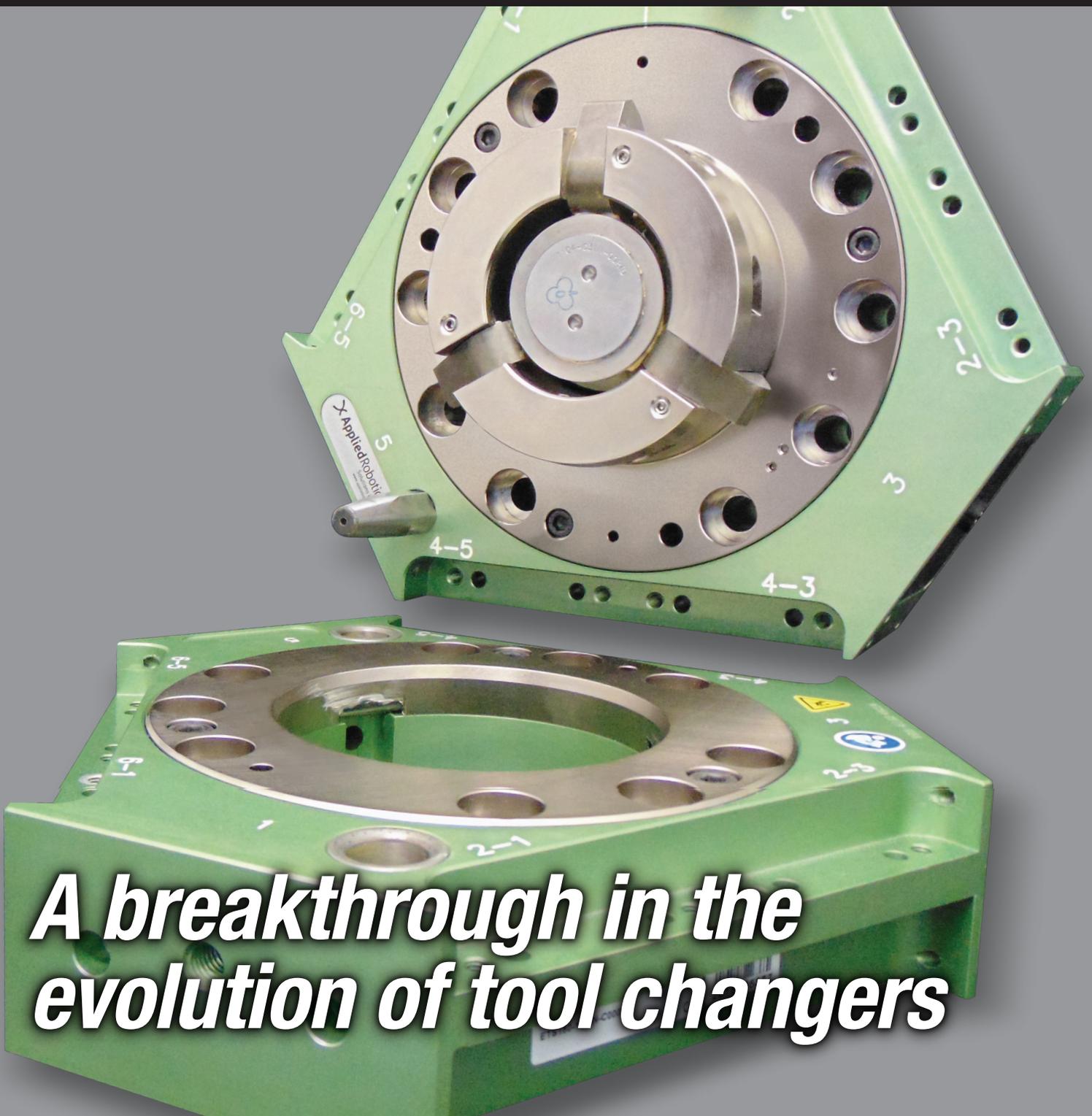


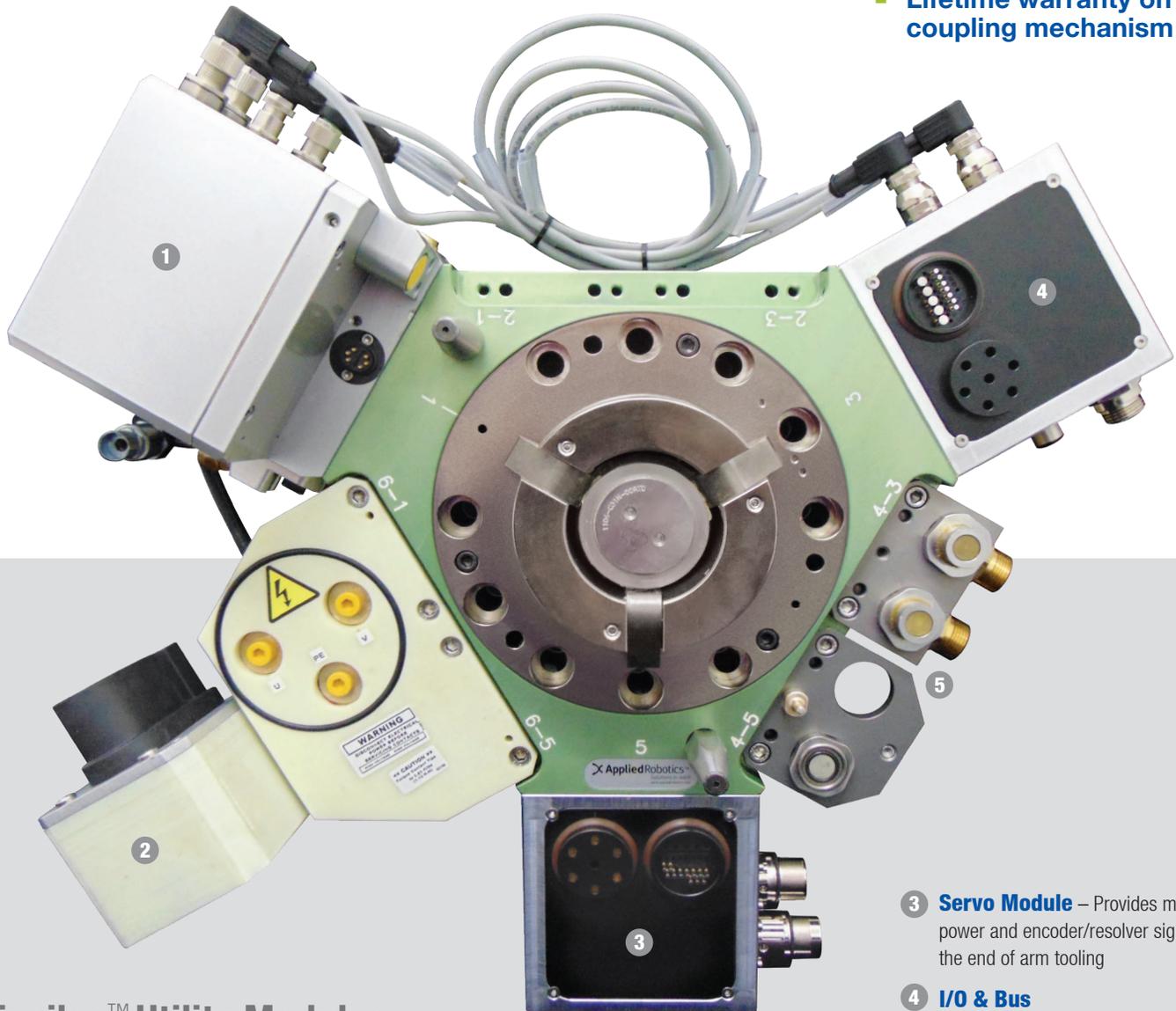
Epsilon™ Automatic Tool Changers



A breakthrough in the evolution of tool changers

Superior Features for Today's Production Environments

- Locking mechanism as secure at 5 million cycles as first cycle
- Positive retract
- Improved size to payload ratio
- Minimal maintenance
- Couple/uncouple sensing
- Direct bolt to ISO 9409-1 patterns
- Noise Emissions <70 dB(A)
- Lifetime warranty on coupling mechanism parts



Epsilon™ Utility Modules

A host of support items complement our automatic tool changers. From high power to pneumatics to coolant and data communications, we offer everything needed to automatically connect seamlessly. Epsilon™ has what you need to control these connections, all packaged in attractive utility modules that mount neatly to the side bosses of the tool changers.

- 1 Safety Control Module (SCM)**
Performance Level E Safety Solution, when paired with an approved switch meets all requirements of EN ISO 13849-1 standard, *Safety of machinery-safety-related parts of control systems*
- 2 High current Support (HIKVA)**
These modules are specifically designed for the high current transfer required in welding applications

- 3 Servo Module** – Provides motor power and encoder/resolver signals to the end of arm tooling
- 4 I/O & Bus Communication Module**
Pass communication and control signals through the tool changer to the end of arm tooling. All connections are heavy duty, industrial grade with dependable self cleaning spring probe connections.
- 5 Pneumatic and Fluid fittings**
Pass air, water and coolant from the robot through the tool changer to the end of arm tooling. All valves are self sealing to prevent leakage when in the uncoupled state.

Epsilon™ — the best engineered tool changers are now even better

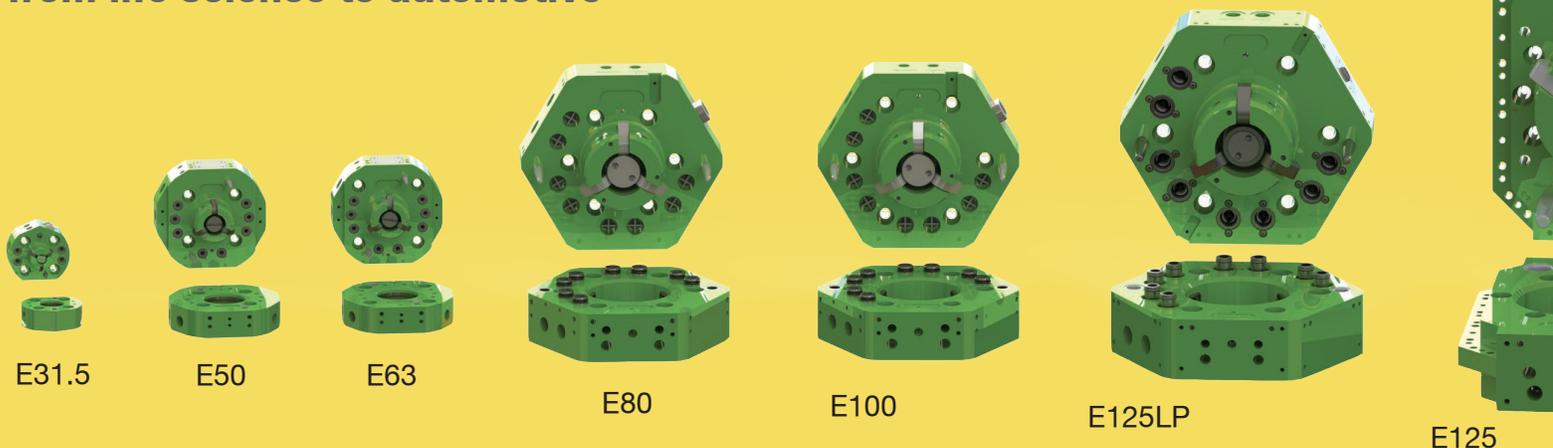
AUTOMATIC TOOL CHANGERS RESIDE BETWEEN A ROBOTIC ARM AND ITS TOOLING allowing the robot to change tools and support utilities on the fly, with no work stoppage. A tool changer is productivity.

The new Epsilon™ incorporates advantages of three previous generations of Applied Robotics, Inc. tool changers with enhancements for today's faster and stronger robots.

- **Higher strength materials** improves size to payload ratio
- **Minimal required maintenance** provides low cost of ownership
- **Direct bolt to ISO 9409-1 patterns** limit the need for robot adaptor plates
- **Couple/uncouple sensing** available on all models
- **Optional tool present sensing**
- **Compatible with existing utility modules** from Applied Robotics
- **Many units share spare parts** for reduced stock requirements
- **Best-in-class locking mechanism** with self-centering cams
- **Mechanical locking feature** ensures robot and tool remain connected under loss of power or air pressure

Lab Automation > Docking & Utility Connection > Pick and Place > Dispensing > Small Part Material Handling

The Epsilon™ line covers all sizes and applications from life science to automotive



Note: Epsilon™ part names correspond to the robot bolt patterns. I.e. use part E100 for a robot with a 100mm mounting surface.

Applied Robotics cam lock vs. competitors' ball and collet

The Engineered Cam: The Applied Robotics cam lock design has stood the test of time and is known to provide superior reliability and performance. An engineered part, not just an off the shelf ball bearing, Our purpose built cam lock will outperform ball and collet configurations in every way. Reduced maintenance requirements and longevity of service ensure a lifetime cost of ownership far lower than any other design. In fact, the Applied Robotics cam lock is so robust and reliable, it has a life time guarantee. Here's why.

Wear: Over time, the Epsilon™ cam's progressive profile continuously compensates for wear, maintaining a rigid connection. At 5 million cycles the cam design locks as securely as it did on cycle one. Conversely, ball bearings in ball and collet designs wear out with use and become smaller, degrading the connection and potentially introducing a gap and/or play between the robot and tool.

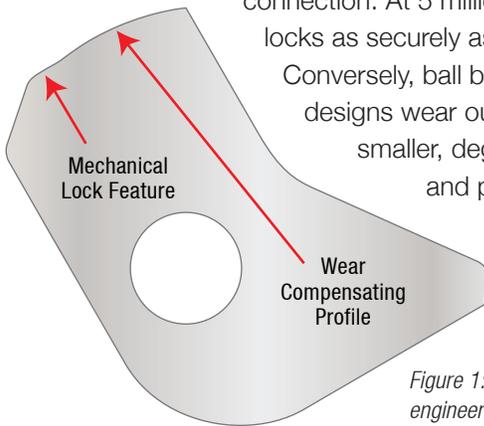


Figure 1: The Applied Robotics engineered cam locks as securely at 5 million cycles as cycle one.

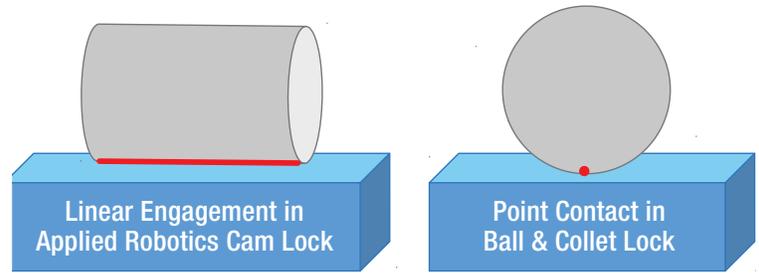


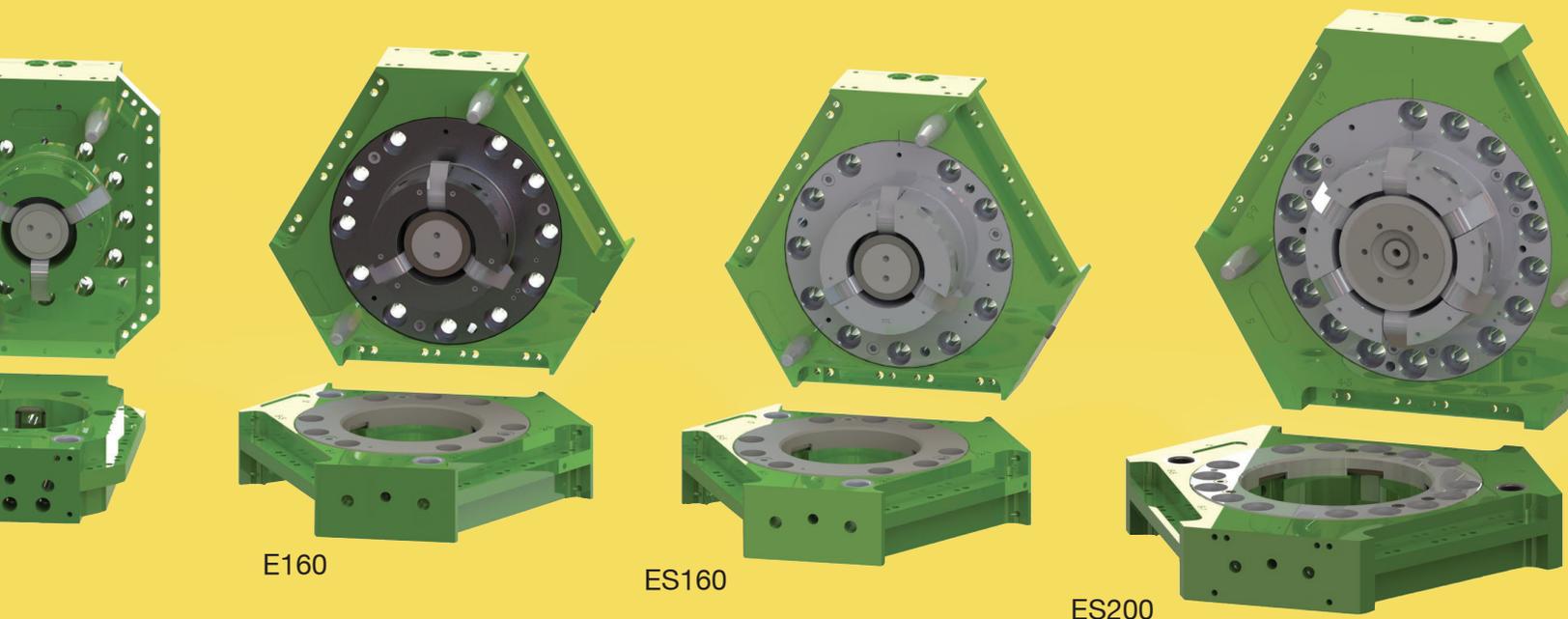
Figure 2: Line vs. Point contact, provides more surface area for engagement and also resists rotational movement along the length of the red line, Illustrated above.

Retract & Release: Epsilon™ cams are controlled by a double-acting piston and drive mechanism. This double acting cylinder arranged with the Applied Robotics cam design enables a “positive retract.” Air pressure is applied to one chamber forcing the cams out and into the coupled position while a second chamber is pressurized to move the piston in the opposite direction pulling the cams back in and releasing the connection. This level of control and confidence is not provided by the ball and collet method, which does not allow for “positive retract.” A ball and collet design relies on gravity to allow the balls to release the collet. When introduced to dirt and debris

Disadvantages of Ball and Collet

- Inherently very heavy
- Point to point contact is inherently weaker
- Tool and tool changer will gap with wear
- Rotational stability in axis direction only given by guide pins

> Part Feeding > Machining > Stamping > Assembly > Welding > Heavy Load Material Handling



that exist in a factory, it's possible for the balls to jam in the locked position, potentially pulling a tool unintentionally out of the stand.

Rotational Repeatability: In addition to providing a positive lock/unlock between the robot and tool, it is of the utmost importance the two sides of a tool changer remain precisely aligned. If the mechanism has mechanical variance due to wear, the repetitive task the robot is performing will lose its repeatability. This is another area where the

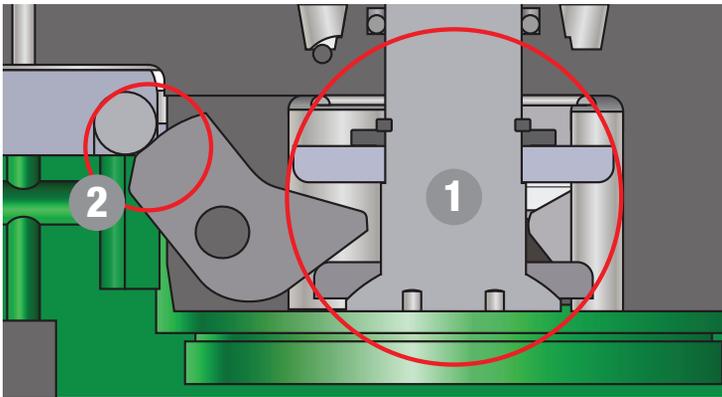


Figure 3: Floating driver (1) ensures full contact every time it couples & mechanical lock (2) on the larger models (E80 to ES200) prevents tool separation during a loss of power or air pressure

cam clearly and consistently outperforms a ball and collet arrangement. As seen in Figure 2, the cam provides a line contact that will resist rotation. In this scenario the guide pins in the master (robot side) of a cam unit are only responsible for guiding the two halves together, not for preventing rotation of the assembly. The rotational stress is largely absorbed by the cams and associated dowel, not by the guide pins. Conversely, a ball and collet design is essentially a bearing race. In order to keep the assembly from rotating, the guide pins are forced to shoulder the rotational inertia building up in the assembly as the robot moves. Rotational stresses wear the guide pins prematurely and begin to introduce play between the joined halves of a ball and collet tool changer, destroying repeatability. In time, the pins must be replaced which leads to downtime and expense. In the worst case scenario, the pins could shear off allowing the entire assembly, tooling and materials to freewheel, damaging products, equipment and potentially causing an injury. This simply does not happen with the positive locking cam system found in the Epsilon.™

Applied Robotics — our engineering advantages are your productivity advantages.

Product Specifications

Model	Rated Payload	Operating Moment (MX, MY)	E-Stop Moment (MX, MY)	Operating Torque (MZ)	E-Stop Torque (MZ)	Tensile Force (FT)	Compressive Force (FC)	Rotational Repeatability	User Pneumatic Flow (at 60 psi)	User Pneumatic Pressure Range	Couple/ Uncouple Sensing Voltage
	kg (lb)	Nm (in-lb)	Nm (in-lb)	Nm (in-lb)	Nm (in-lb)	N (lb)	N (lb)	deg.	NLPM (SCFM)	bar (psi)	VDC
E31.5	10 (22)	52 (465)	79 (700)	30 (265)	60 (520)	934 (210)	4,159 (935)	± .04	179 (6.9)	0-7 (0-101)	10-30
E50	25 (55)	88 (780)	168 (1,485)	120 (1,060)	375 (3,320)	3,336 (750)	17,837 (4,010)	± .02	285 (11)	0-7 (0-101)	10-30
E63	50 (110)	112 (990)	168 (1,485)	220 (1,945)	375 (3,320)	3,336 (750)	17,837 (4,010)	± .02	285 (11)	0-7 (0-101)	10-30
E80	90 (198)	465 (4,120)	890 (7,880)	640 (5,665)	1,585 (14,025)	13,345 (3,000)	31,649 (7,115)	± .01	376 (14.5)	0-7 (0-101)	10-30
E100	120 (264)	548 (4,850)	890 (7,880)	960 (8,495)	1,585 (14,025)	13,345 (3,000)	31,649 (7,115)	± .01	376 (14.5)	0-7 (0-101)	10-30
E125LP	225 (495)	1,737 (15,730)	2,875 (25,459)	2,020 (17,875)	3,953 (34,985)	15,750 (3,540)	49,370 (11,100)	± .01	Contact Applications Engineering	0-7 (0-101)	10-30
E125	350 (770)	2,576 (22,800)	4,817 (42,631)	4,180 (36,995)	5,110 (45,225)	24,754 (5,565)	127,998 (28,775)	± .01	N/A	N/A	22-28
E160	525 (1,155)	3,775 (33,405)	5,787 (51,220)	4,800 (42,480)	5,945 (52,615)	37,120 (8,345)	160,003 (35,970)	± .01	N/A	N/A	22-28
E160 (STL)*	525 (1,155)	4,300 (38,060)	9,095 (80,490)	4,800 (42,480)	5,945 (52,615)	37,120 (8,345)	160,003 (35,970)	± .01	N/A	N/A	22-28
ES160	800 (1,760)	5,649 (50,000)	11,322 (100,215)	5,2800 (46,730)	6,690 (59,210)	49,486 (11,125)	160,003 (35,970)	± .01	N/A	N/A	22-28
ES200	1,500 (3,300)	15,097 (133,620)	17,998 (159,300)	11,660 (103,200)	14,590 (129,130)	96,393 (21,670)	246,031 (55,310)	± .01	N/A	N/A	22-28

Operating Temperature: 5-60°C (40-140°F) • Noise Emissions: <= 70 dB(A) in any direction • Supply Pressure: 5-7 bar (72-101 psi)

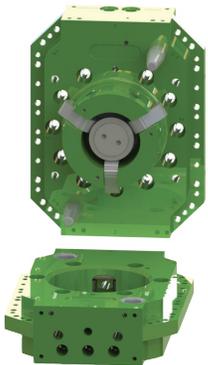
* E160 (STL) utilizes a steel tool side and an aluminum robot side.

Specialty Models

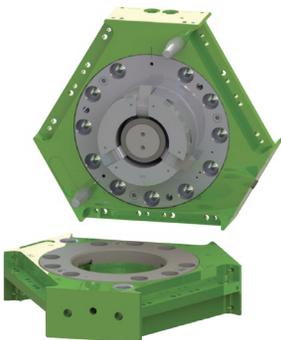
ONE THING HOLDS TRUE in robotic automation...work spaces keep getting tighter and loads keep getting heavier. Here are some highlights of three models that address this trend.



E125LP — Today's metal fabricators need to handle larger loads than ever. Since press tending requires a small package in order to load, unload and position parts in a press brake. The Epsilon™ 125 Low Profile is ready to flex its muscles and get to work in your metal fab with a capacity of 225kg (440lbs)!



E125 — The Epsilon™ 125 is easy to spot because of its rectangular profile. Although not as slim as the E125LP, the shape of the E125 addresses an ever increasing market need. Not only is a fully loaded E125 capable of lifting up to 350kg (770lbs), the unique profile allows it to fit through an automobile window, facilitating in cabin welding. Another advantage to this package is the ability to tuck neatly into the end of arm shroud now being delivered on some popular robots.



ES160 — The standard E160 package is similar to the legacy Applied Robotics Sigma 3, the undisputed “go to” work horse of automatic tool changers for years. The Sigma 3 footprint and high payload capacity have been extremely popular, but again following the trend, requests have come in for the same package size with a slightly higher capacity. Hence the ES160, which retains the E160 footprint, but upgrades to a steel sender that jumps capacity to a stout 800kg (1760lbs).

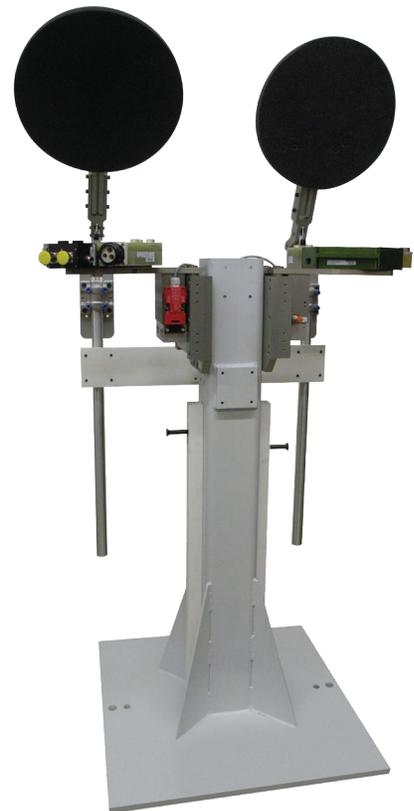
LEARN MORE

Contact our customer service department at
(518) 384-1000 or info@appliedrobotics.com

Accessories

Tool Stands — Applied Robotics tool stands feature a compact, universal design with the high moment capacity required to safely and securely hold tooling when not in use. Spring loaded compliancy and tool presence sensing are available as well as specialized heavy-payload versions.

Cover Assemblies — Even the cleanest production areas are still subject to airborne debris. Extend the life of your investment by always using a cover assembly with your tool changer. Outfitted with an adjustable power clamp, the cover will automatically open and close allowing easy access for the robot when picking up or dropping off a tool.



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