 USING LAN-XI FOR SOUND AND VIBRATION MEASUREMENTS

Vladimír Hájek

B&K s.r.o., Palisády 20, 811 06 Bratislava, Slovak Republic
bruel@chello.sk www.bruel.sk

Abstract: In this paper the new LAN-XI system is discussed. LAN-XI Data Acquisition Hardware is a versatile system of modular hardware for sound and vibration measurements that can be used as a stand-alone single-module front-end, a multichannel system consisting of a frame with some single-module front-ends or a distributed multichannel system with multiple single-module front-ends located close to each measurement point. With LAN-XI one-cable operation a standard LAN cable can be used for transferring the measurement data, synchronous sampling and system power thanks to Power over Ethernet technology and Precision Time Protocol.

1 Introduction

Recently the multichannel sound and vibration measurements have been difficult to perform because of difficult and time-consuming setup and management of measurement equipment, cables and transducers.

2 LAN-XI - The next generation of acquisition hardware

New generation of Pulse LAN-XI hardware [1], [2], [5] makes it easier than ever to set up the measurements regardless of transducer type, distance between measurement points, and the nature and size of your measurement object. Fewer cables and less hardware means more accuracy, more flexibility and more time.

2.1 Flexible system

The same equipment is used to make a multichannel measurement using several large rack systems with more than 1000 channels one day, and a two-channel measurement using a stand-alone single module the next. Any module is a LAN-XI measurement system [3] in itself and can be used in a rack, as stand alone or in a distributed system – see Figure 1. A LAN-XI system can be configured according to the measurement needs. The number of channels and measurement bandwidth is entirely up to the application. The Gigabit LAN data backbone supports extreme data throughput, and if this is not enough, then the system is designed so that additional networks can run in parallel.

Figure 1. Using LAN-XI system as a distributed system
2.2 One cable operation

Standard LAN cables for synchronous sampling between modules and system power can be used thanks to Power over Ethernet (PoE). This minimizes the number of cables required and results in lower cost, less downtime, easier maintenance, and greater flexibility of installation. The IEEE 1588 Precision Time Protocol (PTP) provides a protocol for synchronizing the clocks of modules in a distributed measurement system, thus providing correlated data acquisition across the measurement transducers.

2.3 Field and laboratory use

With LAN-XI one system does the test job whether it is in the lab or in the field. The modules and the detachable front plates are cast in magnesium for maximum stability, light weight, and tough field use. The modules are fan-less. Less noise means silent operation and less measurement disturbance.

2.4 Intelligent front-end

Each input module has a front-panel display that monitors information on identification and status, has a wide range of overload detection features, and indicates incorrect conditioning. Each module also has its own homepage for storing information. Interchangeable front panels let you decide which cable type to use and make for easy swap of transducers. So less hardware is needed.

3 Extension of dynamic and frequency ranges

Brüel & Kjaer PULSE LAN-XI [3], [4], [5] seamlessly integrates unique technologies such as Dyn-X and REq-X. As a result, easy setup, no overloads, an expanded frequency range, and optimum all-round performance save not only time but also provide accurate measurement results first time. The input modules support TEDS (Transducer Electronic Data Sheets).

3.1 Extension of dynamic range – Dyn-X

Dyn-X are innovative state-of-the-art input modules with a useful analysis range exceeding 160 dB. With Dyn-X technology [7], the entire measurement and analysis chain, for the first time, matches or outperforms the transducer used for measurement. This eliminates the need

![Figure 2. Comparison of Dyn-X input module and standard 24-bit input module for sound measurements](image)
for an input attenuator for ranging the analysis-system input to the transducer output. In Figure 2., a noise measurement example [5] is shown. The measurement is performed in a standard office environment with background speech and a person whistling. The measurement clearly illustrates the improved dynamics of the Dyn-X input channel when compared to a standard 24-bit input channel. The difference is close to 30 dB above 4 kHz. The 24-bit standard input channel is measuring system noise instead of environmental office noise.

In Figure 3., the Dyn-X input channel is compared to the 24-bit standard input channel for a 1 kHz sine wave attenuated 150 dB corresponding to a signal level of 0.22 µVrms [5]. The noise floor and the spurious components are below –160 dB for the Dyn-X input channel and the sine wave is easily detected. For the standard 24-bit input channel, the sine wave is buried in noise.

### 3.2 Extension of frequency range – REq-X

REq-X - Response Equalisation eXtreme is a new technique that flattens the frequency response of a transducer (accelerometers and microphones) in real-time. Response Equalisation is done by filtering the time signal of a transducer by the inverse of the frequency response. Response Equalisation can be added to any transducer with a frequency response stored in the Transducer Database, and to all TEDS accelerometers. Response Equalisation extends the frequency range in which the transducer can be used – and improves the accuracy of the measurement. This also means that you can use the same microphone for different sound fields – free field, pressure-field, and random. What’s more, the microphone can be corrected for various microphone accessories (for example, windscreen) and a better accuracy obtained. Until now when measuring vibrations it has been recommended only to use an accelerometer up to a third of the resonance frequency. Now [4] the upper frequency can be extended by up to 50% - see Figure 4.
4 Conclusion

Brüel & Kjaer PULSE LAN-XI hardware with unique technologies provides easy setup and accurate measurements. Here are the main benefits it brings:

- **LAN-XI** ensures sample-synchronous measurements over the same LAN connection used for transferring the measurement data. Less cabling is required so less time used for setting up a measurement system and highly accurate measurements are possible over long distances with only a LAN connection.

- Support of TEDS allows automatic detection of attached transducers based on information stored in the transducer electronic data sheets. TEDS information includes sensitivity, serial number, manufacturer and calibration date. It provides easy management of multiple transducers without setup errors.

- **Dyn-X** expands the dynamic range to a one single range from 0 to 160dB. Covering everything in one input range, you no longer have to worry about overloads, underranged measurements or discussions about the validation and verification of measurement results. There is no need for trial runs in order to ensure that the input range is correct, you have a far greater certainty of getting measurements right first time.

- **REQ-X** extends the frequency range of existing transducers, it improves the measurement accuracy and it expands the use of existing microphones that you can use the same microphone for different sound fields.

References