PRESCO ENGINEERING

Predictive Product Development

8 Lunar Drive | New Haven, CT | 06525 | 203.397.8722 | www.prescoinc.com

Who are we?

WE ARE PRESCO ENGINEERING

For over 40 years, we have been helping technology companies successfully bring new products to market.

We are experts at high-performance instruments for an array of applications.

ELECTRONICS • SOFTWARE • MECHANICAL
INDUSTRIAL DESIGN • PROTOTYPING • MANUFACTURING

TECHNOLOGY DEVELOPMENT PARTNER TO OVER $1 BILLION IN EXITS

WE HELP CLIENTS INNOVATE AND BRING BREAKTHROUGH PRODUCTS TO MARKET

When do we get started?

LET'S TALK TODAY

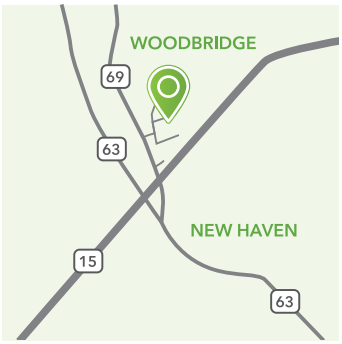
Have a project waiting in the wings? Need to outsource something immediately? We're here and ready to talk when you are!

203.397.8722

Info@prescoinc.com
www.prescoinc.com

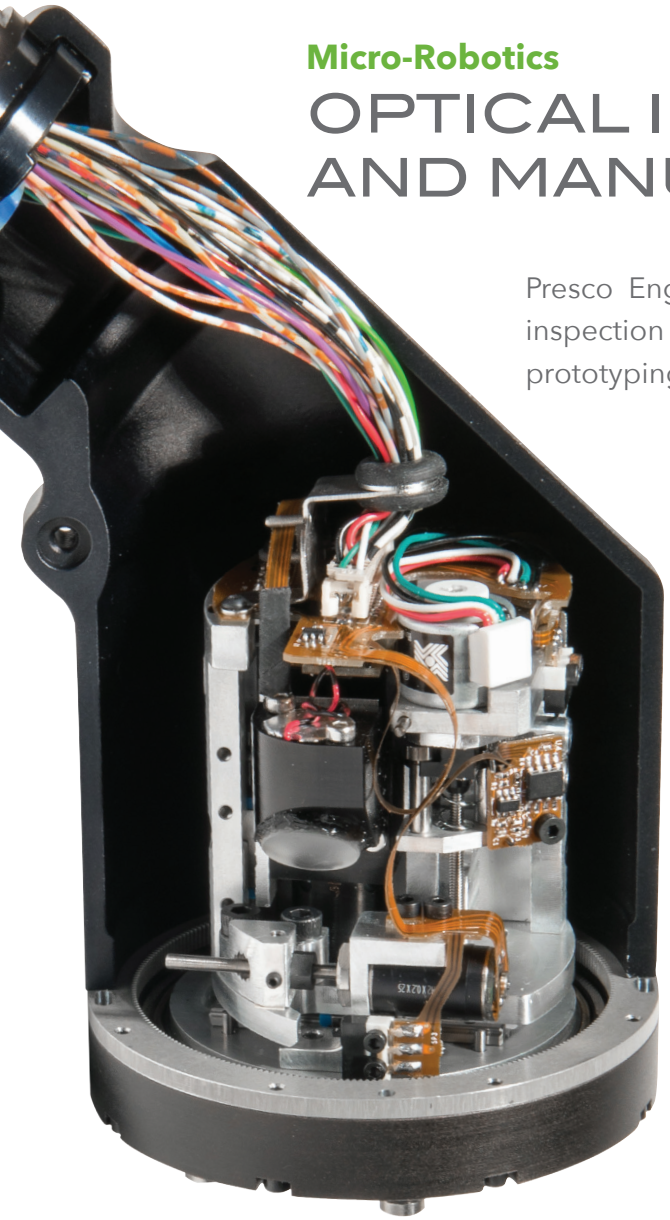
Come visit our renovated office if you're in the area:

8 Lunar Drive
New Haven, CT 06525



Micro-Robotics

OPTICAL INSPECTION DESIGN AND MANUFACTURING



Presco Engineering developed a miniature robot for an optical inspection and cleaning system. Presco's work included design, prototyping, and manufacturing of pre-production units.

- Automated Functions for:
  - Inspection
  - Cleaning of Ganged Fiber Optic Connectors
- Five Axes of Motion
- 50 Micron Positional Accuracy
- Small Size for Installation in Tight Locations

Actual Size

This particular device is designed to ease the inspection and cleaning of fiber optic connectors located in difficult-to-access areas of equipment. A key requirement was small size to allow installation in tight locations and on panels with multiple adjacent connectors.

Presco's robot, with its three-inch diameter and coffee-cup-sized design, is a central element of the low-profile AVIT-rh product. It was designed to meet a number of FiberQA requirements including: small size, high-motion resolution, and excellent repeatability. The miniature stepper motors and R-Theta motion provide resolution better than 25 microns in both radial and rotational axes. To enable the small size and support motion in five axes, Presco designed and fabricated a custom flexible printed circuit to power motors, sensors, and a specially-designed optical microscope. Combined with the FiberQA imaging and processing software, the tool enables reliable detection of optical defects as small as 1.5 microns in diameter.

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DNA Sequencer

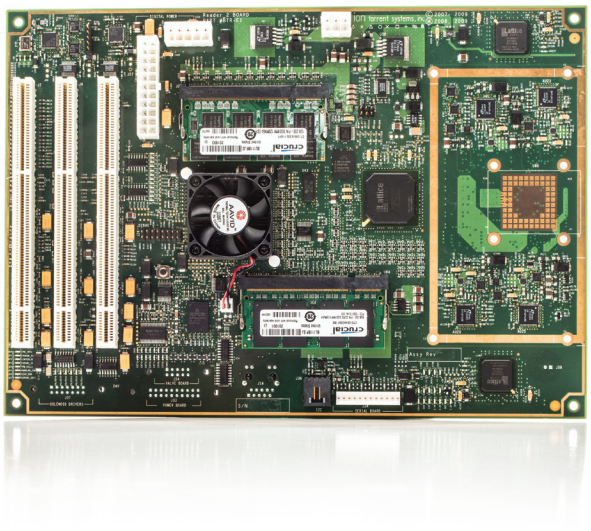
REACHING THE THEORETICAL NOISE FLOOR

Presco was challenged to capture ultra-faint hydrogen ion signals generated during DNA nucleotide incorporation. The problem was high bandwidth (1 GHz x 16 bit aggregate sample rate) and a noise floor very near the theoretical limit. An unusual factor was that the long observation time of this experiment stressed 1/f noise performance in addition to the usual thermal noise limits.

Prototype circuitry was developed and tested in an astonishing four months.

Requirements

- Custom ASIC Chip Reader
- 3 Millions Simultaneous Experiments
- 32-Channels @ 50MHZ
  - Inconsistent DC Offset
- Ultra-low Noise Floor
- Fluidics Control



Implementation

- Electronic and Firmware Development
- 640Msps by 16-bit ADC
- 1uV Noise Floor
- FPGA-Based Lossless Data Compression
- PowerQUICC III Processor with DDR
- Linux Operating System
- Custom Device Drivers
- Gigabit Ethernet
- Touchscreen

*Extraordinary low-noise performance and speed to market were two factors that helped our client get acquired for **$750M** shortly after product introduction.*

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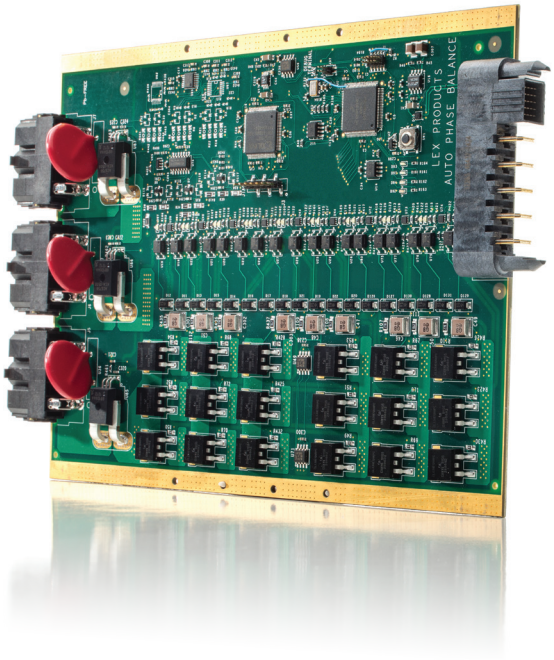
Mil-Spec Power Electronics

3-PHASE AC LOAD BALANCING SYSTEM



Designed for military use, the requirements for this system posed many challenges: seamless phase switching for all types of loads, passive thermal management, and zero single-point failures. Presco developed a complete electronics and software package, including an innovative phase switching technique, and a patent-pending thermal management solution.

Electronic Design

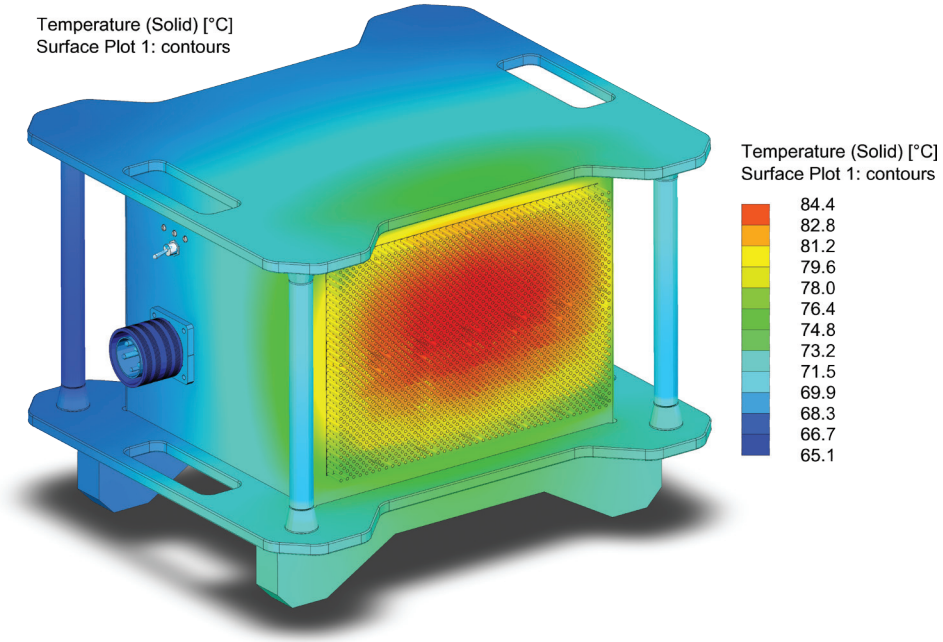
- 40A 3-Phase Generator Input
- 12, 20A Single-Phase User Outputs
- Innovative Zero Switch Time Phase Rotation

Firmware Development

- Multiple ARM Processors with CAN Bus Communications
- Embedded Web Server for Configuration and Status
- Custom Lightweight, Thread-Safe Database

Thermal Management Solution

- -40 to 60°C Ambient Plus Sun Loading
- Metal Backing Plates with Integrated Heat Pipes
- Patent-Pending Design



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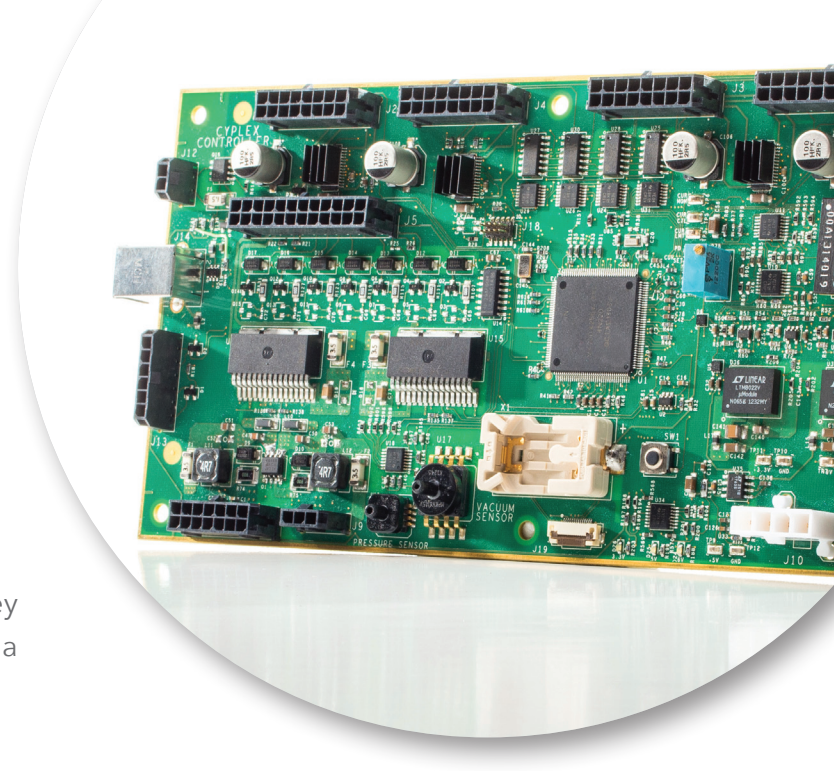
Embedded Controls

MULTI-ANALYTE IMMUNOASSAY INSTRUMENT



CyVek Inc. selected Presco as their design partner for a ground breaking high-speed immunoassay instrument. Starting with off-the-shelf components, CyVek developed a proof-of-concept prototype to confirm their methodology. Then they challenged Presco to design all-new electronics with a much smaller footprint and lower cost.

- Electronic and Firmware Development
- USB Communications
- Dual Temperature Control
- Hardware-Regulated Laser Power Control
- Three-Axis Motion Control
- Valve and Vacuum Control
- Precision Valve Timing Through Software Scripting

*This startup was acquired by Bio-Techne for **$60M** with a potential total earn-out of **$195M**.*

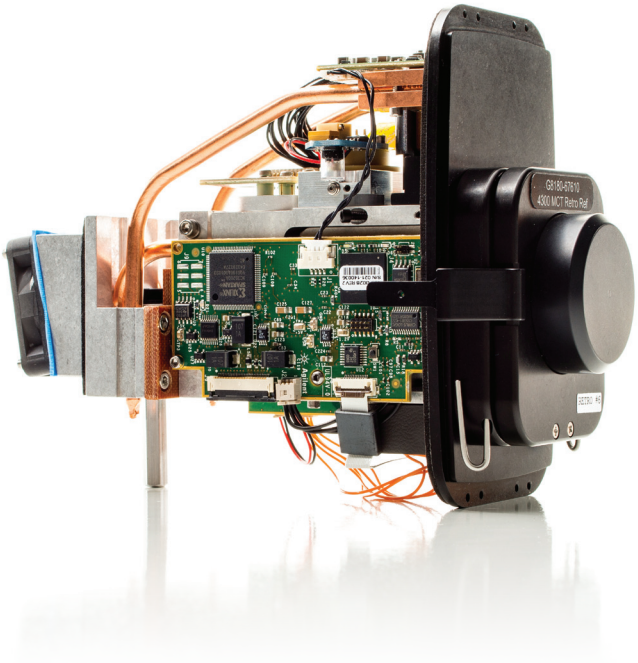
The result was a custom single-board data acquisition and control module which interfaced to a wide variety of peripherals. Presco's software team wrote the embedded code to execute complex control sequences based on high-level commands from a personal computer. This real-time software controls multiple machine axes independently while maintaining high sequencer throughput and sub-millisecond valve timing. The code also implements multiple servo loops for temperature and laser control as well as internal data logging to facilitate performance optimization.

Embedded System Design

HANDHELD SPECTROMETER

Working with one of the leading global providers of scientific measurement tools, Presco helped to develop a next-generation handheld spectrometer. Due to packaging constraints, the electronics were partitioned amongst several circuit boards, making use of all available space.

- Torpedo DM3730 System on Module (SOM)
- Employed Package-on-Package (POP) Technology
- Connected to Color Touch Screen Display Running Windows CE

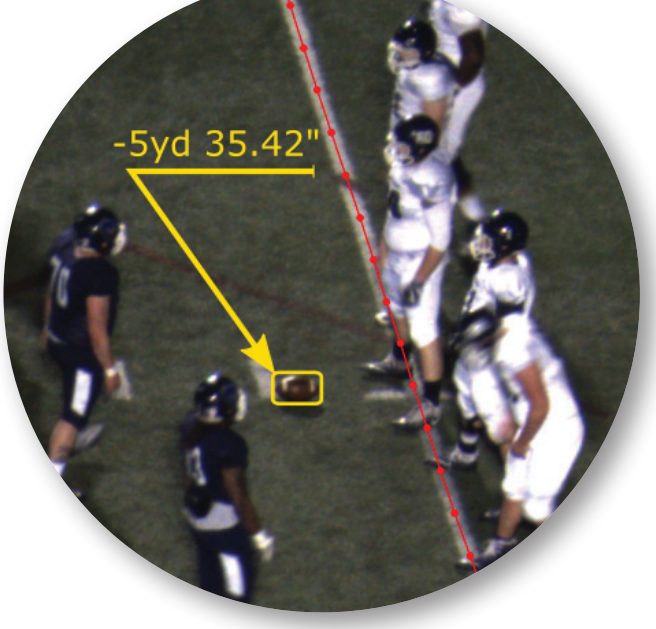


- Three Kinetis K10 ARM Cortex-M4 Processors
- PID Control Loop Regulating Temperatures to 0.005°C
- Smart Battery System (SBS)
- Interface with:
  - RFID Reader
  - Thermoelectric Cooler (TEC)
- Xilinx Spartan-6 FPGA
  - High-Speed Data Manipulation, Compression, and Transmission

Integrated Controller Area Network (CAN) transceivers were used for inter-processor communications and synchronization, employing a multi-channel messaging layer developed in-house. The system also featured Presco's proprietary firmware update library, which provides reliable firmware update capabilities through virtually any interface including CAN, I2C, Ethernet, Modbus, and Serial.

Cutting Edge

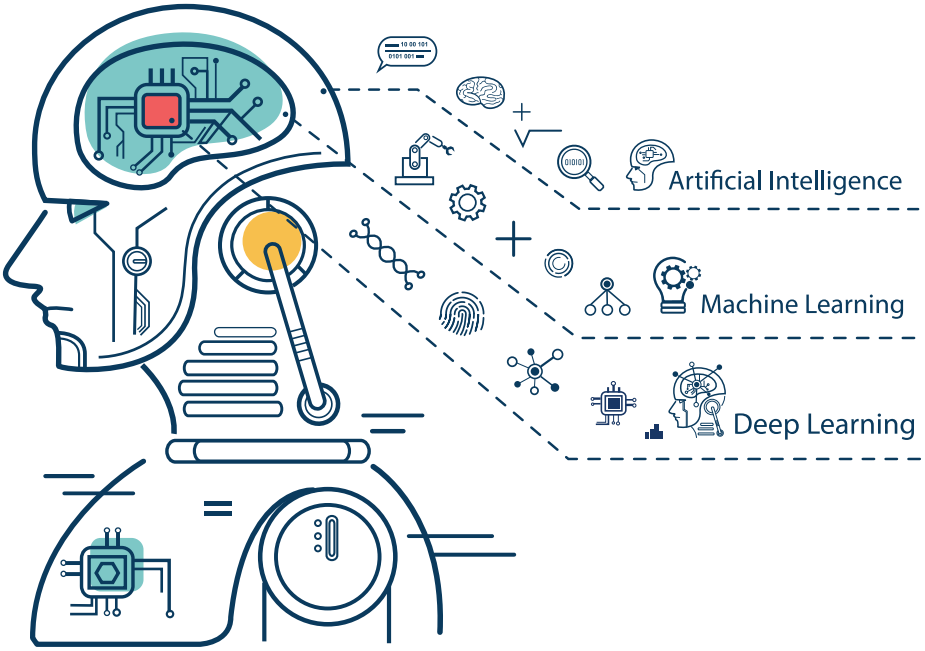
DATA PROCESSING & ANALYTICS



For decades, Presco Engineering has utilized advanced data processing techniques to help solve our clients' most difficult problems. Experienced with various machine learning and image processing frameworks, we are experts at designing, developing, and deploying advanced data processing solutions.

Advanced Data Processing

- Digital Signal Processing Experts
- Advanced Algorithm Development
- Neural Networks and Deep Learning
- High-Performance Real-Time Analysis
- GPU and FPGA Acceleration



Machine Learning / AI

- Multiple Frameworks (TensorFlow, Caffe, MxNet)
- Intelligent Dataset Annotations
- Model Optimization
- Deploy Models on Edge Devices
- Real-World Applications
  - High-Speed Optical Character Recognition (OCR)
  - Acoustic Recognition and Classification
  - Real-Time Object Detection and Segmentation

Image & Video Analysis

- Multiple Frameworks (OpenCV, MATLAB, AForge)
- High-Speed Data Acquisition
- Support for FPGAs and LabVIEW
- Specialized Algorithm Development
- Feature Extraction and Classification
- Object Detection and Segmentation

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Thermal Device Design Challenge

VAGINAL REMODELING

As part of their woman's health initiative, Presco's client approached us with the goal of improving the clinical safety and efficacy of applying RF energy to the external and internal anatomy of the vagina with a unique probe design and software control. Presco worked with their client and MDs to fully understand the opportunities and limitations.

Presco designed injection molded parts using high temperature medical grade materials to achieve a sealed, autoclavable wand. We paid careful attention to the thermal interface between the RF electrode and the internal temperature sensor. This is critical to allow optimal treatment and ensure patient safety.

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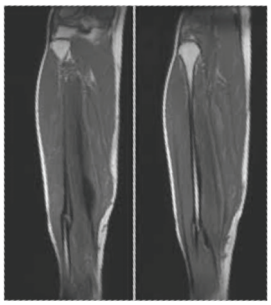
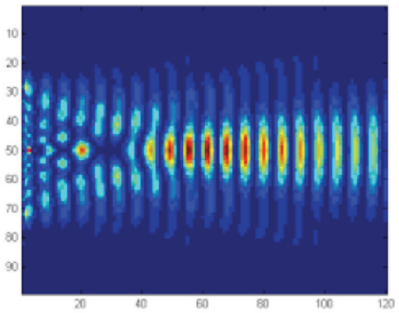
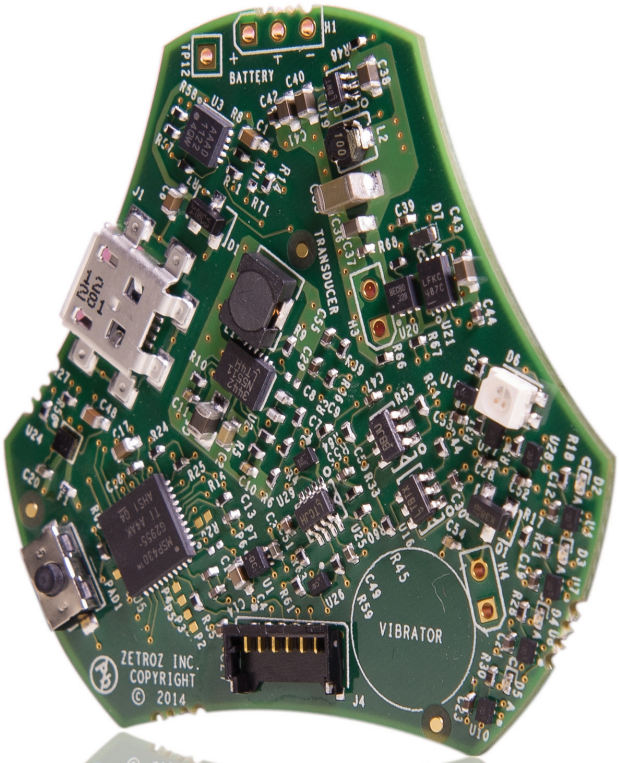
Chronic Pain Mitigation

WEARABLE ULTRASOUND THERAPY

Presco helped our client develop the first multi-hour wearable ultrasound therapy to increase local circulation and accelerate transport kinetics to injured tissues for faster recovery time. We created the smallest functional ultrasound system for pain management and rehabilitation in existence, delivering 1.3 W of low-intensity ultrasound energy at a multi-megahertz frequency to accelerate biological healing processes and reduce pain. This approach is now being used to treat conditions including acute and chronic tendinopathies, muscle strain or spasms, and pain associated with osteoarthritis of the knee.







Presco was instrumental to writing the embedded software that operates the device and providing a complete documentation package to secure an FDA 510k clearance. Presco's internal processes have been designed around FDA submission including compliance with design controls per 21CFR 820.30.

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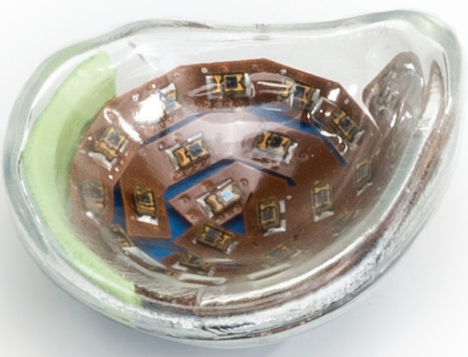
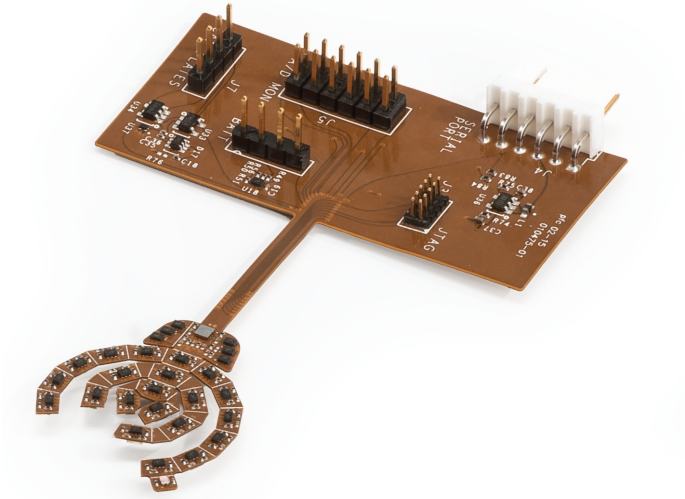
Next Gen Smart Tracking

OCULAR PROSTHESIS



Presco is working with Memorial Sloan Kettering Cancer Center, a world-leading cancer institute, to develop an ocular prosthesis with an electronic display that displays a realistic image to match the remaining biological eye. In order to implement this functionality, Presco developed an innovative orientation sensor to identify the location of the underlying muscles, employing an infrared beacon that is wirelessly energized by the prosthesis. An array of 21 ultra-sensitive optical detectors within the prosthesis triangulates this beacon. Packaged within the prosthesis are a 2x2 mm microprocessor, display driver, battery, battery charger as well as wireless charging receiver circuitry.



Twelve thousand patients a year lose an eye in the U.S. from accidents, infections, cancer, congenital anomalies and advanced ocular conditions such as diabetes and glaucoma. It is estimated that a quarter of a million Americans already have prostheses, and millions are estimated to have such prostheses or are in need of such prostheses worldwide. Current prosthetic eyes can have a good appearance in photographs, but have limited or no movement and therefore do not appear realistic when the patient attempts to move his or her eyes. Also, conventional prostheses do not have pupils that respond to light. Therefore, such prostheses are a daily reminder of an obvious deformity and lead to insecurity of the patient, a reluctance to be seen in public, a feeling of inferiority, and unhappiness.

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R&D Problem Solving

SURGICAL STAPLER

Presco is particularly adept at helping clients solve difficult technical problems. Our cross-functional team brings a wealth of product development experience to the table, with an emphasis on understanding the underlying physics. Often we are called upon to rescue a project that is stalled due to a technical issue.

One such recent project was for a major manufacturer of surgical devices. Their battery-powered instrument contained a processor and FPGA which communicated via Serial Peripheral Interface (SPI), a widely used standard. They were suffering from sporadic errors where the FPGA would become unresponsive. This problem had been known about for months but they had not been able to identify its root cause. We were able to engage to the project for less than 10 days and we identified both the root cause and developed a solution.

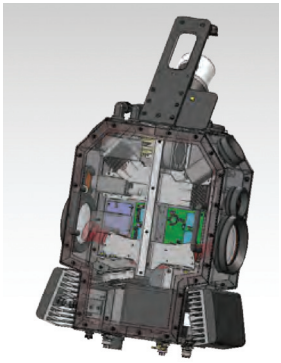
After ruling out all the likely problem sources (FPGA design, power and signal integrity, processor configuration, noise sources), we moved on to stress tests based on our standards compliance experience. The operating room environment is designed to be ESD safe, so our customer was reasonably certain that ESD was not an issue; however, testing with our ESD simulator gun suggested otherwise. Exposed metal areas on the unit had a conductive path to the FPGA that was not clamped by ESD suppression devices. This finding led us to suspect that there was a triboelectric charge potential between the housing of the device and its disposable clamshell, each made up of a mixture of material types.

While ESD mats and materials prevent the user of the device from developing a charge potential versus ground, it is still possible to generate a charge potential between materials within the unit. We designed a test protocol focused on maximizing the amount of sliding contact between the two surfaces in realistic usage scenarios. After running several tests using this protocol, our suspicions were validated. The failures began to occur readily and we were able to generate enough data to prove both the cause of the errors and the effectiveness of our remediation.

Automotive

COMPLEX THERMAL IMAGER

It's a challenge to design a robust electro-optical system for the automotive environment. For this project, Presco integrated six thermal imagers, thermal illuminators, two LIDAR systems, GPS and on-board server class computers. System wide thermal controls were established to protect the electrooptics and prevent lens fogging under extreme cold conditions. Finite element analysis established the correct patterns of air flow and heat exchange. Custom electronics addressed the synchronization needs among the cameras, LIDAR and GPS. The mechanical structure was designed for minimal weight (man portable) and simple maintenance.



Specifications

- Custom Electronics for Gigabit Ethernet Communication with Time Synchronization, Power Management and Temperature Control
- 4 Thermal Cameras with Custom Germanium Optics
- 2 NIR Cameras
- 2 LIDAR Rangefinders for SLAM
- NIR Illumination
- Mechanical Design for Robustness and Quick Release

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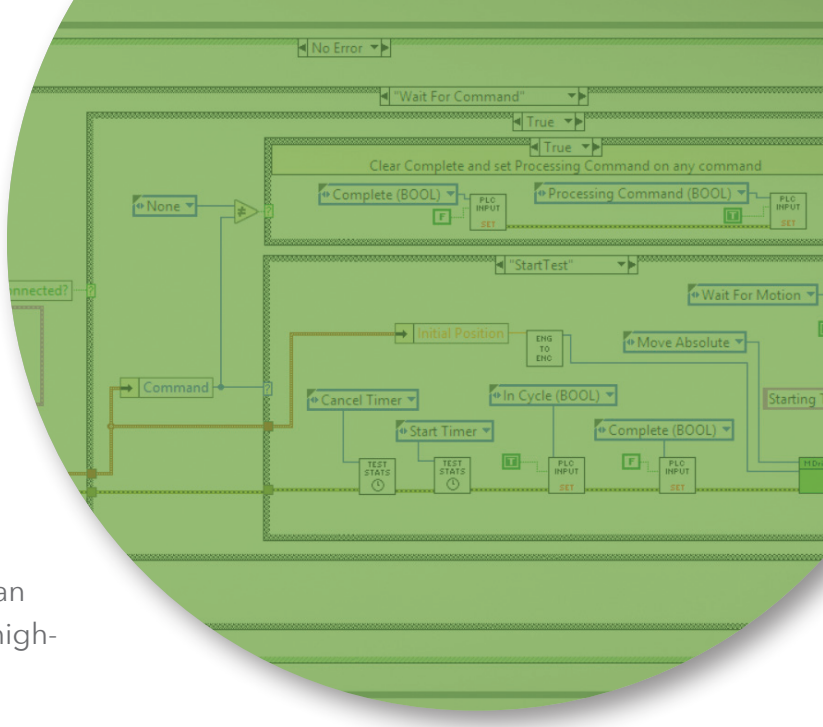
Presco's Approach

NI PLATFORM DEVELOPMENT



Presco Engineering is a great fit for those looking to transition their National Instruments (NI) platform developments to more cost efficient, customized hardware/firmware solutions later in the product development cycle. Get the benefits of both an experienced LabVIEW team as well as decades of high-performance electronics engineering know-how.

NI/Presco Approach to Product Development:

- Reduce risk and shorten time to market
- Refinement of code for deployment
- Tailoring for FDA regulations
- Transition from prototype to production
- Creating a well-architected test framework

NATIONAL INSTRUMENTS Alliance Partner

LabVIEW Certified Developer

LabVIEW and National Instruments hardware and software are great general-purpose tools. As requirements become more specific, Presco can help you tailor solutions which provide just the necessary functionality, with commensurate cost savings. Whether your application is for the life sciences, medical devices, materials identification, clinical diagnostics, transportation or the military, Presco has an excellent track record of delivering smart, sensible development programs.

A National Instruments Alliance Partner with over 10 years of LabVIEW development experience, Presco has multiple NI-certified LabVIEW developers on staff, ready to engage to your next project. Whether you're prototyping a new instrument or designing an automated test fixture, our expert design team is ready to help achieve your vision. Utilizing off-the-shelf hardware modules and the graphical LabVIEW software development environment, Presco can help to minimize your time-to-market.

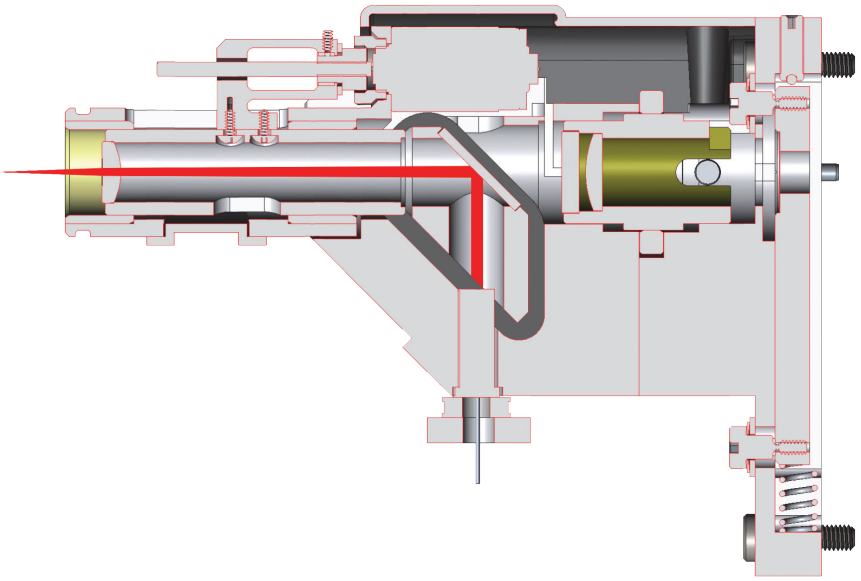
Electro-Optical Engineering

LASERS

Presco has worked with lasers since the 1970s. We've designed laser drivers, thermal controllers, and optical systems ranging from single milliwatt up to multi-kilowatt arrays.

Multi-Wavelength Laser Module

- Zemax® Optical Modeling and Ray Tracing
- Power Supplies for CW, Pulsed, and Quantum Cascade Lasers
- Temperature Control Using Convection, Thermoelectric, and Liquid Cooling
- Single Module with Three Different Wavelengths with Coaxial, Shaped Output Beams
- Wavelength Stabilization for Raman Spectroscopy and FTIR Metrology
- Optical Systems for On-Axis or Grazing Angle Illumination
- Fiber-Coupled and Free-Space Designs



Cross Section of Raman Optical Design