# BK Connect FFT, CPB and Overall Analysis Applets

BK Connect® applets are for customers looking for a point solution that works like they work, providing just what you need in a user-friendly solution. The applets provide the same reliability and thought-through design of an advanced sound and vibration analysis software platform, in a small, self-contained package.

The BK Connect FFT, CPB and Overall Analysis Applets are specifically for standard sound and vibration tests using narrow-band FFT, CPB (constant percentage bandwidth or 1/3-octave) or overall analysis on both stationary and non-stationary signals. Tests can be performed using a single analysis method, or all three simultaneously.

There are two applets that provide full FFT, CPB and overall analysis testing solutions so that you can complete the job at hand:

- **Type 8490-C-N-SYS** *– Go from data acquisition and monitoring to measurement, recording, analysis and reporting*
- **Type 8490-H-N-SYS** *– All-in-one solution for post-processing of time data, data management and reporting*
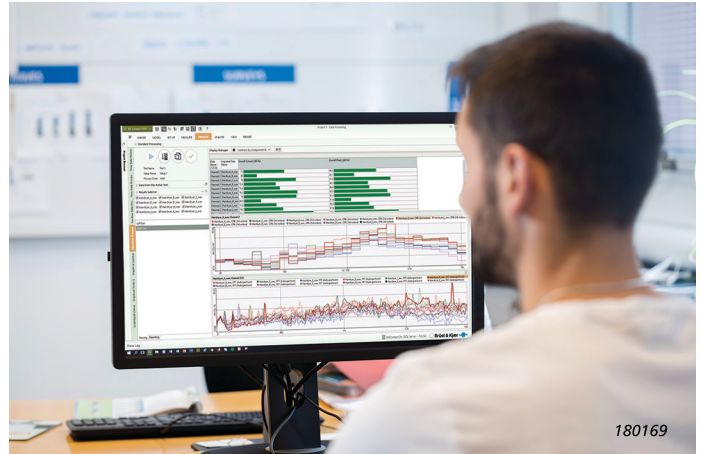
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Uses and Features

Uses

Type 8490-C – Applet for acquisition, recording, batch post-processing, data management and reporting

- General sound and vibration data acquisition, analysis and reporting
- Time data recording
- Batch processing of multiple sets of time recordings
- FFT spectrum analysis for mobility measurements, vibration diagnostics or narrow-band analysis of acoustic signals
- Standardized digital filter-based analysis using 1/3-octave for the determination of sound power levels
- Broadband overall analysis for characterization of noise or vibration signals
- Stationary and non-stationary analysis
- Analysis with different filter settings and FFT bandwidths

Type 8490-H – Applet for batch post-processing, data management and reporting

- General sound and vibration analysis and reporting
- Batch processing of multiple sets of time recordings
- FFT spectrum analysis for mobility measurements, vibration diagnostics or narrow-band analysis of acoustic signals
- Standardized digital filter-based analysis using 1/3-octave for the determination of sound power levels
- Broadband overall analysis for characterization of noise or vibration signals
- Stationary and non-stationary analysis
- Analysis with different filter settings and FFT bandwidths

Features

- User interface, task completion and data organization optimized to fit the job at hand – with tools and components that make FFT analysis quick and easy
- With Type 8490-C, complete testing using a test plan with or without defined DUTs, test conditions and metadata
- Simultaneous multi-analysis of the same recorded data – FFT, 1/3-octave and overall analysis, with the possibility to define different parameters such as frequency span, zoom, etc.
- Visualization, editing and audio playback of time data after recording and in preparation for analysis
- Simple and efficient reporting of results with user-definable layouts metadata
- Embedded reporting using Microsoft® Office products to integrate report creation directly in the test process
- Easy to learn and use, reducing training and test time

With Type 8490-C, you can record and perform analysis in one seamless workflow. A complete set of real-time monitors is preconfigured, and a targeted process (analysis) chain is predefined – ready for you to start analysis. If needed, you can adjust recording parameters and analysis properties to suit your test specifications. When ready, record data using the Record and Process task.

Using the same predetermined processing and analysis tools as Type 8490-C, post-processing applet Type 8490-H allows you to target the post-processing of recorded time data.

Both applets provide eight different predefined setups:
- Stationary tests that allow you to perform standard analyses
  - FFT – FFT spectrum analysis that includes FFT frequency band extraction
  - CPB – 1/3-octave analysis using standard filters
  - Overall – Broadband analysis that includes integration/differentiation pre-processing
  - FFT, CPB, Overall – Simultaneous multi-analysis using all of the above methods
- Non-stationary tests that allow you to perform time-varying analysis
  - FFT – Time varying FFT spectrum analysis that includes FFT frequency band extraction
  - CPB – Time-varying 1/3-octave analysis that includes CPB frequency band extraction
  - Overall – Time-varying broadband analysis that includes integration/differentiation pre-processing
  - FFT, CPB, Overall – Simultaneous multi-analysis using all of the above methods

The user-friendly interface provides automated batch processing of data, immediate display and storage of analysis results and automated reporting.

Fig. 1   Example of analysis setup: Stationary FFT, CPB and overall analysis
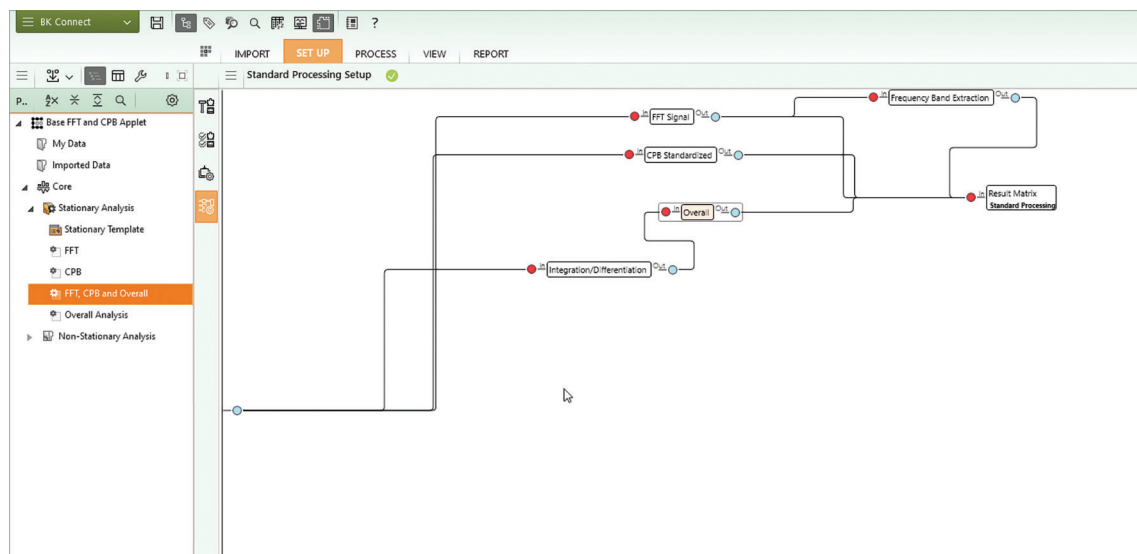
Utilizing BK Connect Application Components
To generate an efficient workflow, the applets take advantage of many of the task-oriented and user-friendly features that are found in full-version BK Connect applications, including:
- In both Type 8490-C and Type 8490-H:
  - Standard Processing Setup and Standard Processing tasks for adjusting the analysis properties and executing the predefined process chains
  - Time Editor for review and editing of time signal including post-processing of BK Connect recordings, HBK sound level meter data or HBK Tescia® data
  - Integrated Result Matrix and Display Manager tools to validate selected data and set up preferred data displays
  - Result Matrix Viewer task to review any data including imported data
- In Type 8490-C only:
  - Hardware Browser and Monitor components for a graphical overview and validation of your front-end channels
  - Transducer Manager and Verification tasks for configuration and calibration of connected transducers
  - Generator Setup task for setting up the generator output in LAN-XI modules with a signal generator
  - Record and Process task for performing complete tests from configuration, recording and processing to result validation – in one interface. Tests are based on a user-defined test plan using a matrix of devices under test (DUTs) and test conditions. Test runs can be automatically averaged based on common metadata
  - Test-based Viewer task, which is connected to the Record and Process task, for validation and comparison of test data with quick and easy tools during testing

The applets also include basic data viewing functionality that a standard BK Connect user would have, such as: access to all the metadata attributes; Microsoft® PowerPoint®-based reporting; exporting to Microsoft® Excel®; and BK Connect Notes for on-screen notations.

Fig. 2   *Processing in the FFT, CPB and Overall Analysis Applet*
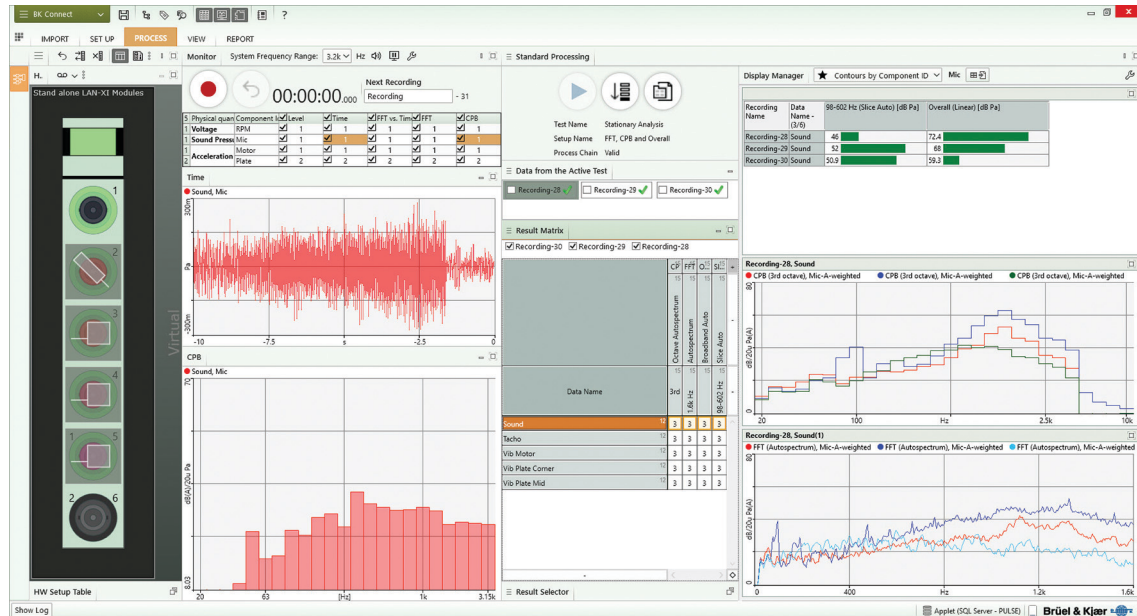
Automated Operations

BK Connect applets' many automated operations make it easy for the novice user and are perfect for repetitive testing:

- Auto-detection of hardware – Automatic detection of connected LAN-XI data acquisition modules and TEDS-enabled transducers
- Data source management– User-definable default data source for processing. The software will always draw data from that source
- Auto-analysis start – Automatic analysis start-up as soon as data is available in the Standard Processing task
- Auto-sizing of active window – Automatic maximization of the active task/component window
- Result selector – User-definable default combination of outputs and display layout. The software will always display and store these results
- Reporting – With a simple click a report will be created using the predefined template and stored with the project
- Done management – User-definable default task completion operation. The software will always perform this task when you complete a task

Hardware Support

Type 8490-C can be used with any single module within the LAN-XI data acquisition hardware platform, including LAN-XI Light Types 3676 and 3677. This means that anywhere between 4 to 12 channels are supported.

If additional channels are required that will require more than one module, then you will need the full version BK Connect application.

The software is delivered via download option or USB installation media.

System

PC SYSTEM REQUIREMENTS
- Operating System: Windows® 10 or 11, Pro or Enterprise, 64-bit, with either Current Branch (CB), Current Branch for Business (CBB), Semi-annual Channel (Targeted) or Semi-annual Channel servicing model
- Microsoft® Office that includes Microsoft Access®. This can be Office 2019 or 2021 (x32 or x64) or Microsoft 365® Desktop version (x32 or x64)
- Microsoft® SQL Server® 2019 or 2022 (**NOTE:** SQL Server 2022 Express included with software)

RECOMMENDED MINIMUM PC
- Intel® Core™ i9, 3 GHz processor or better
- 32 GB RAM
- 1 TB Solid State Drive (SSD) with 100 GB free space, or better
- 1 Gbit Ethernet network[*]
- Microsoft® Windows® 10 Pro or Enterprise (x64) with CB
- Microsoft® Office 2021
- Microsoft® SQL Server® 2022
- Screen resolution of 1920 × 1080 pixels (full HD)

FRONT END
Required for real-time measurements and recording
Front-end Support: One LAN-XI-based data acquisition module

Import/Export

SUPPORTED DATA FORMATS	• .bkc (BK Connect native format) – both function and time data
	• .dat – time data, must also have the ancillary *.rec file (import only)
	• .pti – PULSE LabShop and HBK Tescia time data
	• .wav – time data
	• .csv (based on a predefined format):
	  – Recording data (even abscissa time domain)
	  – 2D complex-valued frequency domain data
	  – 2D real-valued frequency domain data (FFT and CPB)
	  – Geometry file
	• .bks – BK Connect shape files

PROJECT FILE EXPORT AND IMPORT	Export a project to an external "transport" file (*.BKConnectTemplate or *.BKConnectProject), with or without imported or processed data, for archiving outside the database, sharing with other BK Connect users, capturing a snapshot of a particular state, or creating a project template

Data Display

Displays enable viewing and comparison of measurements and results. Data is dragged-and-dropped to/from the Project Browser. The User-defined Display task is the container for displaying graphical results

GRAPH TYPES	Display of functions	
	• Waterfall • Waterfall (step) • Colour contour (3 variants) • Campbell diagram • Bar	• Line • Curve • Curve (step) • Overlay • Overlay (all) • Multi-value
SUPERIMPOSED GRAPHS	A number of functions can be superimposed on the same curve graph	
AXES	• X-axis Scale: Linear, logarithmic and CPB • Y-axis Scale: Linear, logarithmic and dB • Z-axis Scale: Linear and logarithmic	
COMPLEX DISPLAYS	• Real • Imaginary • Magnitude	• Phase • Nyquist • Bode

[*] For data acquisition: A dedicated data acquisition network (LAN or WAN) is recommended. A network that only handles data from the front end improves the stability of the data.

SPECTRAL UNITS	• Root mean square (RMS) • Power (PWR) • Power spectral density (PSD) • Energy spectral density (ESD)	• Root mean square spectral density (RMSSD) • Peak (Peak) • Peak-to-Peak (PkPk)
ACOUSTIC POST-WEIGHTING	A-, B-, C-, D-, L-weighting	
jω WEIGHTING	$1/j\omega^2$, $1/j\omega$, 1, $j\omega$, $j\omega^2$ (single and double integration and differentiation)	
CURSOR TYPES	Depending on the display type, the following are available:	
	• Main • Delta • Order	• Reference • Harmonic • Sideband
	Alignment: Cursors in different displays can be synchronized to allow the changes to one display to be reflected in other displays showing the same or different functions	
CURSOR READINGS	• Acoustic levels • Corrected frequency • Cursor indices and values • Delta • Delta/total • Max. and min. values	• Nearest harmonic • Reference • Resonance • Reverberation • Slice definition • Status • Total

Data Management

Data management is based on a data model that interacts with a Microsoft SQL Server database. Connection to the last used database is automatic upon starting BK Connect. However, the user can connect to a different database at any time during a session. Only one database can be connected at a time.
Local database with each BK Connect installation; optionally accessible via a BK Connect service, one user at a time, over a company network

DATABASE HANDLING	Databases can be created, deleted, backed up and restored
DATABASE MIGRATION TOOL	Tool that allows users to start application using an SQLite database and at a later point migrate data to an SQL Server solution
DATA STORAGE	Uses a filefarm (on disk) referenced by the database to store data files, report templates, pictures. File sizes limited by disk only
DATA SHARING	Via external BK Common file enables one file to contain all results from a common source, including their metadata
METADATA AND DEVICE UNDER TEST	Defined by the user as a method to document valuable information about the test. Enables customized searching for input data and results on the BK Connect local database

Result Matrix Viewer

The Result Matrix Viewer provides a structured overview of results from a large number of tests, making selection and comparison very easy:

RESULT LAYOUT	As a matrix of signals versus analyses
SMART RESULTS GROUPING	Each individual cell in the matrix represents a group of similar results for which comparison is valid
AUTOMATIC RESULT DATA PRESENTATION	Selecting a cell presents the results, either in a table view for scalars, or graphical display for function data
AUTOMATIC REPORT GENERATION	Reports can be generated in Microsoft® PowerPoint, either from blank documents, or from templates prepared in advance

Time Editor

Display, audio playback and pre-processing of time data in preparation for analysis

DATA SELECTION	• Automated generation of regions from multiple files having similar channel configurations – in preparation for batch processing • Manual grouping of regions – for batch processing • Region selection by group of channels and time range • Append regions to other regions (concatenation) • Save regions to project
DISPLAY	• Fast navigation by scrolling through channels, panning and zooming in time axis • Fast spectrogram display – synchronized with time data display & playback • Interactive order slice and frequency spectrum display synchronized with spectrogram cross-hair cursor
PRE-ANALYSIS	• Automatic calculation of rpm profile from a tachometer pulse train

Data Processing Features

• Analysis of time data including pre-processing
• Immediate display and store of analysis results
• Automated processing using the Standard Processing task
• Automated multi-page reporting
Analyzers: FFT, CPB and overall analyzers

Process Chains

PRE-ANALYSIS ELEMENTS	• Integration/Differentiation	
ANALYSIS ELEMENTS	• FFT Signal • FFT Signal vs Time • CPB Standardized	• CPB vs Time • Overall • Overall vs Time
POST-ANALYSIS ELEMENTS	• Frequency Extraction	
GENERAL ELEMENTS	• Result Matrix: Results are presented using the same functionality as in the Result Matrix Viewer, where you can make predefined selections in the matrix, simplifying the process of displaying data	

FFT Analysis

The following specifications apply to all FFT-based analysis

FREQUENCY RANGE	• Baseband and Zoom: 50 – 102400 lines • Frequency Span: 1 Hz – 204.8 kHz in 1, 2, 5 … or 2^n (1, 2, 4, 8 …) sequence (depending on hardware)	
SIGNAL TYPE	Random; Periodic; Transient Properties are automatically set up to a logical default; for example, when transient type is selected, Signal Trigger is selected as the triggering mode	
TRIGGER MODES	• Free run • Signal Trigger: Trigger attributes include level, hysteresis, slope, hold-off, delay and divider	
TIME WEIGHTING	• Exponential • Uniform • Transient	• Hanning • Flat-top • Kaiser-Bessel
OVERLAP	User selectable values of 0%, 50%, 66.67%, and 75%, user editable from 0% to 95%	
OUTPUT	FFT Signal: Autospectrum, Cross-spectrum, Phase-assigned Spectrum, Time, Weighted Time	

CPB Analysis

CPB operates with 1/3-octave bands. The following specifications apply to all CPB-based analysis

1/3-OCTAVE FILTERS	6-pole filters with centre frequencies given by $10^{n/10}$, where $-10 \le n \le 52$ (63 filters). Filters with centre frequencies from 266 mHz to 160 kHz that meet the requirements of:	
	• IEC 61260-1 Class 1 • IEC 1260-1995 Class 1 • IEC 225-1966 • ANSI S1.11-2004 Class 1	• ANSI S1.11-1986 Order 7 Type 1-D • ANSI S1.11-1966 Class 1 Type E • DIN 45651 (1964-01)
CPB SPECTRUM AVERAGING	• Linear (fixed time range) • Linear All (full time range) • Exponential	
MAX./MIN. SPECTRUM HOLD	Max./Min. Hold of spectrum for exponential averaging mode	
ACOUSTIC WEIGHTING	Perform acoustic weighting on sound pressure signals before CPB analyses. Select between A, B, C, D and G-weighting	
OVERALL BANDS	Process overall bands in parallel with the CPB spectra. The overall bands can be acoustic weighted	

Overall Analysis

The following specifications apply to all overall-based analysis

STANDARD	Meets the requirements for a class 1 instrument in IEC 61672-1, ANSI S1.43-1997 Type 1, ANSI S1.4-1983 Type 1, IEC 804-1985 and IEC 651
AVERAGING	Exponential, Impulse, Linear (Leq), Linear All, True Peak, True Peak All
TRIGGER METHOD	Free run; Fixed time interval An auxiliary signal may be used as a trigger signal
FREQUENCY SPAN	1 Hz – 204.8 kHz in 1, 2, 5 … or 2n (1, 2, 4, 8 …) sequence
ACOUSTIC WEIGHTING	As signals, A, B, C, D, G

Reporting

A separate reporting task enables templates to be created in Microsoft PowerPoint

Team Server

EXPORT	• Measurement and analysis files saved and exported to folder via the Project Browser • Does not require Microsoft SQL database
IMPORT	• Import data directly in BK Connect project
FILE FORMAT	Works for all of file types supported by BK Connect, however the .bkc file has more attributes available to be indexed

SEARCH DATA	• Search using multiple attributes (metadata)
	• Two search methods:
	  – Basic: Select search criteria from drop-down menu
	  – Advanced: Build search string using standard query syntax
	• Search strings can be stored as favourites for future reuse
	• Get overview of query results in Results Matrix
	• Select one or more results in matrix and view and inspects data in Results Display

Hardware Setup Features

HARDWARE SUPPORT	Support for any single LAN-XI data acquisition module or a single LAN-XI Light module
TRANSDUCER MANAGER	For transducer setup
HARDWARE BROWSER	For channel setup
GENERATOR SETUP	For setting up any LAN-XI module with built-in signal generator
CALIBRATION	Transducer calibration/verification
SIGNAL MONITORING	Real-time monitor including a monitor recorder

Hardware Configuration

The software automatically detects the front-end hardware and configures the system. If IEEE 1451.4 capable transducers (with standardized TEDS) are being used, these are detected and attached automatically to the correct input channels

Hardware Browser

The Hardware Browser combines the Hardware Matrix and HW Setup Table that work together to provide a highly efficient way to work with any size system

HARDWARE MATRIX	An interactive display of the front-end hardware • Signal levels indicated using coloured rings • Channel overload status, using different symbols for different types of overload • Transducer status, using symbols to identify each transducer type • Calibration/verification status when used in the Transducer Verification task • Drop destination for transducers dragged from the Transducer Manager • Channel selector for the HW Setup Table and overall level meter • Automatic indication of TEDS transducers
LAYOUT VIEWS	• Square Grid: Completely dynamic. Signals form a best-fit grid in the available screen space using coloured rings to display signal amplitude • Bar Grid: Completely dynamic. Signals form a best-fit grid in the available screen space using bars to display signal amplitude Note that the grid displays can be sorted according to Signal Name, Maximum Level, Minimum Level and Level Range
MATRIX DISPLAY STYLES	• Physical: A visually representative display of the physical front end • Logical: Channels shown as coloured rings in the same configuration as the physical front end
HW SETUP TABLE	A channel list that contains all information about the front-end hardware and any transducers connected to it. The number of rows displayed in the table depends on the channel selection made in the Hardware Matrix, the default being all channels. The size of the table updates dynamically according to which channels are selected in the Hardware Matrix, making it very easy to focus on subsets of channels when needed
TABLE EDITING	• Manual editing of channel information • Update from an external XML or UFF 1808 (Channel Table) file or from Microsoft® Excel® • Save HW Setup Table contents to an external XML or UFF 1808 (Channel Table) file for later use • Create different (favourite) views to tailor which columns should be shown
BROWSER HEADER BAR	Tools in the Hardware Browser allow for: • Resetting of channel status • Reconnecting the front end • Display of either the HW Setup Table, the LAN-XI home page, or an overall level meter for all channels

Transducer Manager

The Transducer Manager works with a Microsoft Access® database (as used by PULSE LabShop) to manage transducer specifications and calibration information

INCLUDED TRANSDUCERS	A full set of HBK transducer types, with nominal sensitivities, is provided with all BK Connect installations
ADDING TRANSDUCERS	Individual devices, or groups of devices, can be dragged and dropped onto the Hardware Matrix to add transducers to the configuration and/or add calibration/sensitivity information: • Drag a transducer type to many (or all) channels. The HW Setup Table applies the nominal sensitivity for that type to the selected channel(s) • (Typical) Drag specific devices to individual channels where they are known to be physically connected
DATABASE	Each transducer type can have a number of devices of that type, each with its own unique calibration history

Transducer Verification

Transducer Verification (under Setup) can be used either to verify that transducers are functioning correctly, or to make a new calibration
A transducer calibrator is used to apply the necessary excitation for either verification or calibration. Multiple calibrators can be used simultaneously.
The software automatically detects the calibrator signal and performs the verification/calibration, with coloured status indicators in the Hardware Matrix and HW Setup Table showing In Progress, Failed or Passed. At the end of the procedure, the Transducer Manager is updated along with the HW Setup Table and calibration information is added to the device's calibration history

Generator Setup

SETUP	Graphical tools can be used for setting up excitation type, frequency parameters, output level, level ramp up/down times, and whether burst excitation is to be used	
GENERATOR SIGNAL TYPES	• Sine (fixed frequency) • Continuous and Burst Random	• Periodic and Pseudo-random • Periodic chirp

Real-time Monitor

MONITORS	Channel monitor (time, CPB or FFT), channel level meter, channel level history, elapsed time, rpm profile, tachometer. Includes generator stop/start control buttons
FFT MONITOR	Monitors 2D spectra or 3D spectrograms for all active channels or selected channels. Grouped automatically based on the physical quantity
CPB MONITOR	Monitors 2D spectra for all active channels with the option to apply acoustic weighting to sound pressure signals. Channels are grouped automatically based on the physical quantity
LEVELS MONITOR	Monitors the overall levels displayed in voltage or physical quantity for all active or selected channels. The data can be monitored as instantaneous level or max. hold, using slow, fast or impulsive time weighting
TIME MONITOR	Monitors the complete raw time history for the entire length of the recording, while overlaying overload and marker locations

Record and Process

Perform complete tests in one interface. Using a test plan, you can better document and report test results as you perform

ACTIONS	• Prepare • Annotate • Process	• Record • Inspect • View (opens Test-based Viewer)
TEST PLAN	Includes the following information: • Device under test (DUT) name • Test name • Active test conditions • The setup name • Measurement number • Run number • Status of the recording • Recording information • Metadata based on the test structure	
TIME DATA RECORDING	Select recording setup: • FFT • CPB • Overall • FFT, CPB, Overall Manual start and stop of recordings. Maximum recording length is defined by the size of the recording disk	
RECORDING FILES	• Stored as .bkc (BK Connect native format) • Metadata values saved with the recordings	
PROCESSING	Use predefined process chain (defined in Standard Processing Setup)	
RESULT SELECTION	• Specify whether or not to include in run averaging • Specify the setup to apply • Assign and reassign measurement, test condition, DUT and metadata • Share to Team Server	
RESULT OVERVIEW	• Result layout as a matrix of signals versus analyses • Can contain a wide range of data descriptors, including user-defined metadata	
RESULT DISPLAY	• The Signals table shows all signals processed for the selected run(s) and are grouped based on the physical quantity • Select one or more signals in the Signals table to view data in a display – one for each signal – either in a table view for scalars, or graphical display for function data • If there is reference data in the Project Browser, it is selectable in Test-based Viewer for comparison	

Test-based Viewer

DATA SOURCE	From test plan in Record and Process task
DATA OVERVIEW	• Test plan • Signals list • Reference data list
DISPLAY TYPE	• Fast: Optimized for speed and performance • Standard: Has a lot of functionality
DATA DISPLAY	Data is distributed into displays according to defined display rules. • Adjustable the graph settings • User-definable legends • Set audio gain Data traces can be: • Overlaid per unit • Overlaid all (overlay all regardless of unit) • Stacked (separate, over each other)

Type 8490-C-N-SYS*   FFT, CPB and Overall Analysis Applet
Type 8490-H-N-SYS*   FFT, CPB and Overall Post-analysis Applet

SOFTWARE MAINTENANCE AND SUPPORT AGREEMENTS†
M1-8490-C-N-SYS   Agreement for Type 8490-C-N
M1-8490-H-N-SYS   Agreement for Type 8490-H-N

OTHER BK CONNECT PRODUCTS
For an overview of all BK Connect applications and applets, visit the
BK Connect web page.
NOTE: Applets cannot be upgraded to full-version applications or
added to other applets

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*   "N" indicates the licence is node locked to a PC or dongle. Floating licences not
    available
†   Agreement expiration date to be agreed at time of contract

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