

PRODUCT DATA

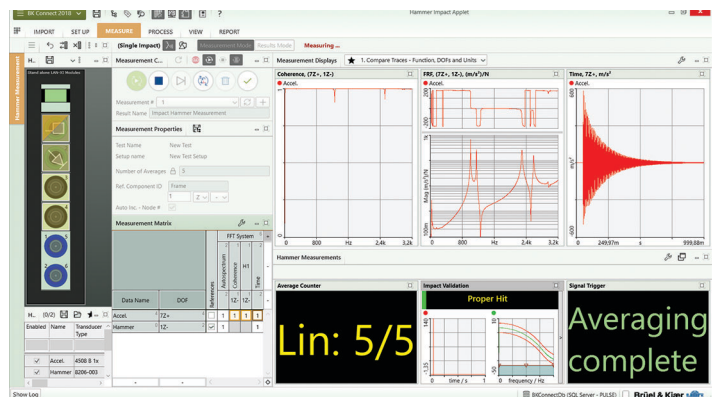
BK Connect Structural Dynamics

BK Connect Hammer Impact Applet Type 8491-A-N-SYS

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.

BK Connect Hammer Impact Applet is specifically for impact hammer measurements, to calculate easily frequency response functions (FRFs) such as accelerance, mobility and compliance. These FRFs can be used, for example, to determine structural resonances in troubleshooting scenarios or during quality control.

The applet provides you with a complete testing solution from data acquisition and recording to data management and reporting. The acquired FRFs can be used with BK Connect Modal Analysis for modal parameter estimation.



Uses and Features

Uses

- Troubleshooting, benchmarking, design verification, quality control or material testing scenarios using roving or fixed hammer impact testing
- Determination of FRFs or 1/FRFs:
 - Accelerance (inertance) or dynamic mass functions
 - Mobility or mechanical impedance functions
 - Compliance (receptance) or stiffness functions
- Estimation of natural frequencies (resonances) and damping estimates for structures with well-separated modes
- Measurement of FRFs as input to modal parameter estimation using BK Connect Modal Analysis Types 8420 and 8420-A

Features

- Single easy-to-use applet from data acquisition and recording to data management and reporting
- Measurement of a wide variety of functions including time signals, auto- and cross-spectra, coherence functions and frequency response functions
- Easy to learn and use, reducing training and test time
- Interactive graphical representation of the front-end hardware with coloured light rings to indicate channel status just as on the physical LAN-XI hardware
- Tear-off of panels such as Hardware Browser, Monitor and Measurement Controls and view in other PC monitors

- Integrated transducer manager and database that includes:
 - Automatic detection and import of data for TEDS-enabled transducers
 - Quick assignment of non-TEDS transducers by simple drag and drop
- Automatic detection of calibration signals with option to automatically apply gain adjustment
- Live Monitor immediately showing levels and spectra for all active channels
- Measurement using single or random impact techniques with:
 - Intuitive graphical hammer setup and measurement interfaces
 - Voice feedback during hammer setup and measurement
 - Automatic undo of last average in case of double hit, soft hit or unacceptable force level roll-off
 - Time data recording during measurement
 - Result Matrix tool for easy display, comparison and reporting of results
- Integrated reporting in the test process using embedded Microsoft® PowerPoint® templates
- Support of SI and imperial units and acceleration in 'g'
- Support of accelerometers, displacement and velocity transducers for response measurements

The Hammer Impact Applet is a point solution for impact hammer measurements to easily calculate frequency response functions (FRFs) such as acceleration, mobility and compliance as well as related functions such as time signals, auto-spectra, cross-spectra and coherence functions. It is a self-contained package requiring no additional BK Connect software licences.

The applet contains a dedicated set of tasks that will take you from data acquisition and recording to data management and reporting. Many of the components and tools known from the full-version BK Connect applications are available in the applet as well. This includes:

- Hardware Browser – for a graphical overview and validation of your front-end channels
- Monitor – for viewing time and frequency data once the system is activated

- Notes – for on-screen notations
- Matrix Calculator – for standard mathematical and statistical operations on function data
- Transducer Manager – for configuration of transducers from a built-in database. New transducer types and devices of specific types can be created easily
- Transducer Verification – for checking the operation of transducers and, optionally, to apply gain adjustment factors for transducers that deviate from their last calibrated sensitivities
- Access to metadata attributes

For geometry-guided hammer measurements or shaker measurements, use Structural Measurements – Hammer and Shaker Type 8411 (see product data [BP 1524](#)).

Using the Applet

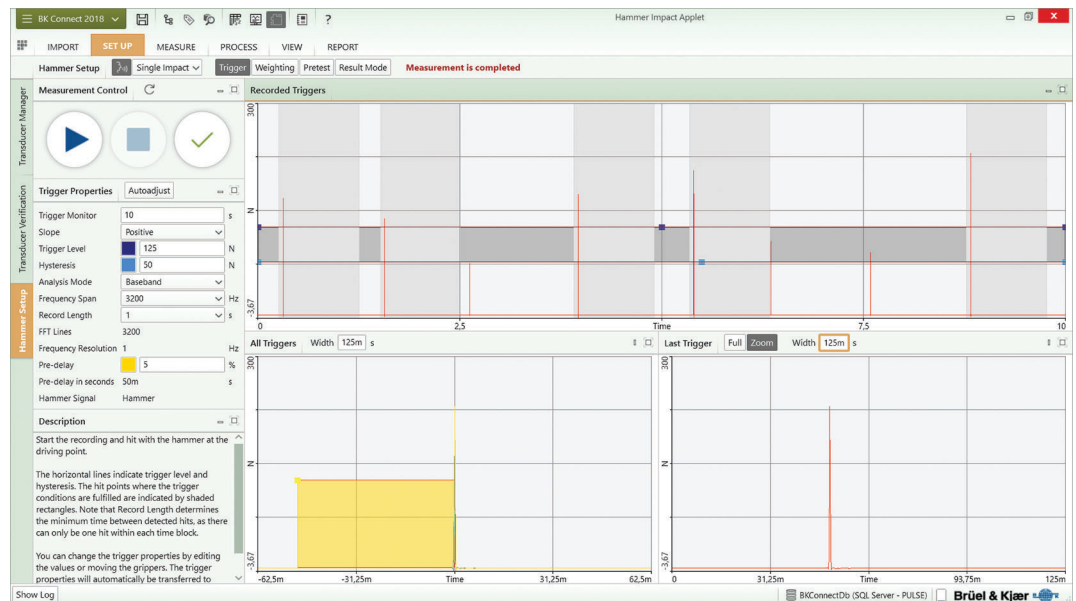
Single impact as well as random impact testing is supported. With single impact testing, the structure is hit once in a given DOF per FFT time record. With random impact testing, the structure is hit randomly in time multiple times for a given DOF per FFT time record. Random impact testing allows for injecting more energy into the structure per time record. This gives a better signal-to-noise ratio for large structures where the frequency range is small resulting in long time records.

Hammer Setup

The Hammer Setup task helps you to set up hammer triggering and hammer and response weighting windows for optimal measurements, when doing single impact testing. For random impact testing, predefined values are used.

The trigger setup is performed by recording a series of typical hammer impacts and using the recording to interactively set the signal trigger parameters with the help of special cursors (Fig. 1) for best possible conditioning of the trigger signal.

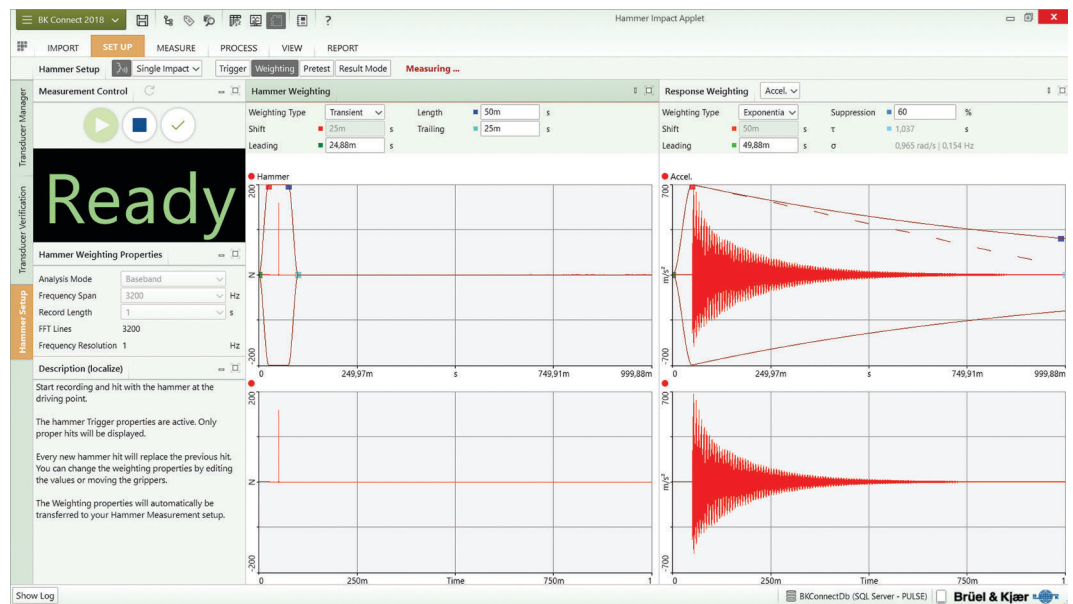
Fig. 1
Hammer Setup: The trigger level and hysteresis are set up using a series of trial impacts (upper graph) and the effects of varying trigger settings, like pre-delay, are observed interactively (lower graphs). The Auto Adjust functionality automatically sets the trigger level and hysteresis



Hammer and response weighting windows help minimize noise and improve the accuracy of the measurement. Dedicated data displays enable you to fine-tune the windows for both the force and the response by typing in the parameters or using graphical grippers (Fig. 2).

Once the trigger parameters and weighting windows are set up, there is a pretest mode for verifying that the overall measurement setup is correct. You can store these measurements if desired.

Fig. 2
Hammer Setup: Time weighting can be set up interactively. Raw input force and acceleration response (upper graphs) are compared with weighted data (lower graphs)



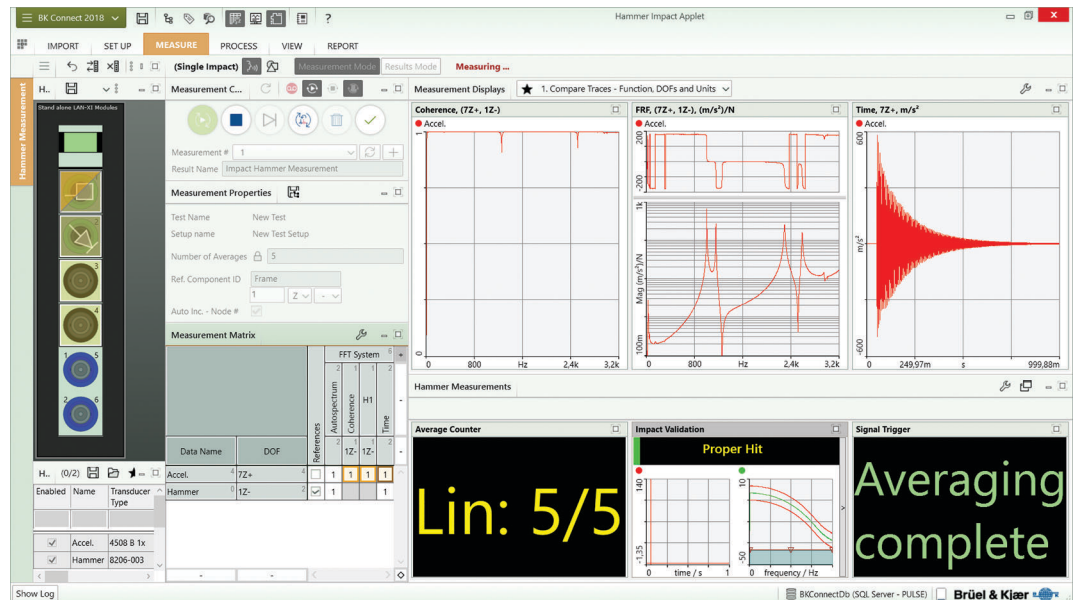
Hammer Measurement

The Hammer Measurement task inherits the settings from the Hammer Setup task and lets you make repeated measurements. It includes a feature for undoing the last average, which can be very helpful when measurement conditions are difficult. Using the Impact Validation monitor, you can easily detect potential double hits, soft hits and unacceptable force level roll-offs in the measurements. You can set up the system to automatically reject

such measurements, so they are not included in the results. Voice feedback is also supported with audible alerts such as 'ready', 'triggered', 'double-hit' and 'overload', that keep you aware of measurement events even if you cannot see the screen.

During the measurements, time data can be recorded simultaneously to disk.

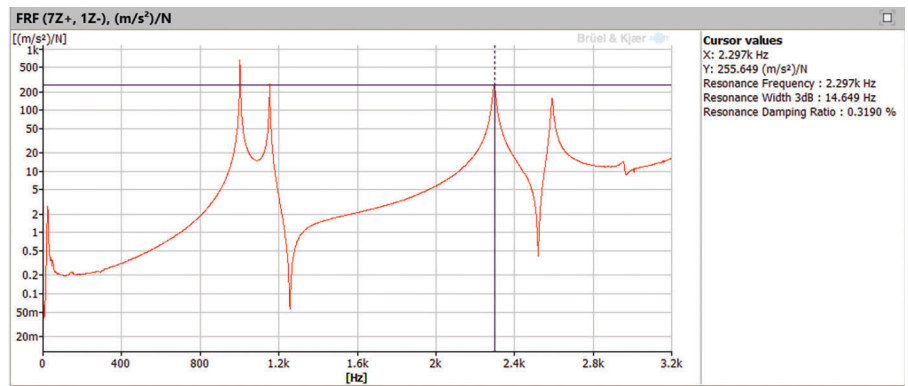
Fig. 3
Hammer Measurement task showing coherence, FRF and the time signal of the response accelerometer. The average counter, signal trigger and impact validation monitors are shown as well



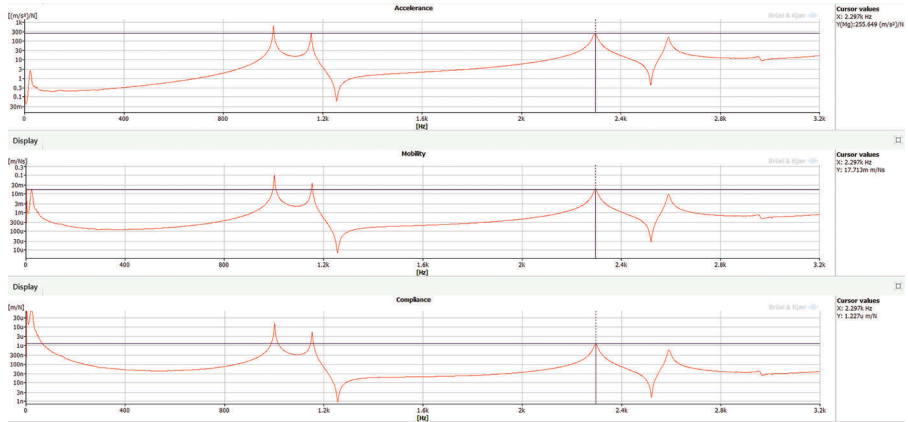
Accurate estimation of resonance frequencies and damping estimates can be made for structures with well-separated modes without doing a full modal analysis.

Using $j\omega$ -weighting, FRFs are easily converted between acceleration, mobility and compliance. Dynamic mass, mechanical impedance and stiffness are easily calculated as well.

Resonance frequency, 3 dB bandwidth and damping ratio for the third mode. Estimates for more heavily damped modes could be obtained using a finer frequency resolution



Accelerance (upper graph), mobility (middle graph) and compliance (lower graph) functions shown for the same FRF



Post-processing in BK Connect Modal Analysis

All FRFs and related functions, such as auto- and cross-spectra, and coherence functions are directly accessible by the BK Connect Modal Analysis applications for modal parameter extraction and validation:

- **BK Connect Modal Analysis Type 8420**
An application designed for single-reference modal analysis with a basic, yet comprehensive, set of mode indicator functions (MIFs), curve-fitters and analysis validation tools. For use with single shaker FRF data and single-reference hammer testing data
- **BK Connect Modal Analysis (advanced) Type 8420-A**
Adds polyreference modal analysis capabilities and advanced MIFs, curve-fitters and analysis validation tools to the Modal Analysis application. For use with shaker MIMO (multiple-input multiple-output) FRF data, polyreference hammer testing data or for advanced analysis and validation of both single and polyreference data

For more information on BK Connect Modal Analysis, see product data [BP 1523](#).

Hardware Support

The Hammer Impact Applet can be used with any single module within the LAN-XI data acquisition hardware platform – from 2 to 12 channels – including the highly portable, 4-input channel LAN-XI Light Type 3676-B-040. Together with LAN-XI Light, you have a complete standalone system ideally suited for impact testing. For example, for roving impact testing you can use up to three uniaxial accelerometers (or a single triaxial accelerometer) as reference, or for fixed impact testing use fixed accelerometers for smaller setups and roving accelerometers for larger setups.

If impact testing is to be done simultaneously in more channels than supported by a single LAN-XI module, you must use the Structural Measurements – Hammer and Shaker Type 8411 application.

Valid from BK Connect 2024.0

System

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 PC SYSTEM

- 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

The following data file formats are supported:

- .bkc (BK Connect native format) – both function and time data
- .csv (based on a predefined format)

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 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 (of data files, report templates, pictures)

Uses a filefarm (on disk) referenced by the database. File sizes limited by disk only

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

DATA SHARING

Via external BK Common file enables one file to contain all results from a common source, including their metadata

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 an interactive display of the front-end hardware, called the Hardware Matrix, and a channel list called the HW Setup Table. These two components, working together, provide a highly efficient way to work with any size system

Header bar buttons 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

HARDWARE MATRIX

The Hardware Matrix has the following functionality:

- 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

Available 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

The HW Setup Table 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

Editing the Table:

- 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

TRANSDUCER MANAGER

The Transducer Manager works with a Microsoft® Access® database to manage transducer specifications and calibration information. A full set of HBK transducer types, with nominal sensitivities, is provided with all BK Connect installations, but more can be added using the Transducer Manager. Each transducer type can have a number of devices of that type, each with its own unique calibration history

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

* 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.

Real-time Monitor

MONITORS

Channel monitor (time, CPB or FFT), channel level meter, channel level history, elapsed time, rpm profile, tachometer

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

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

Transducer Verification

Transducer Verification 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

Hammer Setup

For single impact and random impact test setups

TRIGGER

Record a set of hammer impacts and display as time history. Using graphical tools, adjust the trigger parameters directly on the data display, or by direct parameter entry, until the desired trigger behaviour is achieved. An Auto Adjust functionality sets the Trigger Level and Hysteresis automatically. The aim is to condition the trigger parameters for optimal results

WEIGHTING

The hammer signal and a response signal are displayed in graphs with graphical tools for adjusting the type and amount of time weighting to be applied to each. The aim is to use as much of the measured signals as possible whilst minimizing noise and leakage

PRETEST

Experiment with different FFT settings (bandwidth, number of spectral lines) and perform trial measurements for display and (optional) storage to the database

RESULT MODE

Pretest measurement results can be viewed and overlaid with previous measurements before storing to the database

Hammer Measurements

The Hammer Measurement user interface is streamlined for typical hammer test scenarios in which the hammer excitation location is roved from point to point or performed at a fixed location. All measurement parameters are inherited from the Hammer Setup task. Key features include:

- Last hit undo
- Double-hit detection
- Frequency content warning (soft hit)
- Auto-increment of the reference DOF after a measurement

MEASUREMENT MODE

Includes a measurement control panel that is resizable

Control Settings:

- Auto Start
- Auto Stop
- Auto Undo

Control Buttons:

- Initialize analysis system
- Measurement start/stop
- Next measurement
- Undo last (average) hit
- Delete last measurement
- Data recording during measurement

MEASUREMENT MONITORS AND DISPLAYS

- Average Counter showing average mode and number
- Impact Validation monitor showing the time signal and force spectrum for the hammer. Warns about double hits, soft hits and unacceptable force level roll-off
- Signal Trigger monitor showing status information such as ready, triggered and averaging completed
- Measurement Matrix for flexible selection and display of data

VOICE FEEDBACK

Audible status/error warnings during hammer testing setup and measurement

RESULT MODE

Measurement results can be viewed and overlaid with previous measurements

Matrix Calculator

Standard mathematical and statistical operations on function data such as function math, function statistics, function operators, scaling, statistics, frequency weighting and interpolation

User-defined Display

For fast and flexible data viewing and ad hoc analysis using customized layouts

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

Reporting

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

Type 8491-A-N-SYS* BK Connect Hammer Impact Applet

Software Maintenance and Support Agreements

M1-8491-A-N-SYS Software Maintenance & Support for
Type 8491-A

Other BK Connect Products

For an overview of all HBK Structural Dynamics applications, visit the [Structural Dynamics](#) solutions page. For an overview of BK Connect Core software, visit the [BK Connect](#) page.

NOTE: Applets cannot be upgraded to full-version applications or added to other applets.

Related Accessories

IMPACT HAMMERS

Type 8206	Impact Hammer, four versions, 1.14 – 22.7 mV/N, 220 – 4448 N
Type 8207	Heavy Duty Impact Hammer – One-pound head, 0.225 mV/N, 22.2 kN
Type 8208	Heavy Duty Impact Hammer – Three-pound head, 0.225 mV/N, 22.2 kN
Type 8210	Heavy Duty Impact Hammer – Twelve-pound head, 0.225 mV/N, 22.2 kN
Type 6991-B-001	Ultra-light Impact Hammer w/TEDS, 22.5 mV/N, 900 N
Type 6991-B-004	Impact Hammer w/TEDS, 2 mV/N, 4400 N
Type 6991-B-005	Impact Hammer w/TEDS, 1 mV/N, 8900 N

ACCELEROMETERS FOR STRUCTURAL TESTING

Type 4507-B	Miniature Piezoelectric CCLD Accelerometer
Type 4508-B	Miniature Piezoelectric CCLD Accelerometer
Type 4524-B	Miniature Triaxial Piezoelectric CCLD Accelerometer
Type 4527	Triaxial Piezoelectric CCLD Accelerometer
Type 4529-B	Triaxial Piezoelectric CCLD Accelerometer
Type 4535-B	Triaxial Piezoelectric CCLD Accelerometer

CALIBRATOR

Type 4294	Vibration Calibrator
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A wide range of CCLD, charge and piezoresistive accelerometers are available. Please visit our [Vibration Transducer](#) web page or contact [HBK](#) for details.

* "N" indicates the licence is node locked to a PC or dongle. Floating licences not available

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