QC Software Feature Overview

QC Version 1 to 7 | Rev 1.15 | 2023-10-18

1 QC System Feature Overview

Valid for QC Software version 7.5 / dB-Lab version 212.616
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.	opt.
Spectrum magnitude	✓	✓[2)]	opt.	opt.
Windowing of impulse response	✓	-	opt.	opt.
Phase response	✓	✓	opt.	opt.
Mean level(s) in frequency band(s)	✓	✓[1)]	opt.	opt.
Sound pressure level (opt. A-weighted)	✓	✓[2)]	opt.	opt.
Polarity	✓	✓	opt.	opt.
Time delay	✓	✓[1)]	opt.	opt.
Electrical impedance	✓	✓[1)]	opt.	opt.
Resonance frequency f_s, Loss factor Q_{ts}	✓	✓[1)]	opt.	opt.
Voice coil resistance R_e	✓	✓[1)]	opt.	opt.
Vented box parameters (Q_b, f_b)	✓	-	opt.	opt.
THD + Noise	✓	✓[1)]	opt.	opt.
2nd - 5th order harmonics (IEC and IEEE standard)	✓	✓[1)]	opt.	opt.
HOHD Higher Order Harmonics Distortion	✓	-	opt.	opt.
Incoherence	✓	✓[2)]	opt.	opt.
Rub & Buzz, loose particle, loose connection & drop out detection	✓	✓[1)]	opt.	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)	✓[4)]	✓[4)]	✓	✓[4)]
Multi-channel wave file analysis (up to 128 channels)	✓	✓	✓	✓
Multi-channel aggregation for array applications	✓	-	opt.	opt.
Measurement without KLIPPEL Analyzer hardware connected	-	-	✓	-
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.	opt.
Stimulus shaping (Level Profile)	✓	-	opt.	opt.
Input signal sharing using measured data from other tasks speeding up tests	✓	-	opt.	opt.
Ambient noise detection (2nd microphone, considering test enclosure)	✓	-	opt.	opt.
Measure noise attenuation of test enclosure	✓	-	opt.	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.	opt.
Sinusoidal sweep stimulus (chirp)	✓	✓[1)]	opt.	opt.
Multi-tone stimulus	✓	-	opt.	opt.
Pink or white noise or user defined (wave file) stimulus	✓	✓[2)]	opt.	opt.
Stepped sine stimulus[3)]	✓	-	opt.	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)

[4)] KLIPPEL Analyzer device must be connected for operation

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_{BI}	✓	-	✓	✓
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 Δm (LST Pro only)	✓	✓	-	✓
Stiffness deviation Δk_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				✓	✓	✓
Windows 11 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 is 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.

Bugs are fixed in the latest software version 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						✓	✓