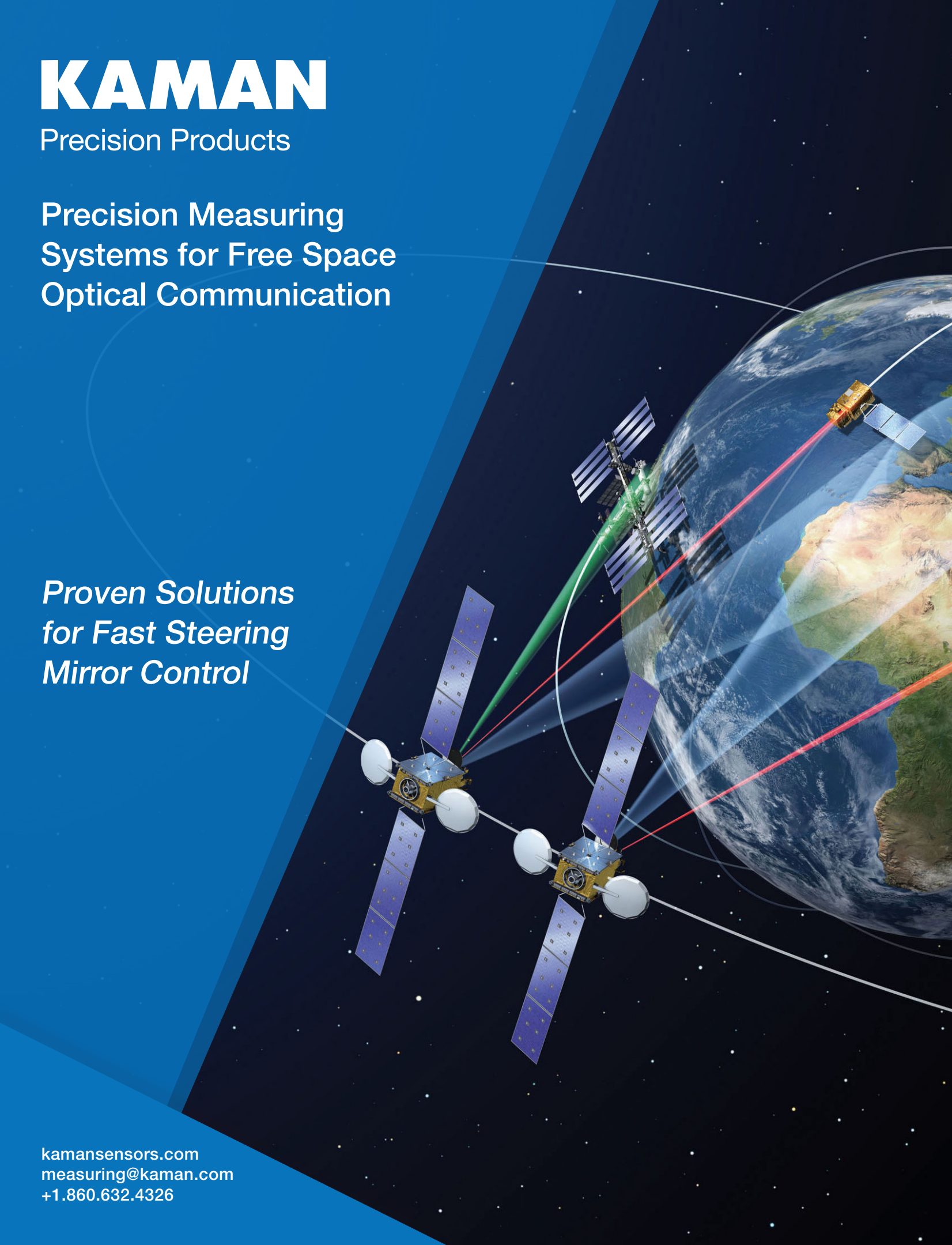
KAMAN

Precision Products

Precision Measuring Systems for Free Space Optical Communication

Proven Solutions for Fast Steering Mirror Control



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KAMAN | Precision Products

Proven Solutions for Fast Steering Mirror Control

Kaman Precision Products' differential inductance transducer systems have a proven track record of outstanding performance in critical fast steering mirror applications. For more than 35 years, Kaman has been designing and manufacturing non-contact eddy current sensors for controlling the position of fast steering mirrors used in intersatellite optical communication. Kaman's measuring systems maintain mirror position accuracy in the sub-micron range, ensuring that a reflected laser beam finds its target hundreds or even thousands of kilometers away.

Our sensors are routinely used in commercial and military imaging and communication satellites, interplanetary exploration vehicles, and laser targeting, night vision, and optics correction systems.

With the dramatic growth in large LEO satellite constellations for global internet and broadband data access, Kaman has leveraged our technology and experience to create a family of differential eddy current sensor systems ideally suited to the demands of the Commercial Space market—greatly reduced cost and dramatically higher production volume while retaining the performance and reliability for which our systems are so well known.

We invite you to contact our team to discuss your requirements and explore how Kaman can help you achieve success with your optical communication system.

Kaman Precision Products Facilities and Capabilities

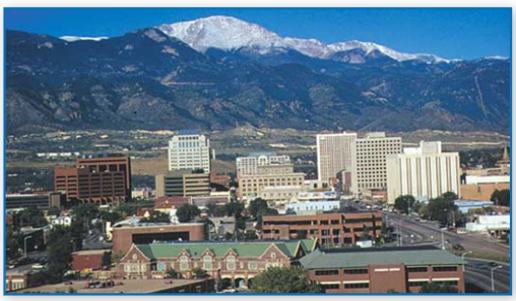
Kaman Precision Products, an AS9100C-certified division of Kaman Corporation, is headquartered in Middletown, Connecticut. We develop and manufacture high-performance, precision non-contact position measuring systems; fuzing and safe & arming solutions; and ruggedized digital data storage systems and media for military and aerospace applications.

Our Measuring systems engineering and product development team, located in Colorado Springs, runs a development lab suited to small-scale custom build, a thermal test chamber, magnetic field generation equipment, automated high-precision proximity measuring instruments, and cryogenic testing capabilities. This research and development center is staffed and equipped for rapid response in the design and testing of electro-optical and pyro-electro-mechanical systems.

Volume production takes place at our 205,000 sq. ft. Middletown facility. Our Business Development, Sales, and Customer Service teams operate from both our Middletown and Colorado Springs locations.

Middletown, CT

- High-volume production
- Laser interferometer calibration
- Optics assembly and calibration
- NIST traceable calibration
- Laser, e-beam, and TIG welding
- CNC machining
- CMM, microscopic, and X-ray inspection
- Thermal, shock, and vibration testing



Colorado Springs, CO

- Electronics test and development laboratory
- Rapid prototyping
- Thermal test chambers and fixturing
- Calibration equipment
- 3D electromagnetic field test equipment
- Solid modeling and finite element static and dynamic structural and thermal analysis
- Electromagnetic simulation
- PCB design
- Numerical simulation and data collection

KD-5100+

The KD-5100+ dual channel differential displacement measuring system uses inductive technology to detect the position or alignment of a conductive target. Each measuring channel utilizes a matched pair of sensors on opposite legs of a balanced bridge circuit. The use of two sensors on each channel minimizes the effects of temperature variations and radiation.

The heart of the KD-5100+ is a proprietary hybrid circuit manufactured to Kaman specifications in accordance with MIL-PRF-38534 Class H. The complete KD-5100+ has been subjected to proton testing and has been thermally tested from -55°C to +100°C. These tests show that the KD-5100+ can survive and operate in the extreme environment of space.

The KD-5100+ features rugged construction with a calculated mean time between failure of more than 55,000 hours in a tactical environment and 238,000 hours in a space flight environment.

Both sensor and electronics are designed for use in vacuum environments down to 10^{-6} Torr without significant outgassing.

Measuring Range (15N Sensor)	Up to ± 0.9 mm
Nonlinearity	±0.1% to ±0.5% FSO, application dependent
Output	±10 V typical
Long-Term Stability	(nominal; stabilized at 21°C scale factor dependent) 1.27 × 10-4 mm/month
Thermal Sensitivity	0.045% FS per °C
Frequency Response	22 kHz @ -3 dB
RMS Input Displacement Resolution	5 × 10^{-4} mm
Input Voltage	±15 VDC
Power Consumption	<2 W (system)
Power Dissipation	<0.5 mW per sensor
Output Characteristics	<20 mA
Operating Temperature Range ***Electronics*** ***15N Sensors***	 -20°C to +60°C -52°C to +105°C
Storage Temperature Range ***Electronics*** ***15N Sensors***	 -20°C to +60°C -52°C to +105°C
Standard Electronics Package Dimensions	50.8 mm × 53.8 mm × 19.1 mm

DIT-5200L

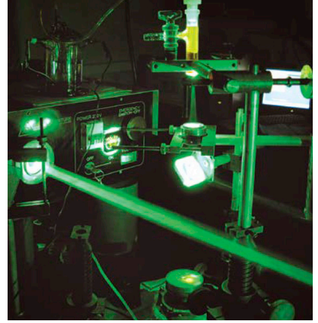
The DIT-5200L is a commercial-based, fully analog product built to IPC A-610 Class 3 standards, which offers opportunity for COTS up screening based on program requirements.

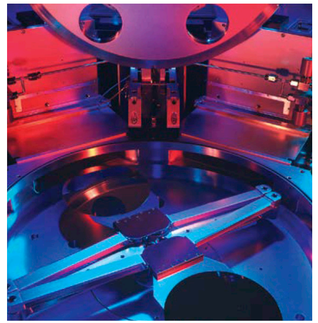
The DIT-5200L signal conditioning electronics is packaged in a die cast aluminum box with MCX style sensor connections. The I/O is on a 9-pin mini-D connector. The input power connections are reverse voltage protected.

The electronics can also be supplied as a bare PCB for installation inside the user's enclosure. Custom configurations can also be designed for OEM application requirements.

The DIT-5200L is CE Marked when purchased in the original enclosure.

Measuring Range (15N Sensor)	Up to ± 0.9 mm
Nonlinearity	±0.1% to ±0.5% FSO, application dependent
Output	±10 V typical
Thermal Sensitivity	0.03% FS per °C
Frequency Response	20 kHz @ -3 dB
RMS Input Displacement Resolution	2 × 10^{-4} mm
Input Voltage	±15 VDC
Power Consumption	<1.35 W (system)
Power Dissipation	<0.5 mW per sensor
Output Characteristics	<20 mA
Operating Temperature Range ***Electronics*** ***15N Sensors***	 0°C to +60°C -52°C to +105°C
Storage Temperature Range ***Electronics*** ***15N Sensors***	 -55°C to +120°C -52°C to +105°C
Standard Electronics Package Dimensions	58.2 mm × 64 mm × 37.3 mm





KD-5600

The KD-5600 product family uses Kaman's custom sensors, signal processing, analog-to-digital converter, and custom calibration system to deliver a precision measuring system. The KD-5600 system uses a common 9-pin connector for reading and writing data.

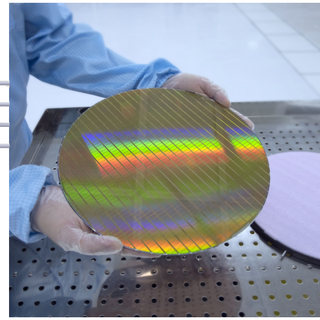
Kaman sensors are designed and tuned for specific applications. The KD-5600 systems use two matched sensor pairs for optimum operation of each channel.

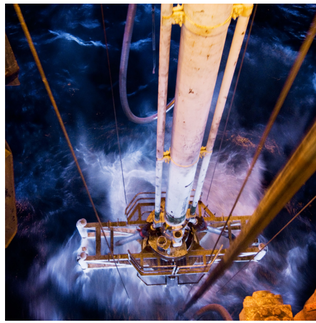
The input signals are filtered and scaled to remove common mode noise, and provide a drive signal. The signal processing also provides digital filtering to reduce signal noise.

Available Configurations:

- KD-5656 – Digital System – Designed to interface directly to an embedded controller with a Master SPI bus. The Digital System outputs two 24-bit digital words, one for Channel X and one for Channel Y, each time the data are received.
- KD-5690 – Front End System – Designed for FPGA interface for high speed operation with data rates as high as 128 kHz, 48 bits of data, 60 kHz bandwidth, and no internal firmware.
- KD-5640 – Analog System – Provides linear analog voltage. The full range output signal is 0-5 VDC with a null position of 2.5 VDC.

Measuring Range (15N Sensor)	Up to ± 0.9 mm
Nonlinearity	±0.1% FSO Analog Output
Output	0-10 V (null at 2.5 V)
Long-Term Stability	0.02% per °C for electronics and sensors combined
Thermal Sensitivity	0.00.% FS per °C
Frequency Response	24 kHz @ -3 dB
RMS Input Displacement Resolution	1 × 10^{-4} mm
Input Voltage	8 to 28 VDC
Power Consumption	<0.6 W (system)
Power Dissipation	<0.5 mW per sensor
Output Characteristics	<20 mA
Operating Temperature Range ***Electronics*** ***15N Sensors***	 -40°C to +120°C -52°C to +105°C
Storage Temperature Range ***Electronics*** ***15N Sensors***	 -55°C to +120°C -52°C to +105°C
Standard Electronics Package Dimensions	67.8 mm × 69.8 mm × 24.3 mm





Sensor Configurations:

The KD-5100+, DIT-5200L and KD-5600 family utilizes the following high performing sensor configurations:

Model 15N-001:
Measuring Range to
± 0.035 inch (± 0.9 mm)

Model 15N-002:
Measuring Range to
± 0.035 inch (± 0.9 mm)

Model 15N-003:
Measuring Range to
± 0.035 inch (± 0.9 mm)

Model 20N-004A:
Measuring Range to
± 0.075 inch (± 1.9 mm)

Model 20N:
Measuring Range to
± 0.075 inch (± 1.9 mm)

Custom Configurations:

Sensor and signal conditioner packaging can be customized for unique requirements.

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KAMAN

Kaman was founded in 1945 by Charles H. Kaman, a visionary aeronautical engineer, businessman, inventor, and philanthropist best known for his work in rotary-wing flight. For the past 75 years, Kaman has been recognized for technical breakthroughs and innovative solutions to critical challenges.

KAMAN | Aerospace

Aerosystems

Fuzing & Precision Products

Engineered Products

Kaman Corporation [NYSE: KAMN]

3,000

EMPLOYEES

Our people have always sought a better way, from helping clients operate more efficiently to pioneering safer ways to fly. We have grown on the strength of the innovation of our people.

$736M

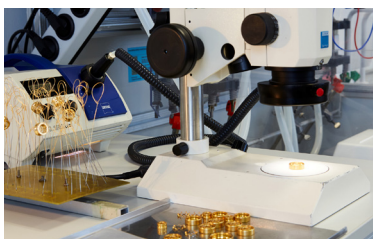
2018 AEROSPACE REVENUE

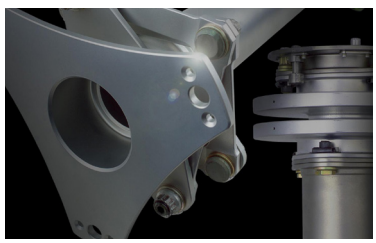
Last year, Kaman Corporation generated $736 million in revenue from continuing operations and continues to grow both organically and through acquisitions.

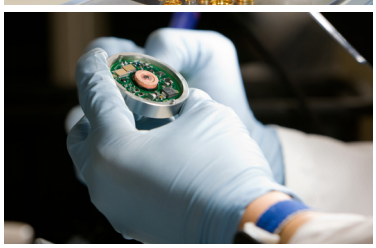
50+

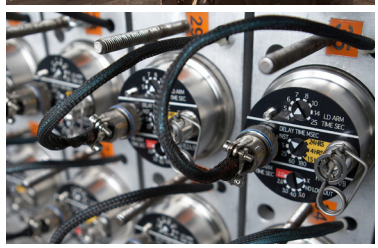
COUNTRIES

Kaman conducts business around the globe and has customers in more than 50 countries.









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SIA

International Organization for Standardization ISO 9001

REGISTERED AS 9100

KPP-MEA-FSM - 01/2020 REV. 1

ISO 9001:2015

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