CoCo-70X Software Specifications

The following software functions are available on CoCo-70X:

- Route vibration collection
- Off-Route measurements
- Job Management
- Dynamic Signal Analysis Mode

CoCo-70X Vibration Data Collector

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CRYSTAL INSTRUMENTS

CoCo-70X Introduction

The CoCo-70X is Crystal Instruments' latest handheld vibration data collector, featuring an improved user interface and redesigned chassis. The CoCo-70X is a four-channel vibration data collector with an IP-67 rating, designed specifically for the machinery Predictive Maintenance (PdM) community. The CoCo-70X offers powerful processing capabilities and an intuitive user-interface, providing users with an easy-to-use data collection experience. The newly designed chassis is lighter and more ruggedized, making the CoCo-70X a perfect device for route-based measurements and off-route dynamic signal analysis.

Analog Input Settings

- Sensitivity: Specified in millivolt per engineering unit (mV/EU)

- Input Mode: DC-Single End, AC-Single-End, IEPE (ICP®)

- High-Pass Filter: 0.1 Hz to 100 Hz user-definable

- Low-Pass Filter: 1 kHz @ -3dB (Enable/Disable by software)

- Label: A text identifier entered for each channel

- TEDS detection: TEDS sensor characteristics can be read by the CoCo-70X

Signal Source (Analog Output) Settings

The Signal Source can be enabled in all testing modes except Order Tracking.

- Output Range: ±10 V (programmable)

- Source Waveforms: Sine, Triangle, Square, White Noise, Pink Noise, DC, Chirp, Swept Sine, Arbitrary

- Arbitrary Waveform Size Limit: up to 128,000 points

- Playback Recorded Signals: Recorded signals can be played back from the output channel with voice annotations

Recording Time Streams and Saving Data Block

Recording Time Streams

In all testing types, continuous Time Streams of enabled channels can be recorded directly to the removable SD card.

- Max Data Recording Rate: 4 channels at 102.4 KHz

- Max Spectral Bandwidth during Recording: 46.08 kHz (sampled at 102.4 kHz)

- Data Recording Trigger Condition: User initiated command, set by timer, set by run-schedule, or input trigger

- Time Duration of Recording: $D = \left(\frac{1\ sample}{4\ byte}\right) * \frac{S}{C * F_{sampling}}$

C   Channel Count (#)
$F_{sampling}$ sampling rate (samples/sec)
D   Recording Duration (seconds)
S   SD Card Storage (bytes)

Sampling Rate	Estimated Recording Time with 128 GB SD Card
4 channels @ 102.4 kHz	21 hours
1 channel @ 102.4 kHz	86 hours
1 channel @ 20.48 kHz	18.08 days

Software Installation and Upgrade

- Software installation and updates: Download software updates directly to the device or download to a PC first. Analysis functions can be updated by connecting to the internet.

- Software functions: Controlled by the installed license key

Connection Type

- Ethernet: Dynamic Host Configuration Protocol (DHCP) or static IP address setup may be used. Connect ethernet directly (One-to-One) or via Local Area Network (LAN). Use of address mask, gateway and Domain Name System (DNS) are supported.

Power Management

Intelligent power management controls the power consumption of the display LCD during measurement with preset timers. It manages the power-down based on residual battery power and heat conditions. Power status including maximum capacity, current capacity and working temperature can be displayed.

Calibration Tool

- Manual Calibration: Use a meter to calibrate the output channel, then the system will automatically calibrate the input channels by using the output signal

- Factory Procedure: A comprehensive and automated calibration tool is available at the factory or designated service center.

- Calibration Report: A final calibration report is generated. The report includes the model number, text for the calibration meter, and operator name. Reports can be viewed or printed from the host PC.

Input Channel and Sensor Settings

- Level Display: bar graph displays the input level. IEPE sensor detection.

- Sensitivity: user-defined with engineering units and input sensitivity settings

- Labels: user-defined channel labels

- Input Types: AC/DC/IEPE coupling and differential or single-ended input type

- Built-in Integration and Double Integration: when acceleration is selected as the physical measurement quantity, digital integration or double integration can be applied to obtain velocity or displacement quantity. When velocity is selected as measurement quantity, digital integration can be applied to obtain displacement. The engineering units after integration or double integration can be set for each channel.

- Digital High-Pass Filter: user-defined cutoff frequency for each channel

Job Management
Add, delete, or edit jobs. Assign machines from factory hierarchy or create custom machines. All Off-Route functions use job management to store data. Must have at least one Off-Route function enabled to use job management.

Advanced Audio Functions
This is the audio function for both listening and speaking. Listening allows the user to hear, via earphones, any of the input channels without interrupting the measurement. The user can adjust the (stereo) earphone volume and customize various Alarm sounds heard through them. Speaking lets the user record voice annotations which are attached to a saved signal or recorded data. The voice annotation can be played back on a PC using the EDM software.

Headphone listening and voice annotation functions are enabled or disabled in the Audio setup window. When the headphone listening function is enabled, the user selects one of the active input channels. The signal will be normalized to an audible range and played into the headphones.

Miscellaneous
- Date and Time: User can set the date, time and time zone.

- Account Management: Account management based on User Name and Password is provided. Multiple User accounts are supported.

- Language: English, Chinese, Japanese, French and Spanish.

- Number Digit Notation: Choice of Engineering notation, Scientific notation or floating point notation.

Route Vibration Collection
The route based data collection mode includes: overall readings, time waveform, spectrum and demodulated spectrum.

- Route Tree Structure: database, factory, space, machine, point, direction and measurement entry

- Advance in Measurement Entry: manual or automatic

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

- Data Review: previously measured data can be recalled for review in the same format and style when the data is saved.

- Route Collection Control: easy navigation from the UI level to routes. View or hold live signals, review measured record, previous measurement entry, next measurement entry, previous point, next point, point and route management.

Vibration Overall Level Readings
Available in route collection.

- Measurement Quantity: acceleration, velocity, displacement, current and tachometer

- Overall Level Readings: peak, peak-peak, average, overall RMS, true RMS

- AdB, VdB, amps: US and SI options for both AdB and VdB

- Magnitude and Cursors: overall RMS value, dual cursors, harmonics, digital readouts on chart

- Amplitudes at Orders: display the spectrum amplitude at 1, 2, and 3 rotating orders

- RMS Calculation in Band: calculate RMS value for any time or auto power signals between two cursors.

Signal Display
- Signal display window consists of one or two traces on the LCD panel. Each trace displays one or more signals, in the format of reading or graphic plot.

- Display Traces: readings only, waveform only, spectrum only, readings + readings, readings + waveform, readings + spectrum, waveform + waveform, waveform + spectrum, spectrum + spectrum and demodulation spectrum. User can switch from one trace to another by pressing Next Trace button.

- Horizontal Axis of Spectrum Scaling: linear, log

- Vertical Cursor: one or two vertical cursors controlled with the arrow buttons

- Cursor Numeric Display: shows the signal values on screen at the cursor location for all signals in a trace. Cursor value display area can be moved.

Alarms
- Alarms Levels: up to 3 alarm levels (warning, alarm, danger), comparison to previous measurement

- Reading Alarm: alarms can be applied to overall RMS, peak, peak-peak, average or true RMS for each channel. Alarms can be created using baseline values.

- Waveform Alarm: alarms will apply to the time domain

- Spectrum Band Alarm: applied to any spectrum and checked against the whole frequency range or a specific band.

- ISO Standard Alarm: ISO 2372 for rotating machinery operating from 600 to 12000 RPM; ISO-10816-2 for land-based steam turbines; ISO 10816-3 for industrial machines; ISO 10816-4L for gas turbines.

- Display: instantaneous measurement, measured value, alarm limits, and previous measurement. Bar graph display of measurement and alarm levels.

Basic Off-Route
- Quick Analysis Functions included: High Frequency Analysis, Low Frequency Analysis, High Resolution Analysis, Transient Time Capture

- Manual Analysis Functions included: Time Waveform, FFT, FRF, demod spectrum, zoom analysis

- Measurement Channels: 1 to 3 measurement channels with tachometer enabled or disabled

- Data Review: previously measured data can be recalled for review in the same format and style when the data is saved.

High Frequency Analysis
High Frequency Analysis can be applied when there are a lot of peaks on the right hand side of the spectrum, or when a high frequency band is in alarm.

Available in Quick Analysis.

- Functions Computed: Auto Power Spectrum
- FFT Block Size: 4096
- Spectral Lines: 1800
- Frequency Range: 3.52 kHz
- Data Window Functions: Hanning
- Spectral Averaging: linear
- Average Number: 4
- Measurement Quantity: acceleration, velocity, displacement, or electrical current
- Display Spectrum Type: peak
- Unit: English and metric units

Low Frequency Analysis
Low Frequency Analysis is useful for very low turning speeds, usually below 10 Hz (600 RPM). Low Frequency

Analysis statistically enhances data to remove integration error.

Available in Quick Analysis.

- Functions Computed: Auto Power Spectrum
- FFT Block Size: 512
- Spectral Lines: 225
- Frequency Range: 110 Hz
- Data Window Functions: Hanning
- Spectral Averaging: linear
- Average Number: 4
- Measurement Quantity: acceleration, velocity, displacement, or electrical current
- Display Spectrum Type: peak
- Frequency Domain Axis: Hz
- Unit: English and metric units

High Resolution Analysis
High resolution Analysis increases the resolution of spectral data to separate closely spaced peaks and sideband frequencies for rotor bar or gear mesh problems. High Resolution Analysis acquires data with better spectral resolution that the standard route or marked spectra.

Available in Quick Analysis.

- Functions Computed: Auto Power Spectrum
- FFT Block Size: 16,384
- Spectral Lines: 7200
- Frequency Range: 8.00 kHz
- Data Window Functions: Hanning
- Spectral Averaging: linear
- Average Number: 4
- Measurement Quantity: acceleration, velocity, displacement, or electrical current
- Display Spectrum Type: RMS
- Frequency Domain Axis: Hz
- Unit: English and metric units

Transient Time Capture
The Transient Time Capture program lets you collect large, unbroken time waveforms from up to four inputs.

Available in Quick Analysis.

- Signals Acquired: time waveform from up to 4 channels
- Block Size: 2048

- Frequency Range: 25.60 kHz
- Measurement Quantity: acceleration, velocity, displacement, or electrical current
- Unit: English and metric units
- Acquisition Modes: Free-Run or trigger

Time Waveform
Available in Manual Analysis.

- Functions Computed: Linear Spectra, Auto Power Spectra.
- Block Size: 256, 512, 1024, 2048, 4096, 8192, 16,384, 32,768
- Spectral Lines: 112, 225, 450, 900, 1800, 3600, 7200, 14400
- Frequency Range: 22 Hz to 46 kHz in 34 selectable stages (and equivalent RPM)
- Data Window Functions: Uniform, Hanning
- Spectral Averaging: exponential, linear, peak hold
- Overlapping ratio for spectral analysis: 0%, 25%, 50%, 75%, or as high as possible
- Measurement Quantity: acceleration, velocity, displacement, or electrical current
- Display Spectrum Type: peak, peak-peak, RMS or dB
- Frequency Domain Axis: Hz, RPM, or Order
- Unit: English and metric units
- RPM detection: read from tachometer

Fast Fourier Transform (FFT)
Available in Manual Analysis.

- Functions Computed: Linear Spectra, Auto Power Spectra.
- Time Waveform Number of Samples: 256, 512, 1024, 2048, 4096, 8192
- FFT Block Size: 256, 512, 1024, 2048, 4096, 8192
- Spectral Lines: 112, 225, 450, 900, 1800, 3600
- Frequency Range: 22 Hz to 46 kHz in 34 selectable stages (and equivalent RPM)
- Data Window Functions: Uniform, Flattop, Hanning, Hamming, Flattop, Uniform, Kaiser-Bessel, Blackman, Force, Exponential, Force-Exponential
- Spectral Averaging: exponential, linear, peak hold
- Overlapping ratio for spectral analysis: 0%, 25%, 50%, 75%, or as high as possible
- Measurement Quantity: acceleration, velocity, displacement, or electrical current

- Display Spectrum Type: peak, peak-peak, RMS or dB
- Frequency Domain Axis: Hz, RPM, or Order
- Unit: English and metric units

Frequency Response Function (FRF)
Available in Manual Analysis.

- Functions Computed: Linear Spectra, Auto Power Spectra, Cross Power Spectrum, Coherence, Frequency Response Function
- FFT Block Size: 256, 512, 1024, 2048, 4096, 8192
- Spectral Lines: 112, 225, 450, 900, 1800, 3600
- Frequency Range: 22 Hz to 46 kHz in 34 selectable stages (and equivalent RPM)
- Data Window Functions: Uniform, Flattop, Hanning, Hamming, Flattop, Uniform, Kaiser-Bessel, Blackman, Force, Exponential, Force-Exponential
- Spectral Averaging: exponential, linear, peak hold
- Overlapping ratio for spectral analysis: 0%, 25%, 50%, 75%, or as high as possible
- Measurement Quantity: acceleration, velocity, displacement, or electrical current
- Display Spectrum Type: peak, peak-peak, RMS or dB
- Frequency Domain Axis: Hz, RPM, or Order
- Unit: English and metric units

Zoom Analysis
Compute auto power spectra within a user-defined frequency band. With Zoom Analysis, the user achieves very high frequency resolution without computing the entire spectrum.

Available in Manual Analysis.

- Functions Computed: Linear Spectra, Auto Power Spectra, Frequency Response Function, Coherence, and Phase
- Maximum Analysis Frequency: 2 inputs: up to 46 kHz; 4 inputs: up to 37 kHz
- Smallest ZOOM Bandwidth: 0.28125 Hz
- Maximum Zoom FFT Lines: 1800 lines
- Highest Theoretical Frequency Resolution: 0.00015625 Hz
- Acquisition Modes: Free-Run or trigger
- Maximum Zoom Bandwidth: 4 inputs: up to 46 kHz
- 4 inputs: up to 37 kHz

Demodulated Spectrum

Available in both route collection and Manual Analysis

- Demodulated Bandwidth: 24 bandwidth options from 125 Hz to 1.44 kHz up to 32 kHz to 46.08 kHz

- Maximum Analysis Frequency: 2 inputs: up to 46 kHz; 4 inputs: up to 37 kHz

- Smallest ZOOM Bandwidth: 0.28125 Hz

- Window Functions: Hanning, Hamming, Flattop, Uniform, Kaiser-Bessel, Blackman, Force, Exponential, Force-Exponential.

- Averaging: Exponential, Linear, Peak Hold, Time Exponential, Time Linear

- Spectrum Units: EU_{pk-pk}, EU_{pk}, EU_{rms}, EU_{rms}^2, EU^2/Hz, $EU^2 \cdot s/Hz$, degree (Phase)

- Overlap Ratio: 25%, 50%, or 75%, Maximum possible overlap

- Correlation Functions: Auto- and Cross-Correlation Functions

- Linear Spectrum Scaling: Peak or RMS

- Power Spectrum/PSD Scaling: RMS, Power, Power Spectral Density, Energy Spectral Density

- Acquisition Modes: Free-Run or trigger

Bump Tests

Bump Tests check for resonance on a machine. During the test, hit the machine with a hammer and look for peaks at the different frequencies. You want to determine if the high amplitude is caused by high input force or low input force that is amplified by resonance.

The analyzer has two Quick Analysis functions for Bump Tests: Bump Test Equipment Off and Bump Test Equipment Running. The Bump Test functions are single-channel measurements. For two or four channels, use the FRF mode in Manual Analysis.

Bump Test - Equipment Off

Bump Test Equipment Off lets you check for resonance when the equipment is not running. Use this measurement when high vibration is unexplained. The spectrum may show a broad hump of energy or a single discrete peak. Use a normal hammer for this measurement.

Available in Quick Analysis.

- Functions Computed: Waveform, Spectrum

- Block Size: 512, 1024, 2048, 4096, 8192, 16384

- FFT lines: 225, 450, 900, 1800, 3600, 7200 (selectable)

- Frequency Range: 0.22 Hz to 46 kHz in 34 selectable stages (and equivalent RPM)

- Data Window Functions: Uniform, Flattop, Hanning

- Spectral Averaging: linear

- Measurement Quantity: acceleration

- Display Spectrum Type: peak

Bump Test - Equipment Running

The Bump test Equipment Running confirms resonance when you cannot turn the equipment off to perform a normal bump test. It also helps remove background vibration. Use a normal hammer for this measurement.

Available in Quick Analysis.

- Functions Computed: Waveform, Spectrum

- Block Size: 512, 1024, 2048, 4096, 8192, 16384 (selectable)

- FFT lines: 225, 450, 900, 1800, 3600, 7200 (selectable)

- Frequency Range: 0.22Hz to 46kHz in 34 selectable stages (and equivalent RPM)

- Data Window Functions: Uniform, Flattop, Hanning

- Spectral Averaging: negative averaging

- Measurement Quantity: acceleration

- Display Spectrum Type: peak

Order Tracking

Developed to operate with a precise digital tachometer, the Order Tracking option uses high-speed digital resampling and proprietary DFT processing to acquire whole and fractional orders at a fast slew rate. Order Tracking can record Time Streams, real-time Order Tracks and Order Spectra, narrow- and fixed-band RPM Spectra, overall RPM Spectrum, and Order Tracks with Phase data.

Order Tracking (C70X-50) includes functions in Quick Analysis, Manual Analysis, and DSA Mode.

- Quick Analysis Functions: Order Tracking, Coast Down Peak Hold, Coast Down Peak and Phase

- Manual Analysis Functions: Order Tracking

- DSA Mode Functions: Order Tracking

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

- Data Review: previously measured data can be recalled for review in the same format and style when the data is saved.

Real-Time Order Tracks and Order Spectra

Real-Time Order Tracks are signals that present the signal amplitude of a specified Order graphed against RPM. Multiple Order Tracks are measured, displayed, and saved.

Order Spectra are Auto Power Spectra with the horizontal axis normalized to orders.

Available in Quick Analysis, Manual Analysis and DSA Mode.

- Max Order Tracks: 28 tracks with 1 channel; 8 tracks with 4 channels

- Max Order of Interest: 200

- Order Tracks Scaling: Linear spectrum with peak or RMS scaling

- Power spectrum with RMS scaling

- Spectrum Units: EU_{pk}, EU_{rms}, EU_{rms}^2

- Tracking RPM Range: 3 – 300,000 RPM (0.05 Hz – 5 kHz)

- Spectrum RPM Resolution: 10 – 10,000 RPM

- Delta Order of Spectrum: 0.025 to 1

- Acquisition Mode: Free Run, Run Up, Run Down, Run Up and Down, Run Down and Up

- Order Spectrum View Mode: Two dimensional, waterfall, or spectrogram (with RPM as z-axis)

Narrowband RPM Spectra
Narrowband RPM spectra are 3D signals that display the Auto Power Spectra changing with RPM. Fixed Band RPM spectra are RMS measurements extracted from the 3D RPM spectrum within fixed frequency bands.

Available in Manual Analysis and DSA Mode.

- RPM Range: 3 – 300,000 RPM (0.05 Hz – 5 kHz)

- RPM Resolution: 10–10,000 RPM

- FFT Block Sizes: 256 – 4,096 points (8 channels)

- Average Mode: Linear, Exponential, Peak Hold

- Window Functions: Hanning, Hamming, Flat-top, Kaiser-Bessel, Blackman, Force, Exponential, Force-Exponential

Spectrum Type and Scaling:
- Linear Spectrum: Peak or RMS scaling

- Power Spectrum or PSD: RMS scaling

- Spectrum Units: EU_{pk}, EU_{rms}, EU_{rms}^2, EU^2/Hz, $EU^2 \cdot s/Hz$

- Acquisition Mode: Free run, run up, coast down

- Fixed Band RPM Spectra:

- The instrument calculates the total power within a fixed, user-definable band and plots the data against RPM.

- Spectrum Units: EU_{rms}, EU_{rms}^2

Order Tracks with Phase
Order Tracks with Phase are order spectra with phase measurement data relative to the tachometer signal. All specifications are equivalent to real Order Tracks. Order Tracks with Phase may also be displayed as Bode, Polar, or Nyquist plots. With this option the Orbit display is enabled for any two data channels.

Available in Manual Analysis and DSA Mode.

Tachometer Processing
The user may view the original tachometer input waveform or translated RPM signal. The user sets the RPM trigger threshold, rising or falling edge detection, and the number of pulses per revolution. Tachometer signal processing automatically removes unwanted noise and glitches.

Coast Down - Peak Hold
Coast Down Peak Hold checks for resonance during a coast down by holding the highest amplitude in a spectrum. When you shut down the equipment, the operational frequency may excite a suspected resonant frequency. If the vibration peak at the shaft turning speed passes through a resonant frequency during the coast down, the amplitude increases at that frequency and indicates resonance. Coast Down Peak Hold displays only the highest frequency in that range.

Available in Quick Analysis

- Functions Computed: Order Spectrum

- Max Order Tracks: 28 tracks with 1 channel; 8 tracks with 4 channels

- Max Order of Interest: 200

- Order Tracks Scaling: Linear spectrum RMS scaling

- Spectrum Units: EU_{rms}

- Tracking RPM Range: 3 – 300,000 RPM (0.05 Hz – 5 kHz)

- Spectrum RPM Resolution: 10 – 10,000 RPM

- Delta Order of Spectrum: 0.025 to 1

- Acquisition Mode: Coast Down

- Average Mode: Peak Hold

Coast Down - Peak and Phase
Peak and Phase collects and displays synchronous peak and phase waveform measurements as a function of the equipment RPM. Use this to display data collected during start up or coast down. A once-per-revolution tachometer pulse in addition to the vibration signal is required.

Available in Quick Analysis

- Functions Computed: Order Spectrum

- Max Order Tracks: 28 tracks with 1 channel; 8 tracks with 4 channels
- Max Order of Interest: 200
- Order Tracks Scaling: Linear spectrum with peak or RMS scaling
- Reading Units: EU_{pk}
- Tracking RPM Range: 3 – 300,000 RPM (0.05 Hz – 5 kHz)
- Spectrum RPM Resolution: 10 – 10,000 RPM
- Delta Order of Spectrum: 0.025 to 1
- Acquisition Mode: Coast Down
- Average Mode: Linear, Exponential, Peak Hold, none
- Order Spectrum View Mode: Two dimensional

Octave Analysis and Sound Level Meter
Octave Analysis
The Acoustic Data Acquisition software option for CoCo and Spider hardware includes Real-time Octave Filters, Sound Level Meters, and Microphone Calibration functions. These three operations allow users to perform many acoustic measurement operations.

Available in Manual Analysis and DSA Mode

- Standards: ANSI S1.11:2004, Order 3 Type 1-D
  - IEC 61260-1995
- Octave Fractional Resolution: 1/1, 1/3, 1/6, 1/12
- Average Type: Linear, exponential, peak hold
- Time Weighting: Fast, slow, impulse, user-defined
- Frequency Weighting: A, B, and Z comply with IEC 61672-2002 class 1.
- B complies with IEC 60651-1979 type 0.
- Midband Frequencies: Base 10 in accordance with ANSI std. S1.11:2004 Annex A.
- Frequency Range (Band centers):
  - 1/1 Octave: 0.125 Hz to 16 kHz
  - 1/3 Octave: 0.1Hz to 20 kHz
  - 1/6 Octave: 0.1Hz to 20 kHz
  - 1/12 Octave: 0.1 Hz to 20 kHz
- Accuracy: <0.2 dB (1 second stable average, single tone at band center)
- Dynamic Range:
  - For a 1/3 octave with a 2 second stable average as per ANSI S1.11:2004, using a pure Sine tone at 1 kHz input:
- Noise Floor: -24 dB
- Maximum: 111 dB

- Filter Implementation: Real-time digital filters
- Acquisition Mode: Free run, continue after trigger
- Acquisition Source: Input time signal, RMS level, time delay
- VC Curves: Workshop (ISO), Office (ISO), Residential Day (ISO), Operating Theater (ISO), VC-A, VC-B, VC-C, VC-D, VC-E, VC-F, and VC-G

Sound Level Meter
The Sound Level Meter (SLM) is a related application in the acoustic data acquisition software. This module is also referred to as an Overall Level Meter. The SLM applies a frequency weighting filter to the input signal and time weighting to the filter's output. Various acoustic measurements are then extracted from both the input and output signals of this frequency weighting filter.

Available in Manual Analysis and DSA Mode

- Standards: IEC 61672-1 2002
- Filter Implementation: Real-time digital filters
- Frequency Weighting: A, C, Z   (per IEC 61672-2002 Class 1)
  - B (per IEC 60651-1979 Type 0)
- Time Weighting: Fast, slow, impulse (per IEC 61672-2002)
  - User-defined
- Average Time Interval: 0.125 seconds to 24 hours.
- Unique moving linear averaging method allows independent setting of averaging time interval and time trace update rate.
- Linear Operating Range: 110 dB
- Inherent Noise:
  - A weighted: -10 dB or less
  - B weighted: -13 dB or less
  - C weighted: 1 dB or less
  - Z weighted: 16 dB or less
- Measurement Range:
  - A weighted: 0 to 110 dB
  - B weighted: 0 to 110 dB
  - C weighted: 5 to 110 dB
  - Z weighted: 20 to 110 dB
- Frequency Weightings: Z, A, B, C
- Time Weighting: Fast, Slow, Impulse, User-Defined
- Sound Level Measurements: Time-Averaged, Sound-Exposure, Statistical, Peak, Maximum Time-Averaged, Maximum Time-Weighted, Minimum Time-Averaged,

Minimum Time-Weighted

- Acquisition Mode: Free run, continue after trigger

- Acquisition Source Type: Input time signal, RMS level, time delay

- Measure Time Control: Free run, user-defined

- Decay Time Constants:

  ○ Fast: 34 dB/s (per IEC 61672-1 2002 requires >25 dB/s)

  ○ Slow: 4.34 dB/s (per IEC 61672-1 2002 requires 3.4 – 5.3 dB/s)

  ○ Impulse: 35 ms time constant when signal level increasing and 1,500 ms when decreasing

Shock Response Spectrum Analysis

Compute Shock Response Spectrum (SRS) for all channels up to 12 octave ranges using maxi-max, maximum negative, and maximum positive analysis techniques.

Available in Manual Analysis and DSA Mode.

- Filter Implementation: Real-time digital filters that simulate single Degree-of-Freedom system.

- Octave Fractional Resolution: 1/1, 1/3, 1/6, 1/12, 1/24, 1/48

- Filter Damping Ratio (1/2Q): 0 – 100%

- Average Types: Linear, exponential

- SRS Spectrum Types: Maximum positive, maximum negative, maxi-max.

Basic Dynamic Signal Analysis

The user has the option to operate the CoCo-70X in Dynamic Signal Analysis (DSA) mode. This section describes the DSA Mode software functions included in C70X-63: Basic DSA.

FFT Analyzer Functions

Available in DSA Mode.

- Transient Time Block Size: up to 65,536 points for 1 channel, up to 16,000 points for 4 channels.

FFT Block Sizes and Spectral Lines:

Channels [Samples]	Max. Block Size	Max. FFT Lines
1	65,536	28,800
4	16,384	7,200

- Window Functions: Hanning, Hamming, Flattop, Uniform, Kaiser-Bessel, Blackman, Force, Exponential, Force-Exponential.

- Averaging: Exponential, Linear, Peak Hold, Time Exponential, Time Linear

- Spectrum Types: Linear Spectrum, Auto Power Spectrum, Frequency Response Function, Coherence, Cross Power Spectrum, and Phase Spectrum

- Spectrum Units: EU_{pk-pk}, EU_{pk}, EU_{rms}, EU_{rms}^2, EU^2/Hz, $EU^2 \cdot s/Hz$, degree (Phase)

- Overlap Ratio: 25%, 50%, or 75%, Maximum possible overlap

- Correlation Functions: Auto- and Cross-Correlation Functions

- Linear Spectrum Scaling: Peak or RMS

- Power Spectrum/PSD: RMS, Power, Power Spectral Density, Energy Spectral Density

- Scaling: Free-Run or external trigger

- Acquisition Modes:

Zoom Spectrum Analysis

Zoom Spectrum Analysis provides very high-resolution spectra by concentrating the analysis upon a user-specified frequency range (flower to fupper) within the DC-to-selected maximum frequency bandwidth.

Available in DSA Mode.

- Functions Computed: Linear Spectra, Auto Power Spectra, Frequency Response Function, Coherence, and Phase.

- Maximum Analysis Frequency: 2 inputs: up to 46 kHz; 4 inputs: up to 37 kHz;

- Smallest ZOOM bandwidth: 0.28125 Hz

- Maximum Zoom FFT Lines: 1800 lines

- Highest Theoretical Frequency Resolution: 0.00015625Hz

- Acquisition Modes: Free-Run or external trigger

Double-Hit Detection and Auto-Rejection

Alerts the user of a double-hit. Auto-Rejection allows double-hit measurements to be automatically rejected.

Saving Signal Blocks

Signal Blocks are saved based on a list predefined by the user. Data is stored in .REC format.

Export Data File Formats

Signal blocks or recorded time streams can export via EDM to other data formats:

- Data Formats: ASAM-ODS XML, UFF ASCII, UFF Binary, ASCII, Excel CSV, MATLAB, WAV

Real-Time Digital Filters

Real-time digital filters are CSA modules that are applied

in the data conditioning phase. The user can cascade real-time filters or other data conditioning modules to construct powerful real-time analysis functions.

Available in DSA mode.

- Filter Design Display (in EDM): The user enters cut-off frequencies, criteria of attenuation, ripple, and filter orders; a preview of the filter curve is displayed as settings are updated.

- Decimation Filter: 2:1 decimation with built-in anti-aliasing filter. Anti-aliasing attenuation is greater than -80 dB, providing sufficient removal of high frequency noise. Decimation stages are selectable by the user; each stage decimates data by two, removing every other sample point.

- FIR Filter Using Window Method: FIR filter designed based on data window applied to the sine function.
  - Data window types: Hanning, Hamming, Flattop, Uniform, Kaiser-Bessel, and Blackman
  - Filter Types: Low-pass, high-pass, band-pass, band-stop types;
  - FIR Taps: 11 – 127

- FIR Filter Using Remez Method: The Remez FIR Filter module utilizes the Parks-McClellan algorithm to design and apply a linear-phase filter with an arbitrary multi-band magnitude response.
  - Filter Types: Low-pass, high-pass, band-pass, band-stop types
  - Filter Length: 11 – 127

- IIR Filters (3 types):
  - Filter Topography: Butterworth, Chebyshev, and Elliptic
  - Filter Types: Low-pass, high-pass, band-pass, band-stop
  - Filter Order: 1 – 20

Histogram and Statistics Functions

The Histogram and Statistics function is a single processing module that is applicable to any Time Stream. The output of the module is a histogram signal and associated statistical results. The display format is selected on the CoCo-80X. Available in DSA Mode.

- Histogram Parameters: Number of Bins for the bar chart, Amplitude ranges

- Histogram Display View Mode: Cumulative, Linear (normalized or non-normalized), Log (Normalized or non-normalized)

- Statistics Results: Mean, Max, Min, Skewness, Variance, Crest Factor, Kurtosis

ODS Modal

ODS Modal lets you collect cross-channel ODS and Modal data. Modal analysis is the process of determining the modal characteristics, including natural frequency, mode shape, aand damping of an elastic structure. ODS stands for operating deflection shape. Use a dual or four channel analyzer for ODS testing. For more efficient data collection, use the four-channel analyzer with four sensors or a single accelerometer and triax sensor. Collect two, three, and four channel waveform and spectra data (ODS data only) or two, three, and four channel impact data (Modal data only). You need to collect phase and magnitude data. The analyzer formats the data for use with EDM Modal. Upload the data to EDM Modal for viewing and analysis.

Available in DSA mode.

- Signal Types: Time Waveform, Auto and Cross spectrum, Frequency Response Function, and Coherence

- Input Type: Excitation and Response

- Roving Pattern: Excitation or Response with optional point ID auto increment function

- File export via EDM: ASAM-ODS, UFF, and Binary UFF

Dynamic Balancing

Balancing is the process of adding or removing weights from equipment to change the distribution of mass. The center of mass should be at the center of rotation. Use the Balance program to correct an imbalance issue with a machine. You can do single or multi-plane balancing in this program.

Available in DSA Mode.

- Measurement Type: acceleration, velocity, or displacement

- Trial Weight Estimate: available for both planes

- Trim Balance: multiple iterations available

- Average: measurement with programmable averaging to reduce the noise

- Display: RPM signal display, balancing graphic polar display and time trace display

- Trial Run: trial and compensation weight display in tabular mode or graphic polar mode

- Split Weight: integrated function to split weight on two defined angles

- Combine Weight: multiple weights can be combined together

- Units: English or metric units

- RPM Range: 5 to 200,000 RPM

- Phase Display: display with 4 digits from 0 to 360° (or

any other user-defined unit). Accuracy ± 0.5

- Project Management: save, recall, and send to PC

Vibration Intensity
Available in DSA Mode.

- Channel Count: Analysis on 3 channels (x, y, z axis)
- Time Waveform Recording: Raw data recording, Weighted RMS trace for each channel
- Calculation Methods:
  - Standard (Basic) Method
  - Running RMS Method
  - Fourth Power Vibration Dose Method
- Reported Values:
  - Weighted RMS total or for individual signals;
  - Maximum Transient Vibration Value (MTVV) for each direction;
  - Vibration Dose Value (VDV) for each direction
- Reports: Automatically generate PDF reports that can be reviewed on the CoCo or uploaded to the computer. Reports contain the following values:
- Applications   Position Frequency Range
- Calculation Method   Test Time   Weighted RMS – channel
- Weighted RMS – Overall Test   Conclusion   (if applicable)
- Weighted Signal Trace Display: Track any weighted input channel over time. Values are updated every second.

Whole Body Vibration
- Standards: ISO 2631-1:1997
- Applications: Health, Comfort, Perception, Motion Sickness
- Testing Positions: Seated, Standing, Recumbent (lying)
- Frequency Weightings: Wa, Wd, We, Wf, Wj, Wk
- Frequency Range:
- 0.5 Hz – 80 Hz: Health, Comfort, Perception
- 0.1 Hz – 0.5 Hz: Motion Sickness

Hand-Arm Vibration
- Standards: ISO 5349-1:2001
- Frequency Weightings: Wh
- Frequency Range: 6.3 Hz – 1250 Hz

Building Vibration
- Standards: ISO 2631-2:2003, BS 6472-1:2008

- Frequency Weightings: Wm
- Frequency Range: 1 Hz – 80 Hz

Ship Cabin Vibration
- Standards: ISO 6954:2001
- Frequency Weightings: Wm
- Classification: A, B, C
- Frequency Range: 1 Hz – 80 Hz

Automated Test and Limiting Check
The Automated Limit Test function allows the CoCo to compare live data to predefined limits in the time or frequency domain.

Available in DSA Mode.

- Test Signals: Time Blocks, Auto Power Spectra, Frequency Response Functions, Octave Spectra, Linear Spectra and Coherence Functions
- Supported Limit Signal Types: High or Low, user-definable profile
- Supported Spectrum Type: EU_{peak}, EU_{pk-pk}, EU_{rms}, $(EU_{rms})^2$
- Max Limit Signals: 64
- Test Schedule: Multiple test schedules may be saved and executed sequentially
- Testing Log and Summary Report: Up to 1,024 major events are automatically logged. A summary report showing limit check results is available for the last schedule run
- Schedule Activation Control: Schedules are easily enabled with the long press of Display button
- Limit Check Alarm Events: Beep, flash screen, add event to log, send message to host PC, save signals, send emails

Power System Stabilizer
Calculates FRF signals and provides phase information. The output voltage is set and adjusted manually by the user during testing.

Available in DSA Mode.

- Standards: GB/T 7409, DL/T 583, DL/T 650, DL/T 843
- Average Type: Linear, Exponential, Peak Hold, Synchronous Linear, Synchronous Exponential
- Measurement Channels: 2 input channels

Sound Power
Sound power measurement using sound pressure is now available on the CoCo-80X. Sound pressure levels and

corresponding sound power are calculated based on the ISO 3744 and 3745 standards.

An intuitive user interface along with helpful graphics displays the test point status. There are multiple test room types and microphone arrangements. When the test is complete, a report is generated. Octave spectra signals are also saved during the test.

Available in DSA Mode.

- Standards: ISO 3744 and 3745
- Octave Fractional Resolution: 1/3
- Average Type: Linear, Exponential, Peak Hold, Synchronous Linear, Synchronous Exponential
- Time Weighting: Fast, slow, impulse, user-defined
- Frequency Weighting: Z, A, B, C
- Frequency Range: 0.1 Hz to 20 kHz
- Accuracy: <0.2 dB (1 second stable average, single tone at band center)
- Dynamic Range: For a 1/3 octave with a 2 second stable average as per ANSI S1.11:2004, using a pure Sine tone at 1 kHz input:
  - Noise Floor: -24 dB
  - Maximum: 111 dB
- Filter Implementation: Real-time digital filters
- Acquisition mode: Free run
- Test Room Types: Hemi-Anechoic and Anechoic
- Microphone Arrangements: Fixed – Equal/Unequal Areas, Co-Axial, Meridonial, Spiral

Ordering Information
PC Requirements for VDS Software
- Operating System Support: Windows 7 or higher
- Operating System Type: 32-bit or 64-bit
- Minimum Processor Speed: 1.5 GHz Dual-Core x86
- Minimum RAM: 4 GB
- Minimum Free Space: 10 GB

Warranty and Support
Each hardware purchase, C70X-P02 and C70X-P04, includes a 1 year software subscription and a 1 year hardware warranty. Extended warranty and support options are available for all Crystal Instruments products. Warranty and support options are separated into three types, software subscription, hardware warranty, and the Premier Technology Support Agreement.

Extended software subscription includes periodic updates, bug fixes, and application support by phone or online. All new updates can be downloaded without extra charge during the subscription period. Extended hardware warranty provides repair and one annual calibration at no charge. For repair, the customer pays the shipping fee when the unit is returned to the CI factory and CI pays for its return. Extended hardware warranty can only be purchased for products still under warranty. The Premier Technology Support Agreement includes both the software subscription and limited hardware warranty, in addition to an annual hardware calibration, and temporary loaner unit. See Premier Technology Support Agreement Brochure for more information.

Part Number	Short Description	
Hardware		
C70X-P02	CoCo-70X system: Two inputs, One output.	
C80X-P04	CoCo-70X system: Four inputs, One output.	
Other Hardware Options		
C70X-2CH	Enable 2 additional input channels	
Software Options		
C70X-40	Route and Basic Off-Route	
C70X-41	Bump Test	
C70X-50	Order Tracking	
C70X-51	Octave Analysis and SLM Analysis	
C70X-54	Shock Response Spectrum	
C70X-60	Manual Calibration	Standard
C70X-61	Auto Calibration	
C70X-62	Basic DSA	
C70X-63	ODS Modal	
C70X-64	Dynamic Balancing	
C70X-65	Vibration Intensity	
C70X-66	Automated Test and Limiting Check	
C70X-67	Power System Stabilizer (PSS)	
C70X-68	Sound Power	
PC Software Options		
VDS-01	Vibration Diagnostic System (VDS)	
VDS-02	Machine Class library and Class Builder	
VDS-03	Route/Machine Builder/Automated Diagnostics	
Accessories		
C70X-A01	CoCo-70X Battery	Standard shipment includes 1
C70X-A02	CoCo-70X Power Supply	Standard shipment includes 1
C70X-A02NA	North America Power Plug	Standard shipment includes 1
C70X-A02EU	Europe Power Plug	
C70X-A02UK	UK Power Plug	
C70X-A04	Battery Charger (Desktop)	
C70X-A10	LEMO-BNC Cable for Input, Output, and Tacho	Standard shipment includes 1
C70X-A15	Alligator to Alligator Clip adaptor	
C70X-A16	BNC-BNC Cable (1 m)	
C70X-A17	BNC To BNC T-port	
C70X-A20	Ruggedized Hard Case (Pelican)	
Additional CoCo Accessories		
C70X-A50	SD Card to USB Card Adaptor and Reader	Standard shipment includes 1
C70X-A51	128 GB SD Card	Standard shipment includes 1
C70X-A52	256 GB SD Card	
C70X-A66	Ethernet Cable (1 m)	Standard shipment includes 1
C70X-A68	Audio Adaptor cable (20 cm)	
C70X-A81	CoCo-70X Kickstand (Replacement)	
C70X-A82	CoCo-70X Shoulder Strap	
C70X-A90	CD for EDM, the host software, User's Manual in PDF	
C70X-A91	USB Stick for EDM, the host software, User's Manual in PDF	Standard shipment includes 1
C70X-A93	Certificate of Calibration	Standard shipment includes 1
C70X-A95	Equipment Condition Certificate	Standard shipment includes 1

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