

# **Spiders with 256 kHz Sampling Rate**

**Application Note 067**



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Crystal Instruments EDM 9.0 release introduces new additions to the Spider product line featuring support for sampling rates up to 256 kHz.

The new Spider-80Hi and Spider-80Ci are scalable versions of the Spider system featuring the impressive new 256 kHz sampling rate. Recording can also be performed at sampling rates up to 256 kHz for all eight channels on these Spider modules.

The compact, ultra-portable four channel version of the Spider has also been developed to support a 256 kHz sampling rate. Currently, three variations of the compact Spiders supporting the 256 kHz sampling rate are available: Spider-20H, Spider-20HE, Spider-20i.

**Spider-80Hi and Spider-80Ci**

The Spider-80Hi and Spider-80Ci are brand new cards that can be plugged into the Spider-80Xi 8-slot or 4-slot chassis. (Figure 1.1)

Similar to the Spider-80Xi products, the Spider-80Hi and Spider-80Ci are equipped with dual ADC technology which provides a dynamic range of 160 dB and 58 stages of a sampling rate selection ranging from as low as 0.48 Hz to as high as 256 kHz.

All EDM modules including EDM-VCS (Vibration Control System) and EDM-DSA (Dynamic Signal Analysis) supports the new Spider-80Hi and Spider-80Ci hardware.

**High Channel Count System:**

Multiple Spider-80Hi and Spider-80Ci front-ends can combine to create a high channel count system with up to 1024 channels. Up to 8 front-ends can fit within one chassis and multiple chassis can connect through Ethernet using a Spider-HUB industrial network switch.

The high channel count system can



Figure 1.1

also include the Spider-80SGi or Spider-80Ti modules when data from strain, strain gage-based sensors, RTDs, thermocouples or any other special sensors need to be acquired with Spider-80Hi system.

As featured in Crystal Instruments Spider system hardware, the Spider-80Hi and Spider-80Ci also support time synchronization through the IEEE 1588v2 protocol. This technology provides an excellent phase match even when front-ends are used at 256 kHz

**Raw Time Recording:**

All 8 channels of the Spider-80Hi and Spider-80Ci can continuously record at the highest sampling rate of 256 kHz when Spider-NAS storage is used. The Spider-NAS is equipped with a high data speed SSD card which supports recording of all the channels within the chassis (64 channels) at the highest sampling rate. Multiple chassis can be chained together to continuously record at the highest speeds for up to 1024 channels.

The Spider-NAS now supports up to

2 TB SSDs facilitating continuous recording of 64 channels at 256 kHz for over 8 hours.

**Charge mode inputs**

The major difference between the Spider-80Hi and the Spider-80Ci is that the Spider-80Ci has integrated charge amplifiers in addition to all the other input modes and features supported by the Spider-80Hi.

**Spider-20H, Spider-20HE and Spider-20i**

The Spider-20 series of products have been extremely popular in applications where a small channel count or small form factor data acquisition is needed. (Figure 2.1)

The newest generation of the Spider-20 systems are now available in three unique forms:

**Spider-20i**

A new addition to the traditional Spider-20 series is the Spider-20i. The Spider-20i is an Ethernet based Spider-20 system supporting a 256 kHz sampling rate with an industrial enclosure. Without any buttons or a battery, this device is suitable to

be deployed in rough industrial environments for momentary or permanent data acquisition, recording or monitoring.

### Spider-20H (Wi-Fi)

The Wi-Fi version of Spider-20 supports a 256 kHz sampling rate, includes 4 GB of built-in flash memory and a battery.

### Spider-20HE

The Ethernet based version of Spider-20 supports a 256 kHz sampling rate, includes 4 GB of built-in flash memory and a battery.

### Applications

High sampling rates beyond 102.4 kHz are usually required to capture high amplitude sharp transients. These are typically generated in blast tests, Pyroshock events, drop shock tests, crash tests, etc. (Figure 3.1)

Components included in rockets and space vehicles are subject to severe shock vibrations. To ensure reliability during missions, testing is undertaken using controlled explosives. A high sampling rate data acquisition device to acquire data from the shock sensors would reliably measure the high frequency content during these tests.

Shock Response Spectrum (SRS) calculations need sampling rates that are at least 10 times the maximum frequency of interest. With a limitation of 102.4 kHz, frequencies of up to only 10 kHz can be analyzed. With the new generation of Spiders, the SRS spectrum for maximum frequencies of 25 kHz can be



Figure 2.1



Figure 3.1

acquired and analyzed. In addition, by capturing the data at the maximum possible sampling rate, all the time domain features can be effectively captured and preserved. The acquired data can be processed in real time or post processed with different settings to completely analyze the data.

In some vibration control applications, analyzing harmonics at

frequencies much beyond the usual frequencies of excitation are needed. In these applications, high sampling rates of up to 256 kHz could be used in parallel to a controlled vibration test to analyze frequencies that are much beyond the excitation frequencies.

### References:

<https://jscfeatures.jsc.nasa.gov/pages.ashx/383/Pyroshock>

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