# QC Software Feature Overview

QC Version 1 to 7 | Rev 1.12 | 2022-03-30

## 1 QC System Feature Overview

Valid for QC Software version 7.2 / dB-Lab version 212.240
For details, please see specifications under www.klippel.de.

| | QC STANDARD | QC BASIC | QC Stand-alone Software | QC Tasks in R&D 212 |
|---|---|---|---|---|
| **Results and Features of the QC SYSTEM** | | | | |
| Amplitude frequency response | ✓ | ✓ | ✓ | opt. |
| Spectrum magnitude | ✓ | ✓[2)] | ✓ | opt. |
| Windowing of impulse response | ✓ | - | ✓ | opt. |
| Phase response | ✓ | ✓ | ✓ | opt. |
| Mean level(s) in frequency band(s) | ✓ | ✓[1)] | ✓ | opt. |
| Sound pressure level (opt. A-weighted) | ✓ | ✓[2)] | ✓ | opt. |
| Polarity | ✓ | ✓ | ✓ | opt. |
| Time delay | ✓ | ✓[1)] | ✓ | opt. |
| Electrical impedance | ✓ | ✓[1)] | - | opt. |
| Resonance frequency $f_s$ | ✓ | ✓[1)] | - | opt. |
| Loss factor $Q_{ts}$ | ✓ | ✓[1)] | - | opt. |
| Voice coil resistance $R_e$ | ✓ | ✓[1)] | - | opt. |
| Vented box parameters ($Q_b$, $f_b$) | ✓ | - | - | opt. |
| THD + Noise | ✓ | ✓[1)] | ✓ | opt. |
| 2nd - 5th order harmonics (IEC and IEEE standard) | ✓ | ✓[1)] | ✓ | opt. |
| HOHD Higher Order Harmonics Distortion | ✓ | - | ✓ | opt. |
| Incoherence | ✓ | ✓[2)] | ✓ | opt. |
| Rub & Buzz, loose particle, loose connection & drop out detection | ✓ | ✓[1)] | ✓ | opt. |
| Pass / Fail statistics | ✓ | ✓ | ✓ | ✓ |
| Limits calculated automatically | ✓ | ✓ | ✓ | ✓ |
| Flexible data export | ✓ | ✓ | ✓ | ✓ |
| Advanced limit algorithms (Jitter) | ✓ | ✓ | ✓ | ✓ |
| On- and Off-line statistics for yield and single value results, histogram analysis | ✓ | ✓ | ✓ | ✓ |
| External control interfaces of Klippel QC (Automation API, IO Monitor API) | ✓ | ✓ | ✓ | ✓ |
| Support of 3rd party audio interface (e.g., sound card; up to 15 channels in/out) | ✓ | ✓ | ✓ | ✓ |
| Multi-channel wave file analysis (up to 128 channels) | ✓ | ✓ | ✓ | ✓ |
| Measurement without Klippel Analyzer hardware | - | - | ✓ | - |
| Real-time monitoring of microphone signal | ✓ | ✓ | ✓ | ✓ |
| IO Task (control digital interface, user interaction) | ✓ | ✓ | ✓ | - |

| | QC STANDARD | QC BASIC | QC Stand-alone Software | QC tasks in R&D 212 |
|---|---|---|---|---|
| Preconditioning Task (break-in, ferro-fluid conditioning) | ✓ | ✓ | ✓ | - |
| Klippel Analyzer hardware control (mic power supply, volt / current measurement) | ✓ | ✓ | - | ✓ |
| Digital hardware interface (Results, Start switch) | ✓ | ✓ | - | ✓ |
| Ultra-fast testing (Speed Profile) | ✓ | - | ✓ | opt. |
| Stimulus shaping (Level Profile) | ✓ | - | ✓ | opt. |
| Input signal sharing using measured data from other tasks speeding up tests | ✓ | - | ✓ | opt. |
| Ambient noise detection (2nd microphone, considering test enclosure) | ✓ | - | ✓ | opt. |
| Measure noise attenuation of test enclosure | ✓ | - | ✓ | opt. |
| All linear T/S parameters (electrical domain) | ✓ | - | - | opt. |
| Select golden reference units (on-line and off-line) | ✓ | - | ✓ | - |
| Manual sine sweep (live scope) with waveform (fundamental and Rub&Buzz) and spectral analysis | ✓ | ✓[1)] | ✓ | opt. |
| Process indices $C_{pk}$, $P_{pk}$, process control (Weco, Nelson rules) | ✓ | - | ✓ | opt. |
| Sinusoidal sweep stimulus (chirp) | ✓ | ✓[1)] | ✓ | opt. |
| Multi-tone stimulus | ✓ | - | opt. | opt. |
| Pink or white noise or user defined (wave file) stimulus | ✓ | ✓[2)] | ✓ | opt. |
| Stepped sine stimulus | ✓ | ✓[3)] | ✓ | opt. |
| Grading (multiple limits for grade classification) | ✓ | - | ✓ | ✓ |

opt.: optional task; available with appropriate QC-task license

[1)] available with *QC Basic* (default with *SPL+IMP Sound Pressure + Impedance Task*)

[2)] available with *QC Basic special application* (with *SAN Spectrum Analysis Task*)

[3)] for evaluation with SPL task only, requires feature license (free)

## 2 Optional Tasks and Add-Ons

| | QC STANDARD | QC BASIC | QC Stand-alone Software | QC tasks in R&D 212 |
|---|---|---|---|---|
| **Optional Task or Add-Ons:** | | | | |
| **MSC Task: Motor-and-Suspension-Check** | | | | |
| Voice coil offset $X_{off}$ | ✓ | - | - | ✓ |
| Suspension asymmetry $A_{kms}$ | ✓ | - | - | ✓ |
| Force factor limited displacement $X_{Bl}$ | ✓ | - | - | ✓ |
| Compliance limited displacement $X_c$ | ✓ | - | - | ✓ |
| **BAC Task: Balanced Armature Check** | | | | |
| Armature offset | ✓ | - | - | ✓ |
| Linear parameters | ✓ | - | - | ✓ |
| High-speed testing < 1 s | ✓ | - | - | ✓ |
| **ALD Task: Air Leak Detection** | | | | |
| MODulated distortion - detect air leakage | ✓ | - | ✓ | ✓ |
| DETerministic distortion - detect driver defects | ✓ | - | ✓ | ✓ |
| Random distortion - detect loose particles | ✓ | - | ✓ | ✓ |
| Integration of MODulated and DETerministic distortion in SPL Task | ✓ | - | ✓ | ✓ |
| **ALS Task: Air Leak Stethoscope** | | | | |
| Localize air leakage and other defects | ✓ | - | ✓ | ✓ |
| Auralization of defect symptoms | ✓ | - | ✓ | ✓ |
| **MTD Task: Multi-tone Distortion** | | | | |
| Multi-tone excitation, spectrum, distortion and noise floor | ✓ | - | ✓ | ✓ |
| **EXD Task: External Devices** | | | | |
| High-level GPIB support (IEEE 488 & 488.2) | ✓ | - | ✓ | ✓ |
| Control and include external measurement instrumentation equipment | ✓ | - | ✓ | ✓ |
| Automated Bluetooth® pairing and profile control | ✓ | - | ✓ | ✓ |
| Flexible custom sequence or easy preset mode | ✓ | - | ✓ | ✓ |
| **EQA Task: Equalization + Alignment** | | | | |
| Automatic source equalization (level profile) | ✓ | - | ✓ | ✓ |
| Manual and automatic alignment of voltage / level | ✓ | - | ✓ | ✓ |
| Manual and automatic alignment of frequency response | ✓ | - | ✓ | ✓ |

| | QC STANDARD | QC BASIC | QC Stand-alone Software | QC tasks in R&D 212 |
|---|---|---|---|---|
| **LST Task: Linear Suspension Test** | | | | |
| Suspension part & passive radiator testing | ✓ | ✓ | - | ✓ |
| Resonance frequency of suspension part $f_0$ | ✓ | ✓ | - | ✓ |
| Loss factor of suspension part $Q_0$ | ✓ | ✓ | - | ✓ |
| Effective stiffness $k_0$ and compliance $c_0$ | ✓ | ✓ | - | ✓ |
| Measure large parts using SPM hardware bench | ✓ | ✓ | - | ✓ |
| Mass deviation $\Delta m$ (LST Pro only) | ✓ | ✓ | - | ✓ |
| Stiffness deviation $\Delta k_0$ (LST Pro only) | ✓ | ✓ | - | ✓ |
| **MSP: Match-Speaker-Tool** | | | | |
| Find best matching pairs from pool of speakers | ✓ | ✓ | ✓ | ✓ |
| Find best matching DUTs to target curve | ✓ | ✓ | ✓ | ✓ |
| **SYN Add-On: External Synchronization** | | | | |
| Synchronize measurements with 3rd party audio devices (e.g. Bluetooth) | ✓ | - | ✓ | ✓ |
| Measure stand-alone sound sources | ✓ | - | ✓ | ✓ |
| Cope with varying delays | ✓ | - | ✓ | ✓ |
| WAVE export of stimulus sequence | ✓ | - | ✓ | ✓ |
| WAVE import and analysis of recorded responses | ✓ | - | ✓ | ✓ |
| Use stimulus or unique noise ID for synchronization | ✓ | - | ✓ | ✓ |
| **PNI Add-On (SPL): Production Noise Immunity** | | | | |
| Full noise immunity (auto repeat + intelligent merging) | ✓ | - | ✓ | ✓ |
| **MHT Add-On (SPL): Meta-Hearing Technology** | | | | |
| Isolated Defect Distortion (IDD) by active compensation of regular distortion | ✓ | - | ✓ | ✓ |
| **HI-2 Add-On (SPL): Blat Distortion (Automotive)** | | | | |
| Specially weighted harmonics distortion measure used in automotive industry | ✓ | - | ✓ | ✓ |
| **DCX Add-On (SPL): Laser-based T/S Parameter Measurement[3)]** | | | | |
| Dynamic displacement DC component vs. frequency | ✓ | - | - | ✓ |
| Excursion peak and bottom (envelope) vs. frequency | ✓ | - | - | ✓ |
| Compensation of dynamic displacement DC component (requires EQA Task) | ✓ | - | - | ✓ |
| Control of AC excursion / envelope (requires EQA Task) | ✓ | - | - | ✓ |
| **3DL Add-On (SPL): Spectrogram 3D Limits** | | | | |
| Time-frequency analysis of chirp response using auditory filter bank | ✓ | - | ✓ | ✓ |
| Easy spectrogram limit setting for defect fingerprint detection | ✓ | - | ✓ | ✓ |
| Detect excitation frequency and spectral content of defect | ✓ | - | ✓ | ✓ |

| TSX Add-On (IMP): Laser-based T/S Parameter Measurement[3)] | | | | |
|---|---|---|---|---|
| Full linear T/S parameter set based on one-step laser displacement measurement | ✓ | - | - | ✓ |
| Force factor Bl & moving mass $M_{ms}$ | ✓ | - | - | ✓ |
| State of the art speaker modeling incl. advanced suspension creep fitting | ✓ | - | - | ✓ |

*[3)] This feature requires KA3 hardware*

# 3 Version Overview for General QC Software Features

Always latest version of major QC version is considered.

| | QC Version | | | | | |
|---|---|---|---|---|---|---|
| **Feature** | **2** | **3** | **4** | **5** | **6** | **7** |
| **OS / Database related** | | | | | | |
| Windows XP compatibility | ✓ | ✓ | < 4.3 | < 5.1 | | |
| Windows 7 compatibility | | ✓ | ✓ | ✓ | ✓ | |
| Windows 8 compatibility | | | ✓ | ✓ | ✓ | ✓ |
| Windows 10 compatibility | | | | ✓ | ✓ | ✓ |
| New database format (*.kdbx based on SQL) | | | ✓ | ✓ | ✓ | ✓ |
| **Tools / Help** | | | | | | |
| Automatic backup for test setups and configurations | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| IO-Monitor API (legacy software control interface) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Automation API (software control interface) | | | | | | ✓ |
| Performance log to check duration and distribution of test time | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Auto-detect (auto test start when DUT connected) | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Flexible IO control / integration (trigger tests, assign verdicts to output pins) | | ✓ | ✓ | ✓ | ✓ | ✓ |
| UI language: German | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| UI language: Spanish | | ✓ | ✓ | ✓ | ✓ | ✓ |
| UI language: Portuguese | | ✓ | ✓ | ✓ | ✓ | (✓) |
| UI and setup language: Chinese | | | ✓ | ✓ | ✓ | ✓ |
| Import settings (on- /offline) and limits | | | ✓ | ✓ | ✓ | ✓ |
| Log of all changes on setup and reference history | | | ✓ | ✓ | ✓ | ✓ |
| Additional feature library framework for customization | | | | ✓ | ✓ | ✓ |
| Live-monitoring of microphone signal | | | | ✓ | ✓ | ✓ |
| Manual Sweep: live analyzer w/ waveform, spectrum, signal characteristics | | | | ✓ | ✓ | ✓ |
| Online detection of new golden DUT | | | | ✓ | ✓ | ✓ |
| Batch file execution after test (calling external software)* | | | | ✓ | ✓ | ✓ |
| Text file result logging (export of test results in plain text files)* | | | | ✓ | ✓ | ✓ |
| Validation of serial numbers* | | | | ✓ | ✓ | ✓ |
| Sequence control (conditional skip, repeat tasks)* | | | | ✓ | ✓ | ✓ |
| Batch execution comprising multiple QC operations, verdict collector for batch | | | | | ✓ | ✓ |
| New sensor management, unified with R&D | | | | | | ✓ |

| | QC Version | | | | | |
|---|---|---|---|---|---|---|
| **Feature** | **2** | **3** | **4** | **5** | **6** | **7** |
| **Measurement Features** | | | | | | |
| Input EQU in SPL and SPL-IMP task | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Save and reload captured signals as wave files | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check individual frequency points, phase, SNR, U, I in impedance task | | ✓ | ✓ | ✓ | ✓ | ✓ |
| User-defined, frequency dependent Rub&Buzz filter (high and low pass) | | | ✓ | ✓ | ✓ | ✓ |
| Post-processing task (e.g., for stereo deviation tests) | | | ✓ | ✓ | ✓ | ✓ |
| Band level measure in SPL and SPL+IMP task | | | | ✓ | ✓ | ✓ |
| $2^{nd}$ - $5^{th}$ order harmonics (IEC and IEEE standard) | | | | ✓ | ✓ | ✓ |
| Vented box parameter fitting ($f_b$, $Q_b$) | | | | ✓ | ✓ | ✓ |
| Minimal impedance value | | | | ✓ | ✓ | ✓ |
| User defined windowing of frequency response | | | | ✓ | ✓ | ✓ |
| Resonance frequency from frequency response (e.g., piezo transducer) * | | | | ✓ | ✓ | ✓ |
| Square wave stimulus* | | | | ✓ | ✓ | ✓ |
| Relative Rub&Buzz in %, dB or normalized to level or fundamental | | | | | ✓ | ✓ |
| Normalized frequency response (level, golden DUT, reference DUT average) | | | | | ✓ | ✓ |
| Input Signal Sharing using measured data from other tasks speeding up tests | | | | | ✓ | ✓ |
| Reprocess stored wave files with modified setup (batch) | | | | | ✓ | ✓ |
| Stepped sine stimulus* | | | | | ✓ | ✓ |
| Multi-channel testing with $3^{rd}$ party audio interfaces and WAVE files (open loop testing) | | | | | | ✓ |
| **Limit Features** | | | | | | |
| Floating limit mode for frequency response: *Best fit* | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Multiple limits for grading | | | ✓ | ✓ | ✓ | ✓ |
| Limit mode for Harmonics and Rub & Buzz: Relative to average level | | | | ✓ | ✓ | ✓ |
| **Hardware** | | | | | | |
| Production Analyzer hardware with USB only interface | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Testing with $3^{rd}$ party audio devices | | | ✓ | ✓ | ✓ | ✓ |
| Impedance testing with $3^{rd}$ party front ends (e.g. amplifier with voltage/current sensing) | | | | | | ✓ |
| Klippel Analyzer 3 hardware | | | | | ✓ | ✓ |
| QC Card for KA3 | | | | | >6.2 | ✓ |
| **Statistics** | | | | | | |
| Off-line / Yield Statistics (YST) | | ✓ | ✓ | ✓ | ✓ | ✓ |
| On-line production yield (overall and individual verdicts) | | | | ✓ | ✓ | ✓ |
| Process control: Nelson, Weco or customized rules | | | | ✓ | ✓ | ✓ |

*Feature Libraries, see manual for more info

# 4 Version Overview for Optional Tasks, Modules and Add-Ons

| | QC Version | | | | | |
|---|---|---|---|---|---|---|
| **Feature** | **2** | **3** | **4** | **5** | **6** | **7** |
| MSC Task: Motor and Suspension Check | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| MHT Add-on: Meta Hearing Module | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| MSP: Match Speaker Tool | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| PNI Add-on: Noise Immunity Module | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ALD Task: Leak Detection Module | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| LST Task: Linear Suspension Test | | ✓ | ✓ | ✓ | ✓ | ✓ |
| LST Task: Linear Suspension Test update (with microphone, up to 18”) | | | | ✓ | ✓ | ✓ |
| EXD Task: External Devices Pro | | ✓ | ✓ | ✓ | ✓ | ✓ |
| EXD Task (Bluetooth): Automatic Bluetooth pairing and codec control | | | | | ✓ | ✓ |
| SYN Add-on: External Synchronization (Bluetooth, Playback only devices) | | | ✓ | ✓ | ✓ | ✓ |
| BAC Task: Balanced Armature Check | | | ✓ | ✓ | ✓ | ✓ |
| CST Curve Statistics | | | ✓ | ✓ | | |
| ALS Task: Air Leak Stethoscope | | | | ✓ | ✓ | ✓ |
| EQA Task: Equalization and Alignment | | | | ✓ | ✓ | ✓ |
| STAT: Statistical Analysis | | | | | ✓ | ✓ |
| HI-2 Add-on: weighted harmonics distortion | | | | | ✓ | ✓ |
| TSX Add-on: Laser based T/S Parameter (Bl, Mms) | | | | | ✓ | ✓ |
| DCX Add-on: Dynamic excursion check and control | | | | | ✓ | ✓ |
| COH Task (Beta): Coherence (replaced by SAN) | | ✓ | ✓ | ✓ | (✓) | |
| SAN Task: Spectrum Analysis | | | | | ✓ | ✓ |
| 3DL Add-On: Spectrogram 3D Limits for SPL Task | | | | | (✓) | ✓ |
| MTD Task: Multi-tone Distortion | | | | | ✓ | ✓ |

Additional modules and add-ons require a paid license

* included in *QC Standard*, *QC Stand-alone* and *QC Basic* (*special application*)

# 5 Supported Software and Hardware Overview

Any data version marked with the checkmark are compatible with the QC Version. For old data or setups that are not supported anymore, an intermediate software may be used to load and update older setups.

Software support for older versions is restricted. A service contract may be required, if customers are not able or willing to update and older software versions need support.

Issues are fixed in the newest software version only in most cases. For this reason, free minor updates are released for each major QC version.

| | QC Version | | | | | | |
|---|---|---|---|---|---|---|---|
| **Feature** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **QC 1 Reference DUTs and Setup** | ✓ | | | | | | |
| **QC 2 Reference DUTs and Setup** | ✓ | ✓ | | | | | |
| **QC 3 Reference DUTs and Setup** | ✓ | ✓ | ✓ | | | | |
| **QC 4 Reference DUTs and Setup** | ✓ | ✓ | ✓ | ✓ | | | |
| **QC 5 Reference DUTs and Setup** | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| **QC 6 Reference DUTs and Setup** | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| **QC 7 Reference DUTs and Setup** | | | | ✓ | ✓ | ✓ | ✓ |
| **Production Analyzer with Firewire + USB Interface** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| **Production Analyzer with USB Interface** | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Klippel Analyzer 3 with USB Interface** | | | | | | ✓ | ✓ |