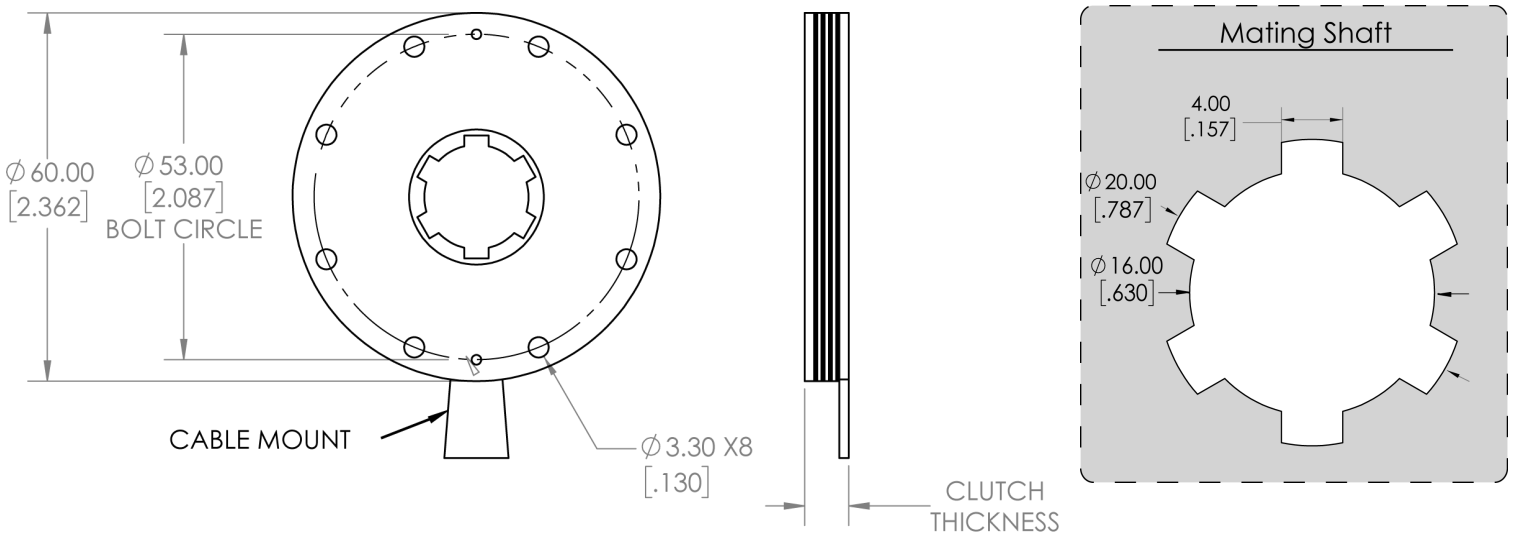
ESTAT ACTUATION

Compact motion starts—and stops—with us

UltraSlim Rotary Evaluation Unit

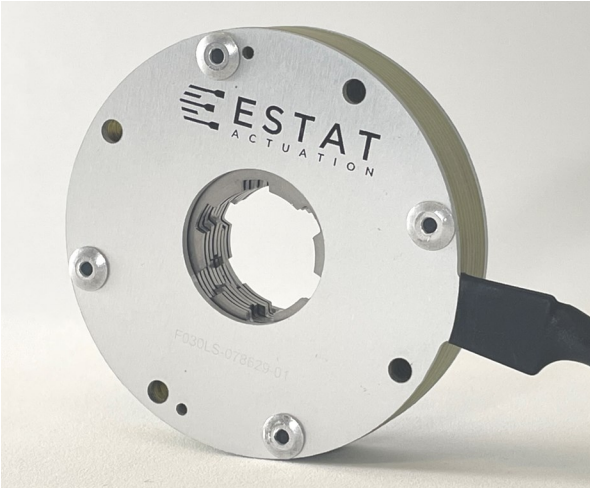
F-060-XXX-S-C-N-NO-20

UltraSlim units provide the same holding torque as conventional options with 10x less mass, 10x less volume and 1000x less power consumption. The F-060 design is available in a number of thicknesses to achieve different target-holding torques. All of the evaluation units are composed of clutch modules. Each clutch module adds 0.25 Nm of holding capacity for an additional 1.2 mm of thickness. The F-060-0.25, F-060-0.75, F-060-1.50, and F-060-2.25 are full clutch units composed of multiple clutch modules spacers and caps.



	Number of Modules			
Technical Specifications	**1**	**3**	**6**	**9**
Max rated torque—Nm (in-lb)	0.25 (2.2)	0.75 (6.6)	1.5 (13.3)	2.25 (19.9)
Clutch thickness (including caps)—mm (inch)	4.4 (0.17)	6.7 (0.26)	10.2 (0.40)	13.7 (0.54)
Weight: clutch only—g (lb)	30 (0.07)	48 (0.11)	74 (0.16)	100 (0.22)
Rotational inertia—kg m^2 (lb ft^2)	$1.3x10^{-6}$ ($3.0x10^{-5}$)	$3.9x10^{-6}$ ($9.0x10^{-5}$)	$7.8x10^{-6}$ ($1.8x10^{-4}$)	$1.2x10^{-5}$ ($2.7x10^{-4}$)
Off-state friction—Nm (in-lb)	< 0.05 (0.44)	< 0.05 (0.44)	< 0.1 (0.88)	< 0.1 (0.88)
Response— msec	< 30	< 30	< 30	< 30
Power consumption (1 Hz cycling)* — **W**	< 0.005	< 0.014	< 0.027	< 0.041
Activated maintenance power — **mW** @ 300V	< 0.12	< 0.36	< 0.72	< 1.08

**Power consumption at one Hz cycling is the average power consumption experienced by the clutch when it is activated for 0.5 seconds and deactivated for 0.5 seconds in a repeating cycle.*



Device overview:

F-060 clutches can be paired with our digital control voltage drivers to allow direct integration into existing systems. They can also be combined with ESTAT's battery powered voltage drivers for immediate evaluation seconds after unboxing.

The clutch itself is extremely compact. ESTAT clutches are formed of multiple clutch modules (below) each measuring only 0.8 mm thick. Stacking multiple modules increases the torque capacity of the clutch. The quantity and diameter of these modules can be selected to fit any application.

Our clutches are 10 times lighter and 1000 times more efficient than conventional electromagnetic options.

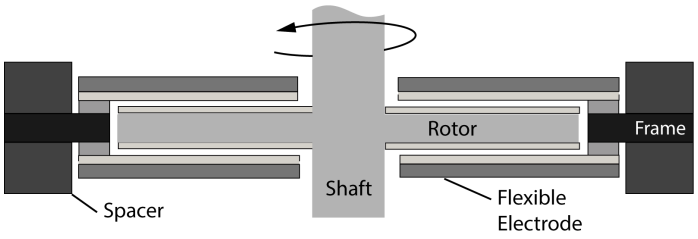
Device operation:

ESTAT clutches are load-bearing capacitors. Applying voltage across the clutch electrodes causes accumulation of positive charges on one side of the clutch and negative charges on the other. This results in adhesion between the rotor and the flexible electrodes, which locks the clutch. As capacitors, ESTAT clutches require minimal maintenance current to remain engaged. The clutch disengages when the voltage potential is removed. Power-off engage circuitry can be provided if "normally closed" behavior is desired.

The inner clutch rotor interacts with a spline shaft. The outer clutch electrodes are connected to the clutch housing. Clutches can be customized to fit spline shafts, keyed shafts or other transmission elements.

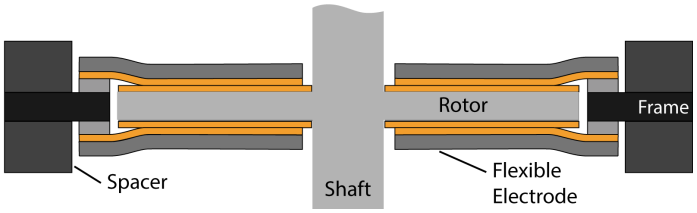
Disengaged - Power Off

Shaft and rotor are free spinning



Engaged - Power On

Shaft and rotor are coupled to outer frame



A note on clutch thickness:

ESTAT clutches are made of stacked modules separated by spacers. The top cap ensures even pressure is applied to the assembly. The bottom cap keeps the assembly together as a single unit. OEMs may choose to eliminate the bottom cap all together and depending on the design, may also eliminate the top cap. The thicknesses of each layer are as follows:

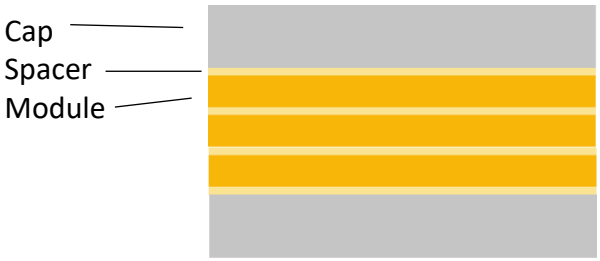
-Top and bottom caps: 1.5 mm

-Spacers: 0.4 mm

-Clutch modules: 0.8 mm

Thicknesses listed on the previous page include all modules, spacers and two clutch caps

Clutch Thickness Contributors



Email **info@estat.tech** for availability, questions, or to place an order.

ESTAT Actuation Inc. ● www.ESTAT.tech ● 91 43rd St. Pittsburgh, PA 15201

Note: specifications subject to change without notice.

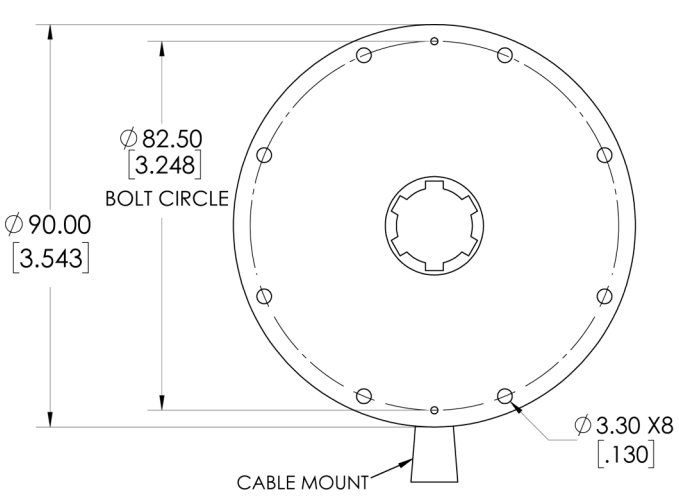
ESTAT ACTUATION

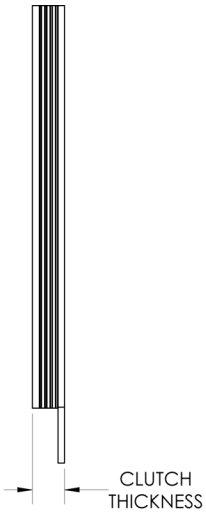
Compact motion starts—and stops—with us

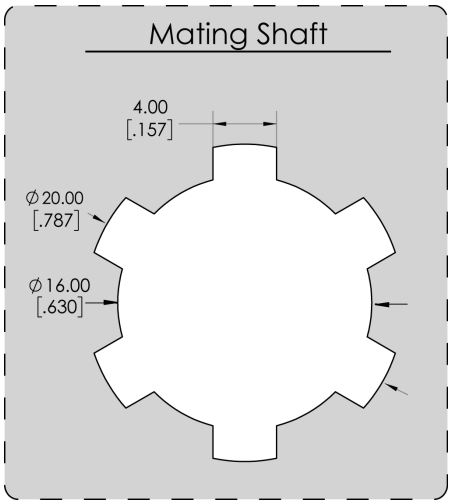
UltraSlim Rotary Evaluation Unit

F-090-XXX-S-C-N-NO-20

UltraSlim units provide the same holding torque as conventional options with 10x less mass, 10x less volume and 1000x less power consumption. The F-090 design is available in a number of thicknesses to achieve different target-holding torques. All of the evaluation units are composed of clutch modules. Each clutch module adds 2.0 Nm of holding capacity for an additional 1.2 mm of thickness. The F-090-0.25, F-090-0.75, F-090-1.50, and F-090-2.25 are full clutch units composed of multiple clutch modules spacers and caps.







	Number of Modules			
Technical Specifications	**1**	**3**	**6**	**9**
Max rated torque—Nm (in-lb)	2 (17.7)	6 (53.1)	12 (106.2)	18 (159.3)
Clutch thickness—mm (inch)	4.3 (0.17)	6.6 (0.26)	10.0 (0.39)	13.5 (0.53)
Weight: clutch only—g (lb)	73 (0.16)	123 (0.27)	200 (0.44)	280 (0.62)
Rotational inertia—kg m^2 (lb ft^2)	$1.1x10^{-5}$ ($2.6x10^{-4}$)	$3.3x10^{-5}$ ($7.8x10^{-4}$)	$6.7x10^{-5}$ ($1.6x10^{-3}$)	$1.0x10^{-4}$ ($2.3x10^{-3}$)
Off-state friction—Nm (in-lb)	< 0.05 (0.44)	< 0.05 (0.44)	< 0.1 (0.88)	< 0.1 (0.88)
Response— msec	< 30	< 30	< 30	< 30
Power consumption (1 Hz cycling)* — **W**	< 0.006	< 0.019	< 0.038	< 0.057
Activated maintenance power — **mW** @ 300V	< 0.17	< 0.51	< 1.02	< 1.53

**Power consumption at one Hz cycling is the average power consumption experienced by the clutch when it is activated for 0.5 seconds and deactivated for 0.5 seconds in a repeating cycle.*

Device overview:

F-090 clutches can be paired with our digital control voltage drivers to allow direct integration into existing systems. They can also be combined with ESTAT's battery powered voltage drivers for immediate evaluation seconds after unboxing.

The clutch itself is extremely compact. ESTAT clutches are formed of multiple clutch modules (below) each measuring only 0.8 mm thick. Stacking multiple modules increases the torque capacity of the clutch. The quantity and diameter of these modules can be selected to fit any application.

Our clutches are 10 times lighter and 1000 times more efficient than conventional electromagnetic options.

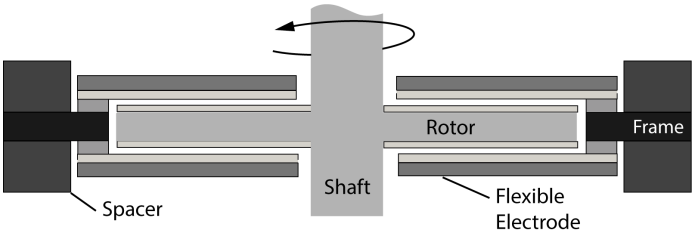
Device operation:

ESTAT clutches are load-bearing capacitors. Applying voltage across the clutch electrodes causes accumulation of positive charges on one side of the clutch and negative charges on the other. This results in adhesion between the rotor and the flexible electrodes, which locks the clutch. As capacitors, ESTAT clutches require minimal maintenance current to remain engaged. The clutch disengages when the voltage potential is removed. Power -off engage circuitry can be provided if "normally closed" behavior is desired.

The inner clutch rotor interacts with a spline shaft. The outer clutch electrodes are connected to the clutch housing. Clutches can be customized to fit spline shafts, keyed shafts or other transmission elements.

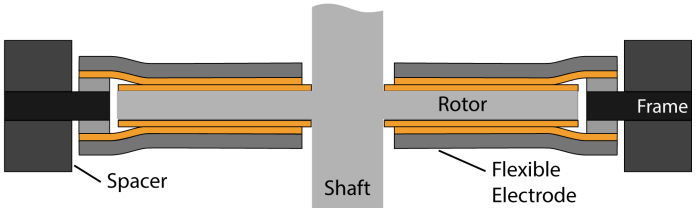
Disengaged - Power Off

Shaft and rotor are free spinning



Engaged - Power On

Shaft and rotor are coupled to outer frame



A note on clutch thickness:

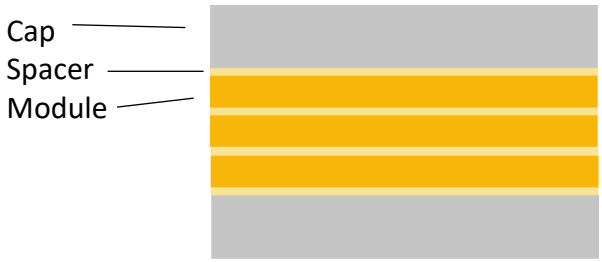
ESTAT clutches are made of stacked modules separated by spacers. The top cap ensures even pressure is applied to the assembly. The bottom cap keeps the assembly together as a single unit. OEMs may choose to eliminate the bottom cap all together and depending on the design, may also eliminate the top cap. The thicknesses of each layer are as follows:

-Top and bottom caps: 1.5 mm

-Spacers: 0.4 mm

-Clutch modules: 0.8 mm

Clutch Thickness Contributors



*Markers denote low, medium and high voltage driver settings

Email **info@estat.tech** for availability, questions, or to place an order.

ESTAT Actuation Inc. ● www.ESTAT.tech ● 91 43rd St. Pittsburgh, PA 15201

Note: specifications subject to change without notice.

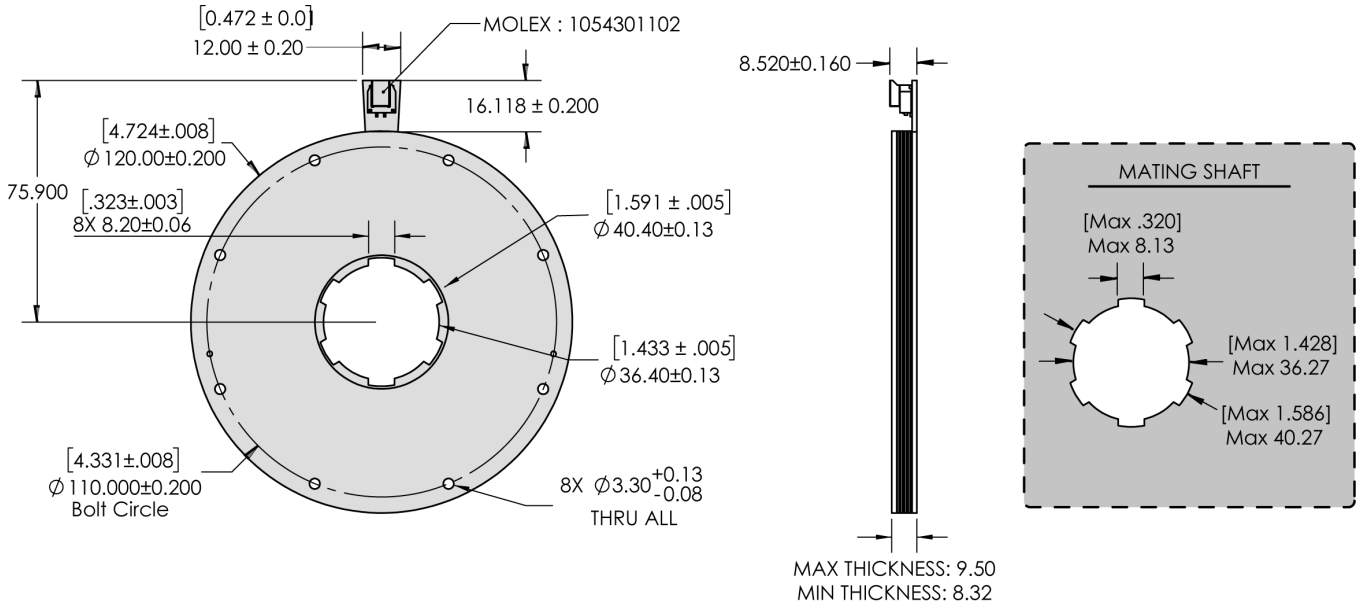
ESTAT ACTUATION

Compact motion starts—and stops—with us

UltraSlim Rotary Evaluation Unit

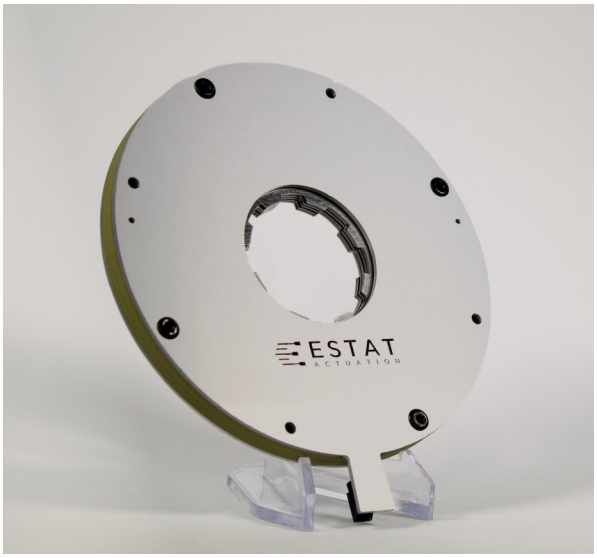
F-120-XXX-S-C-N-NO-20

UltraSlim units provide the same holding torque as conventional options with 10x less mass, 10x less volume and 1000x less power consumption. The UltraSlim Evaluation Unit is available in a number of thicknesses to achieve different target-holding torques. All of the evaluation units are composed of clutch modules. Each clutch module adds 3.5 Nm of holding capacity for an additional 1.2 mm of thickness. Clutch units ship with a base and handle for instant evaluation after unboxing.



	Number of Modules			
Technical Specifications	**2**	**3**	**4**	**6**
Max rated torque—Nm (in-lb)	7.0 (62.0)	10.5 (92.9)	14 (123.9)	21 (185.9)
Clutch thickness—mm (inch)	5.2 (0.2)	6 (0.24)	6.8 (0.27)	8.4 (0.33)
Weight: clutch only—g (lb)	163 (0.27)	206 (0.46)	336 (0.74)	464 (1.02)
Rotational inertia—kg m^2 (lbm ft^2)	7.43×10^{-5} (1.76×10^{-3})	1.11×10^{-4} (2.64×10^{-3})	1.49×10^{-4} (3.52×10^{-3})	2.334×10^{-4} (5.29×10^{-3})
Off-state friction—Nm (in-lb)	< 0.02 (0.16)	< 0.03 (0.24)	< 0.04 (0.32)	< 0.06 (0.48)
Response— msec	< 30	< 30	< 30	< 30
Power consumption (1 Hz cycling)* — **W**	< 0.020	< 0.035	< 0.040	< 0.045
Activated maintenance power — **mW** @ 300v	< 0.40	< 0.85	< 1.2	< 1.3

**Power consumption at one Hz cycling is the average power consumption experienced by the clutch when it is activated for 0.5 seconds and deactivated for 0.5 seconds in a repeating cycle.*



Device overview:

F-120 clutches can be paired with our digital control voltage drivers to allow direct integration into existing systems. They can also be combined with ESTAT's battery powered voltage drivers for immediate evaluation seconds after unboxing.

The standard operating voltage is 300V with a max voltage of 325V. Voltages below 300 will produce lower torque capacity, enabling the clutch to be used as a mechanical fuse.

The clutch itself is extremely compact. ESTAT clutches are formed of multiple clutch modules (below) each measuring only 0.8 mm thick. Stacking multiple modules increases the torque capacity of the clutch. The quantity and diameter of these modules can be selected to fit any application.

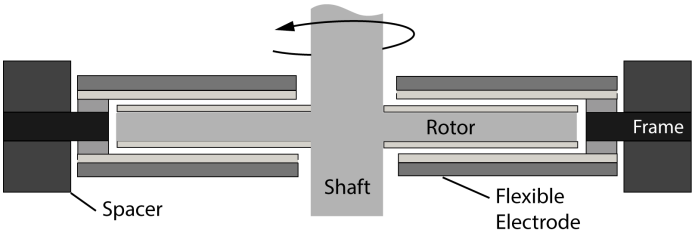
Device operation:

ESTAT clutches are load-bearing capacitors. Applying voltage across the clutch electrodes causes accumulation of positive charges on one side of the clutch and negative charges on the other. This results in adhesion between the rotor and the flexible electrodes, which locks the clutch. As capacitors, ESTAT clutches require minimal maintenance current to remain engaged. The clutch disengages when the voltage potential is removed. Power-off engage circuitry can be provided if "normally closed" behavior is desired.

The inner clutch rotor interacts with a spline shaft. The outer clutch electrodes are connected to the clutch housing. Clutches can be customized to fit spline shafts, keyed shafts or other transmission elements.

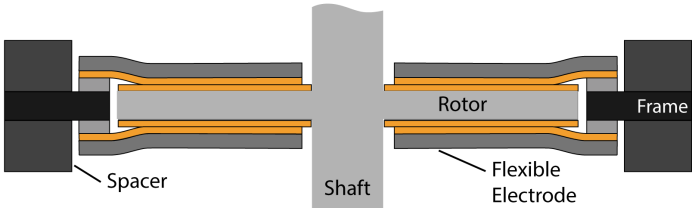
Disengaged - Power Off

Shaft and rotor are free spinning



Engaged - Power On

Shaft and rotor are coupled to outer frame



A note on clutch thickness:

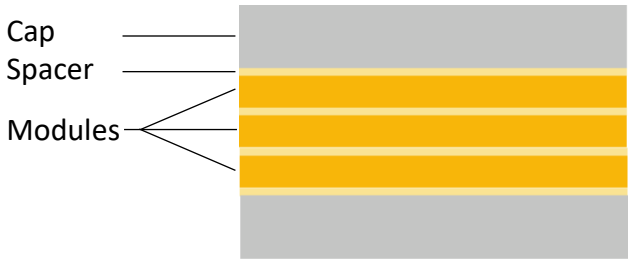
ESTAT clutches are made of stacked modules separated by spacers. The top cap ensures even pressure is applied to the assembly. The bottom cap keeps the assembly together as a single unit. OEMs may choose to eliminate the bottom cap all together and depending on the design, may also eliminate the top cap. The approximate thicknesses of each layer are as follows:

-Top and bottom caps: 1.5 mm

-Spacers: 0.4 mm

-Clutch modules: 0.8 mm

Clutch Thickness Contributors



Email **info@estat.tech** for availability, questions, or to place an order.

ESTAT Actuation Inc. ● www.ESTAT.tech ● 91 43rd St. Pittsburgh, PA 15201

Note: specifications subject to change without notice.