Based on the specifications provided, here is a detailed description of the Displacement Measuring Interferometer (IDS3010) and its Environment Compensation Unit (ECU).

This system is an advanced, high-precision instrument designed for measuring minuscule changes in position or distance, known as displacement. At its core, it uses the principles of laser interferometry, a technique that leverages the wave properties of light to make measurements with extraordinary accuracy, often on a sub-nanometer scale. Such systems are crucial in fields where precision is paramount, like semiconductor manufacturing, nanotechnology, and scientific research.

## IDS3010: Displacement Measuring Interferometer

The IDS3010 (ID: 1010623) is a sophisticated, three-axis laser interferometer system designed for industrial and scientific applications requiring the highest degree of measurement accuracy and stability.

### Core Performance and Precision

The standout feature of this interferometer is its exceptional precision. It can operate over a working distance of up to 5 meters (extendable to 30 meters on request), making it versatile for both small-scale and large-scale setups. The system is capable of resolving movements down to the picometer level, as the resolution of its digital and analog interfaces can be freely configured, starting from just 1 picometer ($1 \times 10^{-12}$ m). To put this in perspective, a picometer is about 100 times smaller than a typical atom.

Its performance is further characterized by:
High Dynamics: It can accurately track targets moving at speeds of up to 2 m/s with a measurement bandwidth of 10 MHz, ensuring no data is lost even during rapid movements.
Exceptional Stability: The system boasts a signal stability of just 0.110 nanometers over a 2-second interval (at a working distance of 77 mm), demonstrating its reliability for sensitive, long-duration measurements.

### Laser System and Operation

The IDS3010 utilizes two distinct lasers for its operation:
1. Measurement Laser: A Class 1 Distributed Feedback (DFB) laser emitting invisible infrared light at a wavelength of 1530 nm. Class 1 is the safest laser classification, requiring no special safety precautions during normal use. This laser is the heart of the measurement system and features an extremely high wavelength accuracy of ± 0.05 ppm (parts per million), guaranteed for three years. This ultra-stable wavelength is the foundation of the system's repeatable and accurate measurements.
2. Alignment Laser: A visible red laser (650 nm) with an output power under 0.5 mW. This beam is used as a guide to simplify the initial setup and ensure the measurement laser is correctly aligned with the target.

A key modern feature of the IDS3010 is its integrated web server. This allows for complete remote operation, alignment, and initialization via a standard web browser connected through an Ethernet port. This eliminates the need for specialized software or drivers, simplifying integration and use.

## Connectivity and Physical Design

The controller is designed for seamless integration into complex automated systems. It offers a variety of real-time data interfaces with a bandwidth of up to 25 MHz:
Analog: Real-time sine/cosine signals.
Digital: AquadB and High-Speed Serial Link (HSSL) interfaces.

Physically, the controller is compact and robust, housed in a chassis measuring 55 × 52 × 195 $mm^3$ and weighing 730 g. It has a low power consumption of just 8 W, making it efficient for continuous operation.

## Environment Compensation Unit (ECU)

The ECU (Article No: 1014395) is a vital companion module for the IDS3010, designed to ensure measurement accuracy in real-world, ambient environments rather than in a vacuum.

## Purpose and Function

The wavelength of a laser—the very "ruler" an interferometer uses—changes slightly as it travels through air. This change is dependent on the air's refractive index, which is influenced by temperature, atmospheric pressure, and relative humidity. Without correcting for these environmental fluctuations, significant measurement errors would occur.

The ECU's function is to continuously measure these three parameters with high precision and feed the data back to the IDS3010 controller. The controller then uses this information to calculate the refractive index of the air in real-time and compensate for its effect on the laser wavelength.

## Technical Specifications and Impact

The compact ECU (28 × 61 × 20.5 $mm^3$, 41.5 g) contains integrated sensors with the following accuracies:
Temperature (T): ± 0.1°C
Pressure (p): ± 1 hPa
Relative Humidity (rH): ± 2%

By using the ECU, the overall system accuracy is dramatically improved. It guarantees a measurement accuracy of ± 1.0 ppm over a distance of 5 meters. This compensation is what allows the interferometer to achieve its picometer-level precision in a normal lab or factory setting, not just in a perfect vacuum.

The ECU is designed for plug-and-play integration with all IDS models, connecting via a simple RJ12 connector.

Applications

Given its ultra-high precision, dynamic performance, and environmental compensation, the IDS3010 system is ideally suited for demanding applications such as:

Semiconductor Manufacturing: For wafer stage positioning, lithography alignment, and inspection systems.

Precision Machining & Metrology: Calibrating machine tools, coordinate measuring machines (CMMs), and other measurement instruments.

Nanotechnology: Positioning and manipulation of objects on the atomic and molecular scale, such as in scanning probe microscopes.

Optics and Materials Science: Measuring thermal expansion, vibrations, and material properties with extreme accuracy.

These sensor heads are the "eyes" of the IDS3010 system. While the IDS3010 controller is the processing brain, these passive optical heads are responsible for sending and receiving the laser light to and from the target. Each one is a single-axis sensor, designed for a specific type of application and environment. Choosing the correct sensor head is critical for the success of the measurement.

Let's break down these highly specialized components.

Understanding the Naming and Key Differences

The model names might look complex, but they follow a logical pattern that tells you everything you need to know. For example, IDSH/M12/C1.6/LT/HV:

IDSH: Interferometer Displacement Sensor Head

M12 / D4 / etc.: Describes the mounting or main diameter (e.g., M12 metric thread, 4 mm diameter).

C1.6 / F40 / etc.: Describes the optics. 'C' stands for Collimating (with a 1.6 mm beam), while 'F' stands for Focusing (with a 40 mm focal length).

/RT /LT/HV /UHV/RAD: This crucial suffix defines the operating environment.

There are two primary categories of optics and three main environmental ratings that define these sensors.

1. Optics Type: Collimating vs. Focusing

This is the most fundamental difference, dictating how the sensor interacts with the target.

Collimating Sensor Heads (C-Series)

Collimating optics produce a straight, parallel beam of laser light, much like a laser pointer. This beam does not focus to a point but maintains its diameter over a long distance.

How they work: These sensors are designed for long-range measurements (up to 5 meters with the C7.6) and require a special target called a retroreflector. A retroreflector is a prism or an array of

prisms that reflects the laser beam directly back along its original path, even if it's not perfectly aligned. This makes setup much easier and more tolerant of slight misalignments.

Use Case: Ideal for measuring the position of moving stages, gantries, or any application where the distance between two points needs to be monitored with high precision over a significant range.

Models in this category:

C1.6 Models: Feature a 1.6 mm beam diameter for working ranges up to 1000 mm.

C7.6 Models: Have a larger 7.6 mm beam, enabling longer working ranges up to 5000 mm and greater angular tolerance (±15°).

Focusing Sensor Heads (F- and D-Series)
Focusing optics use a lens to concentrate the laser beam into a tiny spot at a specific distance, known as the focal length.

How they work: These sensors don't require a retroreflector. They can measure directly off of many reflective or even some diffuse surfaces, such as mirrors, polished glass, or semiconductor wafers. They are designed for short-range, high-precision measurements where attaching a retroreflector isn't feasible.

Use Case: Perfect for applications like measuring surface profiles, lens positioning, tool-tip vibration, or determining the thickness of transparent materials by measuring the front and back surfaces.

Models in this category:

F40 Models: A versatile focusing head with a 40 mm focal length and a ~45 µm spot size.

D12/F2.8 Models: Highly specialized for the semiconductor industry, with a very short 2.8 mm focal length and a tiny ~14 µm spot size, perfect for measuring directly on silicon wafers.

D4/F17 & D1.2/F18 Models: These are miniaturized sensor heads, with diameters of just 4 mm and 1.2 mm, respectively. Their incredibly small size allows them to be integrated into extremely compact spaces, like inside lens assemblies or complex scientific instruments.

2. Environmental Compatibility
Each optical type is available in different versions to withstand extreme conditions.

RT (Room Temperature)
Environment: Designed for standard ambient conditions. Operates in normal air pressure from 0°C to 50°C.

Construction: Uses standard, high-quality materials suitable for lab or industrial factory floors.

LT/HV (Low Temperature / High Vacuum)
Environment: Built for demanding scientific and industrial processes. They can operate in a High Vacuum (down to 10

$10^{-8}$ mbar) and at cryogenic temperatures (down to the millikelvin range, or -273.15°C) up to 423 K (150°C).

Construction: These heads are built with carefully selected materials. Crucially, they use NASA-compliant low-outgassing adhesives. This ensures the sensor itself doesn't release contaminants that could ruin a sensitive vacuum environment or coat optical surfaces. They are connected via specialized metal-tubing fibers and vacuum feedthroughs.

LT/UHV/RAD (Low Temperature / Ultra-High Vacuum / Radiation Hardened)
Environment: This is the most robust category, designed for the most extreme environments. It can operate in Ultra-High Vacuum ($10^{-10}$ mbar), at extreme temperatures, and can withstand a significant radiation dose of up to 10 Mgy.

Construction: Similar to the LT/HV versions but with materials selected for maximum radiation resistance.

Use Case: Essential for applications in particle accelerators, nuclear research, satellite systems, and space exploration where both vacuum and high radiation levels are present.

3. Special Feature: FLEX Mounts
The M15.5/.../FLEX models are a unique subcategory that includes an integrated high-precision alignment mechanism.

Function: These sensor heads have a built-in flexure structure that allows for fine-tuning the pointing angle of the laser beam (±1° tilt range) with high resolution (0.03°).

Advantage: This dramatically simplifies the alignment process. Instead of needing to physically adjust the entire mounting bracket, users can make tiny, precise adjustments directly on the sensor head itself, saving significant time and effort during setup.

Models: This FLEX feature is available for both collimating (M15.5/C1.6/FLEX) and focusing (M15.5/F40/FLEX) sensor heads.

Connection to the IDS3010 System
Each of these sensor heads is a single-axis device. The IDS3010 controller can manage up to three of them simultaneously. A typical setup involves connecting the optical fiber from one, two, or three of these sensor heads to the three corresponding channels on the controller. The choice of which sensor head(s) to use is determined entirely by the measurement task:

Measuring a moving stage over 1 meter in a lab? A C1.6/RT head with a retroreflector is a great choice.

Checking the surface profile of a silicon wafer inside a vacuum chamber? You would need a D12/F2.8/LT/HV.
These devices are piezoelectric controllers, which are sophisticated power supplies and control units. Their job is to generate the precise voltage signals needed to drive piezoelectric actuators or "piezo

motors." These motors expand or contract on a microscopic level when voltage is applied, allowing for incredibly fine movement control, a technology known as nanopositioning. 🧠

The choice between the AMC100, AMC110, and AMC300 depends on the application's required precision, number of axes, physical space, and the specific type of attocube positioner being used.

Shared Capabilities
Before highlighting the differences, it's useful to know what these controllers have in common. All three models are high-performance units that share a robust core feature set:

Axis Support: Each controller can drive up to 3 axes.

High-Speed Operation: They can generate signals with a frequency of up to 5 kHz on a single axis (or 2 kHz when running all 3 axes simultaneously) and deliver a high peak current of over 16 A for rapid stepping motion.

High Resolution: All controllers feature a 16-bit signal resolution, allowing for extremely fine voltage steps of 680 µV.

Modern Connectivity: They can be operated remotely via Ethernet and support a wide range of software environments, including JSON REST API, Python, LabVIEW, Matlab, and C#.

Synchronization: They include trigger inputs (LVDS, LVTTL) on a GPIO port for synchronizing motion with external instruments like cameras or data acquisition systems.

attocube Motion Controller 300 (AMC300)
The AMC300 is the most advanced and multi-functional controller in this lineup, designed for the highest performance and flexibility. 🚀

Key Function: It's designed to drive attocube's AN series* of nanopositioners. Its standout feature is the dual-mode voltage output. It provides a 0–65 V signal for coarse stepping motion and a separate, ultra-clean ±65 VDC signal for continuous, analog-like fine positioning.

Superior Precision: The fine positioning mode is exceptionally precise, with an output noise level of less than 1.3 mVpp (millivolts peak-to-peak). This extremely low noise translates into smoother, more stable movement at the nanometer scale compared to the other models.

Scalability and Control: The AMC300 is highly scalable. The tabletop version supports 3 axes, while a 19-inch rack-mountable version can be configured to control up to 6 axes. Furthermore, its /PRO feature allows multiple units to be connected via daisy-chaining for synchronized control of even more axes.

Unique Feature: A major differentiator is its compatibility with a Sony DualShock 4 (DS4) gamepad. This allows for intuitive, real-time manual control of the positioners via Bluetooth or cable, which is incredibly useful for sample navigation or coarse alignment.

Ideal For: High-end research and development, multi-axis setups (e.g., hexapods), and applications requiring the absolute lowest noise for smooth, continuous scanning motions.

attocube Motion Controller 110 (AMC110)
The AMC110 is a robust, industrial-standard controller designed for seamless integration into larger systems. 🏭

Key Function: It is optimized for attocube's ECS series of positioners, providing a single 0–45 VDC output signal for both stepping and fine motion.

Form Factor: The AMC110 is built into a full-width, 19-inch rack-mountable chassis (44.4 cm wide). This standardized size makes it the perfect choice for building into existing equipment racks in industrial settings or large-scale lab experiments.

Integrated Features: This controller comes with valuable features for precision applications. It includes built-in Rotation Compensation software and supports direct integration with the IDS3010 interferometer system, allowing for closed-loop positioning where the controller uses real-time feedback from the interferometer to achieve absolute position accuracy.

Ideal For: System integrators and users who need to incorporate a reliable nanopositioning controller into standard 19-inch industrial or laboratory racks. Its features are tailored for automated and high-accuracy closed-loop applications.

attocube Motion Controller 100 (AMC100)
The AMC100 offers the same core electronic performance as the AMC110 but in a significantly smaller package. It's the compact workhorse of the series. 🔬

Key Function: Like the AMC110, the AMC100 is designed for the ECS positioner series and delivers an identical 0–45 VDC output signal. Electronically, its performance in terms of voltage, current, and frequency is the same as its larger sibling.

Form Factor: Its main advantage is its size. With a compact, half-width chassis (22 cm wide), it takes up minimal space. Two AMC100 units can fit side-by-side in the same space as one AMC110.

Integrated Features: Despite its smaller size, it does not compromise on functionality. It also includes the Rotation Compensation and IDS interferometer integration features, making it a fully capable controller for high-precision, closed-loop tasks.

Ideal For: Academic labs, R&D on crowded benchtops, and any application where space is a premium but the full functionality of a professional-grade piezo controller is still required.

These EC Series positioners are the high-precision "muscles" that are controlled by the "brains" of the attocube Motion Controllers (AMC100, AMC110, and AMC300) you asked about previously. They are the physical stages that move your sample or optic with incredible accuracy.

All the positioners in this series operate on a piezoelectric slip-stick principle. This clever drive mechanism allows for two modes of motion:

Coarse Positioning: Long-range travel is achieved by applying a rapid sawtooth voltage signal. This causes the internal piezo ceramic to expand slowly and then contract very quickly. During the quick

contraction, the stage's inertia overcomes static friction, causing it to "slip" forward a tiny step. Repeating this thousands of times per second results in smooth, long-distance motion.

Fine Positioning: By applying a simple DC voltage, the piezo expands or contracts in a smooth, continuous manner without slipping. This allows for extremely precise, sub-nanometer adjustments within a small range.

Let's break down the different series based on the type of motion they provide.

S Series: Linear Sliders
The S Series are linear positioners designed to move in a straight line. They are the foundation for most positioning tasks, from moving a microscope slide to aligning an optical fiber. All these models operate with a 0–45 V input, making them perfectly suited for the AMC100 and AMC110 controllers.

ECSx3030, ECSx3050, ECSx5050, & ECSx3080: These are the standard single-axis sliders. The main difference between them is their footprint (e.g., 30x30 mm or 50x50 mm) and their coarse travel range, which spans from 20 mm to a long 50 mm (ECSx3080). They are ideal for applications requiring simple, high-precision linear movement and can support loads up to 2 kg.

ECSxy5050: This is a convenient, pre-assembled X-Y stage. It combines two positioners into a single, compact unit with a height of just 16.4 mm, providing 25 mm of travel in two dimensions. This saves space and simplifies the setup for 2D scanning or alignment tasks.

ECSz5050/NUM: This is the most advanced linear slider in the group. The /NUM indicates it has a built-in numerical (optoelectronic) sensor, also known as an encoder. This encoder provides closed-loop feedback to the controller, reporting its true position with 1 nm resolution. This transforms the positioner from a relative mover to an absolute positioning tool with a bidirectional repeatability of just 50 nm, making it perfect for automated and highly reproducible scientific or industrial processes.

R Series: Endless Rotators
The R Series are rotational stages designed for spinning a sample or optic around a central axis. Their signature feature is 360° endless coarse travel, allowing for continuous rotation in either direction.

ECR3030, ECR4040, & ECR5050hs: These rotators are differentiated by their size and load capacity, from the compact ECR3030 (500 g load) to the robust ECR4040 and ECR5050hs (2 kg load). They all offer extremely high fine positioning resolution in the micro-degree (µ°) range.

High Speed (/hs) Model: The ECR5050hs is a "high speed" version, capable of rotating at 15 °/s, 50% faster than the other models, making it suitable for applications where speed is a priority.

G Series: Goniometers for Tilting
The G Series are goniometers, a special type of stage that provides precise angular tilting around a fixed point in space above the positioner itself. This is crucial for applications where a sample must be tilted without shifting its position laterally.

ECGp5050 & ECGt5050: Both models offer a 10° travel range and can handle a 1 kg load. The key difference is the center of rotation—the virtual point in space around which the tilt occurs.

The ECGp5050 has a center of rotation 94 mm above its base.

The ECGt5050 has a lower center of rotation at 77 mm.

Applications: Goniometers are essential for sample alignment in applications like X-ray diffraction, crystallography, and optical beam steering, where the angle of incidence is a critical parameter. Combining two of these allows for both pitch and yaw (or tip and tilt) adjustments.

More details: These EC Series positioners are the precision motion components designed to be driven by the previously discussed attocube Motion Controllers. Their required input voltage range of 0–45 V makes them a perfect match for the AMC100 and AMC110 controllers, which are specifically designed for the ECS (EC Series) product line. At the heart of each positioner is a PZT ceramic actuator that operates on a slip-stick principle, enabling both long-range coarse stepping and exceptionally fine, sub-nanometer scanning adjustments. All the models listed are the Room Temperature (/RT) versions, constructed with an Aluminum body (though Stainless Steel versions for vacuum are also available) and connected via a 50 cm cable with a pre-installed connector. They are designed to operate in a controlled environment with a temperature range of 17–25°C and a relative humidity of 40–60%.

S Series: The Linear Sliders
This series provides high-precision motion in a straight line and forms the basis for a wide range of positioning applications.

The ECSx3030/Al/RT (Article No. 1005651) is the most compact linear slider in this family. It is built upon a 30 × 30 mm footprint with a low profile height of only 9.5 mm, and it weighs just 29 g. For installation, it requires a space of 30 × 51.6 mm. This positioner provides a coarse positioning travel range of 20 mm, moving at a maximum velocity of 4.5 mm/s at room temperature (300K). For ultra-fine adjustments, it offers a fine positioning range of 1.6 µm with sub-nanometer resolution. It can handle a maximum load of 1 kg and generate a maximum dynamic force of 1 N. Its connecting wires are made of copper with PTFE insulation.

Slightly larger, the ECSx3050/Al/RT (Article No. 1005654) shares the 30 mm width but extends its length to 50 mm, resulting in a 30 × 50 mm footprint and a weight of 49 g. While maintaining the same 9.5 mm height, it requires a larger installation space of 30 × 81.6 mm. This increased size allows for an extended coarse travel range of 30 mm. All other performance metrics are identical to the ECSx3030, including the 4.5 mm/s max velocity, 1.6 µm fine positioning range, sub-nm resolution, 0–45 V input voltage, and Copper/PTFE wires. It can support a heavier maximum load of 2 kg and provides 1 N of dynamic force. This model also specifies a roll error motion value, denoted as E_AX.

The ECSx5050/Al/RT (Article No. 1006124) moves to a larger, square platform with a 50 × 50 mm footprint and a weight of 70 g. It maintains the slim 9.5 mm height and requires an installation space of 50 × 81.6 mm. It offers a substantial coarse travel range of 30 mm at a top velocity of 4.5 mm/s. Its fine positioning range is 1.6 µm with sub-nanometer resolution. Like the ECSx3050, it supports a 2 kg maximum load and generates 1 N of dynamic force. The roll error motion for this model is also specified as E_AX.

For applications requiring the longest travel in a narrow profile, the ECSx3080/Al/RT (Article No. 1005657) is the ideal choice. It has a 30 × 80 mm footprint, weighs 78 g, and stands 9.5 mm tall, requiring 30 × 131.6 mm of installation space. It boasts an impressive coarse travel range of 50 mm. Performance characteristics such as the 4.5 mm/s maximum velocity, 1.6 µm fine positioning range, 2 kg maximum load, and 1 N dynamic force are consistent with the other larger models in the series.

For two-dimensional movement in a single component, the ECSxy5050/Al/RT (Article No. 1011872) provides an integrated X-Y stage on a 50 × 50 mm footprint. This unit is taller at 16.4 mm, weighs 109 g, and requires a 75 × 75 mm area for installation. It provides 25 mm of travel in both the X and Y directions, with a maximum velocity of 4.5 mm/s per axis. Its fine positioning range is 1.6 µm with sub-nm resolution. This robust stage can handle a 2 kg load and produces a higher maximum dynamic force of 2 N. Uniquely, it is rated for a much broader suitable temperature range of 0–100°C, and its wires are copper with a Fluoropolymer jacket.

The pinnacle of precision in this series is the ECSz5050/Al/NUM/RT (Article No. 1012096). This is a specialized vertical (Z-axis) positioner built on a 50 × 50 mm footprint, with a significant height of 32 mm and weight of 161 g. It requires a 50 × 50 × 40.5 mm installation volume. Its primary feature is an integrated optoelectronic sensor for closed-loop control. This encoder covers the entire travel range of 8 mm. It has a sensor resolution of 1 nm, provides a bidirectional repeatability of 50 nm, and can achieve a minimum incremental movement of 20 nm in closed-loop operation. This precision comes with a trade-off in speed and power; its max velocity is 2 mm/s, its max load is 400 g, and the sensor consumes 300 mW of power. Its fine positioning range is 0.8 µm. However, it produces a very strong dynamic force of 4 N. Its wires are copper with Teflon/PTFE insulation.

R Series: The Endless Rotators
The R Series positioners are designed for rotational motion, offering endless 360° coarse travel for full rotation applications.

The most compact rotator is the ECR3030/Al/RT (Article No. 1019917), featuring a 30 × 30 mm footprint, a height of 13.5 mm, and a weight of only 28 g. Its body is made of Aluminum and Stainless Steel. It provides 360° endless coarse rotation at a maximum velocity of 10 °/s. For fine adjustments, it has a fine angular range of 12 m° (milli-degrees) with µ° (micro-degree) resolution. It can support a load of 500 g and generate a maximum dynamic torque of 0.5 Ncm.

The mid-size ECR4040/Al/RT (Article No. 1009634) is built on a 40 × 40 mm footprint with a height of 14.5 mm and a weight of 54 g. It also offers 360° endless rotation at 10 °/s. Its fine angular range is 6 m°, and it also has a µ° resolution. It can handle a much larger load of 2 kg and produces double the dynamic torque at 1 Ncm.

For higher speed applications, the ECR5050hs/Al/RT (Article No. 1012481) is the top performer. On its 50 × 50 mm footprint, this "high speed" (hs) model achieves a max drive velocity of 15 °/s. It stands 15 mm tall and weighs 102 g. It offers the largest fine angular range of 15 m° with µ° resolution. It supports a 2 kg load and generates 1 Ncm of dynamic torque.

G Series: Goniometers for Tilting
The G Series positioners are goniometers, providing precise angular tilt around a predefined point of rotation, which is essential for sample alignment.

The ECGp5050/Al/RT (Article No. 1006222) is built on a 50 × 50 mm footprint with a height of 17 mm and a weight of 137 g. It requires a 50 × 69.8 × 19.5 mm installation space. Its defining feature is its center of rotation, located 94 mm above the bottom of the device. It provides a coarse travel range of 10° at a maximum velocity of 3 °/s. Its fine angular range is 1.1 m° with µ° resolution. This powerful goniometer can support a 1 kg load and generates a high dynamic torque of 8.7 Ncm.

Its counterpart is the ECGt5050/Al/RT (Article No. 1006214). It shares the same 50 × 50 mm footprint, 17 mm height, and 137 g weight. However, it requires a slightly different installation space of 50 × 67.6 × 19.4 mm. The key difference is its center of rotation, which is lower at 77 mm from the bottom surface. Its coarse travel range of 10° and max velocity of 3 °/s are identical to the ECGp model. Its fine angular range is slightly larger at 1.4 m° with µ° resolution, and it produces a dynamic torque of 7 Ncm while supporting the same 1 kg maximum load.

his final set of components represents the essential ecosystem of accessories required to build, mount, power, and thermally manage the attocube nanopositioners in real-world experimental setups. While the controllers are the brains and the positioners are the muscles, these adapter plates, mounts, lifts, and feedthroughs are the crucial skeleton and nervous system that bring the entire system together into a functional, stable, and reliable instrument.

Adapter Plates & Mounts (EAPs & AAPs) 🦴
To construct multi-axis systems (like an XYZ stack) or to securely fix a positioner to a surface, a wide variety of adapter plates are required. These precision-machined components ensure perfect alignment and mechanical rigidity. They are broadly divided into two families, EAPs for the EC-series and AAPs for the AN-series of positioners.

EC* Adapter Plates (EAPs) & Mounts
These plates are primarily made of either Aluminium for room temperature applications or Stainless Steel for high vacuum (HV) and ultra-high vacuum (UHV) environments where low outgassing and material stability are required.

L-Holders are used to mount a positioner on its side, essential for creating vertical (Z-axis) motion from a horizontally-acting slider.

The EAP 01 (1005784) is a 17 g Aluminium bracket for the ECSx3030/Al & ECR3030/Al.

Its stainless steel counterpart is the EAP 02 (1006818), weighing 47.4 g.

For the larger 5050 series, the EAP 03 (1007996) is a 51.8 g Aluminium L-holder for the ECSx5050/Al.

The stainless steel version for the ECSx5050/StSt is the EAP 04 (1008002), which weighs 152.9 g.

Brackets are also available for other models, including the Aluminium EAP 07 (1010272) and Stainless Steel EAP 08 (1010274) for the ECSx3040 & ECSx3050 series, and the EAP 10 (1010276), a 49 g Stainless Steel bracket for the long-travel ECSx3060/70/80 models.

Adapters are used to join different types of positioners together.

The EAP 06 (1008971) is a 17 g Stainless Steel adapter for the ECSx30** family.

The EAP 12 (1010386) is an 11.3 g Aluminium plate for the ECR4040 rotator.

For the 50mm series, the EAP 13 (1012606) is a 19.2 g Aluminium adapter, while the EAP 14 (1012607) is its heavier 54.9 g Stainless Steel equivalent.

A special Lift Adapter, the EAP 15 (1012896), is a 33 g Aluminium plate designed for the ECS3080.

Mounts provide the interface to standard optical breadboards or cages.

The EAP 11 (1010385) is a 16.6 g Aluminium Cage Mount for integrating the ECR4040 into optical cage systems.

For mounting onto standard optical tables, the ANB100 (1014790) is an Aluminium plate for the ECSx3030 & ECR3030, and the ANB200 (1022793) is a larger, 180 g Aluminium plate for any EC* positioner.

AN* Adapter Plates (AAPs)
This extensive series, made from high-performance materials like Titanium, Beryllium Copper (BeCu2), and Stainless Steel, serves the AN* positioner family with a vast range of mounting and combination possibilities. They enable complex kinematic arrangements, such as tilting a positioner by 90 degrees, providing in-plane rotation, or adapting different positioner series to each other. For example, the AAP 11 (1005414) is a 56.2 g Titanium plate that tilts an ANPx321 positioner by 90 degrees with a center mount, while the AAP 10 (1005571) is a 6 g BeCu2 plate that allows for in-plane rotation of AN*101 models. The AAP 19 (1010041) is a tiny 0.9 g stainless steel adapter to mount an ANP51 on top of an ECR3030 rotator. The ANB100 (1014790) is also used here as a universal Aluminium mount for attaching AN series positioners to a standard breadboard.

Lifts - Counteracting Gravity 💪
When a linear positioner is mounted vertically to provide Z-axis motion, it must constantly fight gravity. The ECS Lift modules are modular extensions that provide a constant upward force using springs to counterbalance the weight of the stage and its payload. This reduces the strain on the piezo drive, improves vertical positioning performance, and prevents the stage from falling when powered down.

The ECS Lift/3030 (1011297) is designed for the ECS3030 positioner and includes three springs providing forces of 5 N, 8.8 N, and 14.7 N.

The ECS Lift/5050 (1011298) is for the larger ECS5050 and comes with stronger springs rated for 10.5 N, 17.9 N, and 22 N.

Replacement springs are available individually for both the 3030 lift (1011359, 1011357, 1011358) and the 5050 lift (1011361, 1011362, 1011360).

Electrical Vacuum Feedthroughs (EVFTs) ⚡
To operate positioners inside a vacuum chamber, these feedthroughs are essential. They are mounted on the chamber wall and provide an airtight electrical connection between the controller in the outside atmosphere and the positioner in the vacuum. They are all based on DIN 41652 / MIL-C-

24308 standards with 1.0 mm diameter gold-coated NiFe pins, a glass-ceramic seal, and a Stainless Steel 316L flange.

For Ultra-High Vacuum (UHV): The CF-flange types use a single-use copper gasket for sealing and are bakeable to high temperatures.

The EVFT 40CF (1015853) weighs 350 g and has an extremely low helium leakage rate of $< 5\times10^{-10}$ mbar·l/s. It can operate from -200°C to 230°C.

The EVFT 63CF (1015854) is a larger version, weighing 1100 g, with the same impressive vacuum and thermal specifications.

For High Vacuum (HV): The KF-flange types use a reusable O-ring for sealing, which is faster to mount but has a slightly higher leak rate and lower temperature tolerance.

The EVFT 40KF (1015855) weighs 99 g and has a leakage rate of $< 1\times10^{-9}$ mbar·l/s. Its operating range is -40°C to 200°C.

The EVFT 63KF (1015856) is the larger KF version, weighing 294 g, with the same HV performance.

All models are rated for a test voltage of 500 V DC and a maximum current of 5.0 A per pin, with a continuous current of 3 A when all pins are in use.

Thermal Coupling Devices (ATCs) ❄️🔥
In cryogenic applications, efficiently cooling the nanopositioner is critical. The ATC (attocube Thermal Coupler) is a flexible thermal link made of high-purity copper foils. It connects the moving platform of a positioner stack to the fixed cold plate of a cryostat, drawing heat away without restricting the stage's movement.

Standard Models: These provide a passive thermal link. The choice depends on the required foil length to bridge the moving stack, ranging from 35 mm to 100 mm. The thermal conductance improves with shorter lengths; for example, the ATC100/35 (1015998) has a conductance of ~45 mW/K at 5K, while the longer ATC100/100 (1022136) has a conductance of ~18 mW/K. Each model is specified for compatibility with different AN* positioner stacks.

Cer + Heater Models: These are advanced versions that integrate a Cernox temperature sensor and a 50 Ohm heater. This allows for active, closed-loop temperature control directly at the sample position. They feature a wide sensor temperature range of 1.4 K – 325 K with an excellent accuracy of ±5 mK at 4.2 K. The integrated heater is rated for 5 W of power with a maximum current of 0.3 A. These are available in the same foil lengths as the standard models (e.g., ATC100/Cer/35, article 1019452). A customized version (ATC/cust, 1019346) is also available.