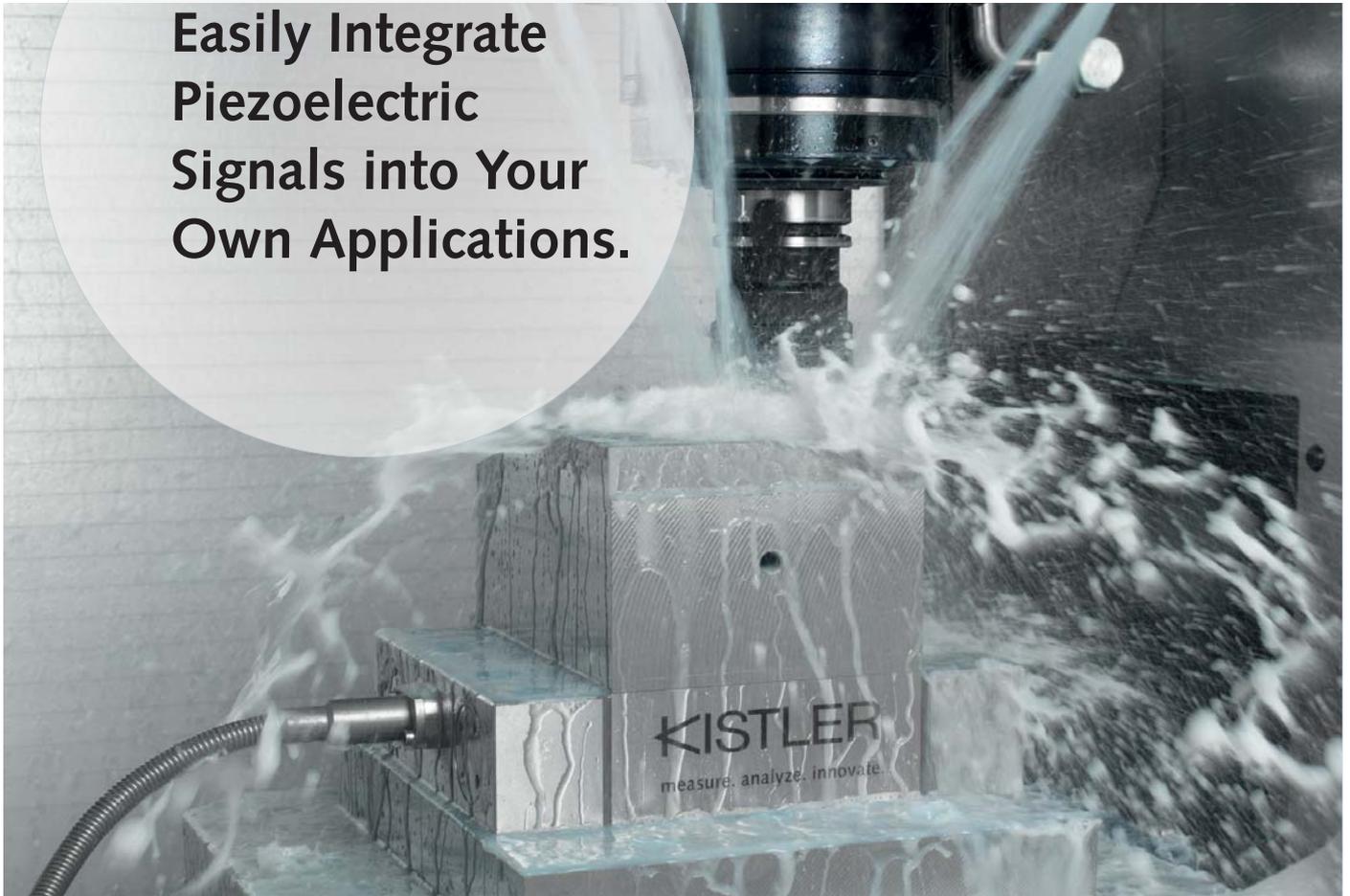


KISTLER

measure. analyze. innovate.

**Easily Integrate
Piezoelectric
Signals into Your
Own Applications.**



Piezoelectric Measurements with CompactRIO™

Optimizing Metal-Cutting Processes for Industry 4.0

Piezoelectric measuring technology offers an extremely wide high-resolution measuring range – making it a highly attractive choice for research, development and laboratory applications. No matter whether you need to measure force, pressure, torque or acceleration: Kistler's solutions support simple integration of piezoelectric sensors in CompactRIO™, the real-time control and data acquisition platform from National Instruments. The Laboratory for Machine Tools and Production Engineering (WZL) at Aachen's Rhine-Westphalia Technical University (RWTH) relies on technology from Kistler to record the process forces that occur during metal-cutting; thanks to direct integration, the laboratory has been able to cut its development outlay significantly.



The charge amplifier module Kistler Type 5171A for CompactRIO™ in use

For decades, the Laboratory for Machine Tools and Production Engineering (WZL) at Aachen's Rhine-Westphalia Technical University (RWTH) has focused with great success on pioneering research in production technology. The Laboratory's four professorial departments carry out fundamental research and develop innovative solutions to rationalize industrial production. Various research projects at the WZL rely on technology from Kistler – and the Laboratory utilizes the advantages offered by the simple integration of piezoelectric signals into commonly used software and hardware platforms.

Benefits of Piezoelectric Measuring Technology

Piezoelectric sensors feature an extremely wide and high-resolution measuring range; their rigidity makes them ideal for highly dynamic processes, and they can even be used at extreme temperatures. For force measurement, a piezoelectric sensor covers up to three measurement ranges as compared to strain gage technology. This means – to take one example – that a single sensor can accurately measure forces ranging from a few newtons to one meganewton.

Easily Integrated into NI CompactRIO™

With Kistler's Type 5171A charge amplifier module, users can benefit directly from the advantages of piezoelectric measurement technology in CompactRIO™, the real-time control and data acquisition platform from National Instruments. Until now, piezoelectric sensors were integrated by using external amplifiers that have to be supplied and configured separately. Digitization of voltage signals requires additional, circuitous analog lines to the data acquisition module. The measuring range of the new charge amplifier module is subdivided into four sections, from $\pm 1,000$ to $1,000,000$ pC. Direct 24-bit digitization in the module has a positive impact on signal quality and noise behavior.

Process Data Acquisition and Test Bench Construction

In the Laboratory for Machine Tools at the RWTH Aachen University, high-resolution piezoelectric sensors have been used for decades to acquire process data or build complex test benches and application-specific demonstrators for practical use in industry.



'Direct integration of these highly versatile charge amplifier modules in the CompactRIO™ controller delivers many benefits: potential error sources are eliminated, configuration of the entire measuring chain becomes simpler, and major potential for automating our research activities can be tapped to enhance repeat accuracy and precision.'

Benjamin Döbbeler, Head of the Cutting Technologies Department

Laboratory for Machine Tools and Production Engineering (WZL) at RWTH Aachen University,
Steinbachstr. 19, D-52074 Aachen, www.wzl.rwth-aachen.de

With the highly complex Industry 4.0 systems of the future in mind, simple integration into commonly used software and hardware systems is an important issue here. The aim is to merge the piezoelectric signals with other sources of signals and information so that increased information content is generated in conjunction with adaptive evaluation algorithms.

Minimal Development Outlay – Maximum Abstraction

In research projects, it is important to minimize development effort while maintaining the required level of abstraction. This can be achieved with the LabVIEW™ graphic programming language and NI's reconfigurable CompactRIO™ system platform. Thanks to high-level system design, this approach enables product developers and system or process specialists to arrive at solutions quickly – with no need to forego functionalities such as FPGA and real-time behavior.

Generating Process Models

Kistler's Type 5171A charge amplifier module for CompactRIO™ is currently deployed in various research projects at the Laboratory for Machine Tools. For example, it is used on a five-axis milling center in a demonstrator to generate process models automatically via a highly complex control system. In this case, the module handles the acquisition of process forces. Frequency-dependent pre-processing and a monitoring function (implemented directly in the FPGA) ensure effective protection for the tool, the machine tool and the measuring system, by means of a rapid feed reaction or an emergency stop in case of disruptions to the process. Direct integration has led to a substantial reduction in development outlay, thanks to the elimination of the communication and control lines needed to control and parameterize the charge amplifier (and the software modules required for them).

Versatile Range of Applications

Applications for a CompactRIO™ with Kistler's Type 5171A charge amplifier module are by no means limited to cutting force measurements: in fact, they range from plastics processing (e.g. injection molding) to joining applications in assembly technology. In future, control of the machines involved could be handled entirely by a CompactRIO™. Especially in forming processes such as deep-drawing and punching, process monitoring systems are often indispensable. Because of the high forces involved, the majority of such applications use force shunt measurements or indirect force measurements via strain sensors and transverse or longitudinal measuring pins.

Maximum Flexibility for Research and Development

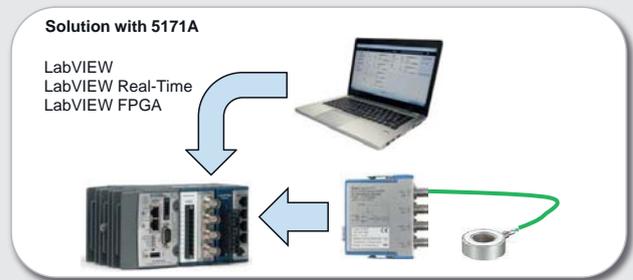
Kistler's versatile measuring equipment can be used for a wide range of research, development and laboratory applications. Whether the situation calls for mobile data acquisition, process monitoring or smaller-scale test bench systems – our flexible modular portfolio offers a wide variety of applications.

Easily Integrated into NI CompactRIO™

With Kistler's Type 5171A charge amplifier insert, piezoelectric force, pressure or acceleration signals can be used directly in real-time applications with a CompactRIO™ system.



The 24-bit charge amplifier module is available as a one- or four-channel model



PE integration in CompactRIO™ with no circuitous wiring

Benefits of Piezoelectric Measurement with the Kistler Type 5171A

- Wiring effort is minimized
- No need for an additional power supply
- Simple to configure and operate
- No need for an additional voltage input module
- Applications with large numbers of channels are easy to implement

More information on the application

www.kistler.com/5171A

LabVIEW™ and CompactRIO™ are registered trademarks of National Instruments Corporation.

Kistler Group

Eulachstrasse 22

8408 Winterthur

Switzerland

Tel. +41 52 224 11 11

Kistler Group includes the Kistler Holding AG and
all its subsidiaries in Europe, Asia, Americas and Australia.

Find your local contact on
www.kistler.com

KISTLER
measure. analyze. innovate.