

# PRODUCT DATA

## Software for PULSE Reflex™ PULSE Reflex Base — Type 8700 PULSE Reflex Core — Types 8702, 8704 and 8706

*PULSE Reflex adds dedicated post-processing applications to the PULSE software environment. It brings together a range of generic post-processing tools for offline analysis and processing of time data, experimental modal analysis and building acoustics data analysis. The innovative GUI delivers genuine ease-of-use through a workflow concept that is easy to learn and consistent across applications.*

*Reporting is built into the workflow and includes tools for automatically creating reports based on previously designed templates. The aim is to make the task of data processing and reporting as simple and straightforward as possible, giving testers and engineers more time to focus on result interpretation.*

*PULSE Reflex Core is the application suite for offline analysis of recorded time data. It is fast and flexible, allowing complex analyses to be set up, stored, and re-used. Multiple sets of input data can be processed together in preset batch operations for increased efficiency.*

*All data is stored in the PULSE Reflex database, which can also include data from the PULSE LabShop real-time environment.*



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## Uses and Features

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### Uses

- Offline analysis of recorded time data
- Visualisation, editing and playback of time data in preparation for analysis
- Simultaneous analysis with multiple FFT and CPB analyzers
- Storage of analysis setups for re-use on other data
- Batch processing of multiple input data
- Storage of data and results in a database with searchable meta-data fields
- Simple and efficient reporting of results with user-defined page layouts and user-selectable meta-data

### Features

- Support of a wide range of time file formats for import from, and export to, native and third party systems

- Project database based on Microsoft® SQL Server®
- Graphical Time Editor capable of dealing with multiple input files simultaneously
- Analysis based on graphical process chain concept with ability to store and re-use analysis setups
- Batch mode operation of process chain for sequenced or accumulative processing of analysis results
- Scratchpad Calculator for mathematical and statistical analysis of spectra and time data
- Display Manager with a flexible, user-definable display strategy
- Embedded reporting with capability of creating multiple pages in a single operation

## PULSE Reflex Base Type 8700

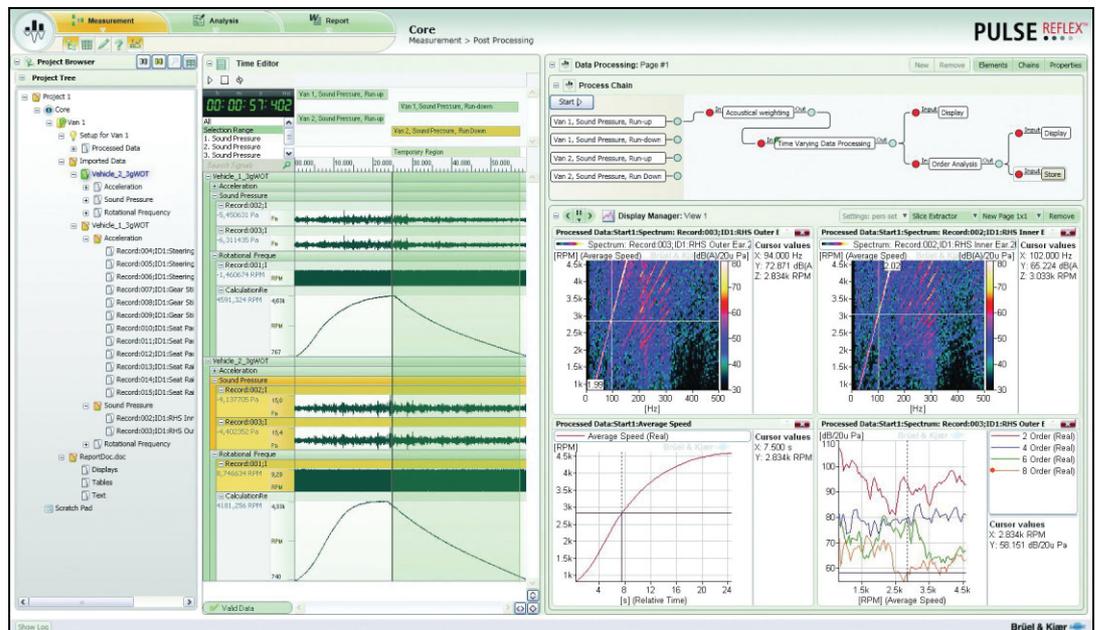
PULSE Reflex Base Type 8700, is the prerequisite for all applications. It provides data import, data management, data display and integrated reporting tools for communicating processed test data.

Key features of PULSE Reflex Base include:

- **Import Browser:** Import of data files from a variety of formats, including:
  - \*.pti files (PULSE Time Data Recorder)
  - \*.wav files (Brüel & Kjær header format)
  - \*.unv and \*.uff files
  - \*.ati files (Test for I-deas time data)PULSE ASCII files (for example, results from a PULSE LabShop Function Organiser)
- **Meta-data Editor:** Set up meta-data for storage to the PULSE Reflex database
- **Project Browser:** Essential data management tool, including data search, filter, selection and editing of data descriptors
- **Display Manager:** Set up and manipulate multiple pages of displays. The Manager also includes a facility for quickly sending selected graphs to a report
- **Scratchpad Calculator:** Standard mathematical and statistical operations can be performed on single functions or groups of functions (time data math functionality requires PULSE Reflex Core Basic Processing Type 8702)
- **Reporting:** The Report Organiser gives a complete overview of available templates and generated reports. You can create reports from the supplied templates, or use a generated report to create new, customised templates. Displays and data in the report can include bindings for quick updates simply by clicking Refresh

## PULSE Reflex Core – Types 8702, 8704 and 8706

*Fig. 1 Example of PULSE Reflex Core graphical user interface showing the Project Browser, graphical Time Editor, Process Chain and displays within the powerful Display Manager*



The PULSE Reflex Core applications are individual sets of data processing tools that cover time data processing, signal analysis and advanced reporting tools, all integrated into the same easy to use GUI environment. Automation tools are embedded in the workflow to enable simple set-up of batch processing for multiple input time files.

At the heart of PULSE Reflex Core are:

- **Time Editor:** Review imported time data and select time ranges and subsets of channels for subsequent processing
- **Process Chain:** Set up analysis using a graphical representation of the process, including filtering, analysis, display and storage of results. A chain is made up of these elements connected together to form an analysis process

Results can be displayed using a display strategy defined in the Process Chain's display element. This functionality provides a means of automatically setting up multiple pages of displays and allows great flexibility in defining where and how the results are displayed. All display pages can then be sent to a report in a single operation making generation of customised reports simple and quick.

In cases where there are many input files from a sequence of related tests, for example repeated runs on a single test item, or an identical test on a number of different test items, there are automation tools allowing all input data to be analysed in one go.

### **PULSE Reflex Core Basic Processing Type 8702**

Type 8702 is the engine room of PULSE Reflex Core, containing the basic toolbox for processing pre-recorded time data. Supported (verified) time data file sources include:

- Time Data Recorder Type 7708 (\*.pti)
- PULSE Data Recorder Type 7701 (\*.dat, \*.rec)
- LAN-XI Stand-alone Recorder (Notar) Type BZ-7848-A (\*.wav)
- PULSE Time Capture Type 7705 (\*.wav)
- Hand-held Analyzer Type 2270 (\*.wav)
- I-deas time file format (\*.ati)
- LDS Photon+ Dynamic Signal Analyzer (binary universal file)

The Time Editor provides for swift and efficient viewing, listening to, and selection of time data in preparation for analysis in the Process Chain. Regions of time data can be appended to one another and combined into a single region for analysis.

Data for analysis can be dragged-and-dropped into the Process Chain, either from the Time Editor or directly from the Project Browser if no editing is required. In the Process Chain, you can select from a library of functional elements, including re-sampling, acoustic weighting, FIR filtering (low, high and band-pass filters), overall level analysis, and FFT analysis. Process chains are highly versatile as they allow for multiple parallel analyses in one run, for example, analysing vibration data at a different bandwidth to acoustic data. Individual chains can be stored for later use, which means that there is no need to repeat the setup after the first time – simply drag-and-drop the previously stored chain into the tool's Data Processing pane. It is also possible to attach a number of regions to a chain and run the analysis in batch mode, thus analysing multiple input regions in one operation.

In PULSE Reflex Core, the Scratchpad Calculator has the added functionality of performing mathematical and statistical operations directly on time data. It is also possible to work on groups of functions, including 3D spectra, or time histories, in a single calculation step, thus increasing speed and efficiency when working with large amounts of input data.

### **PULSE Reflex Core Basic Order Analysis Type 8704**

Type 8704 adds FFT-based order analysis to Type 8702. When a tachometer pulse train is available in the time data file, the analysis can be set up to include RPM as a time-varying tag to 3D spectral maps.

With Type 8704, these additional elements are available in the Process Chain:

- RPM-varying FFT
- Order extraction (order slices extracted from spectra)
- RPM-varying CPB (requires PULSE Reflex Core Standardised CPB Option Type 8706)

The Scratchpad Calculator also has increased functionality providing interactive order extraction.

Typical applications include rotating machinery analysis and processing vehicle or engine speed sweeps (run up/down) with respect to RPM or other time-varying quantities.

### **PULSE Reflex Core Standardised CPB Option Type 8706**

Conforming to IEC, DIN and ANSI standards, Type 8706 provides 1/1-, 1/3-, 1/12- and 1/24-octave analysis with digital filters and simultaneous calculation of overall level, both weighted and unweighted. Acoustic weighting can be applied to the spectrum itself.

The CPB option adds three Process Chain elements:

- CPB
- Time-varying CPB
- RPM-varying CPB (requires PULSE Reflex Core Basic Order Analysis Type 8704)

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## **Specifications – PULSE Reflex Base Type 8700**

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The Windows®-based analysis software is delivered on a DVD. As many signal groups as desired can be created from the measured signals. The license is either node-locked to a PC host ID or hardware key, or floating, locked to a network server

### **PC Requirements**

#### **MINIMUM PC SPECIFICATIONS**

Pentium® processor 2.0 GHz with 2 GB of RAM  
100 GB hard disk with 20 GB free space  
Microsoft® Windows® XP Professional (Service Pack 3)  
Microsoft® Office 2003 (Service Pack 2)  
DVD drive

#### **RECOMMENDED PC SPECIFICATIONS**

2.5 GHz Intel® Core™ 2 Duo-processor, or better  
4 GB of memory  
160 GB Solid-State Drive (SSD) with 20 GB free space  
DVD-RW drive  
1 GB Ethernet connection  
1 COM port, either integrated or through a USB adaptor (except with LAN-XI modules, which use a network connection)  
Microsoft® Windows® Operating System:

- Windows® XP Professional (SP 3)
- Windows Vista® Ultimate (SP 2)
- Windows Vista® Business (SP 2)
- Windows® 7

Microsoft® Office:

- Microsoft® Office 2003 (SP 3)
- Microsoft® Office 2007 (SP 2)

Microsoft® SQL Server® 2008 Express Edition (SP 1) – included  
Adobe® Reader® 9.1 (US version included on the Installation DVD)

### **Import/Export**

#### **FUNCTION DATA IMPORT/EXPORT**

Import and export using PULSE ASCII files and universal files (\*.unv, \*.uff). **Note:** PULSE ASCII files can be exported from the Function Organiser in PULSE LabShop, and from PULSE Data Manager (PDM).

### **Data Display**

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

#### **GRAPH TYPES**

Display of functions in a range of graph types including:

- Waterfall
- Waterfall (step)
- Colour contour
- 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

#### **SPECTRAL UNITS**

- Root mean square (RMS)
- Power (PWR)
- Power spectral density (PSD)
- Root mean square spectral density (RMSSD)
- Energy spectral density (ESD)
- Peak (Peak)
- Peak-to-Peak (PkPk)

#### **ACOUSTIC POST-WEIGHTING**

A-, B-, C-, D-, L-weighting

#### **$j\omega$ 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
- Reference
- Harmonic
- Sideband

**Alignment:** Cursors in different displays can be synchronised to allow the changes to one display to be reflected in other displays showing the same or different functions

### CURSOR READINGS

The cursor values that can be read out include:

- Acoustic levels
- Corrected frequency
- Cursor indices and values
- Delta
- Delta/total
- Max. and min. values
- Nearest harmonic
- Nearest sideband
- Reference
- Resonance
- Reverberation
- Slice definition
- Status
- Total

### Reporting

A separate reporting task enables templates to be created in Microsoft® Word, Excel® or PowerPoint®. Templates contain links

(bindings) to data, meta-data and displays in the PULSE Reflex project, making it easy to create additional reports with new data as data, meta-data and displays are automatically updated. This is particularly useful for standardised reporting

### Data Management

Data management in PULSE Reflex is based on a data model that interacts with a Microsoft® SQL Server® 2008 database. Connection to the database is automatic upon starting PULSE Reflex, so there is no need to manually connect.

- Single local database for each installation of PULSE Reflex; queries and storage performed locally
- Data storage (of data files, report templates, pictures) uses a filefarm (disk file system) referenced by the database; file sizes limited by disk system only
- Meta-data, defined by the user; enables customised searching for input data and results
- Files can either be linked to a project in their original format (at their original location) and worked on without converting to native PULSE Reflex format; or copied and converted to PULSE Reflex format, thereby bringing them under control of the PULSE Reflex database

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## Specifications – PULSE Reflex Core Basic Processing Type 8702

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PULSE Reflex Core Basic Processing Type 8702 includes the same functionality and specifications as PULSE Reflex Base plus the following:

### Import/Export

#### TIME DATA IMPORT/EXPORT

The following time data file formats are supported:

- \*.pti – Time Data Recorder Type 7708
- \*.wav (16-, 24- and 32-bit) – LAN-XI Stand-alone Recorder (Notar) Type BZ-7848-A, Hand-held Analyzer Type 2270, PULSE Time Capture Type 7705
- \*.dat – PULSE Data Recorder Type 7701 (import only)
- \*.ati – I-deas time data file
- \*.unv, \*.uff – Binary and ASCII format universal files (for import/export to 3rd party systems)

### Time Editor

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

- Automatic calculation of RPM profile from a tachometer pulse train
- Fast navigation by scrolling through channels, panning and zooming in time axis
- Region selection by group of channels and time range
- Appending of regions to other regions (concatenation)
- Manual grouping of regions – for batch processing
- Automated generation of regions from multiple files having similar channel configurations – in preparation for batch processing

### Data Processing

All functionality for data processing is contained in the Process Chain, which consists of graphical elements connected together to form an analysis process.

**Input:** An input area is provided into which data is dragged-and-dropped either from the Time Editor or Project Browser

**Storage and Export:** A process chain can be stored in the project for later use. It can also be exported to an external file for transfer to other computers

**Types:** Four basic types of process chain elements – Input, Pre-processing, Analysis and Post-processing

### INPUT ELEMENTS

- Region: Collection of time data signals for processing, with or without time range selection
- Group Region: Master set of similarly named signals from a selection of time data files; used for automated batch operation

### PRE-PROCESSING ELEMENTS

- **Acoustic Weighting:** Pre A-, B-, C- and D-weighting (IEC 651 Type 1)
- **FIR Filters:** Low pass, high pass, band pass and band stop. Filter lengths 512, 1024, 2048, 4096 and 8192 samples
- **Resampling:** To a range of 20 user selectable frequencies from 512 Hz to 524.288 kHz

### ANALYSIS ELEMENTS

- FFT Analyzers, signal FFT, FRF FFT
- CPB Synthesis (1/n-octave, n = all integers from 1 to 24)
- Time-varying FFT
- Frequency Slice Extraction
- Overall Level Analyzer

### POST-PROCESSING ELEMENTS

- Display: Display strategy setup for creation of multiple display pages in the display manager
- Store: Setup of folder structure and names for results output

### Measurement Control

#### AVERAGING

Averaging types available for the measured signals are:

- Linear
- Exponential
- Maximum hold

**Overlaps:** User selectable values of 0%, 50%, 66.67%, and 75%, user editable from 0% to 99%

### Measurement

#### ANALYZERS

FFT and Overall Level analysis

#### FFT Analysis

The following specifications apply to all FFT elements – Signal FFT, FRF FFT, Time-varying FFT and RPM-varying FFT (with Type 8704):

## FREQUENCY RANGE

**Baseband and Zoom:** 50 – 12800 lines

**Frequency Span:** 1 Hz – 204.8 kHz in 1, 2, 5 ... or 2n (1, 2, 4, 8 ...) sequence

## TIME WEIGHTING

The following are available:

- Uniform
- Hanning
- Flat-top
- Kaiser-Bessel

## OUTPUT

**Signal FFT:** Auto Spectrum, Cross Spectrum, Time (last frame only)

**FRF FFT:** Auto Spectrum, H1, H2 and H3 FRFs, Coherence, Cross Spectrum, Time (last frame only)

**Time and RPM Varying FFT:** Auto Spectrum

## Overall Analysis

### AVERAGING

- Exponential
- Linear ( $L_{eq}$ )

### TRIGGER METHOD

- Free run
- Fixed time interval (not less than averaging time)

### FREQUENCY SPAN

1 Hz – 204.8 kHz in 1, 2, 5 ... or 2n (1, 2, 4, 8 ...) sequence

### ACOUSTIC WEIGHTING

Linear, A, B, C, D

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## Specifications – PULSE Reflex Core Basic Order Analysis Type 8704

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PULSE Reflex Core Basic Order Analysis Type 8704 adds to the functionality and specifications of PULSE Reflex Core Basic Processing Type 8702, as follows:

- RPM-varying FFT
- Order Extraction
- RPM-varying CPB (requires Types 8704 and 8706)

## Data Processing

### ANALYSIS ELEMENTS

- Tachometer

### OUTPUT

**RPM-varying FFT:** Auto Spectrum

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## Specifications – PULSE Reflex Core Standardised CPB Option Analyzer Type 8706

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PULSE Reflex Core Standardised CPB Option Type 8706 adds to the functionality and specifications of PULSE Reflex Core Basic Processing Type 8702, as follows:

## Data Processing

### ANALYSIS ELEMENTS

- CPB Analyzer (1/n-octave,  $n = 1, 3, 6, 12, 24$ ) (meets IEC, DIN and ANSI standards)
- Time-varying CPB
- RPM-varying CPB (requires Types 8704 and 8706)

### CPB Analysis (1/n-octave)

Real-time 1/n-octave digital filter analyzer. A number of variants of the CPB analyzer can be used simultaneously.

## Measurement

### 1/1-OCTAVE FILTERS

14-pole filters with centre frequencies given by  $10^{3n/10}$ . Fulfils IEC 1260–1995 Class 1, DIN 45651 and ANSI S1.11–1986, Order 7 Type 1–D, optional range

**Single Channel:**  $-3 \leq n \leq 14$ . 18 filters with centre frequencies from 125 mHz to 16 kHz (25.6 kHz module) or 125 kHz (204.8 kHz module, Type 3110)

### 1/3-OCTAVE FILTERS

6-pole filters with centre frequencies given by  $10^{n/10}$ . Fulfils IEC 1260–1995 Class 1, DIN 45651 and ANSI S1.11–1986, Order 3 Type 1–D

**Single Channel:**  $-10 \leq n \leq 43$ . 54 filters with centre frequencies from 100 mHz to 20 kHz (25.6 kHz modules) or 160 kHz (204.8 kHz module, Type 3110)

**Minimum Mean Time Interval between Spectra:** 5 ms

### 1/12-OCTAVE FILTERS

6-pole filters with centre frequencies given by  $10^{(n+0.5)/40}$

**Single Channel:**  $-30 \leq n \leq 173$ . 204 filters with centre frequencies from 183 mHz to 21.8 kHz

**Minimum Mean Time Interval between Spectra:** 5 ms

### 1/24-OCTAVE FILTERS

6-pole filters with centre frequencies given by  $10^{(n+0.5)/80}$

**Single Channel:**  $-84 \leq n \leq 323$ . 408 filters with centre frequencies from 90.4 mHz to 11.1 kHz

**Minimum Mean Time Interval between Spectra:** 10 ms

### CPB SPECTRUM AVERAGING

- Linear
- Exponential

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## Ordering Information

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**Type 8700-X<sup>a</sup>** PULSE Reflex Base

### CORE APPLICATIONS

Type 8702-X PULSE Reflex Basic Post-processing  
Type 8704-X PULSE Reflex Basic Order Analysis  
Type 8706-X PULSE Reflex Standardised CPB Option

### SERVICE AND SUPPORT PRODUCTS

M1-8700-X PULSE Reflex Base Software Maintenance and Support Agreement  
M1-8702-X PULSE Reflex Basic Post-processing Software Maintenance and Support Agreement  
M1-8704-X PULSE Reflex Basic Order Analysis Software Maintenance and Support Agreement  
M1-8706-X PULSE Reflex Standardised CPB Option Software Maintenance and Support Agreement

a. Where "X" indicates the license model: N (node-locked) or F (floating)

## PULSE Reflex Software Overview

Applications and Upgrades	Type Number	Prerequisites	Further Information
PULSE Reflex Base	8700	See Specifications	
PULSE Reflex Basic Processing	8702	8700	
PULSE Reflex Basic Order Analysis	8704	8700	
PULSE Reflex Standardised CPB Option	8706	8700	
PULSE Reflex Geometry	8719	8700	BP 2257
PULSE Reflex Basic Modal Analysis	8720	8700 and 8719	BP 2257
PULSE Reflex Advanced Modal Analysis	8721	8700, 8719 and 8720	BP 2257
PULSE Reflex Basic Modal Analysis Bundle	8720-A	8700	BP 2257
PULSE Reflex Basic Modal Acquisition and Analysis Bundle	8720-B	–	BP 2257
PULSE Reflex Advanced Modal Analysis Bundle	8721-A	8700	BP 2257
PULSE Reflex Advanced Modal Acquisition and Analysis Bundle	8721-B	–	BP 2257
PULSE Reflex Building Acoustics	8780	8700	BP 2190
PULSE Reflex Building Acoustics – Upgrade from Qualifier	8780-UPG	Qualifier Type 7830	BP 2190

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