

# SPIDER-20

Wireless Dynamic Signal Analyzer and Data Recorder

**Handheld Measurement Solutions**



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# Handheld Field Testing Solution

## Spider-20 Handheld Wireless Dynamic Signal Analyzer

Spider-20 is a compact yet powerful dynamic signal analyzer and digital data recorder. 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.

Spider-20 is a diminutive 5.3 x 4.3 x 1 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.

Spider-20 communicates with the world through its built-in Wi-Fi interface. Use your iPad to setup and view or record time histories as well as perform spectrum analysis or measure Frequency Response and 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.

A secondary version, Spider-20E, replaces Wi-Fi with a wired Ethernet connection. The Spider-20E has the same form factor as the standard wireless version.

Transfer measured data to 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 this Spider into an intelligent unattended monitor capable of responding to data conditions or networked instructions, notifying you of significant conditions via e-mail.





## Industry and Product Applications

### 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 ( $\pm 10\%$ ) for more remote applications.

#### SPIDER-20 & SPIDER-20E PRODUCT HIGHLIGHTS

Weights only 18 Ounces	4 GB Flash Memory	PC Independent
Built-In Wi-Fi (Spider-20)	4 Input Channels	iPad Compatible
Built-In Ethernet (Spider-20E)	1 Tachometer Channel	6 Hour Battery Life



### 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 becomes a full function sound level meter. Add 3 more and

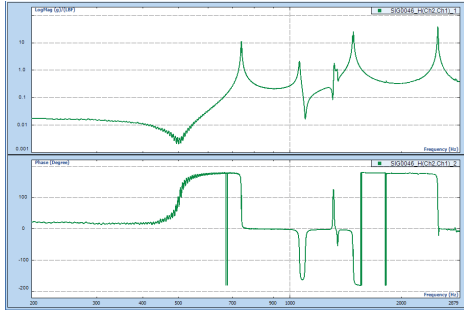
it becomes a multi-channel, multi-function sound level recorder and analyzer. Take the Spider-20 on the road or in the air to record interior noise signatures during full-spectrum vehicle operation. Make and monitor pass-by measurements from the vehicle. Validate all of your recordings in-place on your 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.

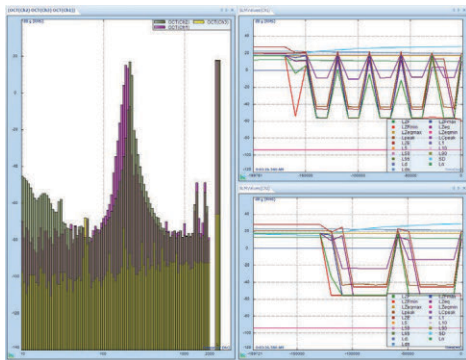
# Spider-20 & Spider-20E Software

## Dynamic Signal Analysis Software Solutions



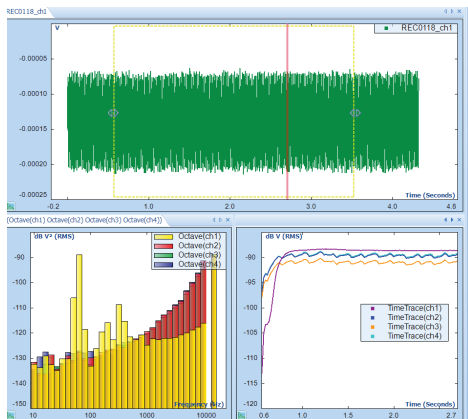
### Frequency Response Function (FRF)

The Spider-20 performs FRF analysis, a function which computes the structural response to steady-state oscillatory excitation. An important application of dynamic signal analysis is characterizing the input-output behavior of physical systems. With linear systems, the output can be predicted from a known input if the frequency response function of the system is known.



### Octave Analysis and Sound Level Meters (SLM)

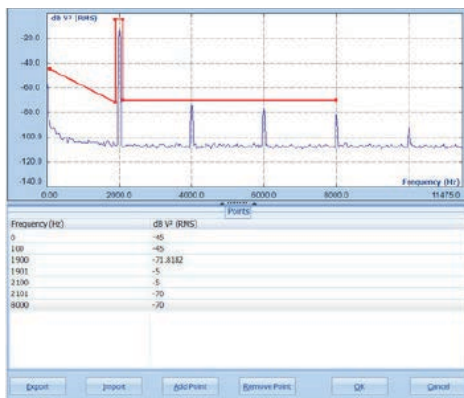
Both octave filter and sound level meters are implemented based on high precision real-time filters. FFT spectral analysis, octave analysis and sound level meter analysis can be executed at the same time.



### Time Waveform Recording

In addition to saving spectral data, the Spider-20 has the ability to record time wave form data. Raw time wave form data from an array of different sensors is displayed and recorded at sampling rates of up to 102.4 kHz. On the fly processing is also available with different data conditioning modules applied to the raw incoming time streams. Data conditioning includes algebraic functions (addition, subtraction, multiplication, and division), digital filtering, integration, differentiation, calibration, and other math operations applied to the continuous incoming time streams.





### Automated Schedule and Limiting Test

Automated limit test function allows the Spider front-end to conduct automated limit checking for time or frequency signals. The function is supported in both PC tethered mode and Black Box mode. Limiting signals are designed using the EDM software on the host PC. There are four elements in a limiting test: signals being tested, upper or lower limits applied, testing schedule, and testing log.



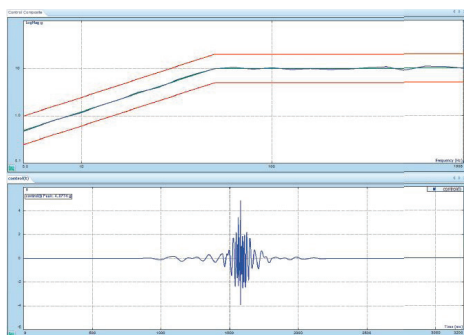
### iPad Application for DSA

The EDM App for iPad by Crystal Instruments is available from the Apple App Store. The EDM App allows access to the Spider-20 front-end when operating in Black Box mode. Users will be able to access a preloaded test on their iPad to run and control the Spider-20 as long as they are within the range of a wireless network. The EDM app can also create and edit tests on the iPad. The display window can show one signal or multiple signals and users can print or email screen shots.



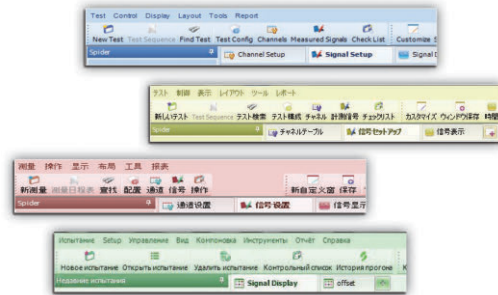
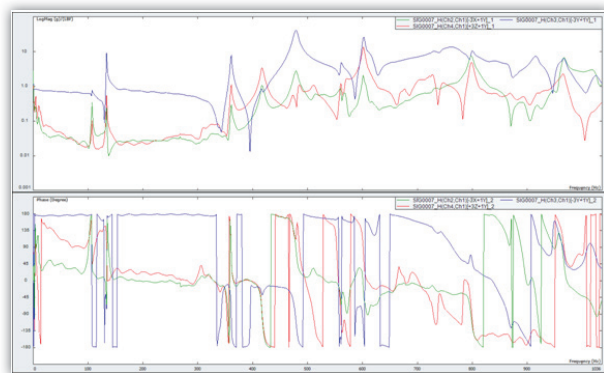
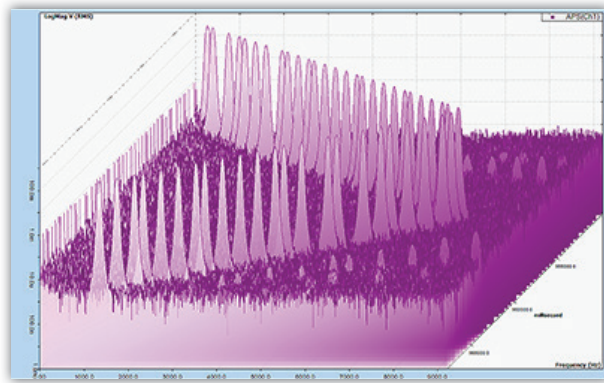
### Real-Time Digital Filters

Real-time digital filters are applied in the data conditioning phase. The user designs the filter model with a graphic design tool provided and uploads the filter design parameters to the front-end for real-time calculation. The graphic design tool draws the filter performance in vertical axis with dB unit and horizontal axis in relative frequency.



### Shock Response Spectrum (SRS) Analysis

Compute the SRS for all channels using maxi-max, maximum negative, and maximum positive analysis techniques. A reference profile is available.



*EDM is available in English, Japanese, Simplified Chinese, Traditional Chinese, and Russian.*

### Complete Suite of Signal Analysis Functions Running on PC:

- Long Waveform Recording with Scope Display
- Transient Capture with Accept/Reject
- Auto and Cross Spectra, Coherence and FRF
- Histogram and Statistics
- 1/1, 1/3, 1/6 and 1/12 Octave Filters and Sound Level Meter
- Order Tracking
- Tacho, Phase and Orbit
- Real-time Digital Filters
- Real-time Math Operations
- Swept Sine Testing
- Shock Response Spectrum (SRS)
- Automated Limiting Test, with Scheduling, Testing Log, Alarm Check
- Arbitrary Waveform Output
- Sensor Calibration
- System Front-end Calibration





## Hardware Specifications

### Analog Input Channels

- Input Channels: 4
- Coupling: AC, DC, IEPE (ICP®)
- Input Range:  $\pm 0.1V$ ,  $\pm 1V$ ,  $\pm 10V$
- Input Dynamic Range: 100 dBFS
- Sampling Rate: 0.48 Hz to 102.4 kHz, with 54 stages
- Maximum Useful Bandwidth: 46.08 kHz

### Tachometer Input Channel

- Tachometer Input Channel: 1
- Connector Type: isolated BNC (shared with the Analog Output)
- Configuration: Tachometer or Output function selected by software
- Shaft RPM Range: 3/N – 300,000/N RPM

### Analog Output Channel

- Output Channels: 1
- Output Range:  $\pm 10$  Volts

### DC Power Input

- Connector Type: 5.5mm Jack connector (on rear panel)

- Voltage: 15 VDC ( $\pm 10\%$ )

### Indicating LEDs

- Power, Start/Stop, Battery, Wi-Fi and Charging

### 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:

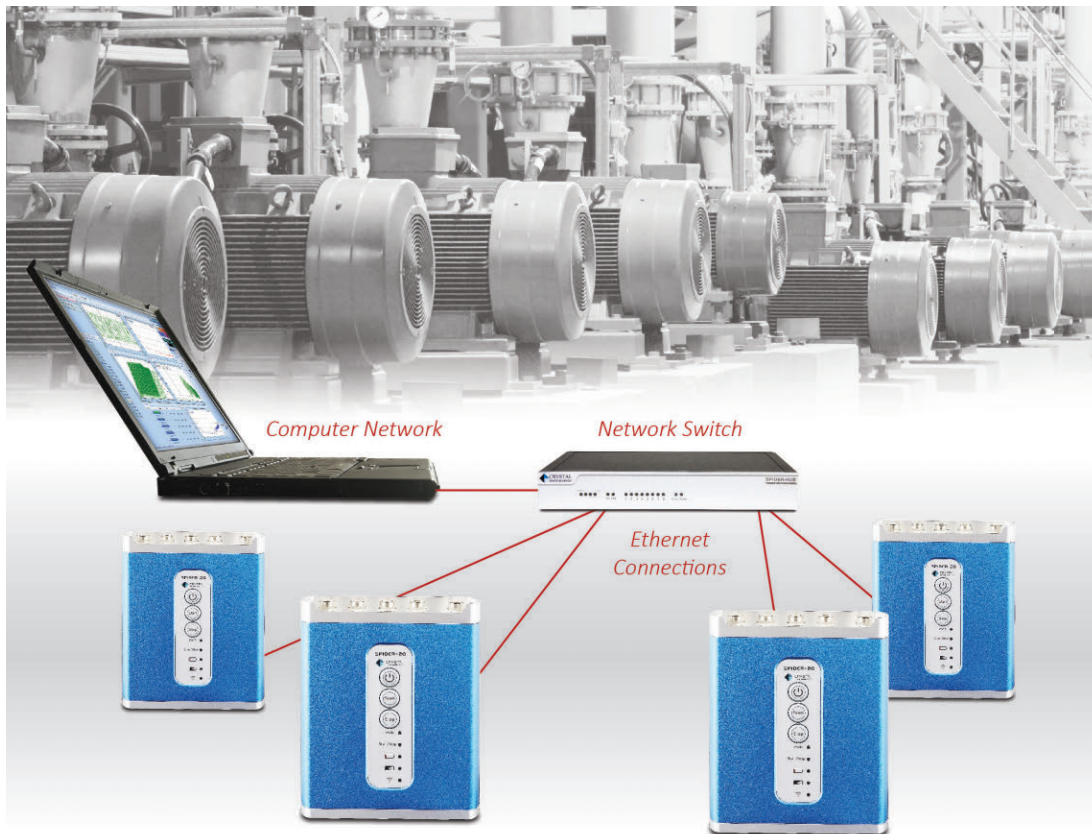
- Ethernet: 100Base-T, RJ45 female connector

### Power Specifications

- Power Supply: interchangeable battery with DC charger interface
- Battery Hours: 6 hours or longer in full operation
- Power Consumption: less than 6W

### Environmental Specifications

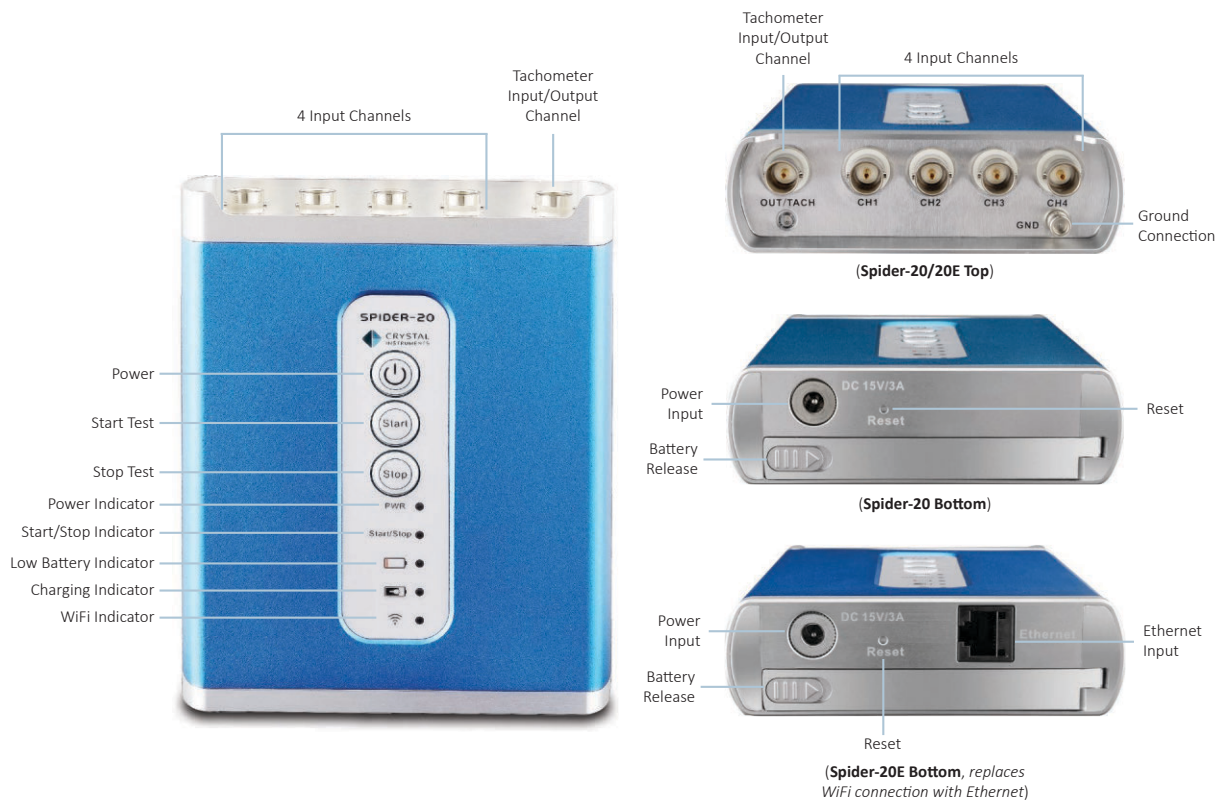
- Enclosure 135mm x 109mm x 32.5mm
- Weight: 0.56kg
- On-Board Flash Memory: 4GB



## Ordering Information

All Spider-20 front-ends include the following accessories: BNC cable (1), power adapter, battery, grounding cable, external battery charger, and user's manual on CD.

<b>S20-P02</b>	Spider-20 Front-end: Two 24 bit IEPE/Voltage inputs enabled, One 24 bit output, BNC connectors, built in Wi-Fi connection, and Black Box engine. EDM App the FFT mode (DSA-37) is included.
<b>S20-P04</b>	Spider-20 Front-end: Four 24 bit IEPE/Voltage inputs enabled, One 24 bit output, BNC connectors, built in Wi-Fi connection, and Black Box engine. EDM App the FFT mode (DSA-37) is included.
<b>S20-2CH</b>	Add Two additional input channels to Spider-20.
<b>S20E-P02</b>	Spider-20E Front-end: Two 24 bit inputs (Voltage, IEPE) enabled, One 24 bit output, 4 GB data flash, BNC connectors, Ethernet connection. Includes FFT Spectral Analysis Software (DSA-10-C08), one output/Tacho enabled (DSA-30), iOS DSA App (DSA-37). Note: the product will be shipped with 4 input channels installed but with only 2 inputs enabled. The remaining two channels can be remotely enabled.
<b>S20E -P04</b>	Spider-20E Front-end: Four 24 bit inputs (Voltage, IEPE) enabled, One 24 bit output, 4 GB data flash, BNC connectors, built-in Ethernet connection. Includes FFT Spectral Analysis Software (DSA-10-C08), one output enabled (DSA-30), iOS DSA App (DSA-37).



#### Supported Software Applications:

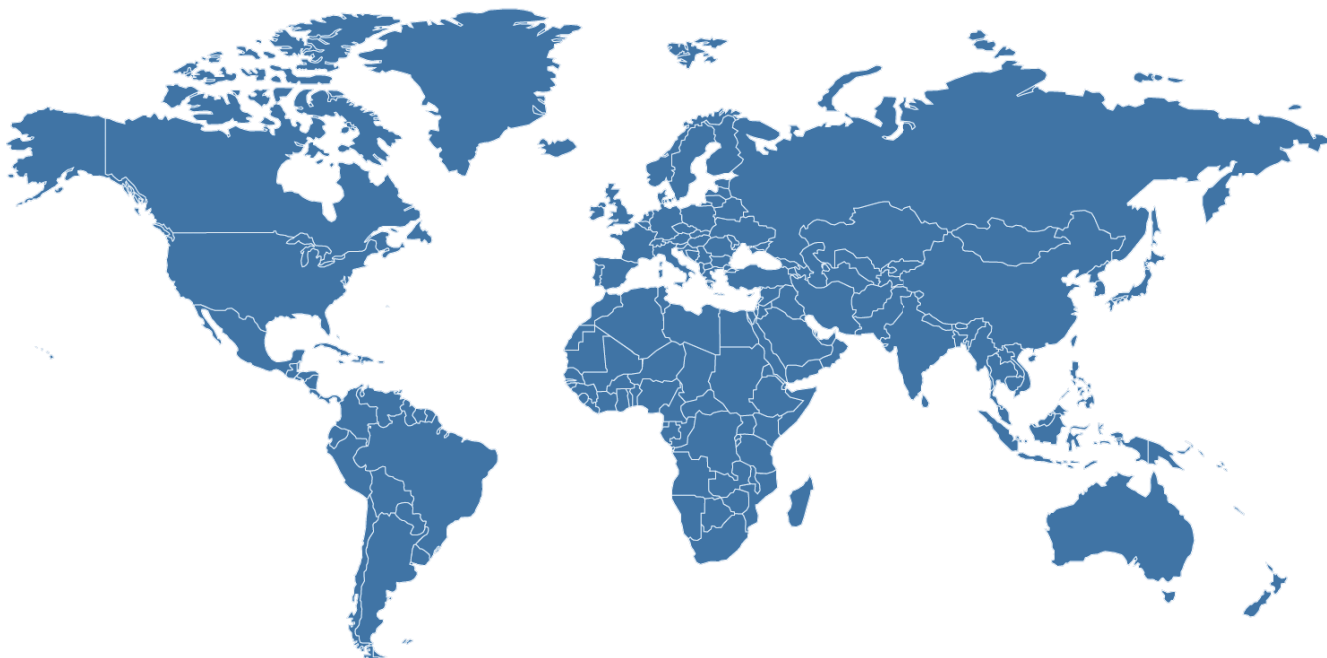
##### *EDM Dynamic Signal Analyzer Mode Software (PC-based)*

<b>DSA-10-C08</b>	FFT Spectral Analysis
<b>DSA-11-C08</b>	Octave Filter Analysis and Sound Level Meters
<b>DSA-12-C08</b>	Real-Time Order Tracking and Order Analysis
<b>DSA-13-C08</b>	Swept Sine Analysis
<b>DSA-20-C08</b>	Time Waveform Recording
<b>DSA-24-C08</b>	Automated Schedule and Limiting Test
<b>DSA-25-C08</b>	Real-Time Digital Filters
<b>DSA-27-C08</b>	Shock Response Spectrum (SRS) Analysis
<b>Spider-CAL</b>	Spider Instrument Calibration Software

##### *EDM App for iOS (iPad-based)*

<b>DSA-37</b>	FFT Dynamic Signal Analysis
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