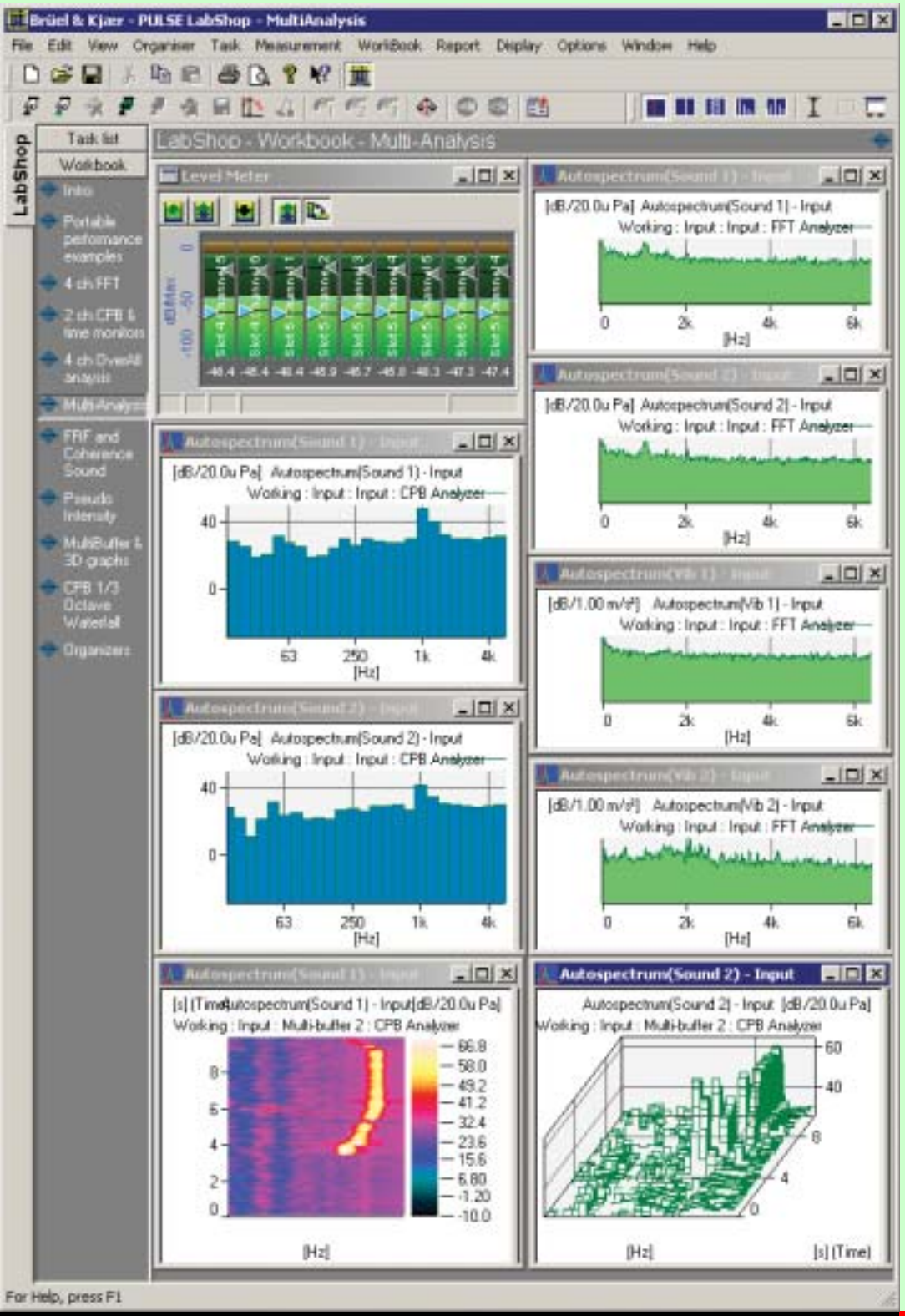
SYSTEM DATA

Software for PULSE Version 7.0 — Types 3560 C, 3560 D, 3560 E with Types 7700, 7701, 7705, 7707, 7770, 7771, 7764, 7767, 7769, 7772, 7773 and 7789



Noise and Vibration Analysis Type 7700 is the base software for the PULSE™ multi-analyzer system. It provides FFT, 1/nth octave and overall analysis as well as the definition of measurement setups, calibration, post-processing, displaying and documenting results. The software supports multiple front-ends and the use of "smart" transducers with TEDS (Transducer Electronic Data Sheets). Types 7770 and 7771 are versions of Type 7700 for FFT and CPB (1/nth octave) analysis, respectively. Other options include:

- Data Recorder Type 7701
- Time Capture Type 7705
- Analysis Engine Type 7707
- MIMO Analysis Type 7764
- PULSE Data Manager Type 7767
- Auxiliary Parameter Logging Type 7769
- SSR Analysis Type 7772
- Envelope Analysis Type 7773
- Time File Management Type 7789

Brüel & Kjær

Contents

PULSE Software and Literature Overview

The base software for a PULSE system is Noise and Vibration Analysis Type 7700, although separate FFT and CPB licenses are available as FFT Analysis Type 7770 and CPB Analysis Type 7771. On this base, you can install further PULSE software such as Data Recorder Type 7701. Table1 illustrates the range of software and application packages available for use with IDA^e PULSE systems.

Table1 *The software and applications available for IDA^e PULSE Systems based on Noise and Vibration Analysis Type 7700, FFT Analysis Type 7770 and CPB Analysis Type 7771 and references to Brüel & Kjær documents*

	Type/Part Number	Noise and Vibration Analysis Type 7700	FFT Analysis Type 7770	CPB Analysis Type 7771	Further Information
Platform					
Analysis Engine Upgrade	7707	•	•	•	Page 11
Data Recorder	7701	•	•	•	Page 12
Time Capture	7705	•	•	•	Page 13
PULSE Viewer License	7709	•	•	•	BP 1855
PULSE Bridge to MATLAB®	7755 B	•	•	•	BP 1854
PULSE Data Manager	7767	•	•	•	BP 1961
PULSE Interface to Sony® SIR-1000	7774	•	•	•	BP 1935
Auxiliary Parameter Logging	7769	•	•	•	Page 16
PULSE Lite	7781/82/83	See Page 21 and Product Data for Type 3560 C–L, BP 1967			
Time File Management	7789	•	•	•	Page 19
Industrial Acoustics					
Sound Quality	7698	•	•	•	BP 1589
Multichannel Sound Power	7748	•			BP 1751
Noise Source Identification	7752	•	•	•	BP 1860
Pass-by Noise	7757	•			BU 0230
Material Testing	7758	•	•		BP 1870
Advanced Intensity Analysis	7759	•	•	•	BP 1890
Acoustic Test Consultant	7761	•	•	•	BP 1908
Beamforming	7768	•	•	•	BP 1995
Spatial Transformation of Sound Fields Component	7780	•	•		BP 1939
Sound Power Value Pack	BZ 5305	•		•	BP 1893
Robot option for 7761	BZ 5370	•	•	•	BP 1908
Electroacoustics					
SSR Analysis	7772	•			Page 17
Vibration					
Order Analysis	7702	•	•		BP 1634
Vold-Kalman Order Tracking Filter	7703	•	•		BP 1760
Structural Dynamic Test Consultants	7753/7765	•	•		BP 1850
ME'scopeVES™	7754	•	•		BP 1843
PULSE Bridge to ME'scope	7755 A	•	•		BP 1843
Operational Modal Analysis	7760	•	•		BP 1889
Multiple-Input Multiple-Output Analysis	7764	•	•		Page 14
Envelope Analysis	7773	•	•		Page 19
Repetitive Testing					
WorkFlow Manager	7756	•	•	•	BP 1862

This System Data includes descriptions of the following software:

- Noise and Vibration Analysis Type 7700
- FFT Analysis Type 7770
- CPB Analysis Type 7771

- Data Recorder Type 7701
- Time Capture Type 7705
- Analysis Engine Type 7707
- Multiple-Input Multiple-Output Analysis Type 7764
- PULSE Data Manager Type 7767
- Auxiliary Parameter Logging, (DC Channel Data Analysis) Type 7769
- SSR Analysis Type 7772
- Envelope Analysis Type 7773
- Time File Management Type 7789

Details of the hardware available for use with Types 3560 C, D and E are given in the System Data:

- IDA^e Hardware Configurations for PULSE 7.0 – BU 0228

Noise and Vibration Analysis – Type 7700

USES

- General noise and vibration testing using real-time multichannel analysis
- General R&D noise and vibration analysis using several analyzers and multiple frequency spans simultaneously
- Real-time measurements on up to 128 channels
- FFT, CPB and Overall analysis with simultaneous measurement of exponential, linear, impulse and peak levels
- Customised measurement solutions
- Data acquisition, measurement, analysis, calibration, post-processing and documentation

FEATURES

- Running under the Microsoft® Windows NT®, Windows® 2000 or Windows® XP operating system, Type 7700 is the basis for an ever-increasing number of sound and vibration applications
- Multi-analysis allows multiple analyses of the same input data, reduces test and reporting time, and ensures consistency of data, for example:
  – Simultaneous FFT and 1/3-octave analysis of the same data
  – Simultaneous analysis using several FFT analyzers with different properties such as frequency span, zoom, etc.
- Supports intelligent IDA^e data acquisition front-end hardware
- Automatic detection of front-end hardware and attached transducers – supports IEEE P1451.4 capable transducers with TEDS (Transducer Electronic Data Sheets)
- Automatic calibration sequencing and registration of calibration history
- Level meter for monitoring of conditioned signals for optimal data quality
- Versatile signal generator, also supporting 8-, 16- and 24-bit *.wav files
- Advanced graphical display and cursor facilities
- Data export in a variety of formats for use with external applications
- Reverberation time calculation
- Fast, automatic report generation using Microsoft® Word
- Integrated with Microsoft® Office allowing, e.g., post-processing using Excel
- Supports external control and data export (OLE automation and ActiveX™ control)
- Supports customisation: VBA (Visual Basic® for Applications) allowing easy customisation of PULSE to fit their needs

Introduction

Noise and Vibration Analysis Type 7700 is the base PULSE software. It allows the definition of configuration and measurement setups, calibration, post-processing, and the display and documentation of results.

The analyzers and other facilities available depend upon the software installed. For PULSE's base software, Noise and Vibration Analysis Type 7700, the following are available:

- FFT Analyzer
- CPB (1/nth octave) Analyzer
- Overall Level Analyzer
- Signal Generator

Analysis Engine – PC-based Real-time Digital Signal Analysis

The Analysis Engine is the part of the PULSE software that enables scalable real-time signal analysis using the PC's CPU without the need for dedicated DSPs. Noise and Vibration Analysis Type 7700 has the real-time analysis capability of 50 beats. That is, it has a real-time channel × bandwidth product of, for example, 300 kHz for FFT with 0% overlap or 200 kHz with 67% overlap. This is defined as 50 "beats", the Brüel & Kjær term for the real-time performance of PULSE.

The Analysis Engine option (Type 7707) provides more analysis capacity, if required, allowing unlimited analysis to the maximum capacity of the PC.

PULSE Projects and Templates

A PULSE project covers the complete measurement process and can involve many different tasks and analyses. Projects are set up, managed and documented using Organisers, the Task Bar and TaskNotes.

- The Configuration Organiser defines the front-end and transducers and allows definition of measurement signals
- The Measurement Organiser allows definition of the types of analyzer to be used and specification of signals to analyse. It also allows the 'drag and drop' of signals to the Configuration Organiser, for reconnection of signals in projects where the front-end in use is different from that used when the project was set up
- The Function Organiser allows set up of a wide range of post-processing functions to be applied to measured data
- The Task Organiser includes a number of Brüel & Kjær defined task groups containing individual tasks that are optimised for the specific work sequence and application

Once a project is set up, it can be saved as a template for use in other projects.

Task-oriented User Interface

PULSE contains a task-oriented user interface (see Fig. 1). The Task Bar allows you to set up stacked menus, the Microsoft® Outlook way. Task Groups provide guidance through the measurement process. Each task group contains a series of tasks that are activated from icons. The icons can be rearranged, or removed, to let you customise measurement sequences. Simply work your way through the task groups and their associated tasks.

For each task that has been defined, a screen layout can be set up with any combination of toolbars and displays you wish to use with the specified task.

An extra toolbar is also available so that an indication of the task status can be shown in the task bar, as you proceed through the tasks in the group.

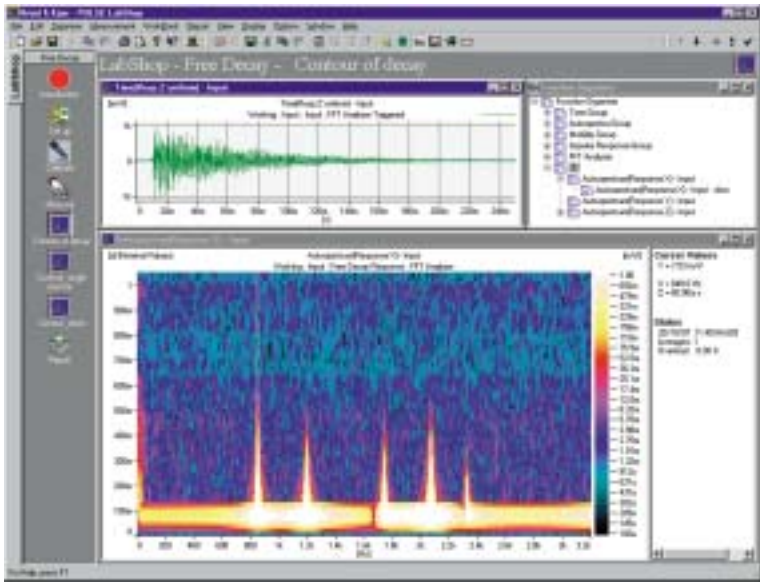


Fig. 1
PULSE software showing task-oriented user interface

User-defined tabs let you quickly switch from one application to another, for example from Modal Test Consultant™ Type 7753 to Noise and Vibration Analysis Type 7700.

Acquisition Hardware and Transducer Handling

TEDS: *Automatic Detection of Transducers and Front-ends*
PULSE automatically detects all connected front-ends and the input modules used (see Fig. 2). If you are using IEEE P1451.4 capable transducers with standardised TEDS, these are detected and automatically attached to the correct channel of the input module. Non-TEDS or non-standard TEDS transducers have to be set up manually.

Fig. 2
Configuration Organiser showing the front-end, modules, transducers and signals in a configuration for a measurement task using a single front-end

Signals
Signals can have descriptive names that are used throughout the system for easy identification. The same physical input can yield multiple duplicate signals for analysis in different ways, for example, with different weightings.

Signals are collected in groups and handled as a single entity, which is beneficial for multichannel analyses, as it allows the same measurement criteria and/or post-processing to be applied to all members of a group. This makes direct comparison of signals straightforward.

Tabular View
In PULSE version 7.0, usability has been improved by providing tabular views that can be customised by the user. An example screenshot from a typical Hardware Setup is given in Fig. 3.

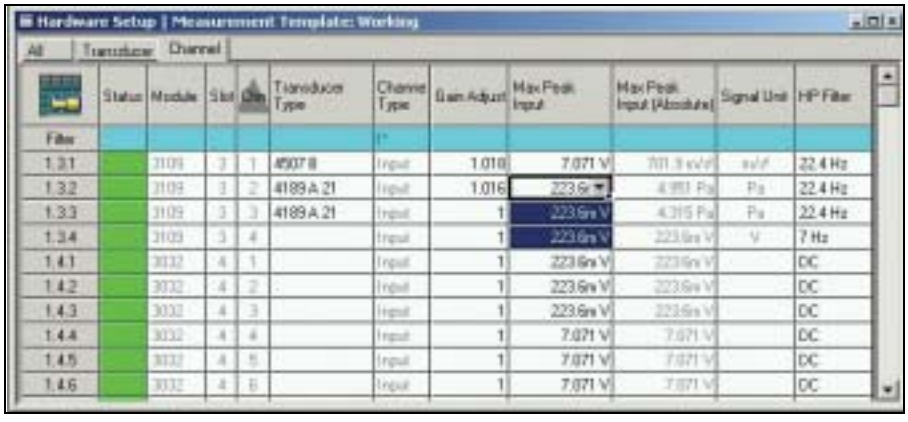


Fig. 3
Hardware Setup table in PULSE 7.0

Fig. 4
Column chooser dialog box in PULSE 7.0

The new hardware table supplements the old Configuration Organiser and signal properties. It uses functions already familiar from packages such as Microsoft Excel, to select and modify parameters for single or multiple channels.

To help you to setup the hardware table quickly, an easy to use column chooser dialog box is provided, see Fig. 4. This allows you to define customised views, by creating new tab pages and adding selected parameters to them. These tab pages can later be edited or deleted as required.

Calibration Master

The Calibration Master is available for calibrating the front-end hardware. The Calibration Master is aware of the hardware configuration and uses automatic detection for where and when to calibrate. The use of this auto-detection facility allows you to fit a specified calibrator to any transducer, turn it on, and the system will detect it and execute the correct calibration procedure for that channel. Thus, it is possible to calibrate the transducer channels in any order. The calibration results for the transducer channels in a front-end are automatically stored in the measurement template.

Global Calibration

A Calibration Database is now shared by all PULSE systems in the test organisation, as part of the global calibration improvements. This means that calibration histories can now be tracked easily.

Transducer Database

The transducer database is used to store transducer information that is automatically retrieved when a transducer is added to a channel (see Fig. 5).

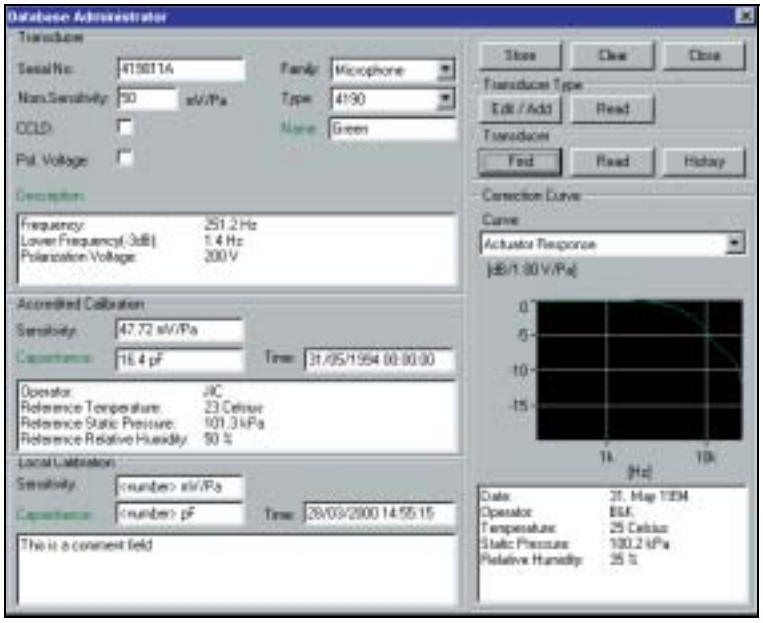


Fig. 5
The transducer database dialog box is used for entering transducer information and for reading in and viewing calibration data. If you have multiple PULSE systems, you can move the database to a net drive, making the same database available to all PULSE users

TEDS:
If an IEEE P1451.4 capable transducer with standardised TEDS is connected to the front-end and the transducer is not already in the database, its data – type, serial number, nominal sensitivity, calibration, microphone capacitance, etc. – are read and automatically stored in the database.

Measurement Organiser

The Measurement Organiser (see Fig. 6) is used for setting up and making measurements.

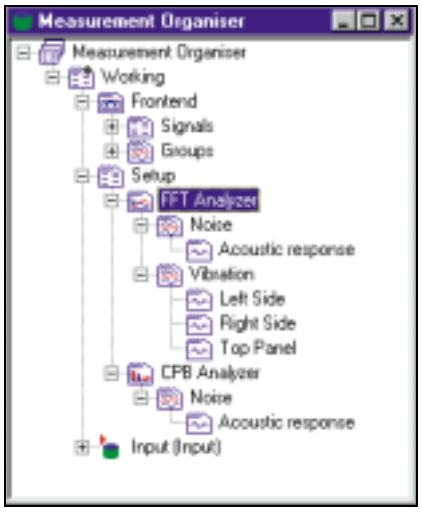


Fig. 6
The Measurement Organiser with a measurement template. Here an FFT analyzer is set up to measure 2 groups with a total of 4 signals, and a CPB analyzer is set up to measure 1 signal

This includes specifying the measurement instruments and the signals, or signal groups, to measure.

The fact that PULSE can simultaneously analyse the same signal in a number of different ways, for example, simultaneous FFT and octave analyses, greatly reduces the overall test time and ensures consistency between analyses. It is possible to analyse the same or different signals in different analyzers using different frequency spans and/or bandwidths, for example, having one FFT analyzer analysing to 25 kHz with 800 lines and another FFT analyzer analysing the same or different signals to 1.6 kHz with 6400 lines.

Fig. 7
The Measurement Organiser properties, illustrated for an FFT analyzer

The tab pages of the analyzer properties window (see Fig. 7) allow you to specify how to treat the incoming measurement data. For the various measurement types, such as autospectrum and cross-spectrum, you can select from a comprehensive set of record and averaging triggers with respect to 2D and 3D measurements and displays. You can even start the FFT Analyzer with an event trigger.

Any measurement template can be saved for reuse, so it is easy to repeat measurements. Saved measurements can be recalled at any time and measurement resumed or selected parts re-measured.

Level Meter

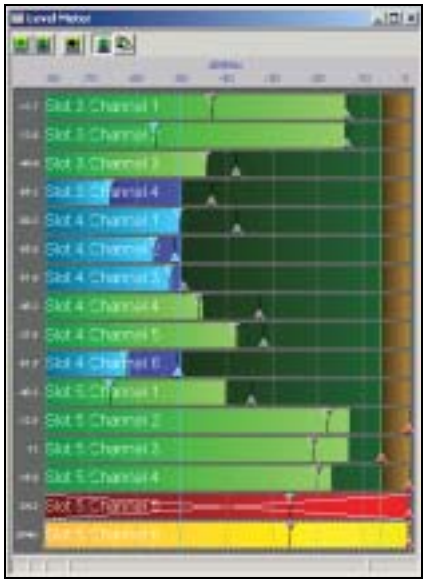


Fig. 8
PULSE's Level Meter allows you to monitor the conditioned signals and optimise your measurement data

The level meter provides an easy way of monitoring the current dynamic range of input signals, the max. and min. values in a given period of time, and indicates the occurrence and type of overloads and shows headroom and underrange values.

One advantage of the level meter is that it can be used for autoranging non-stationary signals: a trial measurement run can be made with max. hold enabled, after which you can autorange to these maximum values before making a real measurement without annoying overloads.

Pop-up menus on the display and y-axis provide easy access to a number of features such as Autoranging, changing display labels, choice of y-axis, etc., and a toolbar adds buttons for commonly used features such as resetting the max. and min. indicators and changing the orientation of the display (y-axis vertical or horizontal).

Functions

The Function Organiser is for setting up the post-processing applied to measured signals. A wide range of function types are supplied (see the Post-processing specifications for CPB and FFT analyzers). Functions are inserted in user-defined groups for ease of management and to allow a number of functions to be shown in the same display graph. The data for the functions in a group can come from any measurement template within the current project – data from different projects can be compared by saving and importing measurement templates.

Function groups can be saved in a variety of formats for re-use. This allows different sets of measurement data to have the same post-processing functions applied to them.

Displays

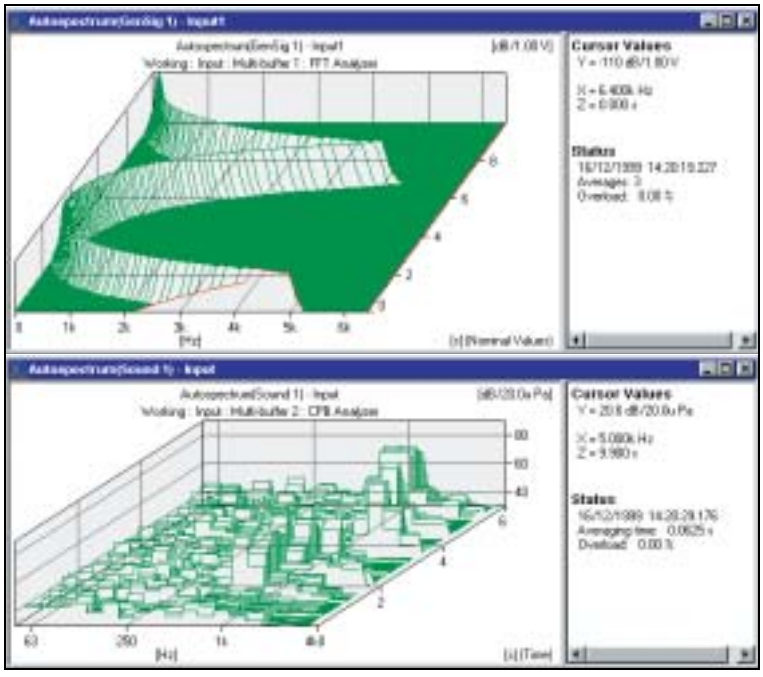


Fig. 9
Waterfalls showing FFT and 1/3-octave acoustic response from multi-analysis using FFT and Real-time Digital Filter (CPB) analyzers

The Display Organiser is for setting up the display of results. Calculated functions can be viewed in a wide range of graph types, including:

- Waterfall
- Colour contour
- Curve
- Bar
- Line
- Overlay
- Multi-value

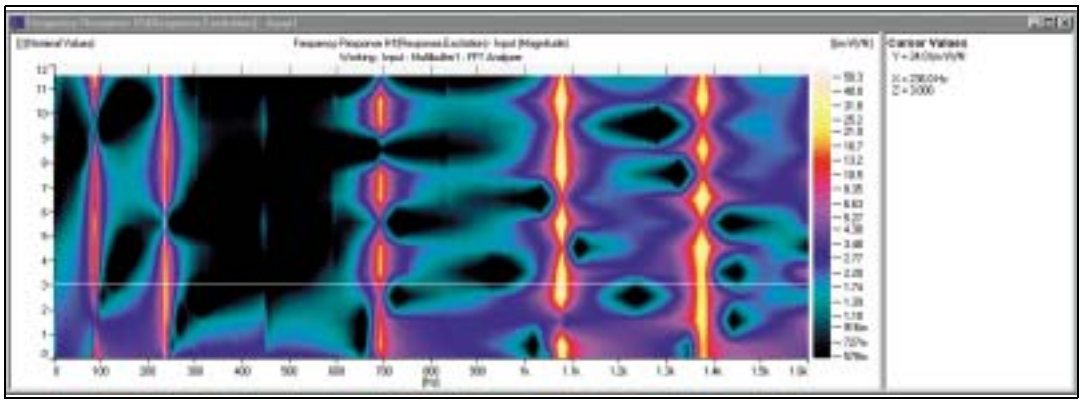
A number of functions can be superimposed and displayed using the same axes in curve graphs. Interpolation can be used with contour plots, see Fig. 10. Slices can be created from contour or waterfall plots. The X-, Y- and Z-axis can be set as linear or logarithmic, and a dB scale can also be selected for the Y-axis. A graph can be shown using any combination of these axis types and autoscaling can be selected. You can display the magnitude, phase, real part or imaginary part of a function. Nyquist and Orbit plots are also available. The spectral scaling units for graphs include:

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

A wide range of cursor types are available including Main, Delta, Reference, Harmonic and Sideband. Cursors can be aligned so that changes made in one display are reflected in other displays. This is useful for obtaining and comparing cursor readings for functions at the same axis value in different displays. A wide range of cursor readings are available in PULSE (see Specifications).

Any display setup can be saved for re-use. This allows sets of measurement data to be displayed in the same manner. The colour, line width and style used for each function can be set up individually.

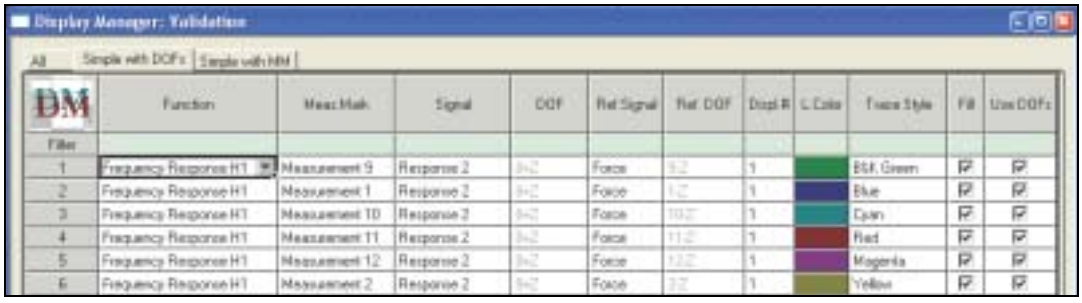
Fig. 10
An interpolated contour plot of a measurement made using an FFT analyzer



Tabular View

In PULSE version 7.0, usability has been further improved by allowing the user to customise how the displays and functions are shown, via the Display Manager. An example screenshot from the Display Manager is given in Fig. 11.

Fig. 11
Display Manager table in PULSE 7.0



The new Display Manager supplements the old Function Organiser and Display Organiser. It facilitates the creation and modification of functions, simplifies the connection of functions to displays and manages display properties.

Fig. 12
Column chooser dialog box in PULSE 7.0

To help you to set up the Display Manager quickly, an easy to use column chooser dialog box is provided, see Fig. 12. This allows you to define customised views, by creating new tab pages and adding selected parameters to them. These tab pages can later be edited or deleted as required.

Fig. 13
Report generated in Microsoft® Word

Reporting

The Report Organiser is where report setups are defined and stored. PULSE's built-in report generator allows fast and automatic generation of reports in Microsoft® Word. When you generate a report, the setup is automatically loaded into a Word template. This template can be edited and the final report document worked with in the same way as any other document in the word-processing package.

You can also select the report template to use with a report setup. This enables the development of a catalogue of report templates for different purposes that include, for example, company information and logos.

Data Export

PULSE allows you to select the format in which you want to export data. A number of formats are available including:

- PULSE ASCII – for exporting data in ASCII format for use in spreadsheets, etc.
- PULSE Binary – for saving functions for import into other PULSE projects
- Universal File Format (UFF) – for data export with degree-of-freedom information to, for example, structural analysis packages
- Binary UFF – for reduced file size and improved performance, and for the export of extra function types
- SDF – a Hewlett-Packard® file format used in many applications
- WAV[1] – for use, for example, with Sound Quality Program Type 7698 and for playback over a sound card
- STAR Binary – for data export to Modal Analysis Type 7750

If you have PULSE Bridge to MATLAB® Type 7755 B installed, PULSE allows you to export groups of data from the Function Organiser for further processing using MATLAB®.

Custom Control Programs

Visual Basic®is now embedded within PULSE and custom control programs can be developed for the automation of measurement procedures using OLE Automation, Delphi™ and Visual C++®, etc. With such programs, PULSE becomes a server that allows easy and automated gathering of data or complete analyses, including report generation to be performed at the click of a mouse button. PULSE includes an extra help file, type library and a range of programming examples. With the introduction of the Component Organiser, standard and custom components can easily be incorporated.

FFT Analysis – Type 7770

FFT Analysis Type 7770 is intended for users who only require FFT and Overall analysis. With the exception of CPB analysis, it includes all the configuration, calibration, measurement, post-processing, display and reporting features, including multi-analysis, described above for Noise and Vibration Analysis Type 7700.

CPB Analysis – Type 7771

CPB Analysis Type 7771 is intended for users who only require 1/nth octave and Overall analysis. With the exception of FFT analysis, it includes all the configuration, calibration, measurement, post-processing, display and reporting features, including multi-analysis, described above for Noise and Vibration Analysis Type 7700.

Analysis Engine – Type 7707

USES

- Increase the real-time analysis power of your PULSE system without adding dedicated DSP hardware

[1.] This option requires installation of a license for Data Recorder Type 7701 or Time Capture Type 7705

FEATURES

- Unlimited real-time channel × bandwidth analysis, up to the capacity of the PC
- If measurement setup requirements are exceeded, an on-screen message is displayed, informing you that the measurement has been prohibited

PULSE comes with the functionality of 50 'beats' built in. This corresponds to a real-time channel × bandwidth product of 300 kHz for FFT with 0% overlap.

If the processing requirements of the measurement setup exceed the capability of your current system, an on-screen message is displayed, informing you that the measurement has been prohibited. This means that to analyse in real-time, a reduction of the number of channels or a decrease of the measurement frequency range is required. The main advantage of the Analysis Engine option, is that it provides unlimited analysis to the maximum 'beat' capacity of the PC.

For further information on the real-time channel × bandwidth product for measurement with the FFT, CPB, Overall and Order Analyzers, and the performance rating of different PC types, see the Type 7707 specifications.

Data Recorder – Type 7701

USES

- Recording of time data direct to PC hard disk for later analysis using PULSE software

FEATURES

- Simultaneous throughput-to-disk and real-time analysis, allowing verification of recorded data
- Gap-free recording of time data
- Single or repetitive triggering of recording
- Variable replay speed allows data transfer rates to be matched to requirements for real-time analysis – analysis can be faster or slower than real-time
- Read out of data as WAV files, for example for use with Sound Quality Program Type 7698, or in Universal File Format or Standard Data Format
- Analysis of any time segment of the recording

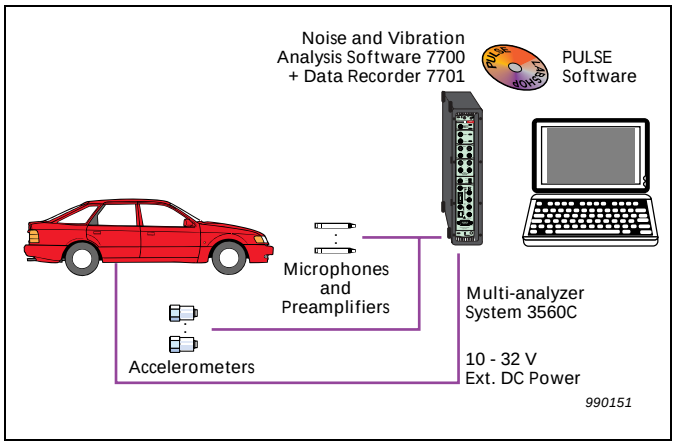
Type 7701 adds a time data recorder to the tools available for PULSE. By allowing you to record time data in real-time and recall it for analysis later, the data recorder can be especially useful:

- for re-analysis of previously acquired time data
- when working in the field
- when working in harsh environments
- when time is limited
- when real-time demands are excessive

Analyse while Recording
The data recorder is an instrument that can be used to record data from all channels direct to disk.

The disk used is the hard disk of your PC. Data recorded to disk can be simultaneously analysed during recording, or replayed later for analysis. The recording rate allows gap-free recording of up to a channel × bandwidth product of 400 kHz (such as 16 channels at 25.6 kHz or more channels at lower frequencies), dependent on the power of the PC.

Fig. 14
A data recording system configuration



Type 7701 is useful for automatic data gathering; it can, for example, be set to record 2 seconds of data every 2 hours.

All relevant data is stored on disk, including full information on front-end configuration, transducers, calibration and measurement setup.

Time Capture – Type 7705

USES

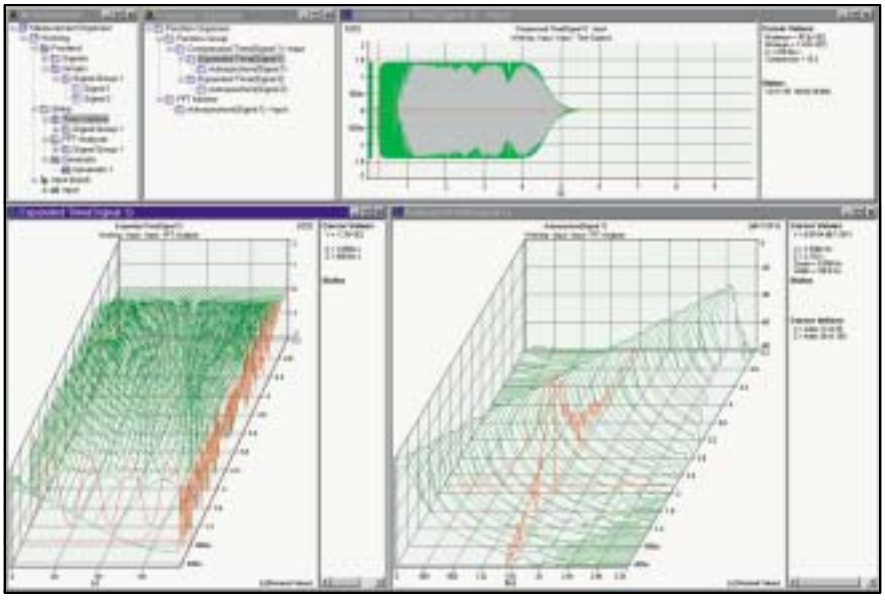
- Capture, retrieval and export of time data sequences
- Capture of long time records for Vold-Kalman Order Analysis using Type 7703
- Post-processing and time inspection of long time records
- Data export including Windows® wave files (.WAV) at selectable sampling rate

FEATURES

- Pre-processing of input data
- All analysis done as post-processing
- Extraction of any selectable part of a recorded signal

Time Capture Type 7705 is designed for the capture of long time signals in RAM and for their subsequent retrieval for post-processing or data export. Operation of Type 7705 is similar to the standard analyzers available in the Noise and Vibration Analysis Type 7700. That is, you insert a time capture “analyzer” in the setup in PULSE’s Measurement Organiser and assign signals or groups of signals in the usual way. Input to Type 7705 comes from the measurement front-end. If Data Recorder Type 7701 is also installed, the input can also be data retrieved from disk. With Type 7705 you can extract any part of the recorded time signal for post-processing.

Fig. 15
From a compressed time view, you can select the part of the signal you want to use for post-processing, synthesise a multi-buffer and display it as an Expanded Time function, and finally, for example, display the autospectrum. The sequence is illustrated in both the Function Organiser and in the arrangement of displays from top to bottom right



Type 7705 has a number of immediate applications:

- If Vold-Kalman Order Tracking Filter Type 7703 is installed in your PULSE system, you can perform Vold-Kalman order analysis on long time signals
- You can capture, post-process and view the signals
- Data can be exported in WAV format – with a selectable sampling rate

Input signals
All signals that are input to Time Capture Type 7705 can be pre-processed in the same way as in other PULSE software, i.e., double or single integration or differentiation, and A-, B-, C- or D-weighting can be applied to the input signals. When capturing time signals, you can specify a frequency range (25.6 kHz, 12.8 kHz, 6.4 kHz, etc.) for post-processing.

Triggers
Triggers are used for starting and stopping the capture of time signals. Any virtual trigger (manual trigger, signal level, etc.) can be used as a start trigger, or you can select free-run, in which case capture starts immediately. You can also select any virtual trigger as the stop trigger. Alternatively, you can set the time capture to "Stop at End".

Post-processing

A Time Viewer implements the extraction and viewing of data from the captured time signal. By adding a Compressed Time function in the Function Organiser, you can display the entire time signal in a compressed view showing minimum and maximum values for a number of samples. Cursors allow you to select the start point and length of time signal from this display. The selected portion of the signal can then be viewed by inserting it as a sub-function and used as input to any post-processing function.

Real-time Performance

The real-time performance is dependent on your PC's capabilities, i.e., processor speed and RAM. The captured time signal is stored in the PC's RAM.

Multiple-Input Multiple-Output Analysis – Type 7764

USES

- Analysis of complex and symmetrical structures
- Analysis of large structures requiring high excitation energy

FEATURES

- Number of inputs limited only by PC's processing power
- Determination of Frequency Response Function H_1, H_v, ordinary coherences and multiple coherences
- Automatic parameter setup when used with Modal Test Consultant™ Type 7753

MIMO Analysis Type 7764 allows Multiple-Input Multiple-Output (MIMO) analysis on large and/or complex, symmetrical structures:

- On large and fragile structures such as aircraft, it may not be possible to drive the entire structure from a single excitation point. The solution is to distribute the excitation over the structure using more, but smaller, exciters.
- On complex, symmetrical structures, repeated roots are found (i.e., more than one mode shape is found at a particular frequency). The solution here is to decompose the repeated roots using MIMO analysis with poly-reference algorithm.

The use of multiple points of excitation reduces the possibility of systematic errors in the FRF measurement, as compared to measurements with only one excitation point.

The excitation signals must be intrinsically uncorrelated and the measurement configuration designed with minimal mechanical coupling between the exciters.

PULSE Data Manager – Type 7767 A–D

USES

- Management of measurement data and analysis results across entire test organisation
- Saving labelled measurement data from PULSE and its applications into a database
- Searching for and retrieving stored measurement data from a database for display, evaluation, comparison and reporting

FEATURES

- Type 7767 A: Single-user license using a local, standard database with predefined structure
- Types 7767 B, C, D: Multiple user licenses allow creation of a customised database for storage of PULSE measurement data
- Supports MSDE (Type 7767 A) and Microsoft® SQL Server 2000 databases
- Save and label multichannel, multi-analysis results as a single-click operation
- Flexible data search and retrieval using intelligent queries and multiple search criteria with meta-data fields
- Drag and drop graphical displays of measurement and analysis results, and overlay curves for data comparison
- Advanced display functionality including 3D waterfall displays and meta-data-based legends
- Simple, intuitive reporting using Microsoft® Word templates
- Live reports in Microsoft® Word using drag and drop – change displays, colours, legends, axis scaling, cursors, etc., in the report
- Data stored in XML data format
- Storage of related files using a file farm
- Integrates with PULSE WorkFlow Manager for a complete testing solution
- Runs as a stand-alone application without PULSE or fully integrated in PULSE
- Runs under Windows® 2000 and XP
- Automation possible using Visual Basic® for Applications

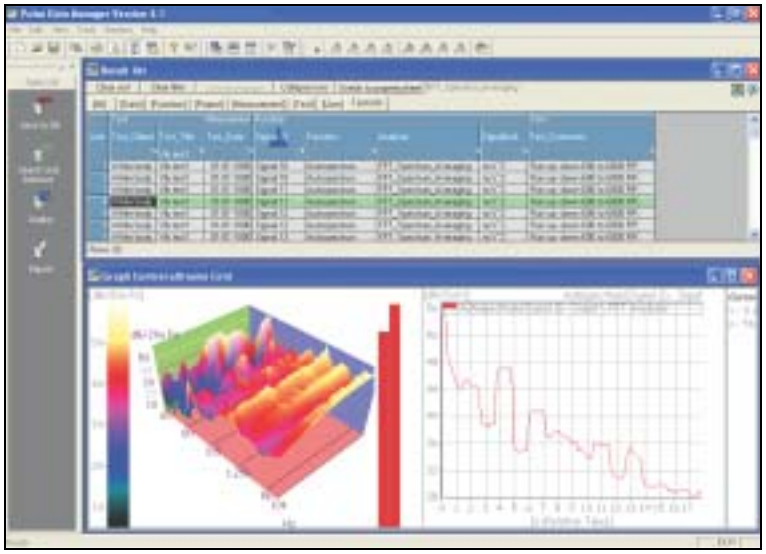


Fig. 16
PULSE Data Management display in PULSE 7.0

PULSE Data Manager Type 7767 (PDM), part of a family of data management solutions, provides all the tools necessary for efficiently managing your data – whether storing, finding, combining, post-processing or reporting. To make things even easier, personalised settings can be stored for easier overview of the data.

PDM enables measurements from PULSE or any of its applications to be labelled with any kind of information (meta-data) and saved to a database. The measurement data can then be searched for and retrieved intuitively for display, comparison or reporting via a range of query options.

Based around Microsoft® SQL databases, PULSE Data Manager streamlines data handling, test documentation and archiving for PULSE. The software can run independently or from within PULSE and integrates with PULSE WorkFlow Manager Type 7756.

For further information, refer to PULSE Data Manager Product Data – BP 1961.

Auxiliary Parameter Logging – Type 7769

USES

- Integration of auxiliary parameters with dynamic data such as FFT, Order and CPB spectra
- Automotive – in-vehicle, pass-by and test cell data acquisition
- Consumer products – test cell data acquisition
- Calibration – logging of environmental parameters like temperature, barometric pressure and humidity
- Production testing – logging of test station physical parameters like gear selection, flow rate, etc.

FEATURES

- Data available as instantaneous, instantaneous maximum, instantaneous minimum, linear average, averaged maximum, and averaged minimum
- Individual Channels can be logged with multiple average settings (i.e., average over 10 seconds and 24 hours)
- Auxiliary data like temperature and wind speed available as time data or as Z-axis tags
- Access to auxiliary channels settings and data through OLE
- 12 channels per Type 7533 and 7536 LAN module

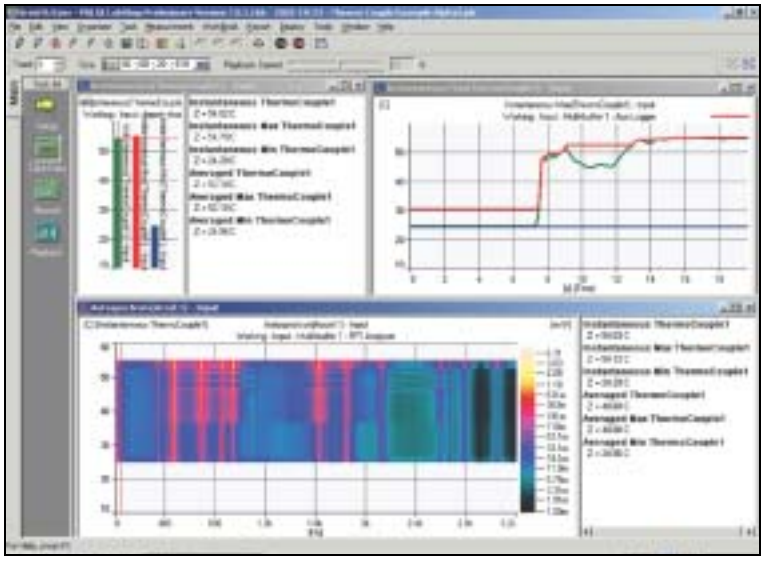


Fig. 17
A typical Auxiliary Parameter Logging display in PULSE 7.0

PULSE Auxiliary Parameter Logging adds logging data acquisition channels to IDA^{e} –based PULSE systems – up to 12 channels per frame – via the “Aux. I/O” connector on their LAN modules (Type 7533 or 7536).

Dynamic noise and vibration metrics are often functions of relatively slowly changing parameters.

Examples include:

- Wind noise, Articulation Index and Loudness that vary with vehicle speed
- Washing machine sound power that is a function of the machine cycle (i.e., wash, rinse, etc.)

- A material's damping that changes with temperature

Manual entry of auxiliary parameters like temperature and humidity is tedious and prone to input errors. Custom solutions patch together separate dynamic and logging data acquisition systems. PULSE Auxiliary Parameter Logging automates the acquisition of auxiliary parameters but avoids the expense and maintainability issues of custom solutions.

With Type 7769, logging data acquisition is fully integrated with PULSE's noise and vibration data acquisition. Logged data is available either as independent time data or as auxiliary values saved with spectrum.

Dynamic data (spectrums and metrics) can be plotted with logged data in X-Y, Waterfall, and Contour plots.

There are many types of signals that measure auxiliary parameters. Some signals for logging are voltages that do not require additional conditioning. Signals from transducers like thermocouples, potentiometers, and strain gages require external conditioning to linearize, filter or power the transducer's signal. Type 7769 includes cables that allow BNC input of signals into a Type 7533 or 7536 LAN module.

The Type 7769 software builds on the PULSE platform and is compatible with other applications such as:

- PULSE Data Recorder Type 7701
- PULSE Order Analysis Type 7702
- PULSE Data Manager Type 7767
- PULSE Bridge to MATLAB™ Type 7755B
- Microsoft® Office and Visual Basic®

Auxiliary Parameter Logging software is an integrated solution for real-world applications that combines dynamic and logging data acquisition. IDA^e PULSE customers only need a Type 7769 Software license (which includes cabling for BNC input) to begin logging extra low-speed channels on their current hardware.

SSR Analysis – Type 7772

USES

- Development and quality control testing of electroacoustic and vibration transducers: loudspeakers, telephones, headphones, microphones, hearing-aids, hydrophones, accelerometers
- Linear and non-linear system analysis
- Acoustical measurements in rooms and vehicles

FEATURES

- Frequency Response measurements using the Steady State Response method
- Level Response measurements using the Steady State Response method
- Fast measurements of individual Harmonic, Intermodulation and Difference Frequency distortion components and total RMS
- Excellent noise suppression using the Steady State Response method

SSR – Steady State Response

The SSR analyzer uses stepped sine excitation to measure steady state response. The response can be measured as a function of excitation frequency or excitation level. The measurement can use an adaptive scan algorithm or linear averaging. The adaptive scan

algorithm ensures that the steady state response is measured to a user-specified accuracy in the minimum possible time – the response is automatically sampled at each excitation frequency or level until the response has stabilised to within the specified accuracy. For linear averaging, a well-defined average is calculated for a specified period of time at each excitation frequency or level.

Fig. 18
SSR Analyzer Setup

The distribution of the excitation frequencies for an SSR measurement can be linear or logarithmic.

The measurement can operate on either complex data or power data. Complex data provides phase information on the response and excellent noise suppression. Power data ignores any phase information, providing accurate results even if the test object has a varying delay.

Measured Response

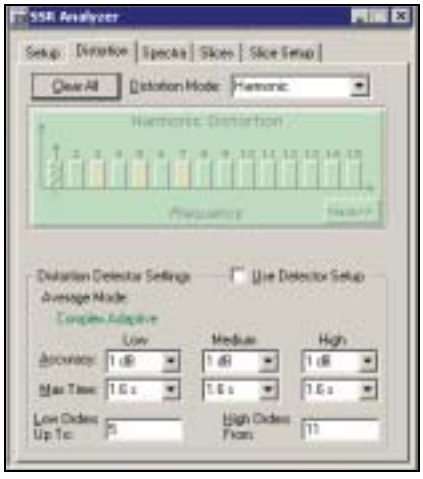
Responses measured can be calculated as the transfer function (relative response) or as the response signal only (absolute response). A frequency sweep or a level sweep can be selected. Linear, logarithmic or user-defined distributions of excitation frequencies can be selected for a frequency sweep. Step size can be set to 1/3-, 1/6-, 1/12-, 1/24- and 1/96-octave. Next, the parameters used for averaging are specified: selection of adaptive or linear averaging using either complex or power data, accuracy, delay and averaging time.

Equalisation

It is also possible to apply a weighting to the generator output. This feature can be used, for example, to keep the sound pressure level from a loudspeaker constant over a specified frequency range. This is achieved by specifying the inverse response of the loudspeaker as weighting for the generator output. Alternatively, an SSR Level and Equalisation dialog allows you to update equalisation iteratively, based on measurement results in the input buffer.

Distortion

Fig. 19
Distortion setup showing harmonic distortion



The SSR analyzer also incorporates extensive facilities for measuring distortion. Graphical menus make it easy to set up the system to perform measurements of Harmonic, Intermodulation and Difference Frequency distortion as well as the total RMS response including noise and distortion.

Harmonic distortion can include any harmonic up to 40th. Total (including fundamental), Total Distortion (not including fundamental) or THD can also be specified. Intermodulation distortion is measured using two test tones of constant or weighted amplitude, f1 and f2. f2 is kept at a fixed, low frequency, while f1 is stepped through the frequency range of interest.

Difference Frequency distortion is measured by exciting the system with two test tones of constant or weighted amplitude, f1 and f2.

The two tones are stepped through the frequency range of interest, while keeping a fixed frequency difference between them.

Envelope Analysis – Type 7773

USES

- Roller bearing elements: Identification of cracks in inner race, outer race or roller defects
- Gear boxes: Identification of cracked or broken teeth from impulsive modulation of the tooth meshing frequency
- Turbine blades: Identification of broken or distorted blades from modulation of the blade passing frequency
- Induction motors: Identification of broken or cracked rotor bars, or bad soldering from modulation of slot harmonics by twice the slip frequency
- Reciprocating machinery: Determination of precise point (in time) in the cycle of impulsive events like valve openings/closings or combustion

FEATURES

- Implemented as one of three “modes” in PULSE’s FFT Analyzer (Baseband, Zoom, **Envelope**)

Envelope Analysis can be used for:

- Amplitude demodulation, i.e., detection of the spectral and temporal representation of the modulating signal
- Spectral (how frequent) and temporal (where in a cycle) identification of the occurrences of impulsive events in rotating machinery

  Most often the impulsive events are of low energy compared to the overall energy in the vibration signal. The higher harmonics of the repetitive impulsive events are amplified at the structural resonances of the machinery. Envelope analysis centred at a structural resonance reveals the occurrences of the impulsive events.

Time File Management – Type 7789

USES

- Allows import, export, inspection and editing of PULSE time data recordings, (*.dat files), before they are submitted for post analysis
- Enables you to listen to any part of the time data recording
- Enables you to focus the post analysis on a particular part of a time data recording

FEATURES

- Accesses data from disk, handling very large files without exhausting computer memory
- Allows you to inspect multiple signals, in both standard and expanded views
- Allows you to listen to the full signal, or selected tracks and ranges
- Allows you to select a time range and select individual tracks
- Allows you to import/export UFF files

Introduction

With the introduction of Time File Management in PULSE version 7.0, it is now possible to listen to time data recordings, as well as to import, edit, inspect, and export them.

User Interface

Time File Management is task-oriented and provides predefined tasks and views that offer an intuitive user interface. Like most PULSE applications, the software is 'task' based, to help guide you through the process in a logical sequence: Setup, Edit and Analysis.

Setup
The setup task enables you to configure your sound card, (various settings are selectable) and set project options, for example re-sampling and export format options.

Edit
This task gives you access to the Signal Selector, where all the Data Recordings are displayed. From here:

- You can choose a recording, by selecting the required *.dat, *.pti or *.uff file for display, via the File Open dialog box
- You can select those signals you wish to view using the Signal Selector
- You can playback selected signals and parts of signals
- You can save (*.pti) or export (*.uff) selected signals or parts of signals, or add them to the Analyze task

Fig. 20
Time File Management display in PULSE 7.0

In the example in Fig. 20, four signal tracks are being edited. The view is divided into two panes. The upper Overview Pane displays all the signals chosen using the Signal Selector, in full. You can then use the cursor to select and play the part of the signal(s) in which you are interested, (see dark blue highlighted areas). The selected part is then displayed in the lower Edit Pane.

Analysis
The purpose of this task is to enable you to analyze, more effectively, the selected data within PULSE. This creates a measurement template with the relevant signals and signal groups.

Import/Export

Time File Management imports *.dat, *.pti and *.uff (Universal File Format) files and exports *.pti and *.uff files.

Electronic License Protection System

General

To accommodate a modern working environment, PULSE version 7.0 introduces an electronic license protection system (FlexLM), which will give more flexibility in the future. There are 2 main license models, N and F, as follows:

- Node locked license (N) – license locked to a specific PC's hardware or hardware key as today (stackable)
- Floating license (F) – a network server provides licenses in a larger work environment

A PULSE system will, as standard, be supplied with a node locked licence locked to a PC host ID. Licenses can be made/fulfilled directly through a WWW interface and hardware keys can be purchased if required.

One of the benefits of this system is that a user can combine licenses from different license models, for instance, by inserting two 7 channel USB hardware keys on a Type 7700 system, the user can create a 14 channel Type 7700 license. In this way, it is possible to 'stack' licenses.

Changes in Licence Structure

PULSE version 7.0 introduces simplified numbering of the software licences. This is to ensure a match between the software license and the actual hardware configuration. This avoids the confusion over numbering that exists with the present system. The numbering convention will be based on the following example: **Type 7700–Xy**

Where '**X**' indicates the license model, either **N**: Node Locked or **F**: Floating and '**y**' is any number between 2 and 16 – the number of channels supported by the license, (e.g., 7700–N7 denotes a node locked, 7-channel license). A 16-channel license supports up to 128 channels.

This convention will also be used for Types 7702, 7770 and 7771.

PULSE Lite

PULSE version 7.0 will include the PULSE Lite analyzer series with enhanced templates. (These are also available for M1 customers.)

PULSE Lite is a lighter, simpler version of Brüel & Kjær's Windows®-based PULSE Multi-analyzer. Novice and expert alike can start troubleshooting and making valid sound and vibration measurements right away. With its strength in simplicity, it is especially suitable for those who do not require a system as sophisticated as a full PULSE system. Setup and display is easy due to a task-oriented user-interface, consisting of a simplified menu bar with standard functionality and a task bar.

For further information, refer to PULSE Lite Product Data – BP 1967.

Specifications – Type 7700, 7770, 7771

Note: All performance specifications require a 300 MHz Pentium® II PC or better

PULSE Software

The Windows®-based analysis software is delivered on CD-ROM. The software can be ordered with a license for measurement on specified number of channels (see Ordering Information). As many signal groups as desired can be created from the measured signals.
The license is node locked, (part of FlexLM license protection system), and locked to a PC host ID.

ACQUISITION PERFORMANCE
Data Transfer rate (No. of Channels × Bandwidth) from front-end via LAN Interface, per front-end:

	LAN Interface Type		
Front-end Type	**7532**	**7533**	**7536**
3560 C	–	150 kHz	–
3560 D, 3560 E	–	150 kHz	400 kHz
3561	75 kHz	–	–

Per front-end: max. no. of channels × bandwidth, (bandwidth ≡ useful frequency span)
Maximum number of front-ends:
10 with Multiframe Control

ANALYSIS PERFORMANCE
Guidelines for the computing power of the analysis engine included in Type 7700, 7770, 7771 expressed as real-time channel × bandwidth product. Analysis Engine capacity can be upgraded with Type 7707

	Channel × Bandwidth	
Real-time FFT	300 kHz, 0% overlap	Type 7700 and 7770
Real-time CPB	100 kHz[a]	Type 7700 and 7771

a. For example, 4 channels to 25 kHz or 8 channels to 12.5 kHz

See also FFT and CPB specifications below

PC Requirements

- Recommended PC: Pentium® 4 1.6 GHz mobile, or faster, with 256 MB of DDR SDRAM, (DELL Latitude Standard Notebook C640), 88 PULSE beats approx.
- 20 GB hard disk or larger
- CD-ROM: 24 x/10 x/24 x DVD/CD/RW ROM
- Video Card Type: ATI Mobility Radeon 7500C
- Sound Board: 16 bit SB Pro-compatible 3D
- Floppy Disk: Modular 1.44 MB
- Network: 56K modem and LAN 10/100 Ethernet
- TFT 14.1" display, 1024 × 768 , 16000 colours or better
- Minimum 300 MB free space on hard disk
- PULSE 7.0 Installation CD
- Microsoft® Windows® 2000 (Service Pack 3)[1] and Windows® XP (Service Pack 1)
- Microsoft® Office 2000 (Service Release 2) or Microsoft® Office XP
- Microsoft® Internet Explorer 6.0
- Adobe® Acrobat Reader 5.1

Hardware Configuration

The software automatically detects the front-end hardware connected and configures the system. If IEEE P1451.4 capable transducers, (with standardised TEDS), are being used, these are also detected and attached automatically to the correct channel of the input module

Calibration

Calibration can be performed before or after measurement. The program uses automatic calibration sequencing

Measurement Control

AVERAGING
Averaging types available for the measured signals are:
- Linear
- Exponential
- Max. hold
- Min. hold
- +Peak
- –Peak
- Overlaps – fixed values of 0 %, 50 %, $66^2/_3$ %, 75 % and max.

TRIGGER TYPES
- Signal
- Manual
- Free-run
- Time
- Generator
- Internal level (CPB and Overall Level analyzers)

A channel or a trigger delay can be applied

PRE-PROCESSING
Pre A-, B-, C- and D-weighting (IEC 651 type 1)

MULTI-ANALYSIS
A number of instruments of the same or different types can be used simultaneously. The instrument types in Type 7700 are:
- FFT analyzer
- CPB analyzer (1/nth octave)
- Overall Level analyzer
- Signal Generator

Measurement

ANALYZERS
For the FFT-, CPB- and Overall Level analyzer specifications see the relevant analyzer specifications at the end of this section

MULTI-BUFFERS
No. of multi-buffers: 4
Maximum capacity: Dependent on RAM in PC

1. PULSE also runs on Windows NT® 4.0 (service pack 6).

Display

Maximum display cycle rate: 25 times per second, per display, depending on PC hardware

GRAPH TYPES
Display of functions in a range of graph types including:
- Waterfall
- Waterfall (step)
- Colour contour
- Bar
- Line
- Curve
- Curve (step)
- Overlay
- Overlay (all)
- Multi-value

Superimposed Graphs: A number of functions can be superimposed on the same curve graph

DERIVED DISPLAYS
Harmonic and individual slices can be cut and extracted from contour, waterfall and overlay plots

AXES
X-axis scale: linear, logarithmic and CPB
Y-axis scale: linear, logarithmic and dB
Z-axis scale: linear and logarithmic

COORDINATES
- 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)

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)

Cursors

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

Other cursor readings can be added

Programmable

Visual Basic® is now embedded in PULSE software and it also supports OLE Automation/ActiveX™ controls, allowing the development of customised control programs. A wide range of functions that are not directly available in PULSE are supported using PULSE Programming Language, written in a text editor and compiled

Export

Export of data to a file in ASCII format or to spreadsheet packages such as Microsoft® Excel 7.0, or later. Also PULSE File Binary, Universal File ASCII/Binary, SDF, WAV (Data Recorder Type 7701 or Time Capture Type 7705 license required) and STAR Binary
With PULSE Bridge to MATLAB® Type 7755 B installed, export of groups of data for further processing using MATLAB®

Reporting

Integrated reporting with Microsoft® Word version 7.0, or later

FFT Analyzer (Types 7700 and 7770)

A number of variants of the FFT analyzer can be used simultaneously

Measurement

FREQUENCY RANGE
Baseband and Zoom: 50–6400 lines
Frequency Span: 1.56 Hz–25.6 kHz in 1, 2, 5, ... or 2^n (1, 2, 4, 8, ...) sequence
Centre Frequency Resolution: 1 mHz

TIME WEIGHTING
The following are available:
- Uniform
- Hanning
- Flat-top
- Kaiser-Bessel
- Transient
- Exponential

FREQUENCY WEIGHTING
- A, B, C, D
- $j\omega^2$, $j\omega$, 1, $1/j\omega$, $1/j\omega^2$

Performance

Guidelines for the computing power of the analysis engine included in Type 7700, 7770 expressed as real-time channel × bandwidth product for measurement of FFT, 400 lines, autospectra, no cross-spectra. Values are scalable with the addition of the Analysis Engine, Type 7707

	Channel × Bandwidth Product	
	0% Overlap	66.7% Overlap
Real-time FFT	300 kHz	200 kHz[a]

a. For example, 8 channels to 25.6 kHz

Pre-processing

The following pre-processing can be selected for an analyzer
- Time
- Autospectrum
- Cross-spectrum

Post-processing

The following post-processing functions can be applied to measured data:
- Complex time (Hilbert transform)
- Monitor time
- Fourier spectrum
- Phase-assigned autospectrum
- Frequency response function (H1, H2, H3)
- 1/Frequency response function (1/H1, 1/H2, 1/H3)
- Coherence
- Signal-to-noise ratio
- Coherent/non-coherent power
- Auto-correlation
- Cross-correlation
- Impulse response (h1, h2, h3)
- Calculated intensity
- Calculated complex intensity
- Calculated mean pressure spectrum
- Calculated velocity spectrum
- p–I index
- Cepstrum
- Liftered Spectrum
- CPB Synthesize
- Orbit

CPB Analyzer (Real-time 1/nth octave) (Types 7700 and 7771)

A number of variants of the CPB analyzer (Real-time 1/nth octave Digital Filter analyzer) can be used simultaneously. The analyzer uses real-time standardised fractional octave digital filters

Measurement

1/1-OCTAVE FILTERS
14-pole filters with centre frequencies given by $10^{3\,n/10}$. Fulfils IEC 1260–1995 Class 1, DIN 45651 and ANSI S1.11–1986, Order 7 Type 1–D, optional range
Single Channel: $-3 \le n \le 14$. 18 filters with centre frequencies from 125 mHz to 16 kHz

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: $-10 \le n \le 43$. 54 filters with centre frequencies from 100 mHz to 20 kHz
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: $-30 \le n \le 173$. 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: $-84 \le n \le 323$. 408 filters with centre frequencies from 90.4 mHz to 11.1 kHz
Minimum Mean Time Interval between Spectra: 10 ms

DETECTORS
- Linear averaging
- Exponential averaging

PROCESSING
The following can be measured:
- Autospectrum
- Cross-spectrum
- Mean pressure spectrum
- Velocity spectrum
- Intensity spectrum
- Complex intensity spectrum

Note: Intensity measurement is for intensity probes with 2 microphones

MAX./MIN. SPECTRUM HOLD
Max./min. hold of spectrum for exponential averaging mode

Performance

The following guidelines are provided for the computing power of the analysis engine included in Type 7700, 7771 expressed as real-time channel × bandwidth product for measurement of CPB autospectra without A & L bands. Values are scalable with the addition of Analysis Engine Type 7707

	Channel × Bandwidth Product			
	1/1-octave	1/3-octave	1/12-octave	1/24-octave
Real-time CPB	130 kHz	100 kHz	40 kHz	20 kHz

Post-processing

The following post-processing can be applied to a CPB measurement
- Phase-assigned autospectrum
- Frequency response function (H1, H2, H3)
- 1/Frequency response function (1/H1, 1/H2, 1/H3)
- Coherence
- Signal-to-noise ratio
- Coherent/non-coherent power
- Calculated intensity/complex intensity
- p–I index

Overall Level Analyzer (Types 7700, 7770 and 7771)

A number of variants of the Overall Level analyzer can be used simultaneously. Any signal can be measured using an Overall Level analyzer. Complies with the requirements for a class 1 instrument in IEC 651, 1979, Sound Level Meters

DETECTORS
• Exponential, Linear, Impulse, Peak

AVERAGING
The following averaging modes are available:
• Average over a period
• Continuous running averaging

Average Over a Period of Time:
Max. Linear Averaging Time: 86400 s (24 hrs.)
Max. Exponential Averaging Time: 1024 s
Max. Peak Detection Time: 36000 s (10 hrs.)

Continuous Running Averaging:
Via cyclic buffer

FREQUENCY SPAN
Maximum: 25.6 kHz

MEASUREMENT MODES
• Exponential (including fast and slow)
• Exponential + impulse
• Exponential + maximum hold
• Exponential + minimum hold
• Linear
• Linear + impulse
• Peak
All modes can be measured simultaneously

ACOUSTIC WEIGHTING
• Linear, A, B, C, D

Performance

Guidelines for the computing power of the analysis engine included in Type 7700, 7770, 7771 expressed as real-time channel × bandwidth product for measurement of overall levels with and without peak. Values are scalable with an additional Analysis Engine, Type 7707

	Channel × Bandwidth Product	
	Without peak	With peak
Real-time overall analysis	300 kHz	120 kHz

Signal Generator (Types 7700, 7770 and 7771)

Provides signals for performing a system analysis. Requires the use of a 4/2-ch. Input/Output Module Type 3109

WAVEFORMS
• Sine – fixed or swept (burst or continuous)
• Dual sine – fixed, swept or combination
• Random (burst or continuous)
• Pseudo-random
• Periodic Random
• User-defined waveform
See Type 3560 C/D/E System Data, BU 0228, for further specifications

Specifications – Analysis Engine Type 7707

Max. channel × bandwidth product for measurement using the analysis engine

		PULSE Performance, Real-time Channel × Bandwidth Product (kHz)			
Required Analysis Engine Licenses	**Analysis Engine (Beats)**	**FFT [a,b,c]**	**CPB [d,e]**	**Order Tracking [f,g]**	**Minimum PC Single/Dual CPU**
Included	50	300	100	40	PII 600 MHz
Type 7707	150	900	300	120	P4 2.7 GHz or Dual PIII 1.8 GHz
	250	1500	500	200	Dual P4 3 GHz

a. 0% overlap, 400 lines
b. FFT requires Type 7700 **or** Type 7770
c. 1, 2, 5 FFT sequence uses more resources than 2^n
d. 1/3-octave
e. CPB requires Type 7700 **or** Type 7771
f. Bandwidth = (Max. no. of orders) × (Max. fundamental), e.g., 2-ch. 6000 RPM, 100 Orders 0% overlap = 20 kHz
g. Order Tracking requires Type 7700 **and** Type 7702

Specifications – Data Recorder Type 7701

PULSE software for use with Multi-analyzer, the Multi-analyzer System Type 3560

PERFORMANCE
Frequency Span: Max. 25.6 kHz per channel
Channel × Bandwidth: 400 kHz

BASEBAND FREQUENCY SPAN
25.6, 12.8, 6.4, 3.2, 1.6 kHz

TRIGGERING
A recording session can be started manually or using a trigger. If triggering is used, this can be a single or repetitive trigger.

Each time a trigger occurs, a new data track is recorded for a specified length of time

ANALYSIS AND DISPLAY
• Replay of recorded data

DATA EXPORT
From local or network drives, the file mover can export data in the following formats:
• Universal File ASCII (UFF)
• Universal File Binary (UFF)
• Standard Data Format (TIM)
• Wave Data (WAV)

Specifications – Time Capture Type 7705

PULSE software for use with Multi-analyzer System Type 3560

Requirements

• The PC requirements for Multi-analyzer System Type 3560 must be fulfilled
• Noise and Vibration Analysis Type 7700 version 5.0 or higher must be installed

Recording

Frequency Span: 25.6 kHz, 12.8 kHz, …, 1.56 Hz
Record Length: 1 ms to 24 hrs. with indication of equivalent record size in samples

TRIGGER
Start: Any virtual trigger or free-run
Stop: Any virtual trigger or Stop at End

Specifications – Multiple-Input Multiple-Output Analysis Type 7764

Type 7764 is software for use with PULSE, the Multi-analyzer System Type 3560

REQUIREMENTS
• The PC requirements for Multi-analyzer System Type 3560 must be fulfilled
• Noise and Vibration Analysis Type 7700 version 6.1 or higher must be installed

MIMO
• Provides calculations of MIMO H_1 and H_v, multiple coherence
• Implemented as an external PULSE function compatible with standard PULSE functions (concerning export, cursors, etc.).
• Automatic parameter setup when used with Modal Test Consultant Type 7753

IDA^e-based PULSE Systems
• Channel count limited only by number of input channels supported

DSP-based PULSE Systems
• Limited number of channels supported

Specifications – Auxiliary Parameter Logging Type 7769

Type 7769 is software for use with PULSE, the Multi-analyzer System Type 3560

Requirements

• The PC requirements for Multi-analyzer System Type 3560 must be fulfilled
• Noise and Vibration Analysis Type 7700 version 7.0 or higher must be installed
• IDA^e LAN module Type 7533 or 7536

SAMPLING RATE
• 10 samples per second on each channel

DETECTORS
• Instantaneous and Linear

AVERAGING
The following averaging modes are available:
• Average over a period
• Continuous running averaging

Average Over a Period of Time:
Max. Linear Averaging Time: 86400 s (24 hrs.)
Min. Linear Averaging Time: 0.1 s
Averaging can be reset by measurement start and/or a user selected trigger

Continuous Running Averaging:
Via cyclic buffer
Averaging can be reset by measurement start and/or a user selected trigger

MEASUREMENT MODES
• Instantaneous
• Instantaneous Maximum
• Instantaneous Minimum
• Averaged
• Averaged Maximum
• Averaged Minimum

All modes can be measured simultaneously. An auxiliary channel can have multiple signals with multiple averaging settings. Only auxiliary signals can be measured using an Auxiliary Parameter Logger. Auxiliary channels can only be measured using an Auxiliary Parameter Logger.

INTEGRATION WITH PULSE PLATFORM
• Data available as multi-buffer tags
• Auxiliary parameter as a fuction of time
• Auxiliary channels can be recorded and played back with Data Recorder Type 7701
• Access to auxiliary channel settings and data through OLE interface

Specifications – SSR Analysis Type 7772

Type 7772 is software for use with PULSE, the Multi-analyzer System Type 3560

Requirements

- The PC requirements for Multi-analyzer System Type 3560 must be fulfilled
- Noise and Vibration Analysis Type 7700 version 6.1 or higher must be installed

Frequency Response Measurement

RESPONSE
Relative response (transfer function) or absolute response (response signal only) can be measured

FREQUENCY SWEEP
A frequency sweep is set up by defining a start and a stop frequency and a number of steps that can be distributed on a logarithmic or linear scale or at user-defined frequencies

- **Frequency Span:** Type 3109, up to 25.6 kHz; Type 3110, up to 102.4 kHz
- **User Defined:** Frequency sweep inserted by the user, as desired
- **Direction:** Up, Down
- **Log:** 1/3-, 1/6-, 1/12-, 1/24-, 1/48- and 1/96-octave steps
- **Log ISO:** Series R10, R20, R40 and R80
- **Log CPB:** 1/3-, 1/6-, 1/12-, 1/24-, 1/48- and 1/96-octave steps according to CPB frequencies
- **Lin:** 1 to 1600 steps

LEVEL SWEEP
A level sweep is set up by defining the excitation frequency, the output level range to be swept and the step size
Output Level: Range and step size for an Output Level sweep can be selected from 0.1 dB to 80 dB

DETECTOR
For optimal estimation of the frequency response, the Steady State Response Detector or Adaptive Scan Algorithm are used. The detector requires that a detector averaging method, a detector accuracy, a detector delay as well as a detector max. time are defined.

- **Detector Averaging:** Complex Adaptive, Power Adaptive, Complex Linear and Power Linear averaging can be selected. When Adaptive averaging is selected, the response is estimated to a user-defined accuracy in the minimum possible time. When Linear averaging is selected, all data within a specified period of time are averaged. Complex indicates that phase information is included in the response, whereas Power indicates no phase information
- **Detector Accuracy:** 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.08, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.6, 0.8, 1.0, 1.5, 2, 3 and 6 dB. The value specifies the required accuracy of the measurement (67% confidence level) when Complex Adaptive or Power Adaptive is selected
- **Detector Delay:** 0 ms, 10 ms, 20 ms, 50 ms, 100 ms, …, 10 s. The value specifies the delay before the detector is activated for each excitation frequency
- **Detector Max. Time:** 0 ms, 100 ms, 200 ms, 400 ms, 800 ms, 1.6 s, 3.2 s, 6.4 s, 12.5 s, …, 13 ks. For complex averaging the value specifies the maximum measuring time after the detector algorithm has been activated. For linear averaging, the value specifies the averaging time

Distortion Measurement

HARMONIC DISTORTION
Simultaneous measurement of selected harmonic products, Total, Total Distortion and Total Harmonic Distortion can be automatically calculated from selected harmonics

- **Harmonics:** Up to 40th harmonic products can be selected
- **Detector Mode:** Common Detector or Individual Detector can be selected. When Common Detector is selected, the Detector Averaging, Detector Accuracy, Detector Delay and the Detector Max. Time are the same for all the selected products and are determined by the Frequency Response Detector. When Individual Detector is selected, the Detector Averaging, Detector Accuracy, Detector Delay and the Detector Max. Time can be set individually for all the selected products and are determined by the Individual Distortion Detector

INTERMODULATION DISTORTION
Simultaneous measurement of selected Intermodulation products up. Total Distortion can be automatically calculated from selected products

- **Intermodulation Frequency:** 5 Hz to 25 kHz
- **Intermodulation Products:** Up 9th order can be selected
- **Detector Mode:** Common Detector or Individual Detector can be selected. When Common Detector is selected, the Detector Averaging, Detector Accuracy, Detector Delay and the Detector Max. Time are the same for all the selected products and are determined by the Frequency Response Detector. When Individual Detector is selected, the Detector Averaging, Detector Accuracy, Detector Delay and the Detector Max. Time can be set individually for all the selected products and are determined by the Individual Distortion Detector

DIFFERENCE FREQUENCY DISTORTION
Simultaneous measurement of selected Difference Frequency products up to 9th order. Total Distortion can be automatically calculated from selected products

- **Difference Frequency:** 5 Hz to 10 kHz
- **Difference Frequency Products:** Up 9th order can be selected
- **Detector Mode:** Common Detector or Individual Detector can be selected. When Common Detector is selected, the Detector Averaging, Detector Accuracy, Detector Delay and the Detector Max. Time are the same for all the selected products and are determined by the Frequency Response Detector. When Individual Detector is selected, the Detector Averaging, Detector Accuracy, Detector Delay and the Detector Max. Time can be set individually for all the selected products and are determined by the Individual Distortion Detector

TOTAL RMS
Measurement of broadband RMS. Includes all distortion products and noise within the frequency range of the analyzer. Specifications for the dynamic range of the input are reduced for this type of measurement
Distortion Products and Noise: < –55 dB re full scale

Specifications – Envelope Analysis Type 7773

Type 7773 is software for use with PULSE, the Multi-analyzer System Type 3560

REQUIREMENTS
- The PC requirements for Multi-analyzer System Type 3560 must be fulfilled
- Noise and Vibration Analysis Type 7700 version 6.1 or higher must be installed

ENVELOPE ANALYSIS
Uses FFT analyzer in Envelope Mode
Detection Range: Set by the Centre Frequency and 2 × selected Frequency Span
For other specifications, see FFT Analyzer (Types 7700 and 7770) on page 23

Specifications – Time File Management Type 7789

Type 7789 is software for use with PULSE, the Multi-analyzer System Type 3560

REQUIREMENTS
- The PC requirements for Multi-analyzer System Type 3560 must be fulfilled
- PC should be equipped with a Windows® compatible sound-card in order to playback signals
- A PC optimised for CPU and hard disk intensive operations is recommended

Ordering Information

Type 7700–Xy[1] Noise and Vibration Analysis
Type 7770–Xy[1] FFT Analysis
Type 7771–Xy[1] CPB Analysis
for use with PULSE, the Multi-analyzer System Type 3560

SOFTWARE
Type 7700–Xy[1] Noise and Vibration Analysis, 2–128 channels

Type 7770–Xy[1] FFT Analysis, 2–128 channels

Type 7771–Xy[1] CPB Analysis, 2–128 channels

Type 7707 Additional Analysis Engine
The software license allows measurements on the number of channels covered by your software license for Type 7700, 7770 or 7771

PULSE VIEWER LICENSE
TYPE 7709 PULSE VIEWER LICENSE

PULSE APPLICATIONS
Type 7701 Data Recorder
Type 7705 Time Capture
Type 7764 Multiple-Input Multiple-Output Analysis
Type 7767 PULSE Data Manager
Type 7769 Auxiliary Parameter Logging
Type 7772 SSR Analysis
Type 7773 Envelope Analysis
Type 7774 PULSE Interface to SONY® SIR-1000
Type 7780 Spatial Transformation of Sound Fields Component
Type 7789 Time File Management

SERVICES
3560–SI1 Installation and Configuration (at Brüel & Kjær)
M1–7700–Xy[1] Noise and Vibration Analysis Software Maintenance & Support Agreement
M1–7770–Xy[1] FFT Analysis Software Maintenance & Support Agreement
M1–7771–Xy[1] CPB Analysis Software Maintenance & Support Agreement

See the Software Maintenance and Support Agreement Product Data (BP 1800) for further details of M1 Agreements

1. Where 'X' indicates the license model, either N: Node Locked or F: Floating and 'y' is any number between 2 and 16 - the number of channels supported by the license, (e.g. 7700-N7 denotes a node locked, 7 channel license). A 16 channel license supports up to 128 channels.

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