

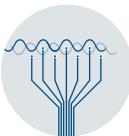


Robust and Cost-Effective Unsteady Pressure Measurement



Resono's unsteady pressure measurement system, Chronos™, combines state-of-the-art data acquisition hardware with novel signal-processing algorithms to improve the productivity of your aerodynamic test and measurement applications. Chronos™ reduces instrumentation and model preparation cost, decreases downtime, and ensures reusability of expensive system components in your wind tunnel and field-testing applications.

Resono's proprietary algorithms address the pneumatic distortion of pressure tap/tubing/transducer systems, enabling well-established pressure scanning systems to be utilized for unsteady pressure measurements in aerodynamic applications without repeatedly replacing expensive fragile equipment. The Chronos™ system allows for accurate unsteady pressure measurements at a fraction of the cost. That's money and time saved with every test.



Make use of the same tap/tubing setup for both steady and unsteady measurements, reducing preparation time.



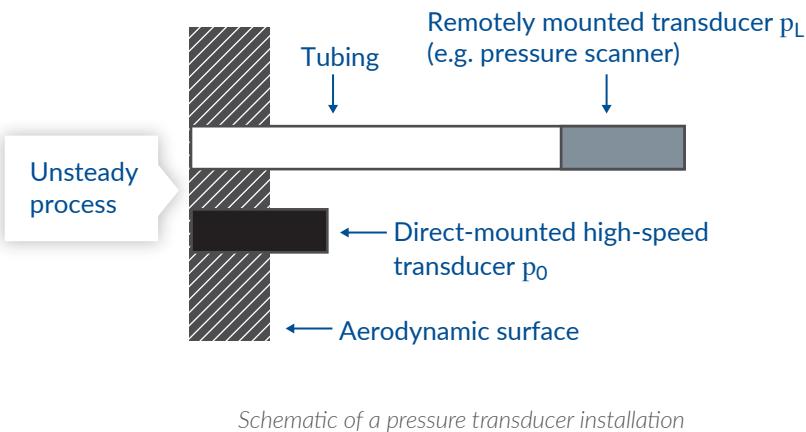
Utilize robustness of pressure scanning technology in challenging applications.



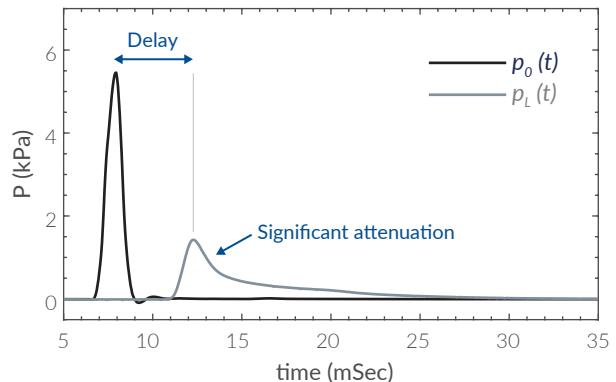
Take advantage of additional flexibility in test design and instrumentation.

Technical Summary

The robust and precise measurement of unsteady surface pressure distribution is paramount for the comprehensive characterization, accurate modeling, precise prediction, and effective control of agile aircraft systems in the present era. However, instrumentation engineers have long grappled with the challenge of capturing time-resolved unsteady pressure measurements at a substantial number of ports, often in the hundreds, while maintaining the highest levels of accuracy and reliability during wind tunnel experiments and flight tests. Our innovative solution revolutionizes unsteady pressure measurement, offering an unparalleled solution to this long-standing problem.



Schematic of a pressure transducer installation

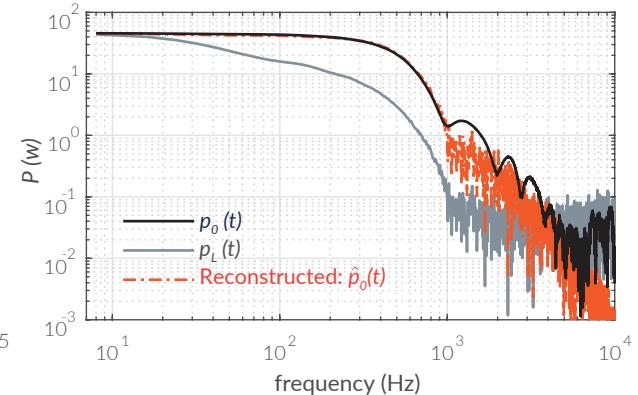
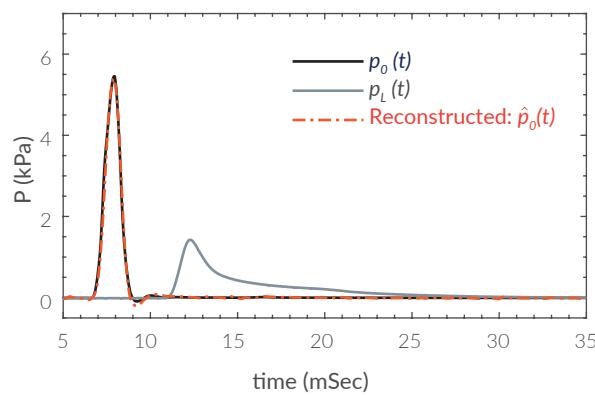


System response for a long tubing system in time domain

Our technology revolutionizes tubing response characterization, tackling pneumatic distortion and system noise with unparalleled precision. Through the integration of state-of-the-art data acquisition electronics, an advanced digital signal processing software, and an ingenious in situ tubing response calibration system, we have unlocked the ability to reconstruct distorted unsteady pressure signals with exceptional accuracy. Experience the power of our innovative solution, capable of resolving pressure fluctuations up to 1kHz across long pneumatic lines extending up to 1 meter. This breakthrough captures the vital physics of diverse aerodynamic flows, delivering important data insights.

We are dedicated to enhancing our algorithms and signal processing toolsets to improve our products and services continuously. Furthermore, we are actively developing techniques to quantify measurements and signal reconstruction uncertainties. This ensures that we provide precise and dependable measurements for your aerodynamic application.

System response for a long tubing system (length = 1.3 m, internal diameter = 0.81 mm) in time (left) and frequency (right) domains. The corrected signal, using Resono's technology, is shown in orange.



Chronos™ System Specifications

Physical Specifications

| | |
|-------------|--------------------------------|
| Dimensions: | 19x17x7 inches (4U rack mount) |
| Weight: | 35 pounds |

Network Specifications

| | |
|--------------------|--|
| Network interface: | 1000BASE-T Ethernet |
| Compatibility: | IEEE 802.3 |
| Number of ports: | 2 |
| Net0: | RJ45 CAT6 Communications/ Data Port |
| Net1: | RJ45 CAT6 External Timing Synchronization Source |

Electronically Scanning Pressure Sensor (ESP)/Auxiliary Input Specifications

| | |
|--------------------------------|--|
| Type of scanners supported: | Measurement Specialties (TE Connectivity) DTC Scanners (ESP 64HD, ESP 32HD, MicroScanner 16MS) |
| ESP receptacle: | ITT Cannon Micro-D Metal Shell (MDM) 15-pin Connector |
| ESP cable: | TE Connectivity PSCB (Lengths from 1 to 150 feet) |
| Scanner/aux measurement range: | +/-10 V differential |
| ADC resolution: | 16-bit resolution |
| Scanner scanning rate: | 32 kHz |
| Auxiliary sampling rate: | 100 Hz, 1 kHz, 10 kHz, 32 kHz, 50 kHz, 100 kHz |

Operating System

Windows 10 or 11, 64-bit Intel/AMD

Time Synchronization

IEEE 1588-2008 (PTP v2)

Trigger IN/OUT Specifications

Input/output type: TTL, single-ended

Voltage input: -0.25 V to 5.25 V

Features & Benefits

Robust pressure scanning technology is used for unsteady measurements

- ✓ Perform tests on different models without the need for new transducers.
- ✓ Eliminate cost & downtime from malfunctioning and failed transducers.
- ✓ Integrate with existing tap/tubing systems, including tap/channels in 3-D printed models.

Tap/tubing system response is determined with a simple process

- ✓ Fully characterize tubing response and perform leak checks in one step.

Steady/unsteady pressures are measured at up to 256 locations with a single Chronos™ system

- ✓ Base your measurement resolution on what is needed to answer your research questions.
- ✓ Decrease your per-channel cost of unsteady measurements.

Unsteady pressure measurements are synchronized with other flow-field or model measurements

- ✓ Gain additional insight on flow from coordinated unsteady pressure measurements.

Unsteady pressures and their uncertainty are reconstructed on multiple channels quickly

- ✓ Replace costly, repeated hardware purchases with reconstruction process.
- ✓ Focus on testing while leaving the analysis to our expert system software.

Primary Components

Pulsar™

A compact handheld device that enables test engineers to characterize the dynamic response of any tap/tubing system.

Presa™

A data acquisition system that interfaces with the Pulsar™ and your existing scanners to unlock the full measurement capability of pressure scanners beyond the existing steady-state measurements.

Pmax™

A software package that provides ultimate flexibility and ease of use in pressure data acquisition and processing. Pmax™ utilizes Resono's algorithms to compensate for latency and distortion caused by the varying length of tubing lines connected to pressure scanners in your test facility.

Presa™ API

The Presa API is a partner API that we provide to our customers using LabVIEW™ accompanied with a comprehensive list of commands and queries. Other languages can be used to interact with Presa provided that they can send and receive data over TCP.

