

CoCo-80 Specifications

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CoCo-80 Hardware Specifications

The CoCo-80 is a powerful and simple to use handheld data recorder and dynamic signal analyzer that is ideal for a wide range of industries including automotive, aviation, aerospace, electronics and military that demand easy, quick and accurate data recording and real-time processing in the field. CoCo-80 is a low-cost, light-weight, battery powered handheld system with unparalleled performance and accuracy. The user interface of CoCo-80 is specifically designed for easy and simple operation while it maintains the capability of providing a wide variety of analysis functions.

CoCo-80 is equipped with 4 or 8 input channels and 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 simultaneously 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 handheld system is equipped with two USB ports, 100 BaseT Ethernet, SD-card interface, audio input/output, 5.7 inch color LCD display and a keypad. The user can connect the CoCo-80 to a PC, download files and upgrade the software through several means of network connections.

The CoCo-80 utilizes a new signal processing method, Configurable Signal Analysis (CSA). CSA provides unique flexibility for real time analysis including filtering and spectral analysis. Data can be downloaded to a PC and managed, analyzed and exported to other applications using the EDM software from Crystal Instruments.

Hardware Architecture

CoCo-80 hardware uses dual CPU architecture. An XScale CPU handles the user interface, project configuration, power management, network communication as well as all the peripherals. A high-speed floating point DSP manages the data input/output and real-time processing. CoCo-80 is also configured with large RAM and NAND flash memory for mass data storage. Special thermo and low power design eliminates the need for a cooling fan and increases the battery operating time. Proprietary hardware technology delivers more than 130 dB dynamic range. The extremely high dynamic range eliminates the need for multiple front end gain settings.

Input Channel Specifications

Input Channels: 4 or 8 input channels configured by the manufacturer

Connector Type: isolated BNC

Coupling: AC, DC, or IEPE (ICP), (4.7mA constant current output)

Input Type: Differential or Single Ended

Input Range: $\pm 10\text{Vpk}$

Input Impedance: 1 Mohm

Input Protection Voltage: 40Vpk

AC Coupling: analog high pass filter at 0.3 Hz @ (-3dB) and 0.7 Hz @ (-0.1dB)

A/D Resolutions: 24 bits + proprietary technology to achieve high dynamic range

Anti-Aliasing Filter: analog anti-aliasing filters

Digital Filter: digital high-pass and low-pass filters

Dynamic Range: 130 dB

Sampling Rate: 0.48Hz to 102.4 kHz, with 54 stages

Maximum Useful Bandwidth: $0.46 \times (\text{sampling rate})$

Total THD + Noise: -100dBfs (DC to 1 kHz)

Amplitude Channel Match: 0.1dB

Phase Channel Match: better than 0.3 degrees up to 20 kHz

Crosstalk: less than -100dB

Frequency Accuracy: better than 1/100,000

Common Mode Range: $\pm 10\text{Vpk}$

Common Mode Rejection: better than 90 dB

Amplitude Accuracy: 0.1% typical

Output Channel Specifications

Output Channels: 1 output channel

Connector Type: 3.5mm audio jack

D/A Resolution: 24 bits

Sampling Rate: up to 102.4 kHz per channel, synchronized with A/D input channels

Dynamic Range: 100 dB

Output Impedance: 50 ohm

Maximum Output Current: 25mA

Sine Amplitude Accuracy: at 1 kHz $\pm 1\%$ (0.34 dB) for 0.1V to 5Vpk

Anti-Imaging Filtering: 160dB/oct digital plus analog filters

Digital Filter: high-pass and low-pass digital filters

Source Waveforms: sine, triangle, square, white noise, DC, chirp, sweep sine

Output Range: programmable 0 to ± 10 Volts

Tachometer Input Specification

The first analog input channel can be configured as tachometer measurement. Threshold -10V~+10V user selectable. Maximum frequency: 102.4kHz, set independent to other measurement channels.

System Specifications

System CPU: XScale™ PXA270 520MHz Processor

Operating System on XScale: Microsoft® Windows CE 5.0

DSP: TMS320C67, floating point, 250MHz

Total Storage: total RAM 128MB, total flash memory used for system and data storage 2GB+

LCD: 5.7" brilliant color TFT VGA display with 320x240 resolution, 3 backlight stages (normal, dark, darker), typical signal display update rate 20~30 updates per second

Power Management: includes two settings: Maximum Active Mode – system keeps all system components running at normal power consumption to ensure the best measurement performance (ideal when powered from AC adaptor) and Automatic Mode - system monitors LCD and peripheral activities and manages the power consumption at optimum state by temporarily powering down unused components (best when powered from battery to maximize battery life)

System Power LED: indicates system is powered on when lit

AC Line Power LED: not lit - no external power, red - external power is on and is charging the main battery, green - external power is on, charge completed, battery capacity indicator on LCD display screen

Audio: 3.5mm earphone connector and built-in speaker provide audio feedback for user interface, built-in microphone for voice annotations

Ethernet: 100 BaseT, RJ45 female connector supports connection to PC

USB Client: 1.1 (mini connector) supports connection to PC

USB Host: 1.1 (type A connector) supports USB peripherals including USB memory stick and USB mouse

Keypad: backlit with power button, SHIFT button that changes the function of navigation buttons, 6

Navigation Buttons: Up, Down, Left, Right, Enter, Back/Forward, 6 Function Buttons: Analysis, Display, Setup, File, Rec/Stop, Save and 6 Soft Buttons with software enabled functions

Internal Clock: maintains date and time

SD card (MMC/SD/SDIO standard), supports wireless card for data communication, 802.11b, requires optional SD wireless card

System Disaster Recovery: In case of system failure, press Power Button for more than 4 seconds or use dedicated Reset pin

Environmental and General Specifications

Enclosure: handheld, rugged plastic design, shock proof with integrated protective holster and internal EMI shielding

Size: 231 mm x 170 mm x 69 mm

Weight: less than 1.71 kg including battery, less than 1.23 kg without battery

Power Supply: AC adaptor accepts 100 to 240VAC (47~440Hz), DC power 15V ($\pm 10\%$), DC-DC voltage isolated adapter (automobile cigarette lighter) capable

Power Consumption: total system power consumption is less than 14 watts in Maximum Active Mode

Main Battery: operating time at least six hours in automatic mode, charging time 4 hours, two power management configuration settings for normal and low power consumption, rechargeable Ni-on battery, 6600mAh

Safety Standard: electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001

Temperature: operating temperature 0 °C to +55 °C, storage temperature -20 °C to +70 °C

CoCo-80 Software Specifications

Data Acquisition and Real-Time Processing Performance

Maximum Data Recording Rate: 8-channel simultaneously streaming recording at maximum sampling rate of 102.4 kHz

Real-Time Spectral Bandwidth: 45 kHz

Real-Time Frequency Response + Recording Rate: 1 excitation plus 7 response inputs with sampling rate up to 102.4 kHz when streaming recording is disabled; up to 64kHz when streaming recording is enabled.

Recording and Saving Data

Dedicated Rec./Stop Button: controls the recording of continuous time stream data to flash memory. All time streams in the data conditioning stage can be recorded continuously

Dedicated Save Button: controls the storage of signal snapshots such as spectra or transient time capture. All long time captures or spectra in the signal analysis stage can be saved

Input Acquisition Settings

Sensitivity: user defined with engineering unit and input sensitivity setting

Labels: user defined channel labels

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

Sampling Rate Settings

User defined sampling rate directly from display screen

Select one of 54 sampling rate stages without stopping the acquisition

Signal Source (Output) Settings

Waveforms: sine, triangle, square, white noise, DC, chirp, swept sine

Measurement Hardware Calibration

System is calibrated at factory before shipping and should be recalibrated annually by a factory authorized calibration service. Calibration software is included with the system and can be operated by the user.

Calibration software is operated using a step by step guide. Final calibration report can be viewed on either CoCo-80 or from host PC.

Self-Test

A self-test utility is included with each system for verifying the conditions of the input and output channels using internal precise signal source.

Display

Color Theme

Two color themes to meet different user preferences: Black with dark background and light foreground and White with light background and dark foreground

Time Domain Display

Auto-Scroll: Automatically scrolls when total duration greater than 0.5 seconds. Horizontal time range is not limited by time capture size.

Block: Display signals frame by frame without scrolling

Vertical Axis of Spectra

Scaling: Linear, dB, or Log

Horizontal Axis of Spectra

Scaling: Linear

Complex Spectral Display

Scaling: dB amplitude, linear amplitude, phase

Cursors

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

Digit Notation Format

Formats: floating point, scientific notation, engineering notation

Signal Trace Scaling

Auto Scaling: software automatically detects the signal magnitude and sets the best window scaling area for each frame of data

Fixed Scaling: 8 types of movement, controlled by the four arrow buttons and SHIFT buttons: move up, down, left, right, Vertical Expand, Vertical Reduce, Horizontal Expand, Horizontal Reduce

Time Display Range: user can change the time domain display period from milliseconds to minutes regardless of the sampling rate

Signal Trace Grid

Grid Format: values displayed on horizontal grid tick marks with round numbers, grids can be turned on or off Xmin and Xmax displayed for vertical grids

Display-Trace Selection

Trace Format: multiple traces can be created, one trace can be displayed at a time, traces can be edited, added or deleted

Signal Format: user assigns one or multiple signals or time streams with the same types (time or frequency) to any trace

Trace Display in Plot or Text: Each trace can display the signals either in its plot drawing or text signatures, such as Max, Min, RMS values.

Status Bar

Status Display: a horizontal bar displays the critical status of the running system, including: time, time stream recording status, AC Power and battery status, network connection status, CSA name, input overload status and sampling rate value

Dimensions and Units

Engineering Units

Acceleration: m/s^2 , cm/s^2 , mm/s^2 , gn, ft/s^2 , in/s^2 , mil/s^2

Velocity: m/s, cm/s, mm/s, ft/s, in/s, mil/s

Displacement: m, cm, mm, ft, in, mil

Force: Newton, Dyne, Kgf, KIPF, LBF, OzF

Pressure: Pa, uPa, ATM, Bar, PSI, KSI

Voltage: Volts, mV

Time: Seconds

Frequency: Hz, kHz, MHz

Angular velocity: Rad/s, Degree/s, RPM

Current: Amp, mA

SPL: dB

Mass: kg, g, LBS, Ounce

Input Units

User selects the preferred physical quantity at system level. User selects corresponding Engineering Units (EU) for each input channel

Data Scaling

Transducer sensitivity (mV/EU) is assigned to each input channel

Internal Representation

Units internally are strictly controlled by the ASAM-ODS standard

Unit Display

Both quantity and unit are displayed on traces

Measurement Data Storage

Mass Data Storage Format

Data Format: compliant with ASAM-ODS hierarchy and structure

Data Precision: mass data saved in 32 bit single precision floating point (4 bytes per word)

Data Structure: all signals are combined and saved in one file for each measurement

Storage of Time Streams and Snapshots

Time Stream Data: storage is controlled by the Rec/Stop button, dedicated Rec/Stop button permits saving a specified list of time streams within the current CSA

Snapshot Data: spectra or transient capture storage is controlled by the Save button, dedicated Save button permits saving a specified list of signals within the current CSA

Conditional Capture: time streams and signals can be stored by other conditions, such as a timer

Export Data File Formats (through EDM, the host software)

ASAM-ODS XML: The ASAM Open Data Source binary format (default, recommended)

UFF ASCII: The ASCII format of UFF files

UFF Binary: The binary format of UFF files

ASCII: in user defined format and selected attributes. User enables the signal attributes and the format of ASCII data and set as template for future use.

Excel CSV: the ASCII file that Microsoft Excel can directly open

MatLab: *.mat binary format that can be opened and analyzed using Matlab

NI- TDM: National Instruments structured storage format

Measurement Data File Review

Storage Capacity Display: shows available capacity in flash memory

Record Files View: shows measured data file names in tablet format, displays the create time, file size, test note or owner information

Review: shows file attributes and either text mode or plot in preview mode

Delete: one or all files can be deleted from flash memory

System Software Functions

About Information

Version: About box displays the version information for hardware platform, firmware and CoCo-80 application software

Subscription: Information is displayed to show the valid time period of software subscription.

Calibration: The last calibration date is displayed

User Information

User Data: save user name, address, and email, information becomes a file attribute for file management

Welcome Page

A welcome screen shows the most frequently used short-cut icons and recently used CSA files.

On-Line Update

CoCo-80 can use Internet connection to connect to Crystal Instruments server and check for new software updates

Detects the status of available network settings, including Ethernet, USB or wireless

Automatically checks the file version and provides update instructions

Download the latest software while software subscription is current

Network Connections

Three tabs to display the connection status of Ethernet, USB or Wireless

Connection status includes the information of hardware physical connection, EDM software detection, Internet connection and CI server connection

Test Note

Set a text comment for any measurement. The comment will be attached to the measured data as a file attribute

User can search through the data using Test Note on the PC to manage data.

Audio

Set and display the volume of microphone and speaker

Power

Display the detail battery power and charging status

Set the power mode: Automatic, Fixed period for turning on and off LCD

Memory and CPU Resource

Display the memory and CPU resource usage

Data Processing Specifications

CoCo-80 combines two instruments, a data recorder, and a signal analyzer into one system. Data recording function including processing the data from native acquisition channels and data conditioning. All the signals in the data recording stage are continuous time streams. They can be displayed or recorded. Data conditioning include $+*$, filtering, integration, differentiation, calibration and other math operations that are applied to continuous time streams.

Acquisition Mode controls how the data is acquired block-by-block and feed them into signal analyzer functions. These time blocks can be either gap-free, overlapped, or with gaps, depending on the acquisition mode selection.

Data processing is realized by using the Configurable Signal Analysis technique. The CSA script consists of one or multiple CSA Modules written in XML. A CSA script can be downloaded from the host PC or CI server through the Internet. The CoCo-80 runs CSA scripts to realize various analysis functions.

Data Conditioning Functions

Math Functions: abs, +, -, *, /, square, square-root, Log, Integration with low pass, Integration with high-pass, double integration with low pass, double integration with high-pass, Differentiation, double differentiation

RMS: apply RMS estimation to an input data stream and generate the output stream continuously

Peak: extract the peak or peak-peak value over a period of time and generate the time stream

OffsetAndScaling: apply a multiplier gain and offset to any input data stream and generate the output stream continuously

Decimation Filter: apply a 2:1 decimation to any input data stream and generate the output stream continuously or apply multiple cascading decimation filters to provide higher decimation ratios

Acquisition Mode

Mode Selection: Free Run, Continuous after Trigger, Single Shot with Trigger, Single Shot without Trigger, Auto-Arm Trigger, Manual-Arm Trigger

Trigger source: Trigger source is designated by the user when the CSA is edited in the host. Any time streams can be used as trigger source. Multiple time streams can be defined as trigger source candidates but only one can be selected at one time.

Trigger Conditions: Trigger Source > High Level (rising edge); Trigger Source < Low Level (falling edge); Low Level < Trigger Source < High Level; Trigger Source > High Level OR Trigger Source < Low Level (Bi-polar)

Trigger Delay: +/- 100% of Block Size

Trigger Setup Display: A special display view is created for trigger setup. The user selects acquisition mode, trigger source, trigger condition, overlap ratio. The arrow buttons serve one of three functions: window scaling, window moving, and trigger threshold position change. Trigger delay is operated by the left-right buttons.

Trigger Run-time Display: In manual arm-mode, a smaller window will pop up for the user to accept or reject the transient captured signals. Accepted signals will be averaged into the spectra.

Signal Analyzer Functions

Transient Time Block Size: up to 128k points for 1 channel, up to 16 k points for 8 channels. (Note: Transient Time Capture stores the data in the local memory. The continuous recording stores the data into flash memory and has “unlimited size”).

FFT Block Sizes: 256~16384 for 8 channels, 256~65536 for 1 channel

Data Window Functions: Uniform, Hann, Hamming, Flat-top, Kaiser-Bessel, Blackman

Averaging: exponential, linear, peak hold, peak hold for specified number of averages

Spectrum Types: linear spectrum, auto-spectrum, frequency response function, coherence, cross-power spectrum, phase spectrum

Auto Spectrum Type and Scaling: linear spectrum with peak or RMS scaling, power spectrum or power spectrum density with RMS scaling (Spectrum Units: EU_{pk}, EU_{rms}, EU_{rms}², EU₂/Hz, EU₂*S/Hz)

Overlapping ratio for spectral analysis: Automatic, 25, 50% or 75%

Order Information

Warranty and Support

Warranty and support are available for all Crystal Instruments products. Warranty and support options are separated into two types: software subscription and hardware warranty. Software subscription includes periodic updates and application support by phone or on-line. Hardware warranty provides repair and calibration at no charge. User pays the shipping fee from the user to CI office and CI pays the shipping fee from CI to the user. Standard purchase comes with 1 year software subscription and 1 year hardware warranty.

Part Number Description

CoCo-P01 Four channel CoCo-80 system and accessories: Four 24bit inputs, One 24bit output, simultaneous sampling up to 102.4kHz, C67xx DSP, 2GB data flash, 520MHz CPU, 5.7” color LCD, Ethernet port, 2USB ports, SD card port, keypad, Windows CE 5.0, EDM PC host software, All data conditioning functions, Time Capture and Spectral Analysis software. Accessories include: main battery(1), USB cable(1), Output cable (1), BNC cable (1), Power cable and adaptor (1), Regular Ethernet cable (1), Cross-Over Ethernet cable (1), CD for EDM, the host PC software, User’s manual on CD in PDF format, Suitcase with foam. 1 year software subscription included, 1 year hardware warranty included.

CoCo-P02 Eight channel CoCo-80 system and accessories: Eight 24bit inputs, One 24bit output, simultaneous sampling up to 102.4kHz, C67xx DSP, 2GB data flash, 520MHz CPU, 5.7” color LCD, Ethernet port, 2USB ports, SD card port, keypad, Windows CE 5.0, EDM PC host software, All data conditioning functions, Time Capture and Spectral Analysis software. Accessories include: main battery(1), USB cable(1), Output cable (1), BNC cable (1), Power cable and adaptor (1), Regular Ethernet cable (1), Cross-Over Ethernet cable (1), CD for EDM, the host PC software, User’s manual on CD in PDF format, Suitcase with foam. 1 year software subscription included, 1 year hardware warranty included.

CoCo-A01 Additional battery (Rechargeable Ni-on, 6600mAh)

CoCo-A02 Wireless SD-Card 802.11g

CoCo-A03 DC-DC adapter used automobile cigarette lighter, voltage isolated

CoCo-A04 Calibration Service at Crystal Instruments

CoCo-A05 One year extended software subscription

CoCo-A06 One year extended hardware warranty

CoCo-A07 Paid engineering services (charged by hours)