Off, Start measurement,

Stop measurement

- *LCD Display*: 128 x 64 dot; Monochrome; Display size: 61 x 31.3mm. Displays the IP address, connection status and input status of the system
- *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
- *Hardware Abort*: Hardware Abort 2 pin port is provided which can be connected to a switch to force turn off the output of the front-end. Connector Type: 2 pin LEMO
- *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

Supported Software Applications

- EDM Vibration Controller (VCS) Mode Software (PC-based)
- EDM Dynamic Signal Analyzer (DSA) Mode Software (PC-based)
- EDM-Modal (experimental Modal Analysis) (PC-based)
- EDM Remote Condition Monitoring Software (PC-based) (DSA-40)
- EDM–Time Data Acquisition (PC-based) (TDA-10)
- EDM Cloud support (Cloud based Monitoring)
- Python API (Cross platform utility)
- EDM App-DSA mode in iOS (DSA-37) (iPad-based)
- Post Analyzer (PC-based post processing software)

8 Slot Chassis

- *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 are configured
- *Size*: 278.4 X 257 X 304 mm (W x H x L)
- *Total Weight*: 12.06 kg when 64 channels configured

The 8 slot chassis supports:

- 8 Spider-80Xi/SGi/Ti front-ends
- Spider-NASi for mass storage
- Spider-HUBi for communication and time sync

4 Slot Chassis

- *Enclosure*: rugged sealed metal box, electrical safety compliant, and internal EMI shielding
- *Power Supply*: 12 – 30 VDC
- *Power Consumption*: less than 50W when 32 channels are configured
- *Size*: 193.8 X 257 X 304 mm (W x H x L)
- *Total Weight*: 8.2 kg when 32 channels configured
- *Battery Hours*: 4 hours with Spider-Battery provided

The 4 slot chassis supports:

- 4 Spider-80Xi/SGi/Ti front-ends
- Spider-NASi for mass storage
- Spider-HUBi for communication and time sync

Hardware Part Numbers

Part Number	Short Description
S80Xi-P08	Spider-80Xi front-end card: 8 Inputs
S80SGi-P08	Spider-80SGi front-end card: 8 Inputs
S80Ti-P08	Spider-80Ti front-end card: 16 Inputs
S80Xi-A35-4N	4-slot chassis with HUB and NAS
S80Xi-A35-8N	8-slot chassis with HUB and NAS

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

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