

# PRODUCT DATA

The STAR System™ Modal and Structural Analysis — Type 7750  
For use with PULSE, the Multi-analyzer System



The STAR System™ complements the advanced measurement environment introduced by PULSE with its advanced tools for structural testing, analysis and reporting. Through an easy to use, intuitive and process-oriented user interface based on Microsoft® Windows®, the STAR System offers easy access to new and occasional users as well as greater productivity to experienced users.

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**7750**

**Brüel & Kjær** 

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## Uses and Features

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- USES*
- Structural testing, analysis, and reporting of measurement data from PULSE, the Multi-analyzer System Type 3560 using the STAR System configurations:
    - STARBase™
    - STARView™
    - STARModal®
    - STARStruct™
    - STARReport™

- FEATURES*
- Runs under Microsoft Windows 3.1, Windows 95 or Windows NT
  - Flexible and modular design accomodates your changing needs
  - Can use measurement data exported from PULSE
  - Comprehensive measurement math operations
  - Time domain analysis and animation
  - Operating deflection shapes
  - Modal analysis
  - Advanced curve fitting
  - Structural dynamics modifications
  - Forced response simulation
  - Multi-level report generation
  - Comprehensive on-line Help and documentation

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## PULSE and the STAR System

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*The unique combination of PULSE and the STAR System offers you a complete system for structural testing measurements, from data acquisition and analysis to display and reporting.*

### **Modelling**

You can create accurate geometric models of the measurement object with the STAR System in a number of ways. Depending on the task at hand, you can either define a model manually, generate meshes using the 3D mesh generator, or graphically draw lines quickly and easily. The STAR System animates these geometries smoothly and offers a vast array of real-time interactive controls to create accurate and clear animations of structures and sub-structures.

### **Data Acquisition with PULSE**

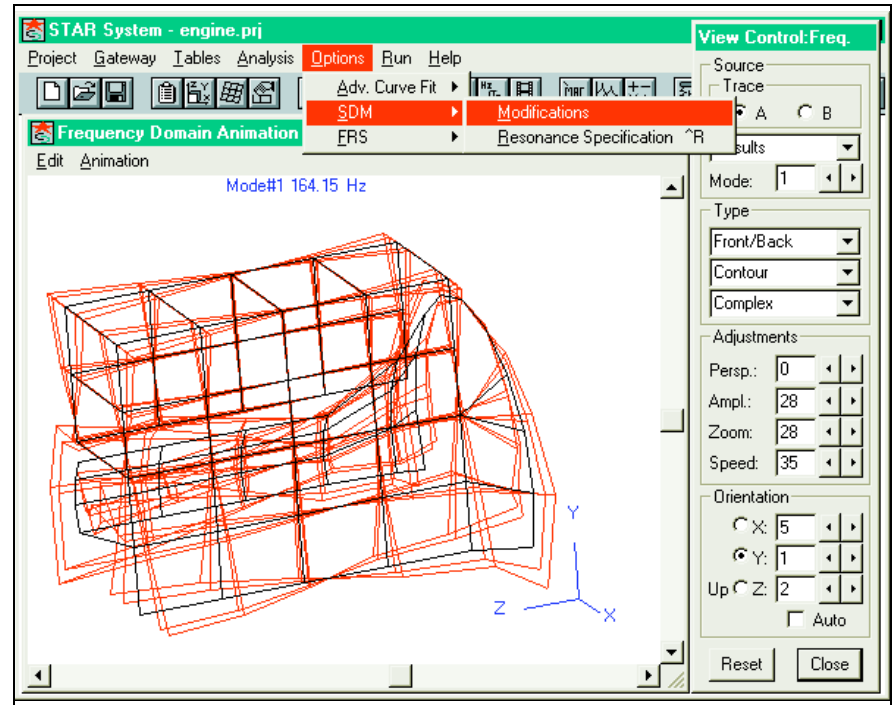
PULSE performs the data acquisition, degree-of-freedom labelling and initial data evaluation. To assist the user in the measurement process, PULSE is supplied with predefined projects for solving numerous structural dynamics measurement tasks. These projects set up PULSE to streamline the data acquisition process as well as the export of data from PULSE to the STAR System. You can easily customize the projects, all of which contain years of built-in measurement know-how.

### **Analysis with the STAR System**

For further operations on the measurement data, the STAR System has an extensive set of measurement math calculation options. The STAR System measurement display is designed specifically for the time- and

frequency-based measurements common to structural analysis and offers a wide range of display options. You can easily copy and paste graphics and data into presentation, word-processing, and spreadsheet applications for making further documentation or performing custom analysis. You can even create advanced reports containing embedded “live” displays and mode shape animation with full interactive viewing control using the STARReport option.

*Fig. 1 A frequency domain animation of the 1st mode of an engine. The STAR System provides a wide range of view controls for manipulating the animation*



## Configurations

The STAR System can be tailored to match your specific needs of today and provide a path of growth for tomorrow because it is offered in a variety of base packages, options, and add-ons.

*Table 1 The STAR System configurations*

Features	STARBase	STARView	STARModal	STARStruct
Measurement Import	X	X	X	X
Measurement Display	X	X	X	X
Measurement Math	X	X	X	X
Time & Frequency Animation	X	X	X	X
Printing/Plotting	X	X	X	X
Time Domain Analysis		X	(optional)	X
Operating Deflection Shapes		X	(optional)	X
Peak Curve Fitting			X	X
SDOF, MDOF, Global Curve Fitting			X	X
Auto Curve Fitting			X	X
Modal Assurance Criterion			X	X
Measurement Synthesis			X	X
Mode Indicator Functions			X	X
Structural Dynamics Modification (SDM)			(optional)	X
Forced Response Simulation (FRS)			(optional)	X
Advanced Curve Fitting			(optional)	X
STARReport	(optional)	(optional)	(optional)	(optional)

## STARBase

STARBase is a low-cost minimum configuration providing measurement import and time and frequency display features. It also allows you to animate results created in other STAR configurations. This makes STAR-Base the ideal package for initial evaluations as well as for reviewing modal test results.

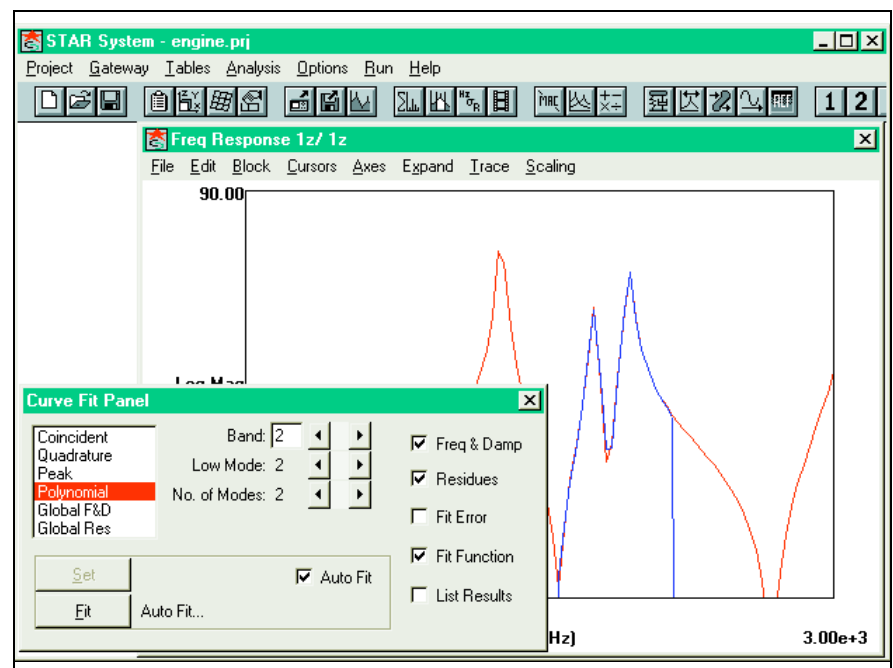
## STARView

In addition to the features supported by STARBase, STARView offers Time Domain Analysis and Operating Deflection Shapes options. These deflection analysis features show you how a structure actually moves. Time Domain Animation is based on time history data and is especially suited to the investigation of transient, non-linear and shock type responses. Operating Deflection Shapes is typically used to show a structure's motion in its normal operating conditions. Deflection analysis is often the first step in solving vibration-related problems.

## STARModal

STARModal offers a complete solution for determining the inherent dynamic properties of an elastic structure in terms of its modes of vibration. A wide variety of curve fitters allow for accurate estimation of the modal parameters and the Modal Assurance Criterion feature determines the correlation between the modes for verifying the validity of your curve fits and identifying coupled modes.

*Fig. 2 Curve fitting of the frequency responses using the unique polynomial curve fitter. Other advanced curve fitters such as Global F&D, Global Residues, etc., are also included*



## STARStruct

A STARModal configuration can be incrementally upgraded to comprise a STARStruct configuration by adding the following options:

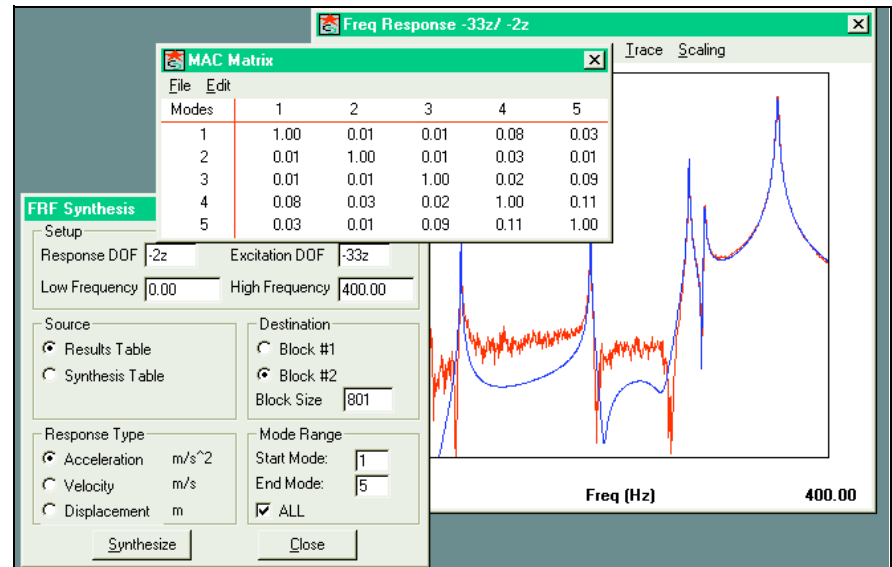
- Advanced Curve Fitting
- Operating Deflection Shapes and Time Domain Analysis
- Structural Dynamics Modification (SDM) and Forced Response Simulation (FRS)

STARStruct includes all features of the STAR System and forms a complete system for structural dynamic analysis. The SDM and FRS tools help you predict how to solve structural problems. With SDM you can

determine changes in the dynamic properties of a structure due to proposed changes in its mass, stiffness and damping properties.

Alternatively, you can use SDM to conduct sensitivity studies by targeting the resonance frequency, and the mechanical modification type and its location. SDM then determines the amount of modification needed. With FRS, you can observe the structure's simulated response to known input forces using measured or synthesized spectra or you can predict operating deflection shape using sinusoidal excitation.

*Fig. 3 Measured and Synthesised FRFs can be compared using a superimposed view and mode shapes can be compared using the Modal Assurance Criterion (MAC). The figure shows only some of the many data comparison options*



### STARReport

STARReport is an easy-to-use advanced Windows report generation tool that employs OLE technology. Interactive data displays and live mode shape animations complete with viewing control can be embedded in nearly any Windows-based word processor, spreadsheet or presentation software. The resulting reports can be freely distributed at no additional software cost.

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## Customer Support

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With your purchase of the STAR System you receive one full year of unlimited phone-in and fax consulting as well as automatic software and documentation updates. After the first year, you can choose to remain on the Total Customer Support (TCS) program to take advantage of additional software features as they become available.

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## Additional Information

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This product data sheet only reveals a small fraction of the capabilities and functionality of the STAR System. For more details, please see the STAR System brochure (available from Brüel & Kjær as BG 1221) or contact your local Brüel & Kjær representative. For more information about PULSE, the Multi-analyzer System Type 3560, please request the Product

Data (BP 1611) and brochure (BG 1216), both of which contain a full description of PULSE and its capabilities and specifications.

### Dynaview™

A helpful addition to any PULSE/STAR System configuration is Dynaview, which is a separate software package that you can use to simplify the task of comparing modal data sets obtained from analytical and experimental sources. Mode shapes from popular FEA codes can be imported and test results can be imported from popular experimental modal analysis programs like the STAR System. Modal Assurance Criteria (MAC) and Coordinate Modal Assurance Criteria (CoMac) can be quickly calculated. Results from Dynaview are easily inserted into reporting and documentation tools.

## Specifications PULSE

**Note:** PULSE must be used with Windows NT, so if both PULSE and the STAR System are being used concurrently, the operating system must be Windows NT.

#### COMPUTER REQUIREMENTS:

- The PC requirements for PULSE, the Multi-analyzer System Type 3560 must be fulfilled

- Noise and Vibration Analysis Type 7700 must be installed

#### DATA EXPORT

- Universal File Format (UFF) (PULSE v2.1 or later)

Spectral Dynamics proprietary STAR Binary Files (from future PULSE versions)

## Specifications STAR System

#### COMPUTER REQUIREMENTS

The STAR System runs on all PC/AT or AT-compatible computers which support the Microsoft Windows operating system.

Minimum requirements are:

- 80386/80486/Pentium/Pentium II CPU with Math coprocessor
- 4 MB RAM
- One 1.44 MB 3.5" floppy drive
- 10 MB available hard drive space
- VGA or better graphics

Supported operating systems:

- Windows for Workgroups 3.11 (STAR installs Win32S extensions)
- Microsoft Windows 95
- Microsoft Windows NT

#### PROJECT MANAGEMENT

- Comprehensive Project Slate stores global project data
- Interactive STAR Gateway™ guides modal test process

#### GEOMETRY

- Automatic 3D geometry mesh generator
- Interactive point-and-click display sequence editor
- Multiple coordinate systems: Rectangular, Cylindrical, Spherical
- Global and local coordinate systems
- Individual structural components with local coordinate systems
- Local coordinate systems allow independent Type selection, Orientation and Offset
- Constraint equations for non-measured points

#### DATA ACQUISITION

- Accepts data file types: Frequency Response Functions, Coherence, Autopower Spectra, Crosspower Spectra, Multiple Coherence (BK3550 only)

- Data file input via: UFF (Universal File Format) Type 58 for PULSE
- Direct interface with analyzer control for: Brüel & Kjær Types 2032, 2034, 2035, 3550
- Data file translation for: Brüel & Kjær Types 2144 and 2148

#### DATA VIEWING AND MANAGEMENT

- Measurement display for: time- and frequency-based data
- Formats: Full, overlay or split
- Types: Standard, Bode, Nyquist, Co-Quad
- Y-axis scales: Real, Imaginary, Magnitude, Phase, Log Magnitude
- X-axis scales: Linear, Log, RPM
- Dual cursors with X/Y readout
- Selectable Autoscaling
- Copy for pasting into other applications: Graphics or Measurement values
- Measurement math functions: FFT, IFFT, Add, Subtract, Multiply, Divide, Conjugate, Integrate, Differentiate, Invert, Clear, Exchange, Move, Random Noise, Filter (High Pass, Low Pass, Band Pass), Set Value, Add Value, Multiply Value

#### MODAL ANALYSIS

- Modal indicator functions: Imaginary, Imaginary squared, Magnitude squared
- Advanced mode indicator functions: Normal mode, Imaginary squared, Log imaginary squared, Real squared, Log real squared, Magnitude squared, Log magnitude squared
- Potential mode identifiers: Stability diagram, S-plane diagram
- Advanced modal identification tools: Stability Diagram for identifying repeated roots
- Local curve fit functions (SDOF): Coincident, Quadrature, Complex peak

# Specifications STAR System (cont.)

- Local curve fit functions (SDOF / MDOF): Polynomial (Rational Fraction Least Squares)
- Global curve fit functions: Hybrid Polynomial
- Advanced curve fit function: Hybrid Least Squares Complex Exponential with Polynomial allows single reference, multi-reference and MIMO (Multiple Input Multiple Output) data sets
- Mode types: Real or complex
- Out-of-band mode compensation: Automatic with Polynomial curve fit functions
- Autofit: Automatically fit all specified functions using fit type independently defined for each frequency band
- FRF synthesis: FRF synthesis from fit data for comparison with measured data
- MAC: Modal Assurance Criterion (MAC) computation

## MODAL AND OPERATING DEFLECTION SHAPE ANIMATION:

- Mode shape traces: 1 or 2
- Trace types: Results, Deformation, Undeformed
- Display types: Full, Split, Front / Back (overlaid)
- Animation types: Contour, Vector
- Result types: Complex, Normal
- Viewing control: Deflection amplitude, View perspective, View zoom, Speed
- View orientation: Select orientation, Select up axis, Interactive rotation around any axis
- Node point highlighting: Single point, Pair, Range, All
- Node point highlighting options: Mark, Point numbers, Results values
- Color selection by: Component, Trace
- Component selection: Individually select components on/off for display
- Component display offset: X, Y, Z offsets per component
- Axis location: Standard, Hide, Center, User defined

## TIME DOMAIN ANALYSIS AND ANIMATION:

- Time history processing
- Digital time domain filtering (High / Low / Band Pass)
- Integration to displacement for actual scaled deflections
- Batch inverse FFT computation: Generates Impulse Response data set from FRF data set
- Animation Types: Contour, Vector
- Animation speed controls: Frames/second, Skip frames
- Animation cycling: Start, Stop, Reset, Select first frame, Select last frame, Single/continuous
- Viewing control: Deflection amplitude, View perspective, View zoom
- View orientation: Select orientation, Select up axis, Interactive rotation around any axis
- Node point highlighting: Single point, Pair, Range, All
- Node point highlighting options: Mark, Point numbers, Results values
- Color selection by: Component, Trace
- Component selection: Individually select components on/off for display
- Component display offset: X, Y, Z offsets per component
- Axis location: Standard, Hide, Center, User defined

## OPERATING DEFLECTION SHAPE (ODS) ANALYSIS

- ODS scaling: Acceleration, Velocity, Displacement
- Amplitude: At a specified frequency or peak tracking within a frequency band
- Peak tracking: Automatically captures peak amplitude within user specified frequency range to allow tracking of machine speed shifts or resonant frequency shifts

## STRUCTURAL DYNAMICS MODIFICATION

- Available structural modifications: Add mass, Remove mass, Add spring between DOFs, Add damper between DOFs, Ground with spring, Ground with damper, Add tuned mass-spring-damper vibration absorber, Add rib stiffener
- Resonance specification: computation of required modification to achieve user specified resonant frequency

## FORCED RESPONSE SIMULATION

- Forced Response Simulation input: Measured or synthesized power spectrum of random, transient, sinusoidal or user-defined excitation forces
- Forced Response Simulation input location: Any DOF in modal model
- Forced Response Simulation output: Acceleration, Velocity, Displacement
- Forced Response Simulation output location: Any DOF in modal model
- Operating Deflection Shape prediction: compute deflection shape from combination of sinusoidal forces applied to any modal model DOFs

## THE MAXIMUM CAPACITIES OF THE STAR DATA TABLES, MEASUREMENT BLOCKS AND DISPLAYS

Frequency Results Table Modes	100
Time Results Table Frames	32000
Structure Coordinate Points	3000
Mode Shape DOFs	9000
Structure Components	32
Display Sequence Table Lines	5000
Constraint Table Lines	200
Measurement Data Block Size	32000
Autofit Bands	100
Synthesis Table Modes	100
Deformation Shape DOFs	9000

# Ordering Information

**7750A-001:** Brüel & Kjær STARBase<sup>1</sup>  
**7750B-001:** Brüel & Kjær STARView\*  
**7750C-001:** Brüel & Kjær STARModal\*  
**7750D-001:** Brüel & Kjær STARStruct\*

All 7750 packages include the Total Customer Support (TCS) program for one year.

## Maintenance and Upgrade Agreements

**7750-MS2:** Upgrade and SMU (TCS) for Brüel & Kjær STARBase/View/Modal/Struct

## Upgrades

**BZ 5257:** Upgrade from Brüel & Kjær STARBase to Brüel & Kjær STARView

**BZ 5258:** Upgrade from Brüel & Kjær STARBase to Brüel & Kjær STARModal

1.NOTE: All STAR System™ software is developed by Spectral Dynamics, Inc., San Jose, California, USA

**BZ 5259:** Upgrade from Brüel & Kjær STARView to Brüel & Kjær STARModal  
**BZ 5260:** Upgrade from Brüel & Kjær STARModal to Brüel & Kjær STARStruct

Note: The latest version of the software is always delivered, so an active TCS contract is required.

## Optional Accessories

**BZ 5261:** Add-on: STARReport

The following three options are only available for STARModal:

**BZ 5262:** Option: Advanced Curve Fitting

**BZ 5263:** Option: Time Domain Analysis & Operating Deflection Shapes

**BZ 5264:** Option: Structural Dynamics Modification & Forced Response Simulation

**7751:** Dynaview<sup>2</sup>

2.NOTE: Customer support services for Dynaview™ are supplied by Practical Systems & Technology, Inc., Centreville, Maryland, USA

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Brüel & Kjær reserves the right to change specifications and accessories without notice