MACHINE CONDITION MONITORING & ANALYSIS

VIBRATION DATA COLLECTORS & REMOTE MONITORING

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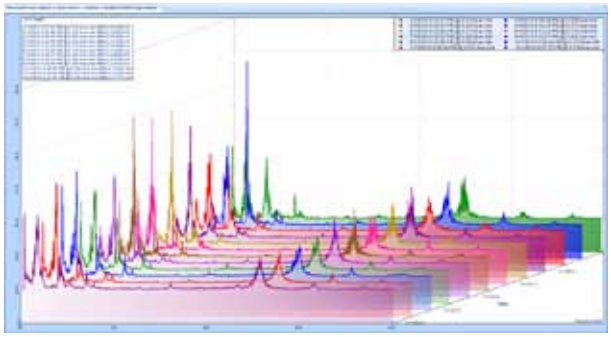
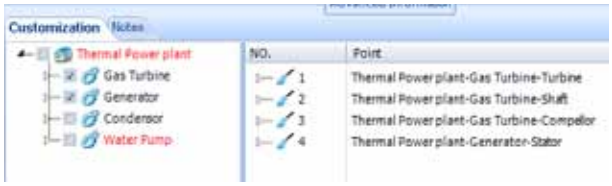
CoCo-80 & CoCo-90
VIBRATION DATA COLLECTORS



Spectral data trend over time



Create and order groups of machines

CoCo-80 & CoCo-90
The CoCo is a handheld data recorder, dynamic signal analyzer, and vibration data collector. The CoCo is ideal for a wide range of industries; including machine condition monitoring, automotive, aviation, aerospace, electronics, and military. These industries demand easy, quick, and accurate data recording in addition to real-time processing in the field. The CoCo units are lightweight, battery powered handheld systems with unparalleled performance and accuracy. The intuitive user interface is specifically designed for easy operation while still providing a wide variety of analysis functions.

The CoCo hardware platform supports two different software working modes: Dynamic Signal Analyzer (DSA) and Vibration Data Collector (VDC). Each working mode has its own user interface and navigation structure. DSA mode is designed for mechanical structure analysis, testing and optimization, electrical, geophysics, and a wide range of other applications. VDC mode is dedicated to route-based machine condition monitoring, vibration data collection, and trending.

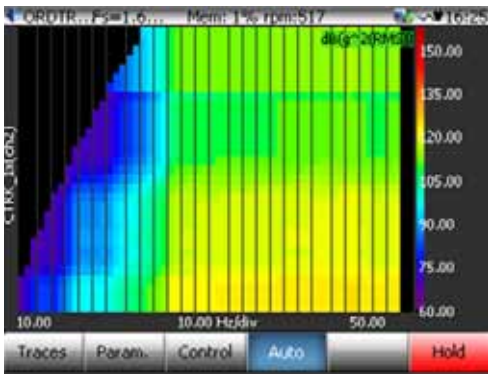
Performance
The CoCo hardware utilizes a dual processor architecture. An XScale CPU handles the user interface, project configuration, power management, network communication, and all peripherals. A high-speed floating point DSP manages the data input/output and real-time processing. The CoCo is also configured with large RAM and NAND flash memory for mass data storage. The patented design eliminates the need for multiple front-end gain settings, while at the same time delivering a dynamic range of more than 150 dBFS.

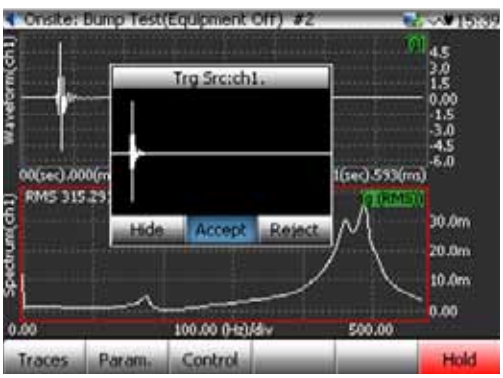
Reliability
The CoCo battery lasts up to 10 hours. Special thermo and low power design eliminates the need for a cooling fan, which increases the battery operating time.

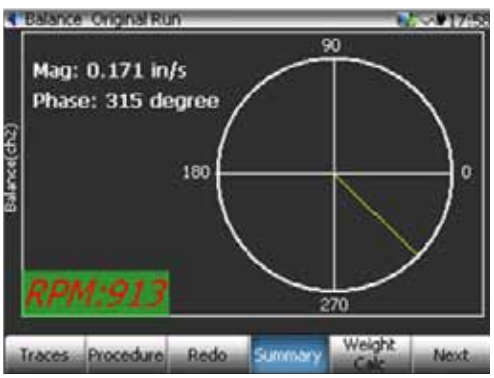
Bearing Library
A comprehensive bearing library is available for purchase through Crystal Instruments. The CoCo also includes a user defined bearing library, which allows the user to add or edit definitions manually.

Flexible Licensing Policy
Crystal Instruments products include a flexible licensing policy, allowing unlimited installations of a purchased product within the same company. This policy minimizes transfer time of equipment between users.

Dynamic Signal Analysis Software Suite Available
Crystal Instruments also offers a full suite of Dynamic Signal Analysis (DSA) software for the CoCo-80 and CoCo-90.







VIBRATION DATA COLLECTOR
SOFTWARE FEATURES

Route Based Condition Monitoring
Measurement Channels: 1 or 3 channels (tri-axis) with tachometer enabled or disabled

Route Collection Control: Easy navigation from the UI level to routes. View or hold live signals, review saved data, previous measurement entry, next measurement entry, previous point, next point, point and route management.

Demodulated Spectrum
Available in both route collection and onsite mode

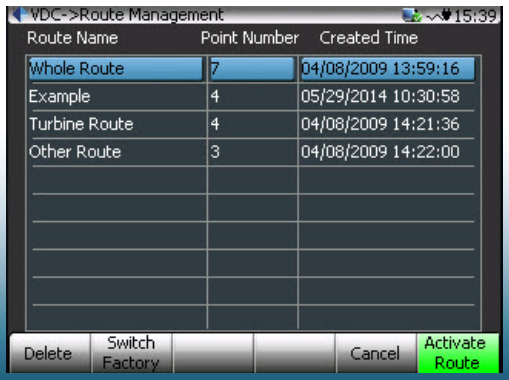
Demodulation Bandwidth: 24 bandwidth options ranging from 125 Hz -1.44 kHz, to 32 kHz - 46.08 kHz

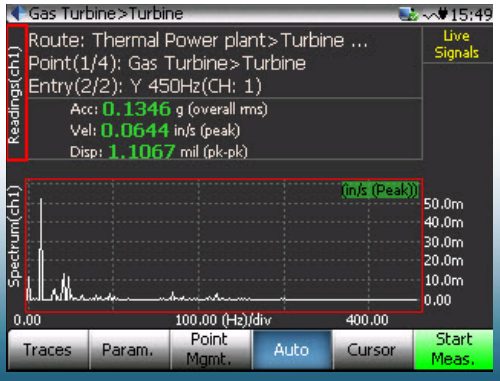
Coast-Down/Run-Up
Trigger setting to collect data when increasing (run-up) or decreasing (coast-down) speed. 3D display for order spectrum data.

Rotor Balancing
Enables users to correct the imbalance without dismantling the machine. It is possible to balance rotors of any size with either 1 or 2 plane balancing. Using the multiple channel option, parallel measurements on 2 sensors are possible, resulting in a faster, safer, and more accurate procedure. The user interface allows stopping and starting balancing as needed and to repeat any single operation without repeating the whole procedure.

Bump Test
Auto power spectra within user-defined frequency band.

Zoom Spectrum Analysis
Increase resolution in the bandwidth of interest. Zoom Spectrum Analysis allows for higher resolution measurements to be made by focusing on a section of the available bandwidth. All available spectral lines are distributed across the selected bandwidth, rather than across the entire available frequency range. Compute FRF, Coherence, Auto Power Spectra, and Phase Spectra.





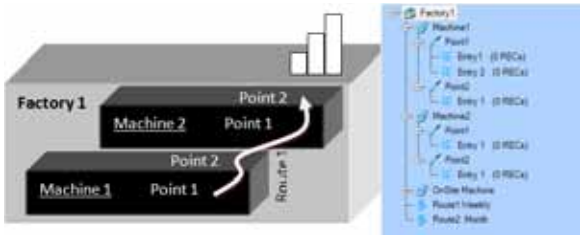
VIBRATION DATA COLLECTOR
MANAGEMENT PC SOFTWARE

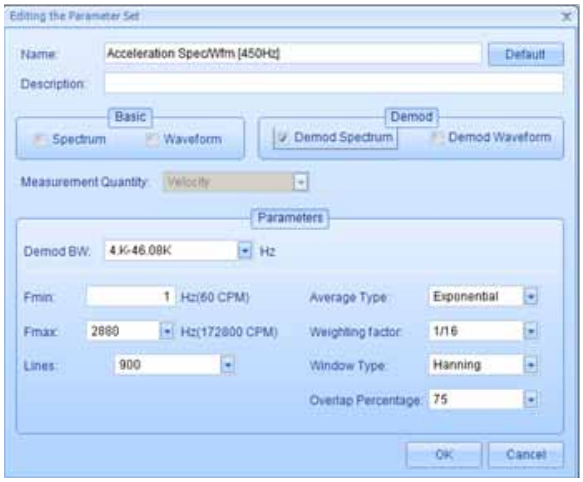
In the vibration data collector mode, EDM is used to create and maintain a hierarchical database of all machines and data for the condition monitoring function within a facility. The user creates a list of all machines and measurement points that will be monitored within the plant. After data collection, the CoCo downloads the data to EDM for post processing, storage, analysis, trending and reporting.

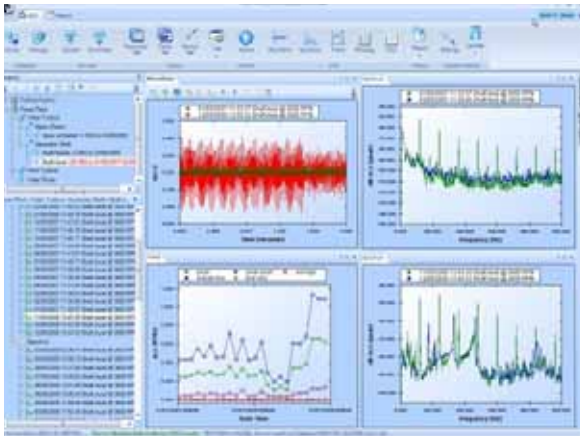
Before measurements are made on a route, the route must first be defined within the EDM software. This task is done for each route and then field measurements are recorded on a route thereafter.

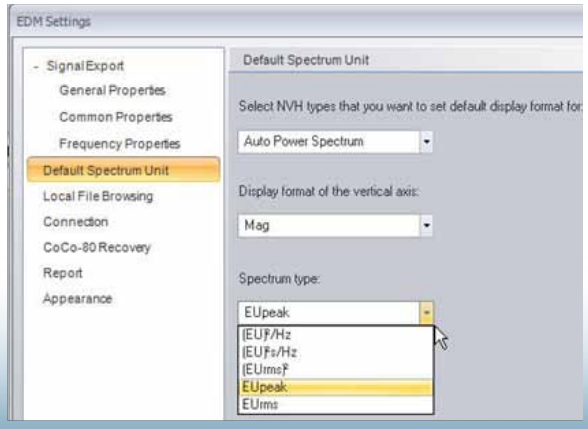
Once the routes are uploaded to the CoCo hardware, the user is able to begin making measurements along a route. After data has been collected along a route it is downloaded from the CoCo hardware to the PC. After the data is downloaded to the PC the user can use the tools in the EDM software to analyze the data, plot waveforms, spectra and trends, print reports and archive the data.

File Management
All CI products save data in ASAM-ODS format for the greatest compatibility and flexibility. EDM also exports signals in the following formats: UFF, BUFF, ASCII UFF, MATLAB file, NI-TDM file, User-Defined ASCII file, .WAV and .CSV (MS EXCEL) file. This file conversion support by EDM guarantees that signals gathered by CI devices are usable in all third party software. Compression algorithms is optionally applied to save disk space. The user customizes the export options such as spectrum units, engineering units, data precision and scaling factors.

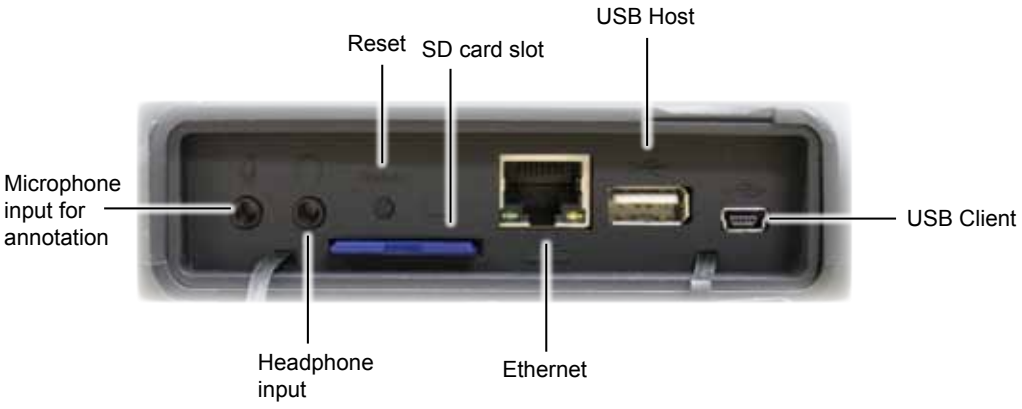








CoCo HARDWARE DIAGRAM



Up to 32 GB SD Card storage

Battery life up to 10 hours

CoCo PRODUCT SPECIFICATIONS

The CoCo-80 is equipped with 2, 4, or 8 input channels through BNC connectors. It can accurately measure and record both dynamic and static signals. The mass flash memory can record 8 channels of streaming signals simultaneously (up to 102.4 kHz) while computing real-time time and frequency based functions. An embedded signal source channel provides various signal output waveforms that are synchronized with the input sampling rate.

The CoCo-90 is equipped with 16 input channels employing LEMO connectors. It can accurately measure and record both dynamic and static signals. The mass flash memory can record 16 channels of streaming signals simultaneously (up to 51.2 kHz) while computing real-time time and frequency based functions. An embedded signal source channel provides various signal output waveforms that are synchronized with the input sampling rate. LEMO to BNC adapters are provided.

The CoCo-80 is configured with 2, 4, or 8 channels. The CoCo-90 features 16 channels in the same form factor as the CoCo-80.

Inputs of CoCo-80
Up to 8 BNC connectors, built-in IEPE current source, single-ended or differential, AC or DC coupling, 150 dBFS dynamic range, dual 24-bit A/D converters, range ±10 Volts (Optional ±20 Volts range)

Inputs of CoCo-90
16 LEMO connectors, built-in IEPE current source, single-ended, AC or DC coupling, 100 dB dynamic range, 24-bit A/D converters, range ±10 Volts

Output
1 SMB connector, 100 dB dynamic range, 24-bit A/D converter

Audio
3.5 mm Audio Jack Stereo connector for earphones, plus built-in speaker and microphone

Dimensions
231 x 170 x 69 mm

Weight
1.71 kg including battery

Power
AC Adapter: 110-240 Volts AC
Max Power Consumption: 14 watts
Battery Operations: up to 10 hours in automatic mode

Host Interface
2 USB ports, 100 Base-T Ethernet, SD Card

Maximum Sampling Rate
102.4 kHz simultaneously (CoCo-80 only)

Flash Memory
4 GB used for system and data storage

LCD
5.7 inch LED backlight, 320 x 240 resolution, color

Typical Real-time Analysis Functions
Math (+,-,*, /), integration, differentiation, FFT, averaging, windowing, auto power spectra, cross spectra, FRF, coherence, real-time filters, RMS, octave, order tracking, swept sine, limiting, alarm/ abort and much more.

Vibration Data Collection Functions
RMS, true-RMS, overall-RMS, waveforms, spectrum, demodulated spectrum, trending and alarm, 2 plane balancing. Measure acceleration, velocity, displacement and tachometer.

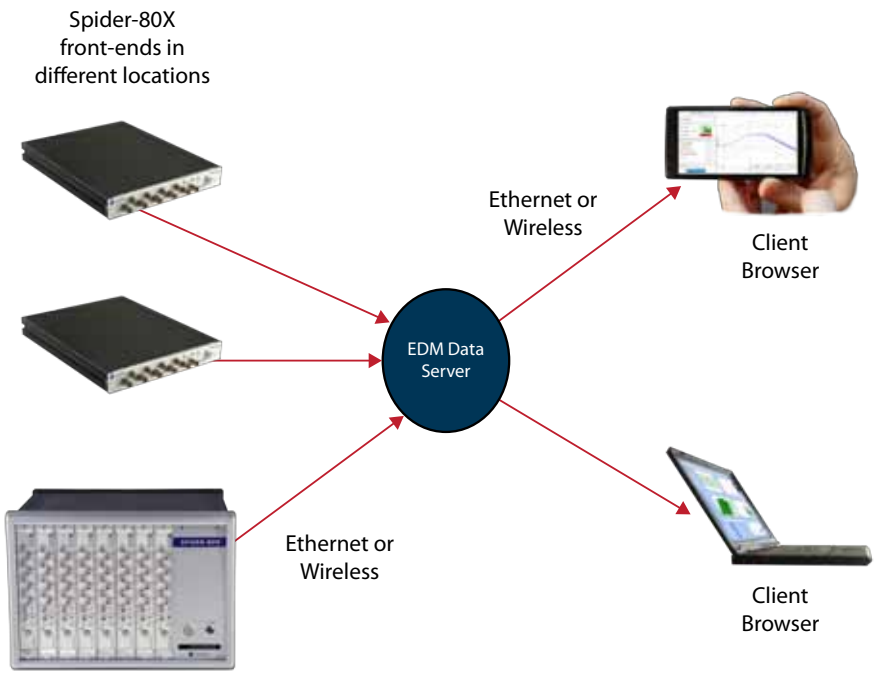


Figure 1: Crystal Instruments Spider-80X monitors and experts joined by a Local Area Network (LAN).

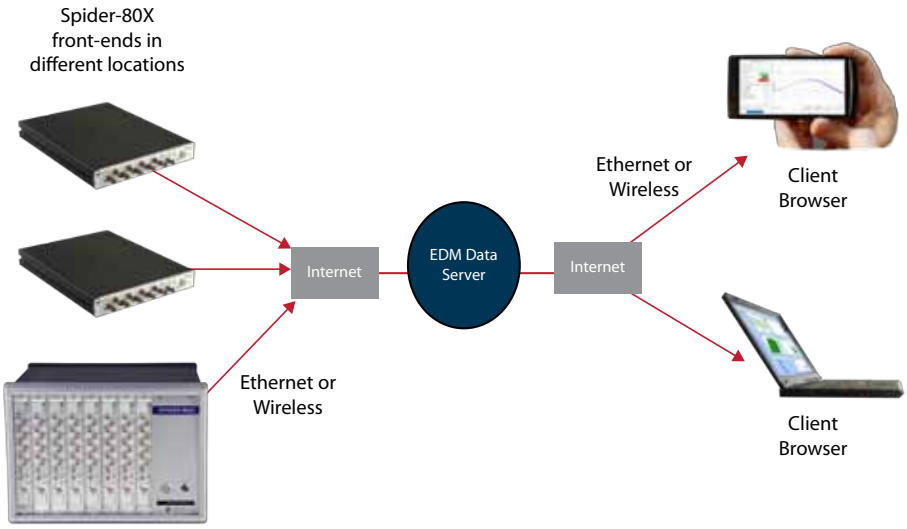


Figure 2: Crystal Instruments Spider-80X and skilled people joined by the Internet.

CLOUD BASED REMOTE MONITORING SOLUTIONS

Sometimes the machinery stretches from Taipei to Tuscaloosa. Or all the interesting action takes place in a tiny room 200' off the ground. That's when EDM Cloud is the tool of choice. With EDM Cloud, the test and the test engineer can be literally oceans apart. Any of the usual EDM tests can be incorporated into a test suite, fully developed in the comfort of the office, then sent to the Spider front-ends far away. Check measurements against a variety of criteria; tests run locally, on the Spiders. Results are available across the world, in real-time.

EDM Cloud is server-based software designed to take vibration and other measurements remotely using Spider front-ends. Applications include machine conditioning monitoring, wind turbine vibration and status monitoring, bridge and railway vibration monitoring, tunnel sound monitoring and more. By opening a web browser on a tablet PC, iPad, PC or a smart phone, the user can access real time or historical data instantly.

Login anywhere in the world to view live signal reports via EDM Cloud by Crystal Instruments.

At most facilities, this is made possible by an Ethernet “backbone” linking all of the manufacturing units into a plant-wide LAN as shown in figure 1. At each manufacturing unit, permanently installed monitoring transducers are wired to monitors at a sheltered proximate central point (typically a local control room). In turn, each monitor is connected to the Ethernet LAN. This allows the data to be viewed and analyzed anywhere the LAN has a port. An Engineering Data Management (EDM) program running on the LAN’s server manages data transfers to any computer on the network running the appropriate browser-based viewing/control software. Add an Internet modem to the LAN to provide a remote communication path to any internet-connected computer in the world.

At facilities lacking a plant-wide Ethernet backbone, the Internet may be used as a substitute path as shown in figure 2. Any combination of broad-band telephone, cable or wireless connection to the internet is fair game. A cellular modem connected to a monitor provides a true stand-alone measurement subsystem. While line power is almost always available within a manufacturing plant, it may not be for other applications. Monitoring bridges, wind-powered generators, road profiles, flutter or airport noise may call for a battery-powered installation, perhaps one with solar (or other) backup. For this reason, the monitoring hardware should be fully capable of running (at full performance) from low voltage DC as well as domestic, overseas and aircraft AC line power.

EDM software supports three levels of operator privilege.. Super-Admins control the privileges of other users, and have all the rights of the lower level users. Admins set up tests: they map out the system and decide what measurements will be needed, then set the limits that define events. They also have all the rights of users. Users monitor signals, but are unable to change the test. Each user has complete control over which signals to examine and which events will generate an alert for that user.

Users can check on installations from anywhere in the world. Both the event log and real-time signals are available online.

CUSTOMIZE MESSAGE STRINGS

When a certain event happens, such as the spectrum of measurement point 1 of bearing 2 exceeding the limit, the event report string can be customized to tell the user exactly what the problem is: “Warning: Measurement point 1 of bearing 2 exceeded limit”. These special strings are logged in the Spider hardware as well as on the Cloud server. The user can view these events or receive them through emails or IM (instant messages).

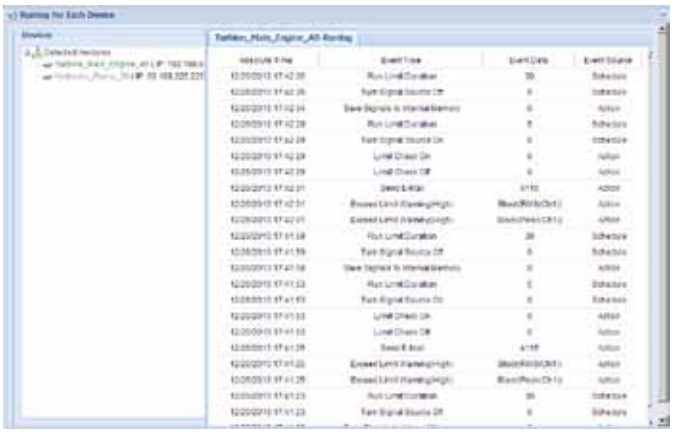
ONLINE ANYWHERE, ANYTIME

Since EDM Cloud is web-based, users can check on installations from anywhere in the world. Both the event log and the real-time signals are available online. Check the time domain signal, flip to spectrum, move through the device map to see every aspect of machine operation. At the same time, other users can be viewing other signals, concentrating on other indications of machine performance. EDM Cloud is the most flexible, customizable test suite available.

SET UP EVENT ACTION RULES

Events are anything that prompts a response from the system. If monitored signals go outside specified limits, (one kind of event), EDM Cloud offers a full suite of responses. Often, the first response will be to report the problem. Other responses might include visual signals, direct commands to other instruments, even shutdown of the system under test.

Any user can request email notification of events. One user might only care if the bearings in units 9 and 10 begin to wear, while another needs to know if the sound level in the level 2 control room a hundred miles away increases too much. Each user sets up a personalized list of events that can trigger corresponding alerts.



View runlog events from any location

Users can receive emails that contain keywords that are preset by the users, for example, "limits exceeded".

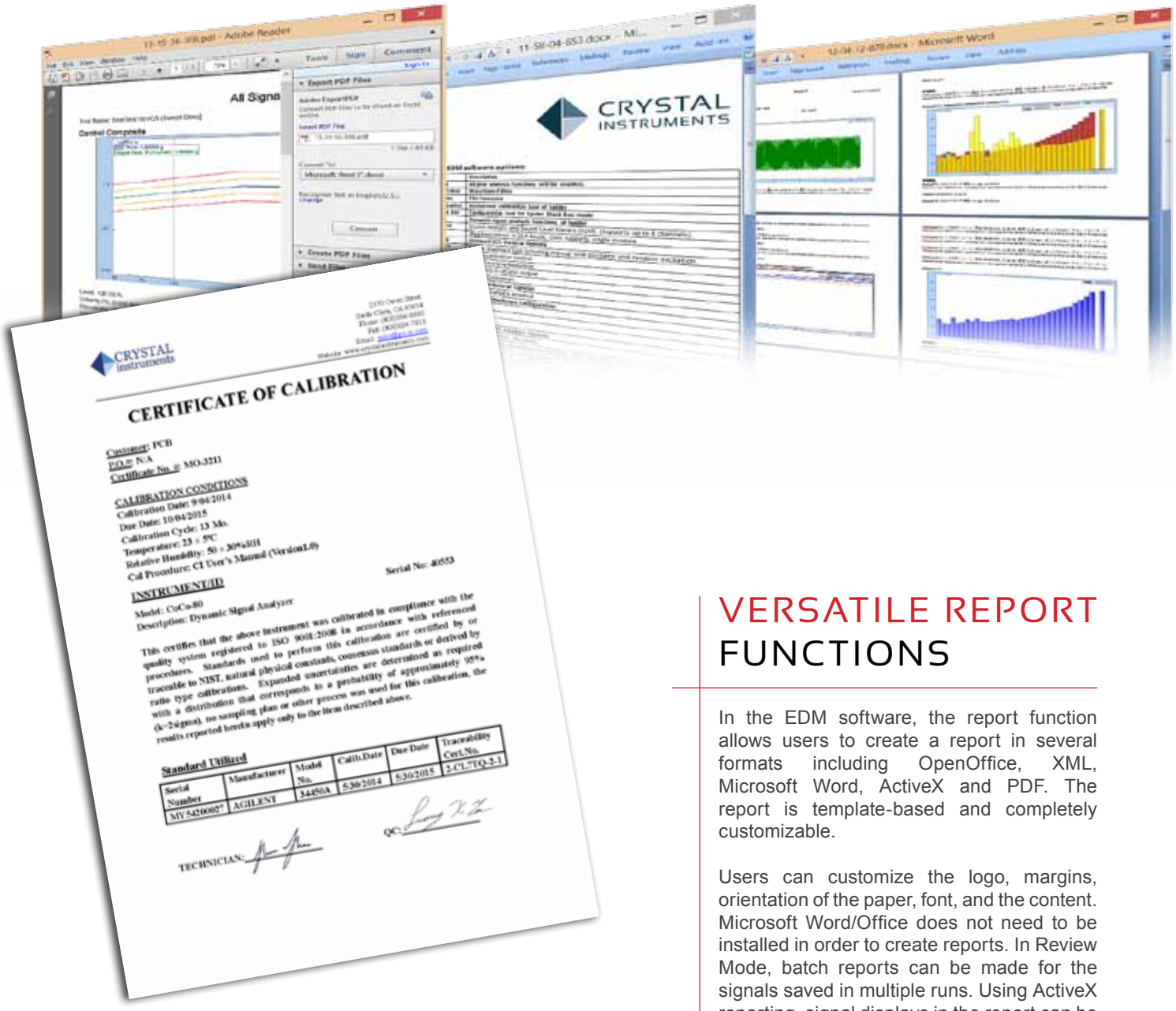
FULLY CONFIGURABLE TESTS

Tests are initially set up and uploaded to the Spider hardware from a PC runing EDM software. Measured signals might include:

- Vibration
  - Time records (realtime blocks, or long time waveform format)
  - RMS or Peak level
  - Harmonics
  - Power spectra
  - Frequency Response Functions (Magnitude and Phase)
- Sound level
- Ancillary measurements such as temperature, humidity, strain, voltage.

Alarm limits can be set for vibration and sound measurements. Up to 64 limit lines per measurement. Up to 64 breakpoints per limit line. Draw the lines with a mouse or stylus or enter in a breakpoint table – tests are completely customizable. At any time, Admins can change test parameters and adjust limits.

The Spider DSP provides powerful and flexible processing functions. FFT, long wave recording, trigger, digital filters, octave and sound level meter measurement, to name a few. These processing functions can be triggered by events or operate on a fixed time schedule. Using the Spiders' unique patented dual A/D technology, high dynamic range data acquisition is possible with superb accuracy for both large and small signals. This is crucial for monitoring processes since the user often has no prior knowledge about the signal levels before critical events occur.

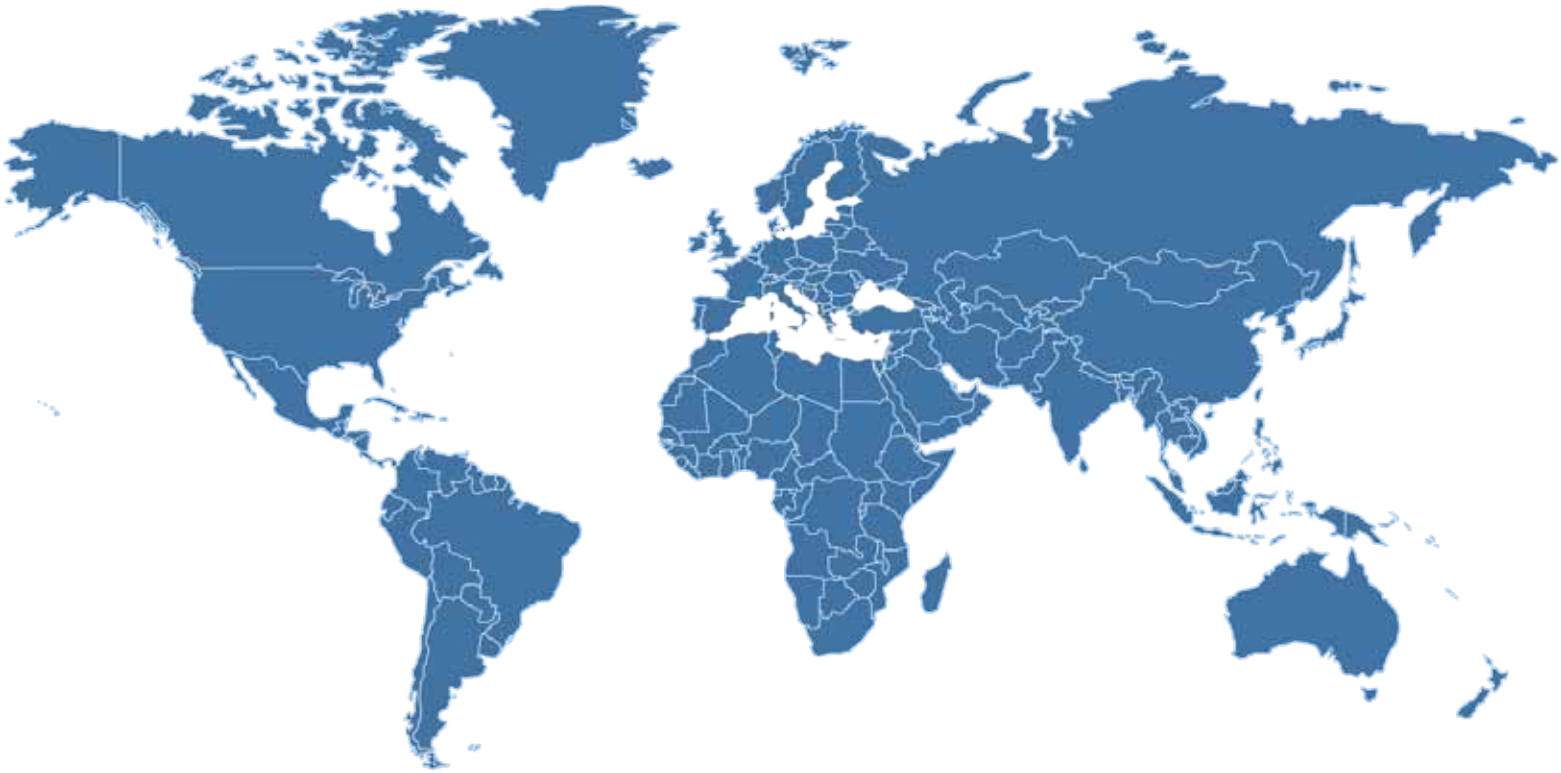


VERSATILE REPORT FUNCTIONS

In the EDM software, the report function allows users to create a report in several formats including OpenOffice, XML, Microsoft Word, ActiveX and PDF. The report is template-based and completely customizable.

Users can customize the logo, margins, orientation of the paper, font, and the content. Microsoft Word/Office does not need to be installed in order to create reports. In Review Mode, batch reports can be made for the signals saved in multiple runs. Using ActiveX reporting, signal displays in the report can be rescaled, analyzed, and zoomed.

- User can select from various templates for creating reports
- Plot reports can be generated by simply right-clicking the mouse
- Company logos can be inserted into the template header or footer
- Reports can be in WORD, XML or PDF format
- “Active Report” allows the user to ZOOM in and out like a graph on the report
- Generate typical hardware calibration reports



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