

SYSTEM DATA

IDA^e Hardware Configurations for PULSE Version 7.0
— Types 3560C, 3560D and 3560E



PULSE™, the Multi-analyzer System Type 3560, is a versatile, task-oriented analysis system. It provides the platform for a range of PC-based measurement solutions from Brüel & Kjær.

A PULSE system consists of a PC with LAN interface, PULSE software, Microsoft® Windows NT®, Windows® 2000 or Windows® XP operating system, Microsoft® Office, and data acquisition front-end hardware.

Type 3560C is a portable system powered by internal batteries or an external DC supply (AC using adaptor). The system can contain one input/output module.

Type 3560D is a portable multichannel system powered by an external DC supply (AC using adaptor). The system can contain up to 5 input/output modules.

Type 3560E is a multichannel system powered by AC. The system is suitable for rack mounting and can contain up to 8 input/output modules.

Up to 10 front-ends can be combined into one measurement system with up to 128 input channels.

This System Data describes the hardware available for Type 3560C, D and E. The software available is described separately.

3560 C, D, E

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Features and Uses

- USES*
- General noise and vibration analysis and related post-processing
 - Multiframe systems comprising up to 10 front-ends with synchronous sampling between front-ends for real-time measurements on up to 128 channels:
 - Type 3560 C: 2 modules (up to 7 input and 2 generator output channels)
 - Type 3560 D: 7 modules (up to 31 input and 10 generator output channels)
 - Type 3560 E: 10 modules (up to 49 input and 16 generator output channels)
 - Signal and system analyses using PULSE software for:
 - General Noise and Vibration Measurement
 - Product Noise Measurement
 - Sound Quality Analysis
 - Sound Power
 - Noise Source Identification
 - Acoustic Material Testing
 - Structural Dynamics
 - Machine Analysis

- FEATURES*
- PULSE runs under Microsoft® Windows NT®, Windows® 2000 or XP operating systems
 - Analysis Engine upgrade software – use your standard PC for real-time signal analysis
 - Automatic detection of front-end hardware and transducers – supports IEEE P1451.4-capable transducers with TEDS (Transducer Electronic Data Sheet)
 - Signal conditioning for noise and vibration transducers including CCLD and Falcon Range® Microphones
 - LAN interface (wireless LAN possible) allows the front-end to be placed close to the test object and reduces transducer cable length
 - Rugged design for industrial use
 - Internal battery (3560 C only)/external DC operated acquisition unit for field use
 - Hot swap of batteries during measurement (3560 C only)

Introduction

PULSE, the Multi-analyzer System Type 3560, is a versatile, task-oriented analysis system for noise and vibration analysis. It provides the platform for a range of PC-based measurement solutions from Brüel & Kjær.

A Type 3560 C/D/E system consists of a PC with LAN interface, PULSE software, Windows NT®, Windows® 2000 or XP, Microsoft® Office and IDA^e-based data acquisition front-end hardware¹. A system can contain up to 128 input channels located in up to 10 front-ends. Part of the PULSE software is an Analysis Engine that allows the system analysis power to be scaled up without the need for extra hardware.

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1. **IDA^e – Enhanced Intelligent Data Acquisition-based front-end.** The term “intelligent” refers to the growing range of unique features including support of transducers with standardised built-in transducer data (TEDS). These features give fast and reliable setup and documentation of the entire measurement chain – from the transducer to the analysis result. The key features of IDA^e are:
- Input and output channels are fully conditioned for microphones, sound intensity probes, CCLD transducers and other transducers acting as voltage sources
 - Selectable high-pass filters and full overload detection, including out-of-band overload and indication of incorrect conditioning for the connected transducer

The input/output conditioning modules perform pre-processing and digitise the transducer signals. The components available for use in Type 3560 C/D/E PULSE systems are given in the Specifications. Further information on the input/output modules is given in Table 1.

Table 1 The types of module used in the Type 3560C, 3560D and 3560E front-ends

Type	Product Name	Frequency Range		Inputs/Outputs		No. in Front-end		
		Lower	Upper	Simultaneous Channels	Input Type	3560 C	3560 D	3560 E
3032 A	6/1-ch. Input/Output Module	0 Hz	25.6 kHz ²	6 Input ² 1 Output	Direct/CCLD ¹ Mic. Preamp. 2 Tacho	Up to 1 of these 4 modules	Up to 5 of these 4 modules	Up to 8 of these 4 modules
3032 B	6/1-ch. Input/Output Module	0 Hz	25.6 kHz ²	6 Input ² 1 Output	Direct/CCLD ¹ Mic. Preamp. 2 Tacho			
UA 1365	Blank Module	-						
3109	Generator, 4/2-ch. Input/ Output Module	0 Hz	25.6 kHz	4 Input 2 Generator Output	Direct/CCLD ¹ Mic. Preamp. 1 Tacho			
3110 ³	Generator, 2/1-ch. Input/ Output Module	0 Hz	204.8 kHz	2 Input 1 Generator ⁵ Output	Direct/CCLD ¹ Mic. Preamp. 1 Tacho			
7533	10 Mbit LAN Interface Module	0 Hz	25.6 kHz	1 Input	Direct/CCLD ¹ 1 Tacho	1 of these 2 modules	1 of these 2 modules ⁴	1 of these 2 modules ⁴
		10 samples/s. ⁸		16 ⁶ Aux Input 2 ⁷ Digital Output	Direct			
7536 ³	100 Mbit LAN Interface Module	10 samples/s. ⁸		16 ⁶ Aux Input 2 ⁷ Digital Output	Direct			

1. Constant Current Line Drive for DeltaTron[®] and ICP[®] Accelerometers or Microphone Pre-amplifier
2. 4 Input/1 Output or 6 Input/0 Output @ 25.6 kHz; 6 Input/1 Output @ 12.8 kHz. **Note:** Only sine wave output available
3. Type 3110 requires Type 7536
4. With reduced EMC specifications for Type 7533 only
5. Upper frequency @ 102.4 kHz
6. Only 12-channel currently supported in software
7. Not currently supported by software
8. Currently supported by software

PULSE Software and Applications

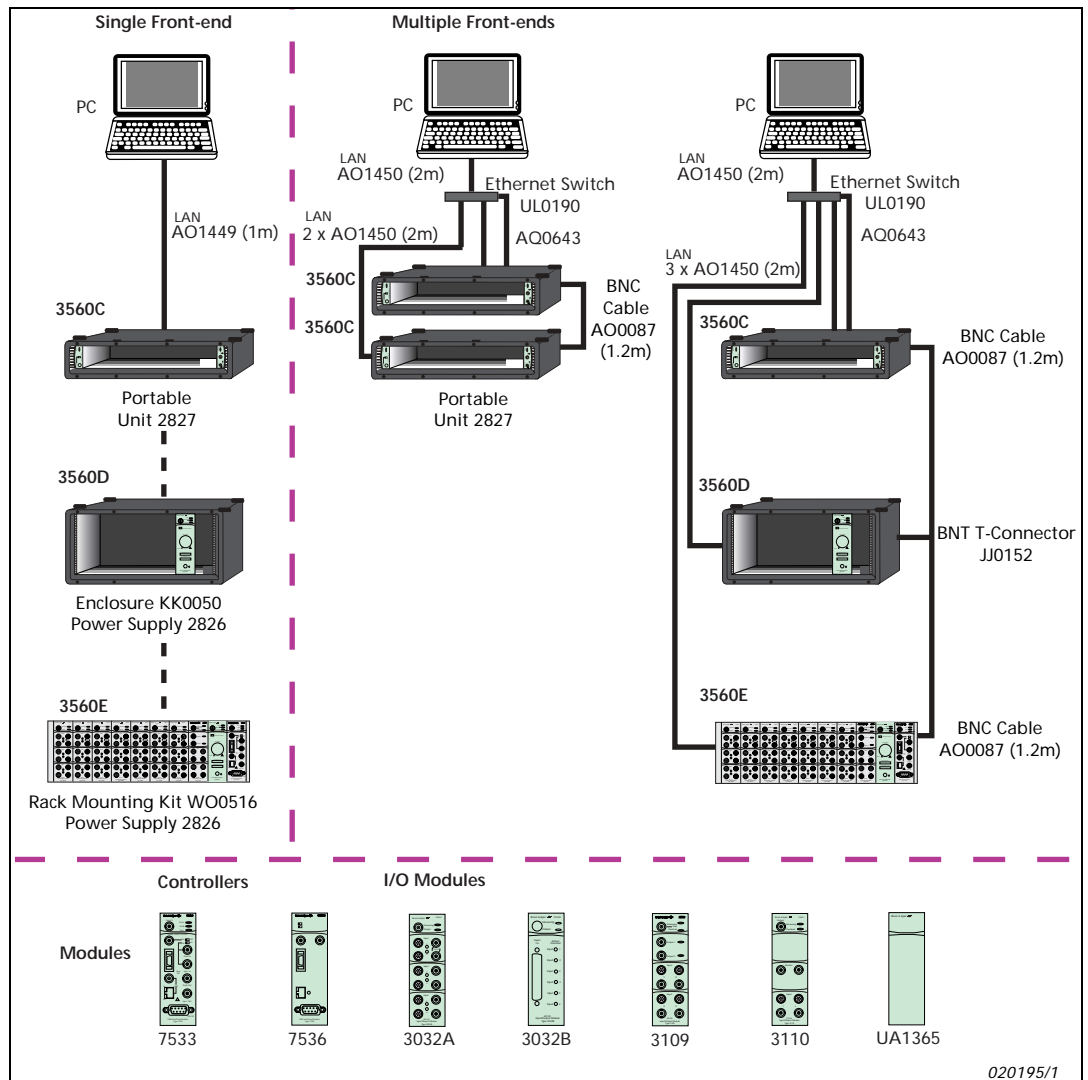
The base software for a PULSE system is Noise and Vibration Analysis Type 7700 with both FFT and CPB analyzers, though separate FFT and CPB licenses are available as FFT Analysis Type 7770 and CPB Analysis Type 7771. On the base, you can install further PULSE software and applications such as Data Recorder Type 7701 and Time Capture Type 7705. For descriptions of the PULSE software please refer to the separate System Data, BU 0229.

Analysis Engine

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. The real-time analysis capability of Noise and Vibration Analysis Type 7700 is defined as 50 "beats", the Brüel & Kjær term for the real-time performance of PULSE. In terms of FFT, that is a real-time channel × bandwidth product of 600 kHz with 0% overlap or 300 kHz with 67% overlap. By adding the optional Additional Analysis Engine (Type 7707), unlimited analysis to the maximum capacity of the PC is allowed.

Hardware Overview

Fig. 1
Overview of the components available for use in a Type 3560 Multi-analyzer System with LAN Interface



See also Fig. 3 to Fig. 5 on page 32 to page 34 for more details of system configurations.

Reliable Design

Environmental

To survive the harsh electrical environment found in, e.g., cars, Portable PULSE has specifications that exceed the European EMC immunity requirements. ISO 7637-1 “Road Vehicles – Electrical disturbance by conduction and coupling” requirements are met. Mechanical robustness is equally high and meets MIL-STD-810C and IEC 68-2-6 standards.

Since all portable PULSE systems are built for outdoor use, they meet strict requirements for temperature and humidity. The operating temperature range extends from -10 to +50°C (+14 to 122°F). Type 3560 C will withstand rain if kept with the front panel facing upwards and the protection cover in place.

Portable PULSE – Type 3560 C

USES

- Portable data acquisition unit for PULSE

FEATURES

- Houses one interface module and one input/output module
- Robust casing for industrial and hard everyday use
- Rain cover for front panel allows passage of cables
- Battery operated or DC powered (10 – 32 V)
- Cooling fans can be turned off for silent operation (auto-restart if too hot)



Introduction

Type 3560 C is a portable data acquisition system with a battery/DC powered Type 2827 power supply unit. It can hold a 10 Mbit LAN Interface Module Type 7533 or a 100 Mbit LAN Interface Module Type 7536 with 1 input channel, and one input/output module. The interface module handles communication with the PC while the input/output module handles measurement input and provides a sample clock. Input/Output modules available are:

Type 3032 A, 3032 B:	6/1-ch. Input/Output Module
Type 3109:	4/2-ch. Input/Output Module
Type 3110:	2/1-ch. Input/Output Module
UA 1365:	Blank Module

Power Supply

Type 2827 can either be powered by two internal Nickel-Metal Hydride batteries or from a 10 – 32 V DC power supply. An external 100 – 240 V AC mains supply unit is included.

When batteries are used¹, indicators on each side of the front panel indicate the condition of the batteries, allowing hot swap without interrupting measurement. When connected to an external DC supply, the batteries are charged automatically.

The unit can be switched on and off from the front panel or, when using more than one front-end in one system, the on/off function can be controlled by another front-end using the Multiframe Control signal. A third possibility is to follow an external DC power supply, so that it switches on when the supply is connected.

Silent Operation, Cooling

During operation, fans keep the temperature of the unit within safety limits. In measurement situations where the fan noise (32 dB at ambient temperatures of 22°C [72°F]) can influence measurement results, the fans can be switched off from the PULSE software. If overheating threatens, the fans are automatically turned on again.

1. Batteries are **not** included.

DC Output

To provide power for accessories such as a LAN switch or wireless LAN for interconnecting more front-ends, the back panel is provided with a 5 and 12 V DC output (LEMO FGG.00.302 connector) with fuse. Cables for these accessories must be ordered separately.

Multichannel Portable PULSE – Type 3560 D

USES

- Multichannel portable data acquisition unit for PULSE

FEATURES

- Houses Power Supply Type 2826, one interface module and up to 5 input/output modules
- Robust casing for industrial and hard everyday use
- Powered by external DC or AC/DC convertor
- Main cooling fans can be turned off for nearly silent operation (auto-restart if too hot)



Introduction

Type 3560 D is a data acquisition system comprising a frame that contains 7 modules. One of these must be the DC Power Supply Unit Type 2826, and one must be a 10 Mbit LAN Interface Module Type 7533 or a 100 Mbit LAN Interface Module Type 7536. The remaining 5 modules can be chosen from:

Type 3032 A, 3032 B:	6/1-ch. Input/Output Module
Type 3109:	4/2-ch. Input/Output Module
Type 3110:	2/1-ch. Input/Output Module ¹
UA 1365:	Blank Module

Power Supply

Power Supply Unit Type 2826 can be powered from a 10 – 32 V DC power supply. An external 100 – 240 V AC mains supply unit, ZG 0430, is provided.

The unit can be switched on and off from the front panel or, when using more than one front-end in one system, the on/off function can be controlled by another front-end using the Multiframe Control signal. A third possibility is to follow an external DC power supply, so that it switches on when the supply is connected.

Silent Operation, Cooling

During operation, fans keep the temperature of the unit within safety limits. In measurement situations where the fan noise (30 dB at ambient temperatures of 22°C [72°F]) will influence measurement results, the main fan units can be switched off from the PULSE software. If overheating threatens, these fans are automatically turned on again.

1. Type 3110 requires 100 Mbit LAN Interface Module Type 7536

DC Output

To provide power for accessories such as a LAN switch or wireless LAN, the back panel is provided with a 5 and 12 V DC output (LEMO FGG.00.302 connector) with fuse. Cables for these accessories must be ordered separately.

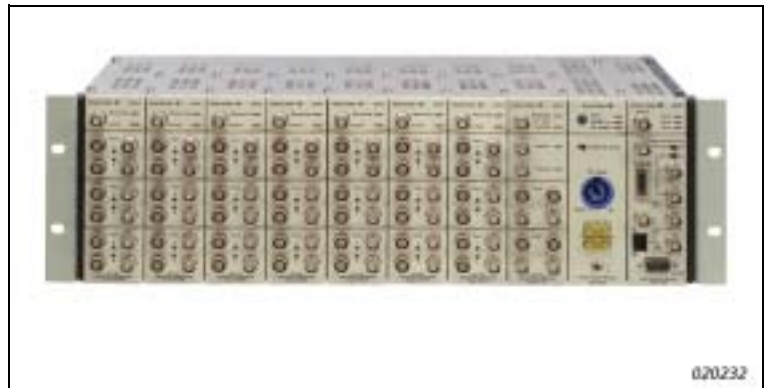
Multichannel PULSE – Type 3560 E

USES

- Multichannel data acquisition unit for PULSE

FEATURES

- Comprises Power Supply Type 2826, one interface module and up to 8 input/output modules
- Powered by external DC or AC/DC convertor
- Optional Rack Mounting Enclosure KQ 0155 and Fan Unit UH 1031



Introduction

Type 3560 E is a rack-mounted data acquisition system comprising 10 modules. One of these must be the DC Power Supply Unit Type 2826, and one must be a 10 Mbit LAN Interface Module Type 7533 or a 100 Mbit LAN Interface Module Type 7536. The remaining 8 modules can be chosen from:

Type 3032 A, 3032 B:	6/1-ch. Input/Output Module
Type 3109:	4/2-ch. Input/Output Module
Type 3110:	2/1-ch. Input/Output Module ¹
UA 1365:	Blank Module

The system is provided with a 19" Rack Mounting Kit, as shown above. A 19" Rack Enclosure KQ 0155 and Fan Unit UH 1031 are available to allow use of Type 3560 E as a stand-alone unit.

Power Supply

Power Supply Unit Type 2826 can be powered from a 10 – 32 V DC power supply. An external 100 – 240 V AC mains supply unit, ZG 0434, is included.

The unit can be switched on and off from the front panel or, when using more than one front-end in one system, the on/off function can be controlled by another front-end using the Multiframe Control signal. A third possibility is to follow an external DC power supply, so that it switches on when the supply is connected.

Cooling

The front-end must be equipped with a standard 19" external fan unit to keep the temperature within safety limits. An optional fan unit (UH 1031) is available.

1. Type 3110 requires 100 Mbit LAN Interface Module Type 7536

10Mbit LAN Interface Module – Type 7533

USES

- Interfacing an IDA^e-based Data Acquisition Front-end to a PULSE System via LAN (Local Area Network)
- 12 auxiliary input channels for measurement of voltage or physical parameters like position, wind speed or temperature with external signal conditioning

FEATURES

- Sets up and transmits data from input modules
- Provides sampling clock for the input modules
- Provides synchronisation interface for a system with multiple front-ends with Type 7533 or Type 7536 LAN Interface Modules
- Connection of remote control for sound intensity measurements via RS–232 interface
- One direct/CCLD input channel with tacho supply
- Each auxiliary channel is sampled at 10 samples per second. The channels are single-ended and have six input ranges from 0.1 V to 31.6 V in 10 dB steps



Introduction

LAN Interface Module Type 7533 controls and routes all communication between the PC and the input/output modules.

Multiframe Control Interface

This interface transmits or receives synchronisation and clock signal to or from other front-ends. This enables up to 10 units to be combined to act as one multichannel system. It also enables all front-ends in a system to be turned on or off simultaneously.

Serial Interface

An RS–232 interface on the front panel allows communication with the optional Remote Control Unit ZH0632 for sound intensity measurements. The interface is also used for setting up the LAN address and testing the front-end hardware.

Input

An input channel with a direct (BNT) input connector for CCLD (including DeltaTron[®]) transducers. The input also conditions a tacho probe and transducers, providing a DC source.

Aux I/O

There are 12¹ auxiliary channels present on a single connector. Each auxiliary channel is sampled at 10 samples per second. The channels are single-ended and have six input ranges from 0.1 V to 31.6 V in 10 dB steps.

1. 4 additional auxiliary inputs and 2 open drain outputs, which allow for simple on/off control, are included for future use

100 Mbit LAN Interface Module – Type 7536

USES

- Interfacing an IDA^e-based Data Acquisition Front-end to a PULSE System via LAN (Local Area Network)
- 12 auxiliary input channels for measurement of voltage or physical parameters like position, wind speed or temperature with external signal conditioning

FEATURES

- Sets up and transmits data from input modules
- Provides sampling clock for the input modules
- Provides synchronisation interface for a system with multiple front-ends with LAN Interface Modules Type 7533 or Type 7536
- Connection of remote control for sound intensity measurements via RS-232 interface
- Each auxiliary channel is sampled at 10 samples per second. The channels are single-ended and have six input ranges from 0.1 V to 31.6 V in 10 dB steps



Introduction

LAN Interface Module Type 7536 controls and routes all communication between the PC and the input/output modules.

Multiframe Control Interface

This interface transmits or receives synchronisation and clock signal to or from other front-ends. This enables up to 10 units to be combined to act as one multichannel system. It also enables all front-ends in a system to be turned on or off simultaneously.

Serial Interface

An RS-232 interface on the front panel allows communication with the optional Remote Control Unit ZH0632 for sound intensity measurements. The interface is also used for setting up the LAN address and testing the front-end hardware.

Aux I/O

There are 12¹ auxiliary channels, present on a single connector. Each auxiliary channel is sampled at 10 samples per second. The channels are single-ended and have six input ranges from 0.1 V to 31.6 V in 10 dB steps.

1.4 additional auxiliary inputs and 2 open drain outputs, which allow for simple on/off control, are included for future use

6/1-ch. Input/Output Module – Type 3032 A, 3032 B

USES

- 6 input channels for multichannel acoustic and vibration measurements

FEATURES

Two versions are available:

3032 A:

Each input channel has independent CCLD/direct and preamplifier input connectors (BNC and LEMO), allowing any combination of transducers

3032 B:

One 37-pole D-sub connector for all 6 input channels. Each channel can be set independently

Both modules feature:

- Floating/non-floating inputs/outputs
- One generator output (BNC) for simple sine tone testing
- Supports IEEE P1451.4 capable transducers with TEDS (setup uses data stored in the transducer)
- Overload indicator indicates incorrect conditioning on connected transducers
- Overload detection including out-of-band frequencies
- DC, 0.7 Hz, 7 Hz, 22.4 Hz and special intensity high-pass filters, independently set for each channel
- Automatic DC offset compensation on input channels
- Independent input ranges for each channel
- Powerful built-in digital signal processors for signal conditioning
- Intensity phase-matching on channels 5 and 6

Type 3032 A features:

- Microphone polarization voltage 0, 200 V (all channels simultaneously)

Functions and features available in the module are determined by software implemented and downloaded from PULSE LabShop.



Input

Each channel on Type 3032 A offers a BNC/BNT¹ input connector for direct or CCLD (including DeltaTron[®] and ICP[®]) transducers and a 7-pin LEMO connector for microphone preamplifiers. The channels are independent, which allows you to mix and match your input types. Charge operation can be obtained using Charge to DeltaTron[®] Converter Type 2647.

1. Ch.1 and ch.2 are equipped with a BNT connector, to provide a DC supply for a Tacho Probe.

Type 3032 B comes with a 37-pole D-sub connector containing all input channels. With appropriate cables this version allows easy and fast connection of multi-transducer systems such as microphone array systems.

Note that Type 3032 B does not support microphones that require external polarization voltage.

For each channel, a LED indicates the status of the channel: “activated” (green) or “overload” (red). A “measuring” LED indicates that a setup is downloaded from the PC-software into the front-end, and that a measurement is performed.

Floating/Non-floating Inputs

All input and output grounds can be set by the PULSE software to be independently floating or non-floating in order to avoid ground loop interference.

Independent Channels

The input channels on the module can be set up independently. This means that you can set up the high-pass filters and input gain separately and attach different types of transducers to different channels. With Type 3032 A, the microphone polarization voltage can be switched on for all channels (**Note:** The microphone polarization voltage is the same on all microphone channels).

For sound intensity measurements, channels 5 and 6 are phase-matched down to 17 millidegrees at 50 Hz.

IEEE P1451.4 Transducers

Type 3032 supports IEEE P1451.4 capable transducers with standardised Transducer Electronic Data Sheets (TEDS). This feature allows automatic front-end and analyzer setup, based on information stored in the transducer. This information includes, for example, sensitivity, serial number, manufacturer and calibration date.

Transducer Conditioning Check

Type 3032 uses two methods to detect transducer cable breaks or whether the wrong conditioning has been chosen. For microphones, their supply current is monitored. For DeltaTron[®] accelerometers (or microphones using DeltaTron[®] preamplifiers), the supply voltage is monitored. If conditioning errors are detected, an error event is indicated as an overload on the specific channel.

Output

The output channel on Type 3032 can be used as a simple, high-quality sine tone generator with a frequency range from 0.1 to 25.6 kHz. The maximum output voltage is $5 V_{\text{rms}}$ delivered in one output range through a 24-bit D/A converter. The signal is provided by a BNC connector, and may be referred to ground or floating.

Generator, 4/2-ch. Input/Output Module – Type 3109

USES

- 4 input channels for multichannel acoustic and vibration measurements
- 2 generator output channels for system excitation for acoustic and vibration measurements

FEATURES, INPUT

- 4 input channels with independent CCLD and preamplifier input connectors, allowing DC, AC, CCLD or preamplifier inputs with combinations of different transducers
- Supports IEEE P1451.4 capable transducers with TEDS (setup uses data stored in the transducer)
- Overload indicator indicates incorrect conditioning on connected transducers
- Overload detection including out-of-band frequencies
- DC, 0.7 Hz, 7 Hz, 22.4 Hz and special intensity high-pass filters, independently set for each channel
- Automatic DC offset compensation
- Independent input ranges for each channel
- Intensity phase-matching on channels 3 and 4

FEATURES, OUTPUT

- Output up to 25.6 kHz
- Waveforms and generator functionality determined by PULSE software



Input

Type 3109 is an all-in-one input/output module, with four independent input channels equipped with two input connectors (BNC/BNT and LEMO) and two output channels, which can be used as signal generators at frequencies up to 25.6 kHz.

Type 3109 offers outstanding input and output capabilities on the same module, whether you are exciting a system or making multichannel measurements with a variety of transducers simultaneously.

Each channel offers a BNC/BNT¹ input connector for direct or CCLD (including DeltaTron[®] and ICP[®]) transducers and a 7-pin LEMO connector for microphone preamplifiers. The channels are independent, which allows you to mix and match your input types. Charge operation can be obtained using Charge to DeltaTron[®] Converter Type 2647.

A common LED indicates the status of the channel: “activated” (green) or “overload” (red), if just one of the inputs has an overload. Type 3109 detects overloads for frequencies outside the measurement frequency range, thus ensuring that the overloads do not interfere with the measurement. A “measuring” LED indicates that a setup is

1. Ch.1 is equipped with a BNT connector, to provide a DC supply for a Tacho Probe.

downloaded from the PC software into the front-end, and that a measurement is performed.

Besides front-end setup, all functionality and features supported by the module are determined by software implemented and downloaded from PULSE LabShop.

Independent Channels

The input channels on the module can be set up independently. This means that you can set up the high-pass filters and input gain separately and attach different types of transducers to different channels. (**Note:** The microphone polarization voltage is the same on all microphone channels).

For sound intensity measurements, channels 3 and 4 are phase-matched down to 17 millidegrees at 50 Hz.

IEEE P1451.4 Transducers

Type 3109 supports IEEE P1451.4 capable transducers with standardised Transducer Electronic Data Sheets (TEDS). This feature allows automatic front-end and analyzer setup, based on information stored in the transducer. This information includes, for example, sensitivity, serial number, manufacturer and calibration date.

Transducer Conditioning Check

Type 3109 use two methods to detect transducer cable breaks or whether the wrong conditioning has been chosen. For microphones, the supply current to the microphones is monitored. For DeltaTron[®] accelerometers (or microphones using DeltaTron[®] preamplifiers), the supply voltage is monitored. If conditioning errors are detected, an error event is indicated as an overload on the front-end.

Output

The two output channels on Type 3109 can be used as signal generators with a frequency range from 0 to 25.6 kHz and can supply all the signals necessary for performing system analysis. The generators are controlled from PULSE software.

Type 3109 is designed around a powerful digital signal processor and a 24-bit D/A converter, and has exceptional flexibility, stability and accuracy. Output levels are adjustable in hardware, with maximum output ranging from 5 mV to 5 V RMS. Lower levels are possible by scaling the signal to the D/A converter. The signal is provided by a BNC connector and can be referred to ground or floating. It is possible to add a DC offset, but any unwanted DC offset is automatically removed.

Waveforms

Waveform functionality is determined by the downloaded PULSE application software.

Emergency Stop

The connector at the top of the module allows connection to an emergency stop control, allowing you to stop the generators immediately.

Generator, 2/1-ch. Input/Output Module – Type 3110

USES

- 2 input channels for multichannel acoustic and vibration measurements
- 1 generator output channel for system excitation for acoustic and vibration measurements

FEATURES, INPUT

- Input up to 204.8 kHz
- 24-bit ADC up to 25.6 kHz bandwidth; 16-bit up to 204.8 kHz bandwidth
- 2 input channels with independent CCLD and preamplifier input connectors, allowing DC, AC, CCLD or preamplifier inputs with combinations of different transducers
- Supports IEEE P1451.4 capable transducers with TEDS (setup uses data stored in the transducer)
- Overload indicator indicates incorrect conditioning on connected transducers
- Overload detection including out-of-band frequencies
- DC, 0.7 Hz, 7 Hz, 22.4 Hz, independently set for each channel
- Automatic DC offset compensation
- High dynamic input ranges, independent ranges for each channel

FEATURES, OUTPUT

- Output up to 102.4 kHz
- Waveforms and generator functionality determined by PULSE software



Input

Type 3110 is an all-in-one input/output module¹. Each of its two input channels is equipped with a BNT input connector for direct or CCLD (including DeltaTron[®] and ICP[®]) transducers and a 7-pin LEMO connector for microphone preamplifiers. The channels are independent, as are the two connectors on each channel. This allows you to mix and match your input types and to switch, for example, between preamplifier and DeltaTron[®] inputs. Charge operation can be obtained using Charge to DeltaTron[®] Converter Type 2647. The BNT connectors also provide a DC supply for use with a tachometer probe.

The output channel can be used as a signal generator at frequencies up to 102.4 kHz.

Type 3110 offers outstanding input and output capabilities on the same module, whether you are exciting a system or making multichannel measurements with a variety of transducers simultaneously.

¹. Type 3110 requires 100Mbit LAN Interface Module Type 7536

An LED indicates the status of each channel: “activated” (green) or “overload” (red). Type 3110 detects overloads for frequencies outside the measurement frequency range, thus ensuring that the overloads do not interfere with the measurement. A “measuring” LED indicates that a setup is downloaded from the PC software into the front-end, and that a measurement is performed.

Besides front-end setup, all functionality and features supported by the module are determined by software implemented and downloaded from PULSE LabShop.

Independent Channels

The input channels on the module can be set up independently. This means that you can set up the high-pass filters and input gain separately and attach different types of transducers to different channels. The microphone polarization voltage can be set separately for each channel.

IEEE P1451.4 Transducers

Type 3110 supports IEEE P1451.4 capable transducers with standardised Transducer Electronic Data Sheets (TEDS). This feature allows automatic front-end and analyzer setup, based on information stored in the transducer. This information includes, for example, sensitivity, serial number, manufacturer and calibration date.

Transducer Conditioning Check

Type 3110 uses two methods to detect transducer cable breaks or whether the wrong conditioning has been chosen. For microphones, the supply current to the microphones is monitored. For DeltaTron[®] accelerometers (or microphones using DeltaTron[®] preamplifiers), the supply voltage is monitored. If conditioning errors are detected, an error event is indicated as an overload.

Output

The output channel on Type 3110 can be used as signal generator with a frequency range from 0 to 102.4 kHz and can supply all the signals necessary for performing system analysis. The generators are controlled from PULSE software.

Type 3110 is designed around a powerful digital signal processor and a 24-bit D/A convertor, and has exceptional flexibility, stability and accuracy. The full dynamic output range is obtained from 7 mV to 7 V peak. Lower levels are possible by scaling the signal to the D/A converter. The signal is provided by a BNC connector and can be referred to ground or floating. It is possible to add a DC offset, but any unwanted DC offset is automatically removed.

Waveforms

Waveform functionality is determined by the downloaded PULSE application software.

Sound Intensity Probe Kit – Type 3599

Fig. 2
The remote control
unit used in
conjunction with
handle UA 1440



Type 3599 is a two-microphone probe kit for measuring sound intensity. The probe set includes the 1/2" Sound Intensity Microphone Pair Type 4197 enabling 1/3-octave centre frequency measurements between 20 Hz and 6.3 kHz. Used with 1/2" Microphone Pair Type 4197, the probe complies with IEC 1043 Class 1. These 1/2" microphones feature patented phase-corrector units making precision low-frequency phase matching a practical possibility, leading to increased measurement range and accuracy.



For controlling measurement progress, Remote Control Unit ZH 0632 is included in Sound Intensity Probe Kit Type 3599. This unit has 4 push buttons and 4 LED indicators whose function is determined by the application program (i.e., start/stop, autorange, save, etc.), and also serves as an ergonomic handle for the probe unit.

For further information, see the Product Data for Type 3599, BP 1880.

Compliance with Standards

(For environmental specifications and compliance with standards for PCs, see the specifications given by their respective manufacturers)

TYPES 3560 C, 3560 D AND 3560 E WITH LAN INTERFACE MODULE TYPE 7533 OR 7536, AND INPUT/OUTPUT MODULE TYPE 3032 A, 3032 B, 3109 OR 3110

 	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand.
Safety	EN 61010-1 and IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111-1: Standard for Safety – Electrical measuring and test equipment.
EMC Emission	EN 61326-1: Electrical equipment for measurement, control and laboratory use. EMC requirements. Part1: General requirements. EN 50081-1 and IEC 6100-6-3: Generic emission standard. Part 1: Residential, commercial and light industry. (does not apply to Types 3560 D/E with Module Type 7533) EN 50081-2 and IEC 6100-6-4: Generic emission standard. Part 2: Industrial environment. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device.
EMC Immunity	EN 61326-1: Electrical equipment for measurement, control and laboratory use. EMC requirements. Part1: General requirements. EN 50082-1 and IEC 6100-6-1: Generic immunity standard. Part 1: Residential, commercial and light industry. EN 50082-2 and IEC 6100-6-2: Generic immunity standard. Part 2: Industrial environment. ISO 7637-1 and 7637-2: Road Vehicles – Electrical Disturbance by Conduction and Coupling. Note: The above is only guaranteed using accessories included in this System Data.
Temperature	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: -10 to +50 °C (14 to 122 °F) Storage Temperature: -25 to +70 °C (-13 to 158 °F)
Humidity	IEC 60068-2-3: Damp Heat: 93% RH (non-condensing at 40°C (104°F))
Mechanical	Operating (peak values) MIL-STD-810C: Vibration: 12.7 mm, 15 ms ⁻² , 5–500 Hz Non-operating: IEC 60068-2-6: Vibration: 0.3 mm, 20 ms ⁻² , 10–500 Hz IEC 60068-2-27: Shock: 1000 ms ⁻² IEC 60068-2-29: Bump: 1000 bumps at: 3560 C, D: 400 ms ⁻² ; 3560 E: 250 ms ⁻²
Enclosure	IEC 60529: Protection provided by enclosures: 3560 C: IP 32; 3560 D: IP 40; 3560 E: IP 20

EFFECT OF RADIATED/CONDUCTED RF, MAGNETIC FIELD AND VIBRATION

Radiated RF: 80–1000 MHz, 80% AM 1 kHz, 10 V/m

Conducted RF: 0.15–80 MHz, 80% AM 1 kHz, 10 V

Magnetic Field: 30 A/m, 50 Hz

Vibration: 5–500 Hz, 12.7 mm, 15 m/s²

Input measured in 7.071 mV range with shorted input. All values are RMS. Conducted RF immunity on all channels is only guaranteed using an external connection from measuring ground to chassis terminal on Types 2826 and 2827

Input/Output	Radiated RF	Conducted RF	Magnetic Field	Vibration
Direct/CCLD	<10 μV	<130 μV	<4 μV	<80 μV
Preamplifier	<10 μV	< 25 μV	<8 μV	<80 μV
Generator	<60 μV	< 25 μV	<4 μV	< 5 μV

Specifications – PULSE, the Multi-analyzer System Type 3560C/D/E

Multi-analyzer Systems Type 3560C, 3560D and 3560E with LAN interface are modular, expandible, multi-analysis systems that include the following components:

- Pentium® II, III or IV PC
- PULSE software
- Microsoft® Windows NT® 4.0, Windows® 2000 or Windows® XP operating system
- Microsoft® Office 97, 2000 or XP
- Front-end comprising:
 - Power Supply/Frame Type 2827
 - or
 - Power Supply Type 2826 with or without Frame KK0050
- LAN Interface Module Type 7533 or Type 7536
- Generator, 4/2-ch. Input/Output Module Type 3109
- 6/1-ch. Input/Output Module Type 3032A or B
- Generator, 2/1-ch. Input/Output Module Type 3110
- or
- Blank Module UA1365

PC Requirements

- Recommended PC: Pentium® 4 1.6GHz mobile or faster, with 256MB of DDR SDRAM, (DELL Latitude Standard Notebook C640), 88 PULSE beats approx.
- 20GB hard disk or larger
- CD-ROM: 24x/10x/24x 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)* and Windows® XP Professional (Service Pack 1)
- Microsoft® Office 2000 (Service Release 2) or Microsoft® Office XP
- Microsoft® Internet Explorer 6.0
- Adobe® Acrobat Reader 5.1
- RS-232 COM port

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

Specifications – Portable PULSE Type 3560C

POWER SUPPLY/FRA
Type 2827

AVAILABLE MODULES

- 4/2-ch. Input/Output Module Type 3109
- 2/1-ch. Input/Output Module Type 3110 (requires Type 7536)
- 6/1-ch. Input/Output Module Type 3032A or 3032B
- LAN Interface Module Type 7533 or 7536
- Blank Module UA1365

POWER REQUIREMENTS

Fulfills the requirements of ISO 7637-1 and 7637-2

Voltage: 10 – 32V DC

Power Consumption:

Without DC output and when fitted with:

- 1 × 7533/7536 LAN Interface Module
- 1 × 3109 4/2-ch., 3110 2/1-ch. or 3032 6/1-ch. Input/Output Module

Nominal: 30W

Max.: 42W (while charging battery)

Ext. Power Connector: LEMO coax., size 0B, ground on shield

BATTERIES

Optional Accessories: 2 × DR35 NiMH or NI 1030, 10.8V (nominal)

Working Time (Continuous): 2½ hours

Charging Time: 5 hours/battery

ACOUSTIC NOISE EMISSION (at 1 m)

	dB SPL, A-weighted at 1 m	dB Lw, A-weighted
Fan Off:	<17	<25
Normal (22°C):	32	40
Max.:	33	41

DC OUTPUT

+ 5V ± 0.3V; max. 1A (fused)

+12V ± 0.8V; max. 1A (fused)

Connector: LEMO FGG.00.302

DIMENSIONS (without protective cover)

Height: 105 mm (4.1 inches)

Width: 376 mm (14.8 inches)

Depth: 300 mm (11.8 inches)

Weight: 5 kg (11 lb.) with LAN Interface Module and Input/Output Module. When fitted with batteries, 6 kg (13 lb.)

Ordering Information 3560C

Type 3560C

Consists of:

Type 2827 Portable Data Acquisition Unit

Also includes the following accessories:

ZG0429 Mains Supply/Battery Charger

ANxxxx Mains Cable for ZG0429

(xxxx: country dependent)

AO0546 Power Supply Cable for in-car use

DD0552 Protection Cover

DH0541 Shoulder Strap

System Options

Type 7700-Xy† Noise and Vibration Analysis, 1 – 128 channels

† 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 an unlimited number of channels

Type 7770–Xy[†] FFT Analysis, 1–128 channels
 Type 7771–Xy[†] CPB Analysis, 1–128 channels
 Type 7533 LAN Interface Module
 or
 Type 7536 LAN Interface Module
 one of the following input/output modules:
 Type 3032 6/1-ch. Input/Output Module
 Type 3109 4/2-ch. Input/Output Module
 or
 Type 3110 2/1-ch. Input/Output Module
 UA 1365 Blank Module
 M1–7700–Xy[†] Noise and Vibration Analysis Software
 Maintenance and Support Agreement
 M1–7770–Xy[†] FFT Analysis Software Maintenance and
 Support Agreement

M1–7771–Xy[†] CPB Analysis Software Maintenance and
 Support Agreement

Optional Accessories

UA 1590 Battery Charger and Holder
 (2 ×) QB 0048 Battery, NiMH DR35
 UA 1556 Notebook Mounting Kit
 UA 1572 19" Rack Mounting Kit for Type 2827
 AQ 0642 Power Cable between UL0196 and Type
 3560 C/D
 AQ 0643 Power Cable between UL0190 and Type
 3560 C/D

See also Fig. 3 on page 32

Specifications – Multichannel Portable PULSE Type 3560D

POWER SUPPLY
 Type 2826

FRAME (incl. Fan Unit)
 KK 0050

AVAILABLE MODULES
 4/2-ch. Input/Output Module Type 3109
 2/1-ch. Input/Output Module Type 3110 (requires Type 7536)
 6/1-ch. Input/Output Module Type 3032 A or 3032 B
 LAN Interface Module Type 7533 or 7536
 Blank Module UA 1365

POWER REQUIREMENTS
 Fulfills the requirements of ISO 7637–1 and 7637–2

Voltage: 10 – 32 V DC

Power Consumption:
 Without DC output and when fitted with:
 1 × 7533/7536 LAN Interface Module
 35 W nominal with 1 input module
 100 W nominal with 5 input modules

Ext. Power Connector: Neutrik Powercon 3-pole

Max. No. of Tacho Probes: 4

ACOUSTIC NOISE EMISSION (at 1 m)

	dB SPL, A-weighted at 1 m	dB Lw, A-weighted
Fan Off:	27	35
Normal (22°C):	30	38
Max.:	42	50

DC OUTPUT
 + 5 V ± 0.3 V; max. 1 A (fused)
 +12 V ± 0.8 V; max. 1 A (fused)
Connector: LEMO FGG.00.302

DIMENSIONS
Height: 194 mm (7.6") with feet, 170 mm (6.7") without feet
Width: 376 mm (14.8")
Depth: 342 mm (13.5")
Weight: 10 kg (22 lb.) with LAN Interface Module and 5 Input/
 Output Modules

Ordering Information 3560D

Type 3560 D
Consists of:
 KK 0050 Enclosure incl. Fan Unit
 Type 2826 Power Supply
Also includes the following accessories:
 ZG 0430 Mains Supply
 AN xxxx Mains Cable for ZG 0430
 (xxxx: country dependent)
 DH 0541 Shoulder Strap

1 – 5 of the following input/output modules:
 Type 3032 6/1-ch. Input/Output Module
 Type 3109 4/2-ch. Input/Output Module
 Type 3110 2/1-ch. Input/Output Module
 UA 1365 Blank Module
 M1–7700–Xy^{*} Noise and Vibration Analysis Software
 Maintenance and Support Agreement
 M1–7770–Xy^{*} FFT Analysis Software Maintenance and
 Support Agreement
 M1–7771–Xy^{*} CPB Analysis Software Maintenance and
 Support Agreement

System Options

Type 7700–Xy^{*} Noise and Vibration Analysis, 1–128 channels
 Type 7770–Xy^{*} FFT Analysis, 1–128 channels
 Type 7771–Xy^{*} CPB Analysis, 1–128 channels
 Type 7533 LAN Interface Module
 or
 Type 7536 LAN Interface Module

* 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 an unlimited number of channels

Optional Accessories

AQ 0642 Power Cable between UL0196 and 3560 C/D
 AQ 0643 Power Cable between UL0190 and 3560 C/D
 AQ 0656 Power supply cable with car service plug for
 3560 D
 UA 1556 Notebook Mounting Kit

See also Fig. 4 on page 33

Specifications – Multichannel PULSE Type 3560E

POWER SUPPLY
Type 2826

RACK MOUNTING KIT
WU0516

AVAILABLE MODULES
4/2-ch. Input/Output Module Type 3109
2/1-ch. Input/Output Module Type 3110 (requires Type 7536)
6/1-ch. Input/Output Module Type 3032 A or 3032 B
LAN Interface Module Type 7533 or 7536
Blank Module UA 1365

POWER REQUIREMENTS
Fulfils the requirements of ISO 7637–1 and 7637–2
Voltage: 10 – 32 V DC

Power Consumption:
When fitted with:
1 × 7533/7536 LAN Interface Module
35 W nominal with 1 input module
140 W nominal with 8 input modules
Ext. Power Connector: Neutrik Powercon 3-pole
Max. No. of Tacho Probes: 2

DIMENSIONS
Height: 134 mm (5.3 inches) (3 standard rack-mounting units)
Width: 482.6 mm (19 inches)
Depth: 300 mm (11.8 inches)
Weight: 8.7 kg (19 lb.) with LAN Interface Module and 8 Input/Output Modules; 17.5 kg (38.5 lb.) with KQ0155 and UH1031

Ordering Information 3560E

Type 3560E
Consists of:
WU0516 19" Rack Mounting Kit
Type 2826 Power Supply
Also includes the following accessories:
ZG0434 Mains Supply
ANxxxx Mains Cable for ZG0434
(xxxx: country dependent)

Type 7536 LAN Interface Module
1 – 8 of the following input/output modules:
Type 3032 6/1-ch. Input/Output Module
Type 3109 4/2-ch. Input/Output Module
Type 3110 2/1-ch. Input/Output Module
UA 1365 Blank Module
M1-7700-Xy* Noise and Vibration Analysis Software
Maintenance and Support Agreement
M1-7770-Xy* FFT Analysis Software Maintenance and
Support Agreement
M1-7771-Xy* CPB Analysis Software Maintenance and
Support Agreement

System Options

Type 7700-Xy* Noise and Vibration Analysis, 1 – 128 channels
Type 7770-Xy* FFT Analysis, 1 – 128 channels
Type 7771-Xy* CPB Analysis, 1 – 128 channels
Type 7533 LAN Interface Module
or

* 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 an unlimited number of channels

Optional Accessories

KQ0155 19" Rack Enclosure
UH1031 19" Fan Unit (Height: 1 standard rack-mounting unit)

See also Fig. 5 on page 34

Specifications – 10Mbit LAN Interface Module Type 7533

Input

FREQUENCY RANGE:

0 Hz to 12.8 kHz @ 32.768 kHz sampling rate
0 Hz to 25.6 kHz @ 65.536 kHz sampling rate

INPUT CONNECTOR

1 × BNT (ch.0) for Direct/CCLD or tacho

TRANSDUCER SUPPLY VOLTAGES

Supply for Tacho Probe: 6 V typical, max. 60 mA
Constant Current Supply for CCLD: +4 mA with a 28 V source

INPUT COUPLING

22.4 Hz high-pass filter: $-0.1 \text{ dB @ } f_1 = 22.4 \text{ Hz}$, slope -18 dB/oct. , $-3 \text{ dB @ } 12 \text{ Hz}$

7 Hz digital high-pass filter: $-0.1 \text{ dB @ } f_1 = 7 \text{ Hz}$, slope -6 dB/oct. , $-3 \text{ dB @ } 0.7 \text{ Hz}$ (0.7 Hz analog filter also active)

0.7 Hz high-pass filter: $-0.1 \text{ dB @ } f_1 = 0.7 \text{ Hz}$, slope -6 dB/oct. , $-3 \text{ dB @ } 0.07 \text{ Hz}$

DC Direct ($f_1 = 0 \text{ Hz}$)

INPUT VOLTAGE RANGE

8 ranges from 7.071 mV to 22.36 V_{peak} in 10 dB steps

INPUT IMPEDANCE

Direct: $1 \text{ M}\Omega \parallel < 200 \text{ pF}$, typ.
CCLD: $> 100 \text{ k}\Omega \parallel < 200 \text{ pF}$, typ.

INPUT PROTECTION

Differential Mode: 50 V_{peak}, 35 V_{rms} or DC
Common Mode: 15 V_{peak}

MAX. INDUCED COMMON MODE VOLTAGE

DC – 80 MHz: 1 V_{peak}

COMMON-MODE REJECTION

DC: 50 dB
0 – 1 kHz: 40 dB

CROSSTALK (source/termination: 50 Ω)

Between ch. 0 and any channel in other modules

0 – 2 kHz: -100 dB
2 – 12.8 kHz: -85 dB
12.8 kHz to 25.6 kHz: -80 dB

ATTENUATOR LINEARITY

$\pm 0.1 \text{ dB @ } 1 \text{ kHz}$

ANTI_ALIASING FILTER

(@ 32.768 and 65.536 kHz sampling rate)

Provide at least 80 dB attenuation of those frequencies that can cause aliasing

Passband: DC $-25.6 \text{ kHz @ } -0.1 \text{ dB}$, slope -18 dB/oct.

OVERLOAD DETECTION

Applied before filters

TOTAL HARMONIC DISTORTION

Better than $-80 \text{ dB} \approx 0.01\%$

NOISE

(10 Hz – 25.6 kHz) terminated with $\leq 50 \Omega$

Range	Equivalent Input Noise
7.071 mV	3 μV_{rms}
22.36 mV	3 μV_{rms}
70.71 mV	5 μV_{rms}
223.6 mV	10 μV_{rms}
707.1 mV	31 μV_{rms}
2.236 V	100 μV_{rms}

7.071 V	316 μV_{rms}
22.36 V	1 mV _{rms}

FREQUENCY RESPONSE (f_l to f_u re 1 kHz)

7 mV to 7 V range: $\pm 0.1 \text{ dB}$

22.36 V range: $\pm 0.3 \text{ dB}$

AMPLITUDE LINEARITY (@ 1 kHz)

0 to 40 dB below full scale: $\pm 0.1 \text{ dB}$

40 to 60 dB below full scale: $\pm 0.4 \text{ dB}$

60 to 80 dB below full scale: $\pm 1.0 \text{ dB}$

ABSOLUTE AMPLITUDE PRECISION

$\pm 0.1 \text{ dB}$, 2.236 V input range (@ 1 kHz)

GAIN AND PHASE MATCH

To any channel in Input Conditioning Module in Type 3109 or Type 3032: Same as channel-to-channel match in Type 3109/3032, except for 22.36 V range

Special Functions

ANALOG AND DIGITAL OFFSET ADJUSTMENT

Offset: -60 dB re max. input

Smart Transducer Support: μLAN communication according to IEEE P1451.4

The functionality of Type 7533 is dependent on the DSP software downloaded (part of application software)

LAN Interface

CONNECTOR

10base2: BNC connector complying with IEEE–802.3 10base2

10baseT: RJ45 connector complying with IEEE–802.3 10baseT

PROTOCOL

TCP/IP and TCP/UDP

ACQUISITION PERFORMANCE

Data Transfer rate (No. of Channels × Bandwidth) from front-end via LAN Interface, per front-end: 150 kHz

Multiframe Control

This must only be connected to other BNC Multiframe Control Sockets in Type 7533 or 7536

RS–232 Interface

RS–232 OUTPUT

Fulfils EIA–562 (electrical) and EIA–574 (mechanical)

OUTPUT SUPPLY

5 V, max. 50 mA

Aux

AUXILIARY I/O

NUMBER OF INPUT CHANNELS

12*

* 16 input channels (12 currently supported in software) plus 2 output channels that are not currently supported in software

INPUT CONNECTOR

1 × High density 20-pole D-sub

SAMPLING RATE

10 samples per second (no internal anti-aliasing filters)

INPUT CONNECTIONS

Single-ended

INPUT VOLTAGE RANGES

Six input ranges from 0.1V to 31.6V in 10 dB steps

INPUT PROTECTION

50 V

INPUT IMPEDANCE

1 MΩ || < 200 pF

PRECISION

Range	Precision
31.6 V	±0.5% of reading ±20 mV offset
10 V	±0.5% of reading ±7 mV offset
3.16 V	±0.5% of reading ±7 mV offset
1 V	±0.5% of reading ±4 mV offset
316 mV	±0.5% of reading ±2 mV offset
100 mV	±0.5% of reading ±2 mV offset

COMPATIBILITY WITH EXISTING TYPE 7533 LAN MODULES

All Type 7533 10Mbit LAN modules are compatible and calibrated

Dimensions

Excluding connectors

Height: 134.0 mm (5.28 inches)**Width:** 42.5 mm (1.67 inches)**Depth:** 234 mm (9.21 inches)**Weight:** 0.71 kg (1.56 lb.)

Ordering Information 7533

Type 7533 LAN Interface Module

Includes the following accessories:AO 1449 LAN Interface Cable crossover with RJ45 (1 m)
AO 1451 RS-232 Cable for PULSE LAN Interface ModuleMM0024 Photoelectric Probe
AO 1472 Pin D-sub to Aux I/O
AO 0594 16 BNC Female to 37-pin D-sub
AO 0595 37-pin D-sub converter cable for DATAQ DI-75B

Optional Accessories

AO 1450 LAN Interface Cable with RJ45 (1.5 m)
UL0167 Intel InBusiness® 8 Port 10/100 Switch for Ethernet
UL0190 4-port Switch
or
UL0190-US 4-port Switch (110 V)
AQ0643 Power Cable between UL0190 and Type 3560 C/D
MM0012 Photoelectric Probe**SOFTWARE**

Type 7769 Auxiliary Parameter Logging

WIRELESS LANUL0196 Access Point with 1 Wireless LAN PCMCIA Card
UL0197 Car Antenna, max. speed 140 km/hr (87.5 mph)
UL0198 Range Extender Antenna for indoor use
UL0199 PCMCIA Card for Notebook PC
AQ0642 Power Cable between UL0196 and Type 3560 C/D

See also Fig. 3 to Fig. 5 on page 32 to page 34

Specifications – 100Mbit LAN Interface Module Type 7536

LAN Interface

CONNECTOR

RJ 45 (10baseT/100baseTX) connector complying with IEEE-802.3 100baseX

PROTOCOL

TCP/IP

ACQUISITION PERFORMANCE

Data Transfer rate (No. of Channels × Bandwidth) from front-end via LAN Interface, per front-end: 400 kHz

Multiframe Control

This must only be connected to other BNC Multiframe Control Sockets in Type 7533 or 7536

Aux

AUXILIARY I/O

NUMBER OF INPUT CHANNELS

12*

INPUT CONNECTOR

1 × High density 20-pole D-sub

SAMPLING RATE

10 samples per second (no internal anti-aliasing filters)

INPUT CONNECTIONS

Single-ended

INPUT VOLTAGE RANGES

Six input ranges from 0.1V to 31.6V in 10 dB steps

INPUT PROTECTION

50 V

* 16 input channels (12 currently supported in software) plus 2 output channels which are not currently supported in software

INPUT IMPEDANCE

1 MΩ || < 200 pF

PRECISION

Range	Precision
31.6 V	±0.5% of reading ±20 mV offset
10 V	±0.5% of reading ±7 mV offset
3.16 V	±0.5% of reading ±7 mV offset
1 V	±0.5% of reading ±4 mV offset
316 mV	±0.5% of reading ±2 mV offset
100 mV	±0.5% of reading ±2 mV offset

COMPATIBILITY WITH EXISTING TYPE 7536 LAN MODULES

Type 7536 100Mbit LAN modules, hardware version 12.0 and greater, are compatible and calibrated
Type 7536, hardware version 11.02 and serial number 2352 315-2352 of version 12.0, are compatible but need recalibration
Type 7536, hardware version 11.02, will not function properly without a simple hardware modification (less than 25 units affected). There is a potential for damage if these modules are used for Auxiliary Logging without the modification

RS-232 Interface

RS-232 OUTPUT

Fulfils EIA-562 (electrical) and EIA-574 (mechanical)

OUTPUT SUPPLY

5 V, max. 50 mA

Dimensions

Excluding connectors

Height: 134.0 mm (5.28 inches)

Width: 42.5 mm (1.67 inches)

Depth: 234 mm (9.21 inches)

Weight: 0.51 kg (1.12 lb.)

Ordering Information 7536

Type 7533 LAN Interface Module

Includes the following accessories:

AO 1449 LAN Interface Cable crossover with RJ45 (1 m)
AO 1451 RS-232 Cable for PULSE LAN Interface Module

Optional Accessories

AO 1450 LAN Interface Cable with RJ45 (1.5 m)
UL 0167 Intel InBusiness® 8 Port 10/100 Switch for Ethernet
UL 0190 4-port Switch
or
UL 0190-US 4-port Switch (110V)
AQ 0643 Power Cable between UL 0190 and Type 2827

AO 1472 Pin D-sub to Aux I/O
AO 0594 16 BNC Female to 37-pin D-sub
AO 0595 37-pin D-sub converter cable for DATAQ DI-75B

SOFTWARE

Type 7769 Auxiliary Parameter Logging

WIRELESS LAN

UL 0196 Access Point with 1 Wireless LAN PCMCIA Card
UL 0197 Car Antenna, max. speed 140 km/hr (87.5 mph)
UL 0198 Range Extender Antenna for indoor use
UL 0199 PCMCIA Card for Notebook PC
AQ 0642 Power Cable between UL 0196 and Type 2827
UA 1617 LAN Cable Relief

See also Fig. 3 to Fig. 5 on page 32 to page 34

Specifications – 6/1-ch. Input/Output Module Type 3032 A, 3032 B

Input

FREQUENCY RANGE

0 Hz to 25.6 kHz @ 65.536 kHz sampling rate for 6 input channels/
no output channels

0 Hz to 25.6 kHz @ 65.536 kHz sampling rate for 4 input channels/
1 output channel

0 Hz to 12.8 kHz @ 32.768 kHz sampling rate for 6 input channels/
1 output channel

INPUT CONNECTOR

3032 A: 2 × BNT (ch.1, ch.2); 4 × BNC (ch.3 – 6); 6 × 7-pole LEMO
(BNC and LEMO connectors sited in parallel)

3032 B: 37-pole D-sub connector

TRANSDUCER SUPPLY VOLTAGES

3032 A: Supply for Tacho Probe (ch.1, ch.2): 6 V, max. 60 mA
Microphone Polarization Voltage: 0 or 200 V for all six
channels together

Microphone Supply Voltage: ±15 V, max. 10 mA/channel
Constant Current Supply for CCLD: +4 mA with a 28 V
source

3032 B: Microphone Supply Voltage: ±15 V, max. 10 mA/channel
Constant Current Supply for CCLD: +4 mA with a 28 V
source

INPUT COUPLING

22.4 Hz high-pass filter: –0.1 dB @ $f_L = 22.4$ Hz, slope –18 dB/oct.,
–3 dB @ 12 Hz

7 Hz digital high-pass filter: –0.1 dB @ $f_L = 7$ Hz, slope –6 dB/oct.,
–3 dB @ 0.7 Hz (0.7 Hz analog filter also active)

0.7 Hz high-pass filter: –0.1 dB @ $f_L = 0.7$ Hz, slope –6 dB/oct.,
–3 dB @ 0.07 Hz

DC Direct ($f_L = 0$ Hz)

INPUT VOLTAGE

7 ranges from 7.071 mV_{peak} to 7.071 V_{peak} in 10 dB steps

INPUT IMPEDANCE

Direct, Microphone: 1 M Ω || <200 pF

CCLD: >100 k Ω || <200 pF

INPUT PROTECTION

Differential Mode: 50 V_{peak}, 35 V_{rms} or DC

Common Mode: 5 V_{peak}

MAXIMUM INDUCED COMMON MODE VOLTAGE

1 V_{peak} DC – 4 MHz

10 V_{rms} 4 MHz – 80 MHz

COMMON-MODE REJECTION

DC: 50 dB

0 to 1 kHz: 40 dB

CROSSTALK (source/termination: 50 Ω)

Between any two channels of a module or between any two
channels in different modules:

0 to 2 kHz: –100 dB

2 kHz to 12.8 kHz: –85 dB

12.8 kHz to 25.6 kHz: –80 dB

ATTENUATOR LINEARITY

±0.1 dB @ 1 kHz

TOTAL HARMONIC DISTORTION

At least –80 dB below max. input ($\approx 0.01\%$)

NOISE (10 Hz to 25.6 kHz terminated with 50 Ω)

Input Range	Equivalent Input Noise
7.071 mV	3 μ V _{rms}
22.36 mV	3 μ V _{rms}
70.71 mV	5 μ V _{rms}
223.6 mV	10 μ V _{rms}
707.1 mV	31 μ V _{rms}
2.236 V	100 μ V _{rms}
7.071 V	316 μ V _{rms}

FREQUENCY RESPONSE

f_L to f_U : ±0.1 dB re 1 kHz

AMPLITUDE LINEARITY (@ 1 kHz)

0 to 40 dB below full scale: ±0.1 dB

40 to 60 dB below full scale: ±0.4 dB

60 to 80 dB below full scale: ±1.0 dB

ABSOLUTE AMPLITUDE PRECISION

±0.1 dB, 2.236 V input range (@ 1 kHz)

CHANNEL-TO-CHANNEL MATCH (any input range)

Maximum Gain Difference: 0.2 dB from lower frequency limit, f_L
to upper frequency limit, f_U

Maximum Phase Difference (within one frame):

1.2° – 0.1° × (f/f_L) from f_L to 10 × f_L

0.2° from 10 × f_L to 640 Hz

0.1° + 0.1° × ($f/640$) from 640 Hz to 6.4 kHz

CHANNEL-TO-CHANNEL MATCH (same input range)

Maximum Gain Difference:

0.2 dB from lower frequency limit, f_L , to upper frequency limit, f_U

Maximum Phase Difference (within one frame):

1.2° – 0.1° × (f/f_L) from f_L to 10 × f_L

0.2° from 10 × f_L to 1280 Hz

0.1° + 0.1° × ($f/1280$) from 1280 Hz to 25.6 kHz

Sound Intensity Phase Match (only for ch. 5 and 6 using Intensity

Filter): Complies with IEC 1043 Class 1 and ANSI S1.12–1995 Class

1, using Brüel & Kjær Sound Intensity Probes

ANTI_ALIASING FILTER

(@ 32.768 and 65.536 kHz sampling rate)

Provides at least 80 dB attenuation of those input frequencies
which can cause aliasing

Passband: DC to 25.6 kHz @ –0.1 dB, slope –18 dB/oct

OVERLOAD DETECTION

Detectors applied before filters. Overload/active indication per
channel on front panel

Output

Frequency Range: 0.1 Hz to 25.6 kHz

Output Connector: BNC, floating or grounded

Max. Output Voltage: 5 V_{rms} in one range (24-bit DAC)

Output Impedance: 50 Ω

Frequency Response re 1 kHz:

0.1 Hz to 12.8 kHz: +0.1, –0.2 dB

0.1 Hz to 25.6 kHz: +0.1, –0.4 dB

Distortion: –80 dB at max. output

Waveforms: Fixed sine

Special Functions

Microphone Charge Injection Calibration:

Max. Test Signal: $5V_{rms}$

Frequency Range: 0.1 Hz to 25.6 kHz

Transducer and Cable Fault Detection:

Microphone supply current monitoring

CCLD idle voltage monitoring

Analog Self-test: Functional Check

Analog and Digital Offset Adjustment:

Offset: -60dB re max. input.

Smart Transducer Support: μLAN communication according to IEEE P1451.4

The functionality, including waveforms, of Type 3032 is dependent on the DSP software downloaded (part of application software)

Dimensions

Excluding connectors

Height: 134.0 mm (5.28 in)

Width: 42.5 mm (1.67 in)

Depth: 234 mm (9.21 in)

Weight: 0.71 kg (1.56 lb.)

Ordering Information 3032

Type 3032: 6/1-ch. Input/Output Module

is available in two versions:

3032 A with BNC/BNT and LEMO connectors

3032 B with 37-pole D-sub connector (cables must be ordered separately)

3032 B only:

AO 0535 37-pole D-sub to 6 Microdot for accelerometers

AO 0536 37-pole D-sub with 2 plugs for triaxial accelerometers

WL 1261 37-pole D-sub with 6×7 -pole LEMO plugs for microphone. preamplifiers

WL 1271 37-pole D-sub with 6 BNC plugs

WB 1487 0/20 dB Attenuator Adaptor for D-Sub connector

Optional Accessories

Type 2647

Charge to CCLD Amplifier

JP0145

BNC to 10-32 UNF Plug Adaptor

AO0526

4p Microtech to $3 \times$ BNC Cable

$3 \times$ BNC to multiplug for triaxial transducers

JP 1040

2×7 -pole LEMO to 10-pole LEMO for Intensity Probe (Type 2683)

WB1497

20dB Attenuator

A wide range of Brüel & Kjær accelerometers, microphones, preamplifiers and sound intensity probes is available for use with a Type 3560 system. These include:

Type 3599 Sound Intensity Probe Kit (includes Remote Control ZH0632)

See also Fig. 3 to Fig. 5 on page 32 to page 34

Specifications – Generator, 4/2-ch. Input/Output Module Type 3109

Input

FREQUENCY RANGE:

0 Hz to 12.8 kHz @ 32.768 kHz sampling rate
 0 Hz to 25.6 kHz @ 65.536 kHz sampling rate
 Lower sampling frequencies are obtained by decimation

INPUT CONNECTOR

1 × BNT (ch.1); 3 × BNC (ch.2–4); 4 × 7-pole LEMO (BNC and LEMO connectors sited in parallel)

TRANSDUCER SUPPLY VOLTAGES

Supply for Tacho Probe (ch.1): 6 V, max. 60 mA
 Microphone Polarization Voltage: 0 or 200 V
 Microphone Supply Voltage: ±15 V, max. 10 mA/channel
 Constant Current Supply for CCLD: +4 mA with a 28 V source

INPUT COUPLING

22.4 Hz high-pass filter: –0.1 dB @ $f_L = 22.4$ Hz, slope –18 dB/oct., –3 dB @ 12 Hz
 7 Hz digital high-pass filter: –0.1 dB @ $f_L = 7$ Hz, slope –6 dB/oct., –3 dB @ 0.7 Hz (0.7 Hz analog filter also active)
 0.7 Hz high-pass filter: –0.1 dB @ $f_L = 0.7$ Hz, slope –6 dB/oct., –3 dB @ 0.07 Hz
 Intensity filter: –0.1 dB @ 120 Hz, slope –6 dB/oct., –3 dB @ 12 Hz
 DC Direct ($f_L = 0$ Hz)

INPUT VOLTAGE

7 ranges from 7.071 mV_{peak} to 7.071 V_{peak} in 10 dB steps

INPUT IMPEDANCE

Direct, Microphone: 1 MΩ || <200 pF
 CCLD: >100 kΩ || <200 pF

INPUT PROTECTION

Differential Mode: 50 V_{peak}, 35 V_{rms} or DC
 Common Mode: 15 V_{peak}

MAXIMUM INDUCED COMMON MODE VOLTAGE

DC – 80 MHz: 1 V_{peak}

COMMON-MODE REJECTION

DC: 50 dB
 0 to 1 kHz: 40 dB

CROSSTALK (source/termination: 50 Ω)

Between any two channels of a module or between any two channels in different modules:

0 to 2 kHz: –100 dB
 2 kHz to 12.8 kHz: –85 dB
 12.8 kHz to 25.6 kHz: –80 dB

ATTENUATOR LINEARITY

±0.1 dB @ 1 kHz

TOTAL HARMONIC DISTORTION

At least –80 dB below max. input (≈0.01%)

NOISE

(10 Hz – 25.6 kHz) terminated with ≤50 Ω

Input Range	Equivalent Input Noise
7.071 mV	3 μV _{rms}
22.36 mV	3 μV _{rms}
70.71 mV	5 μV _{rms}
223.6 mV	10 μV _{rms}
707.1 mV	31 μV _{rms}
2.236 V	100 μV _{rms}
7.071 V	316 μV _{rms}

FREQUENCY RESPONSE

f_L to f_U : ±0.1 dB re 1 kHz

AMPLITUDE LINEARITY (@ 1 kHz)

0 to 40 dB below full scale: ±0.1 dB
 40 to 60 dB below full scale: ±0.4 dB
 60 to 80 dB below full scale: ±1.0 dB

ABSOLUTE AMPLITUDE PRECISION

±0.1 dB, 2.236 V input range (@ 1 kHz)

CHANNEL-TO-CHANNEL MATCH (any input range)

Maximum Gain Difference: 0.2 dB from lower frequency limit, f_L to upper frequency limit, f_U

Maximum Phase Difference (within one frame):

1.2° – 0.1° × f/f_L from f_L to 10 × f_L
 0.2° from 10 × f_L to 640 Hz
 0.1° + 0.1° × $f/640$ from 640 Hz to 6.4 kHz

CHANNEL-TO-CHANNEL MATCH (same input range)

Maximum Gain Difference:

0.2 dB from lower frequency limit, f_L , to upper frequency limit, f_U

Maximum Phase Difference (within one frame):

1.2° – 0.1° × f/f_L from f_L to 10 × f_L
 0.2° from 10 × f_L to 1280 Hz
 0.1° + 0.1° × $f/1280$ from 1280 Hz to 25.6 kHz

Sound Intensity Phase Match (only for ch. 3 and 4 using Intensity Filter): Complies with IEC 1043 standard Class 1 and ANSI S1.12 – 1995 Class 1, using Brüel & Kjær Sound Intensity Probes

ANTI_ALIASING FILTER

(@ 32.768 and 65.536 kHz sampling rate)
 Provides at least 80 dB attenuation of those input frequencies which can cause aliasing
 Passband: DC to 25.6 kHz @ –0.1 dB, slope –18 dB/oct

OVERLOAD DETECTION

Applied before filters. Common indicator on front panel

Output

FREQUENCY RANGE

0 Hz to 25.6 kHz @ 65.536 kHz sampling rate

OUTPUT CONNECTOR

2 × BNC

OUTPUT COUPLING

DC Direct ($f_L = 0$ Hz)

OUTPUT VOLTAGE RANGE

7.07 μV_{peak} – 7.07 V_{peak}

OUTPUT IMPEDANCE

50 Ω

MAXIMUM INDUCED COMMON MODE VOLTAGE

1 V_{peak} DC – 4 MHz
 10 V_{rms} 4 MHz – 80 MHz

COMMON MODE REJECTION

1 Hz to 1 kHz: 50 dB
 1 kHz to 25.6 kHz: 40 dB

CROSSTALK

Between any two channels of module or between any two channels in different modules

0 to 2 kHz: –100 dB
 2 kHz to 25.6 kHz: –85 dB

HARMONIC AND SPURIOUS DISTORTION PRODUCTS (in band)

< 80 dB or 1 μV, whichever is greater

FREQUENCY RESPONSE

1 mHz to 25.6 kHz: ± 0.1 dB re 1 kHz

FREQUENCY ACCURACY AND STABILITY

0.0025% without warm-up (no adjustment necessary)

OUTPUT NOISE

Output Range	Equivalent Output Noise
7.07 μ V – 70.7 mV	3 μ V _{rms}
70.7 mV – 707 mV	20 μ V _{rms}
707 mV – 7.07 V	200 μ V _{rms}

AMPLITUDE LINEARITY (@ 1 kHz)

0 to 60 dB below full scale: ± 0.1 dB

60 to 100 dB below full scale: ± 0.2 dB

100 to 120 dB below full scale: ± 0.5 dB

120 to 140 dB below full scale: ± 1.0 dB

ABSOLUTE AMPLITUDE PRECISION

± 0.05 dB at 1 kHz, 1 V_{rms}, 23°C

± 0.1 dB at 1 kHz, 1 mV to 5 V_{rms}

CHANNEL-TO-CHANNEL MATCH (any output range)

Maximum Gain Difference: 0.2 dB from lower frequency limit, 0 Hz to upper frequency limit f_U

CHANNEL-TO-CHANNEL MATCH (same output range)

Maximum Gain Difference: 0.2 dB from lower frequency limit, f_L , to upper frequency limit, f_U

Special Functions

Microphone Charge Injection Calibration:

Max. Test Signal: 5 V_{rms}

Frequency Range: 0.1 Hz to 25.6 kHz

Transducer and Cable Fault Detection:

Microphone supply current monitoring

CCLD idle voltage monitoring

Analog Self-test: Functional Check

Analog and Digital Offset Adjustment:

Offset: -60 dB re max. input.

Smart Transducer Support: μ LAN communication according to IEEE P1451.4

The functionality of Type 3109 is dependent on the DSP software downloaded (part of application software)

Dimensions

Excluding connectors

Height: 134.0 mm (5.28 in)

Width: 42.5 mm (1.67 in)

Depth: 234 mm (9.21 in)

Weight: 0.71 kg (1.56 lb.)

Ordering Information 3109

Type 3109: Generator, 4/2-ch. Input/Output Module

Optional Accessories

Type 2647	Charge to CCLD Amplifier
JP0145	BNC to 10–32 UNF Plug Adaptor
AO0526	4p Microtech to 3 \times BNC Cable
JP1040	2 \times 7-pole LEMO to 10-pole LEMO for Intensity Probe (Type 2683)
WB1497	20 dB Attenuator

A wide range of Brüel & Kjær accelerometers, microphones, preamplifiers and sound intensity probes are available for use with a Type 3560 system. These include:

Type 3599 Sound Intensity Probe Kit (includes Remote Control ZH0632)

See also Fig. 3 to Fig. 5 on page 32 to page 34

Specifications – Generator, 2/1-ch. Input/Output Module Type 3110

Input

UPPER FREQUENCY

25.6 kHz at 65.536 kHz sampling

102.4 kHz at 262.144 kHz sampling

204.8 kHz at 524.288 kHz sampling

Lower sampling frequencies are obtained by decimation

A/D CONVERSION

24-bit for upper frequency ≤ 25.6 kHz

16-bit for upper frequency > 25.6 kHz

INPUT CONNECTORS: Ch.1 /Ch2: 1 \times BNT + 1 \times 7-pole LEMO

BNT connector is internally connected if voltage input or DeltaTron® input is selected only. LEMO connector is internally connected if preamp.input is selected only

INPUT COUPLING:

DC Direct ($f_L = 0$ Hz)

0.7 Hz high-pass filter: -0.1 dB @ $f_L = 0.7$ Hz, slope -6 dB/oct., -3 dB @ 0.07 Hz

7 Hz digital high-pass filter: -0.1 dB @ $f_L = 7$ Hz, slope -6 dB/oct., -3 dB @ 0.7 Hz, 0.7 Hz analog filter also active

22.4 Hz high-pass filter: -0.1 dB @ $f_L = 22.4$ Hz, slope -18 dB/oct., -3 dB @ 12 Hz

Intensity filter: -0.1 dB, @120 Hz, slope -6 dB/oct., -3 dB @ 12 Hz “A” filter (analog filter : -3 dB @107.7 Hz -6 dB/oct; the rest of A filter is digitally obtained)

Inputs can be single-ended or floating

INPUT VOLTAGE

8 ranges from 7.071 mV_{peak} to 22.34 V_{peak} in 10 dB steps

INPUT IMPEDANCE

Direct, Microphone: 1 M Ω || <200 pF

CCLD: >100 k Ω || <200 pF

MAXIMUM INPUT VOLTAGE

35 V_{peak}

MAXIMUM INDUCED COMMON MODE VOLTAGE

DC – 80 MHz: $5 V_{\text{peak}}$

COMMON-MODE REJECTION

Frequency Range	7 mV – 7 V Input Range Guaranteed	7 mV – 7 V Input Range Typical	22 V Input Range Typical
0 – 100 Hz	>70 dB	>80 dB	50 dB
0 – 1 kHz	>55 dB	60 dB	50 dB
1 – 10 kHz	>30 dB	40 dB	40 dB

CROSSTALK (source/termination: 50 Ω)

Between any two input channels of a module or between any two input channels in different modules:

0 to 2 kHz: –130 dB (7 mV to 7 V ranges); –90 dB (in 22 V range)

2 kHz to 12.8 kHz: –120 dB (7 mV to 7 V ranges); –90 dB (in 22 V range)

12.8 kHz to 25.6 kHz: –110 dB (7 mV to 7 V ranges); –90 dB (in 22 V range)

25.6 kHz to 102.4 kHz: –100 dB (7 mV to 7 V ranges); –90 dB (in 22 V range)

102.4 kHz to 204.8 kHz: –90 dB (7 mV to 7 V ranges); –80 dB (in 22 V range)

ATTENUATOR LINEARITY

± 0.05 dB @ 1 kHz

Typical: ± 0.005 dB @ 1 kHz

ANTI_ALIASING FILTER

Provides at least 90 dB attenuation of those input frequencies which can cause aliasing

OVERLOAD DETECTION

Applied before all filters

HARMONIC DISTORTION

@ Upper Frequency Range	0 – 25.6 kHz @ –3 dB re. Full Scale		0 – 204.8 kHz @ –3 dB re. Full Scale	
	Guaranteed	Typical	Guaranteed	Typical
7 mV – 7 V Range	90 dB (–0.0032%)	96 dB (–0.0015%)	75 dB (–0.017%)	90 dB (–0.0032%)
22 V Range	70 dB (–0.032%)	80 dB (–0.01%)	70 dB (–0.032%)	80 dB (–0.01%)

SPURIOUS FREE DYNAMIC RANGE

All spurious frequencies at least 90 dB below max. input or $< 1 \mu\text{V}$, whichever is greater

Typical: 120 dB below max. input or $< 100 \mu\text{V}$

AMPLITUDE LINEARITY (@ 1 kHz in 25 kHz bandwidth)

	Guaranteed	Typical
0 to 60 dB below full scale	± 0.1 dB	0.005 dB
60 to 80 ^a dB below full scale	± 0.2 dB	0.050 dB

a. If > 25 kHz: –80 dB with carrier

ABSOLUTE AMPLITUDE PRECISION

± 0.05 dB, 2.236 V Input Range (@ 1 kHz)

Typical: ± 0.005 dB @ 1 kHz

NOISE

(Input terminated by $\leq 50 \Omega$)

Input Range	Equivalent Input Noise Input Analog Bandwidth					
	10 Hz – 25.6 kHz 24-bit ADC		10 Hz – 25.6 kHz 16-bit ADC		10 Hz – 204.8 kHz 16-bit ADC	
	Guaranty	Typical	Guaranty	Typical	Guaranty	Typical
7.071 mV	$2 \mu\text{V}_{\text{rms}}$	$1.5 \mu\text{V}_{\text{rms}}$	$2 \mu\text{V}_{\text{rms}}$	$1.5 \mu\text{V}_{\text{rms}}$	$6 \mu\text{V}_{\text{rms}}$	$4 \mu\text{V}_{\text{rms}}$
22.36 mV	$2 \mu\text{V}_{\text{rms}}$	$1.5 \mu\text{V}_{\text{rms}}$	$2 \mu\text{V}_{\text{rms}}$	$1.5 \mu\text{V}_{\text{rms}}$	$6 \mu\text{V}_{\text{rms}}$	$4 \mu\text{V}_{\text{rms}}$
70.71 mV	$2.5 \mu\text{V}_{\text{rms}}$	$1.7 \mu\text{V}_{\text{rms}}$	$4 \mu\text{V}_{\text{rms}}$	$2 \mu\text{V}_{\text{rms}}$	$10 \mu\text{V}_{\text{rms}}$	$6 \mu\text{V}_{\text{rms}}$
223.6 mV	$5 \mu\text{V}_{\text{rms}}$	$3 \mu\text{V}_{\text{rms}}$	$10 \mu\text{V}_{\text{rms}}$	$5 \mu\text{V}_{\text{rms}}$	$20 \mu\text{V}_{\text{rms}}$	$12 \mu\text{V}_{\text{rms}}$
707.1 mV	$10 \mu\text{V}_{\text{rms}}$	$8 \mu\text{V}_{\text{rms}}$	$31 \mu\text{V}_{\text{rms}}$	$16 \mu\text{V}_{\text{rms}}$	$60 \mu\text{V}_{\text{rms}}$	$30 \mu\text{V}_{\text{rms}}$
2.236 V	$30 \mu\text{V}_{\text{rms}}$	$25 \mu\text{V}_{\text{rms}}$	$100 \mu\text{V}_{\text{rms}}$	$50 \mu\text{V}_{\text{rms}}$	$180 \mu\text{V}_{\text{rms}}$	$125 \mu\text{V}_{\text{rms}}$
7.071 V	$100 \mu\text{V}_{\text{rms}}$	$80 \mu\text{V}_{\text{rms}}$	$300 \mu\text{V}_{\text{rms}}$	$150 \mu\text{V}_{\text{rms}}$	$500 \mu\text{V}_{\text{rms}}$	$400 \mu\text{V}_{\text{rms}}$
22.36 V	$300 \mu\text{V}_{\text{rms}}$	$270 \mu\text{V}_{\text{rms}}$	$900 \mu\text{V}_{\text{rms}}$	$500 \mu\text{V}_{\text{rms}}$	$1500 \mu\text{V}_{\text{rms}}$	$1200 \mu\text{V}_{\text{rms}}$

OVERALL FREQUENCY RESPONSE

f_L to 25.6 kHz: ± 0.1 dB

f_L to 102.4 kHz: $+0.1$ dB/–0.2 dB

f_L to 204.8 kHz: $+0.1$ dB/–0.5 dB

CHANNEL-TO-CHANNEL MATCH (any input range)

Maximum Gain Difference: 0.1 dB from lower frequency limit, f_L to upper frequency limit, f_U

Typical Gain Difference: < 0.05 dB

Maximum Phase Difference (within one frame):

$1.2^\circ - 0.1^\circ \times f / f_L$ from f_L to $10 \times f_L$ ($\sim 1.1^\circ$ at f_L and 0.2° at $10 \times f_L$)

0.2° from $10 \times f_L$ to 6400 Hz

$0.8^\circ \times f / 6.4$ kHz – 0.6° from 6.4 kHz to 204.8 kHz

($\sim 2.6^\circ$ at 25.6 kHz, 12.2° at 102.4 kHz and 25° at 204.8 kHz)

CHANNEL-TO-CHANNEL MATCH (same input range)

Maximum Gain Difference: 0.1 dB from lower frequency limit, f_L to upper frequency limit, f_U

Typical Gain Difference: < 0.01 dB

Maximum Phase Difference (within one frame):

$1.2^\circ - 0.1^\circ \times f / f_L$ from f_L to $10 \times f_L$ ($\sim 1.1^\circ$ at f_L and 0.2° at $10 \times f_L$)

0.2° from $10 \times f_L$ to 6400 Hz

$0.4^\circ \times f / 6.4$ kHz from 6.4 kHz to 204.8 kHz

($\sim 1.4^\circ$ at 25.6 kHz, 6.2° at 102.4 kHz and 12.6° at 204.8 kHz)

Sound Intensity Phase Match (only for using intensity filter):

Complies with IEC 1043 standard Class 1 and ANSI S1.12–1995 Class 1 using Brüel & Kjær Sound Intensity Probes (0.017° @ 50 Hz)

Frequency Range	Phase Match Guaranteed	Phase Match Typical
50 Hz – 250 Hz	$\pm 0.017^\circ$	$\pm 0.005^\circ$
250 kHz – 2.5 kHz	$0.017^\circ \times (f/250)$	$\pm 0.05^\circ$
2.5 kHz – 6.4 kHz	$\pm 0.17^\circ$	$\pm 0.08^\circ$

ANALOG SPECIAL FUNCTIONS

Supply for Tacho Probe: 6 V, max. 60 mA (on inner screen of BNT connector) on both channels with automatic switching to non-floating input if used

Polarization Voltage: 0 or 200 V ± 0.5 , individually switched
CCLD on/off: Constant Current Supply for CCLD: + 4 mA with a 25 V source

Charge Injection Calibration:

Max. V_{out} : $5 V_{\text{rms}}$

Frequency Range: 0 to 102.4 kHz

Analog Self-test: Functional check

DC Offset: 60 dB below Max. Input

Input Common Mode Overload Detection for $V_{\text{common mode}}$
 $> \pm 3.16$ V

Cable Fault Detection (Preamp and CCLD)

Transducer Current Fault Detection (Preamp only):
 + 15 V transducer supply current monitoring; Range: 0 to 20 mA, 8-bit resolution
Transducers: Supports IEEE P1451.4 capable transducers with standardised TEDS

Output

Output Connector: 1 × BNC
Output Coupling[†]: DC Direct ($f_L = 0$ Hz), Offset residue:

Signal Voltage	DC Offset
5 V – 0.5 V	1 mV
0.5 V – 50 mV	100 μ V
50 mV – 5 mV	100 μ V
<5 mV	100 μ V

D/A CONVERSION
 24-bit

UPPER FREQUENCY
 102.4 kHz

OUTPUT VOLTAGE RANGE
 1 μ V_{rms} to 7 V_{peak}

OUTPUT IMPEDANCE
 50 Ω

MAXIMUM INDUCED COMMON MODE VOLTAGE
 5 V_{peak}, DC – 80 MHz

COMMON MODE REJECTION

	Guaranteed	Typical
1 Hz – 1 kHz	50 dB	50 dB
1 kHz – 25.6 kHz	24 dB	30 dB
25.6 kHz – 102.4 kHz	10 dB	20 dB

CROSSTALK
 To any channel (input or output)
0 to 102.4 kHz: Better than –120 dB or better than –90 dB re max. input voltage whichever is greater (worse)
Typical: –150 dB @ 1 kHz

RECONSTRUCTION FILTER
 Provides at least 80 dB attenuation of mirror frequencies

HARMONIC AND SPURIOUS DISTORTION PRODUCTS
 F_{out} 0 – 25.6 kHz: < 80 dB re full range output or 1 μ V, whichever is greater

[†] Output can be single-ended or floating

F_{out} 25.6 kHz – 102.4 kHz: < 70 dB re full range output or 1 μ V, whichever is greater
Typical: 100 dB re full range output @ 1 kHz

OUTPUT NOISE

Output Range	Equivalent Output Noise (10 Hz – 25.6 kHz)		Equivalent Output Noise (10 Hz – 204.8 kHz)	
	Guaranteed	Typical	Guaranteed	Typical
7 mV _p – 70.7 mV _p	3 μ V _{rms}	2.5 μ V _{rms}	15 μ V _{rms}	9 μ V _{rms}
70.7 mV _p – 707 mV _p	10 μ V _{rms}	5 μ V _{rms}	50 μ V _{rms}	20 μ V _{rms}
707 mV _p – 7.07 V _p	50 μ V _{rms}	30 μ V _{rms}	300 μ V _{rms}	100 μ V _{rms}

OVERALL FREQUENCY RESPONSE
 ± 0.1 dB re 1 kHz, over the interval 1 mHz to 25.6 kHz
 $+0.1$ dB/–0.3 dB over the interval 1 mHz to 102.4 kHz
Typical: 0.05 dB

FREQUENCY ACCURACY AND STABILITY
 0.0025% without warm-up (no adjustment necessary)

AMPLITUDE LINEARITY (@ 1 kHz)

	Guaranteed	Typical
0 to 60 dB below full scale	± 0.1 dB	± 0.05 dB
60 to 100 dB below full scale	± 0.2 dB	± 0.1 dB
100 to 120 dB below full scale	± 0.5 dB	± 0.2 dB
120 to 140 dB below full scale	± 1.0 dB	± 0.5 dB

ABSOLUTE AMPLITUDE PRECISION
 ± 0.05 dB at 1 kHz, 1 V_{rms}, 23°C
Typical: 0.005 dB

ANALOG SPECIAL FUNCTIONS:
Analog Self-test: Functional check
DC Offset Adjustment: Analogue and digital compensation

Dimensions

Excluding connectors:
Height: 134.0 mm (5.28 inches)
Width: 42.5 mm (1.67 inches)
Depth: 234 mm (9.21 inches)
Weight: 0.71 kg (1.56 lb.)

Ordering Information 3110

Type 3110: Generator, 2/1-ch. Input/Output Module with BNC/BNT and LEMO connectors

Optional Accessories

Type 2647 Charge to CCLD Amplifier
 JP0145 BNC to 10–32 UNF Plug Adaptor
 JP1040 2 × 7-pole LEMO to 10-pole LEMO for Intensity Probe (Type 2683)

WB1497 20 dB Attenuator
 A wide range of Brüel & Kjær accelerometers, microphones, preamplifiers and sound intensity probes is available for use with a Type 3560 system. These include:

Type 3599 Sound Intensity Probe Kit (includes Remote Control ZH0632)

See also Fig. 3 to Fig. 5 on page 32 to page 34

Ordering Information – PULSE Systems 3560C, 3560D, 3560E

SOFTWARE

Type 7700–Xy* Noise and Vibration Analysis, 1–128 channels

Type 7770–Xy* FFT Analysis, 1–128 channels

Type 7771–Xy* CPB Analysis, 1–128 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 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

OPERATING SYSTEM

BZ 5308–xx Microsoft® Windows® 2000 Small Business Edition without Manuals

BZ 5309–xx Microsoft® Windows® 2000 Small Business Edition with Manuals

BZ 5321–xx Microsoft® Windows® 2000 Professional Edition

BZ 5372–xx Microsoft® Windows® 2000 without Manuals

BZ 5373–xx Microsoft® Windows® 2000 with Manuals

xx specifies country: GB, DE, FR, ES, IT, SE

NOTEBOOK PCs†

UL 0165–xx Rocky II+ Ruggedized PC

UL 0174–A–xx Dolch ruggedized Notebook PC

UL 0175–A–xx Dell® Latitude® High-end Notebook PC

UL 0176–A–xx Dell® Latitude® Standard Notebook PC

UL 0218–xx Dell® Latitude® Mid-range Notebook PC

UL 0220–xx Dell® Latitude® Budget Notebook PC

xx specifies country: GB, DE, FR, ES, IT, SE

TOWER PCs†

UL 0211–xx Dell® Dual P4 Workstation 530

UL 0216–xx Dell® Standard Tower PC

xx specifies country: GB, DE, FR, ES, IT, SE

PC ACCESSORIES

UL 0109 19" HP Monitor

UL 0200 Vehicle Adaptor (12 – 32 V) for Rocky II+

UL 0207–xx Microsoft® Office XP Professional Edition

UL 0208–xx Microsoft® Office XP Small Business Edition

UL 0209–xx Microsoft® Office XP Standard Edition with Manuals

UL 0213 17" Flat Panel Display (secondary display for UL 0211)

xx specifies country: GB, DE, FR, ES, IT, SE

* 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

† PCs are constantly updated. Contact your local dealer for latest information.

Fig. 3 Overview of Portable PULSE Type 3560C, 2-module configuration

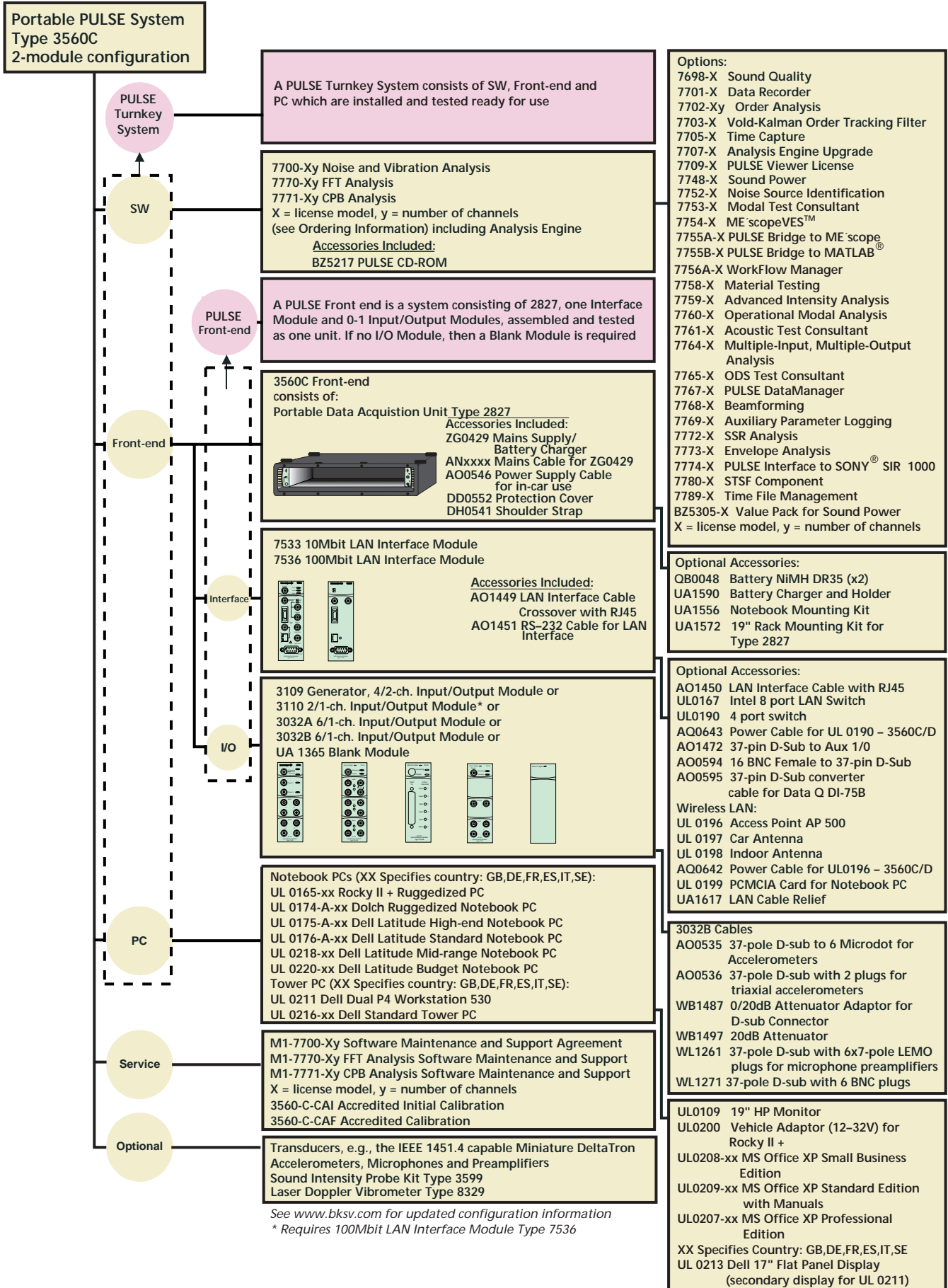
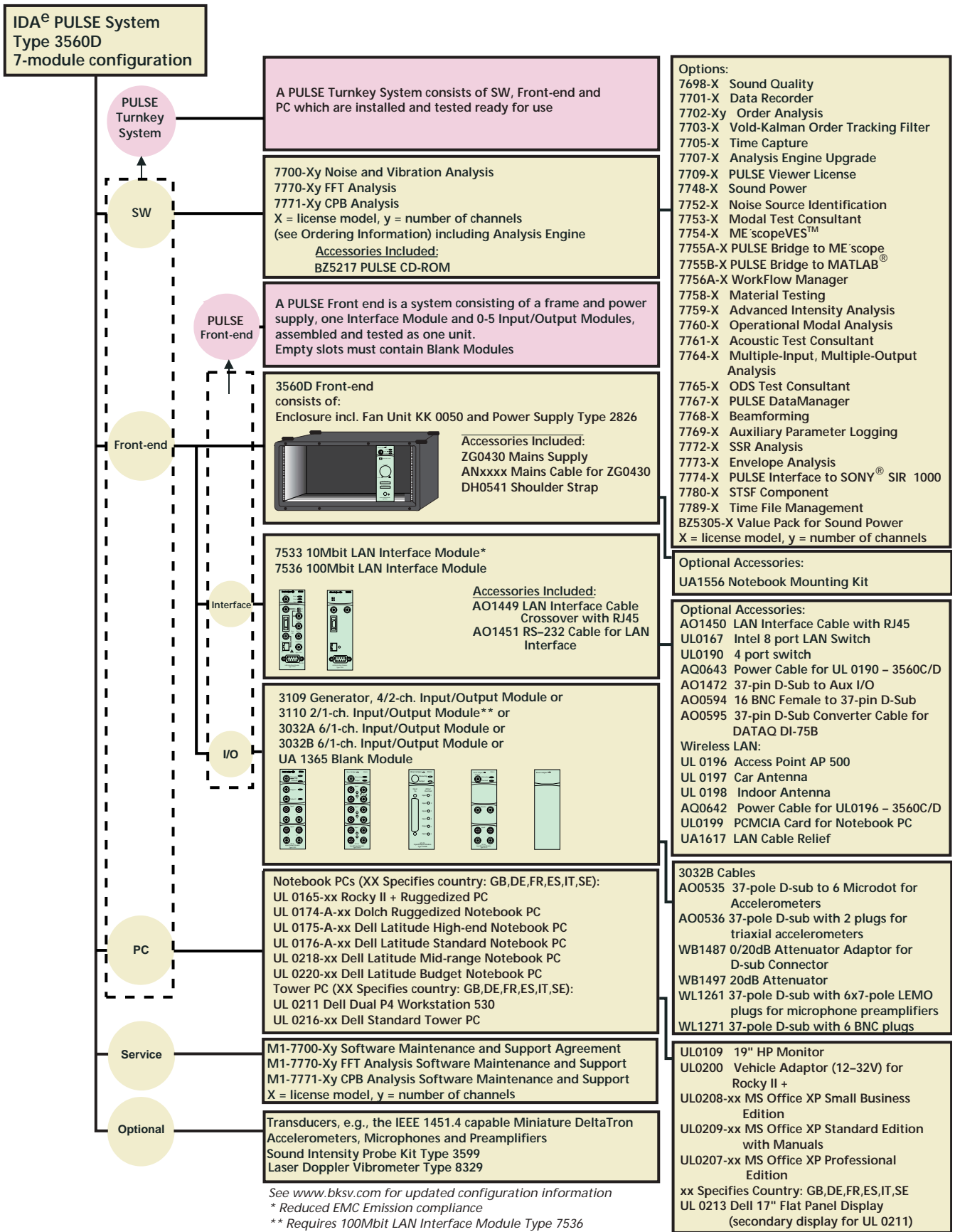
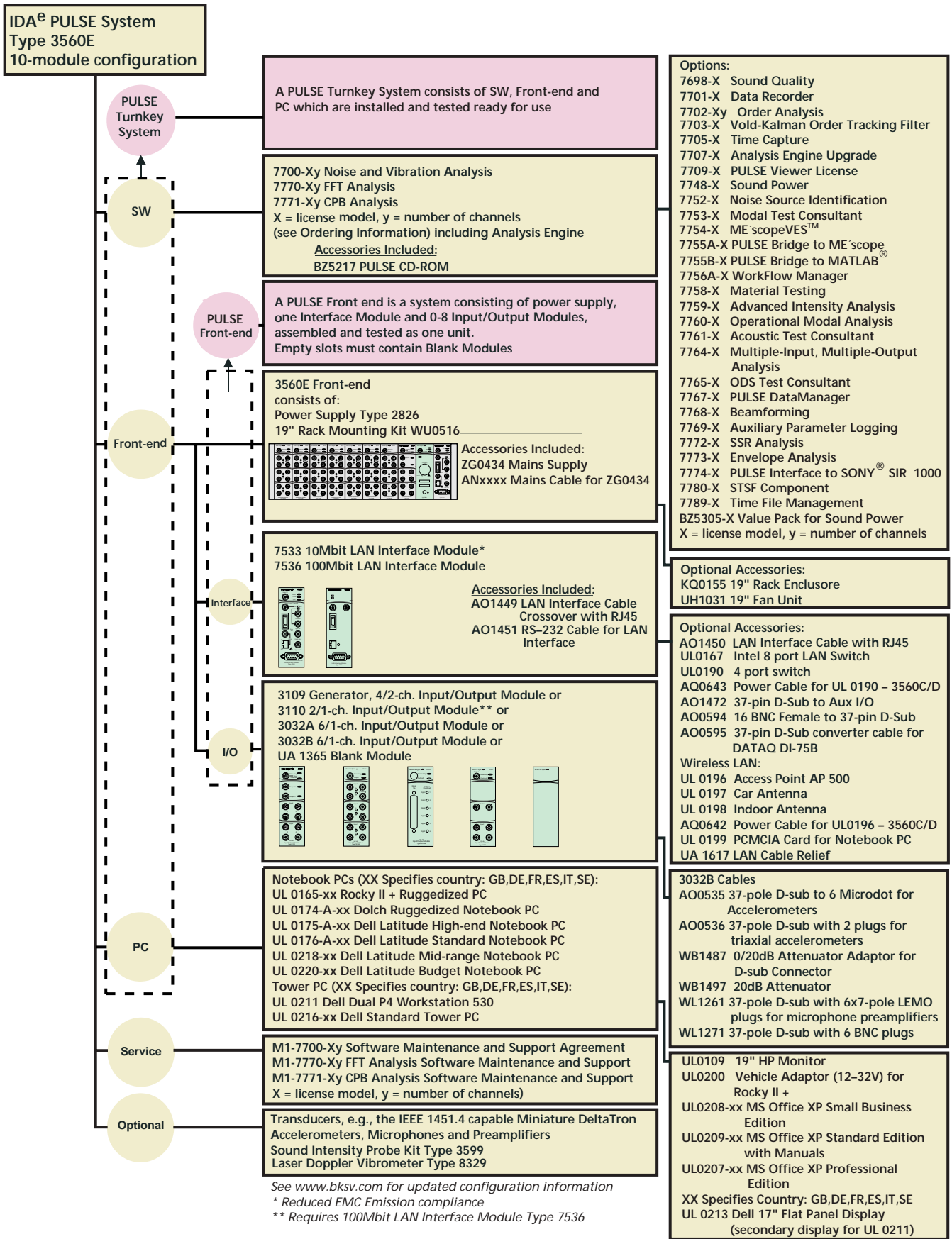


Fig. 4 Overview of Multichannel Portable PULSE Type 3560D, 7-module configuration



010056/3

Fig. 5 Overview of Multichannel PULSE System 3560E, 10-module configuration



PC HARDWARE

AO 1450 LAN Interface Cable with RJ45
 AQ 0643 Power Cable between UL 0190 and Type 3560 C/D
 UL 0167 Intel® InBusiness® 8 port 10/100 Switch for Ethernet
 UL 0190 4-port Switch
 or
 UL 0190-US 4-port Switch (110 V)

WIRELESS LAN (Lucent ORINOCO™)

AQ 0642 Power Cable between UL 0196 and Type 3560 C/D
 UL 0196 Access Point with 1 Wireless LAN PCMCIA Card
 UL 0197 Car Antenna, max. speed 140 km/hr (87.5 mph)
 UL 0198 Indoor Antenna
 UL 0199 PCMCIA Card for Notebook PC

FRONT-ENDS

Type 3560 C Portable PULSE (2-module configuration)
 Type 3560 D Multichannel Portable PULSE (7-module configuration)
 Type 3560 E Multichannel PULSE (10-module configuration)

LAN INTERFACE MODULES

Type 7533 LAN Interface Module
 Type 7536 LAN Interface Module

INPUT/OUTPUT MODULES

Type 3032 A 6/1-ch. Input/Output Module
 Type 3032 B 6/1-ch. Input/Output Module
 Type 3109 4/2-ch. Input/Output Module
 Type 3110 2/1-ch. Input/Output Module*

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 Dell and Latitude are registered trademarks of Dell Computer Corporation

UL 1365 Blank Module

Accessories:

UA 1556 Notebook Mounting Kit
 UA 1572 19" Rack Mounting Kit for Type 3560 C

A wide range of Brüel & Kjær accelerometers, microphones, preamplifiers and sound intensity probes is available for use with a Type 3560 system. The system supports IEEE P1451.4 capable transducers with standardised TEDS

SERVICES

3560-SI1 Installation and Configuration (at Brüel & Kjær)
 M1-7700-Xy† Noise and Vibration Analysis Software Maintenance and Support Agreement
 M1-7770-Xy† FFT Analysis Software Maintenance and Support Agreement
 M1-7771-Xy† CPB Analysis Software Maintenance and Support Agreement

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

See also Fig. 3 to Fig. 5 on page 32 – page 34.

* Type 3110 requires 100 Mbit LAN Interface Module Type 7536

† 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

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

