



Low-Voltage Industrial Motor Drives and Soft Starters

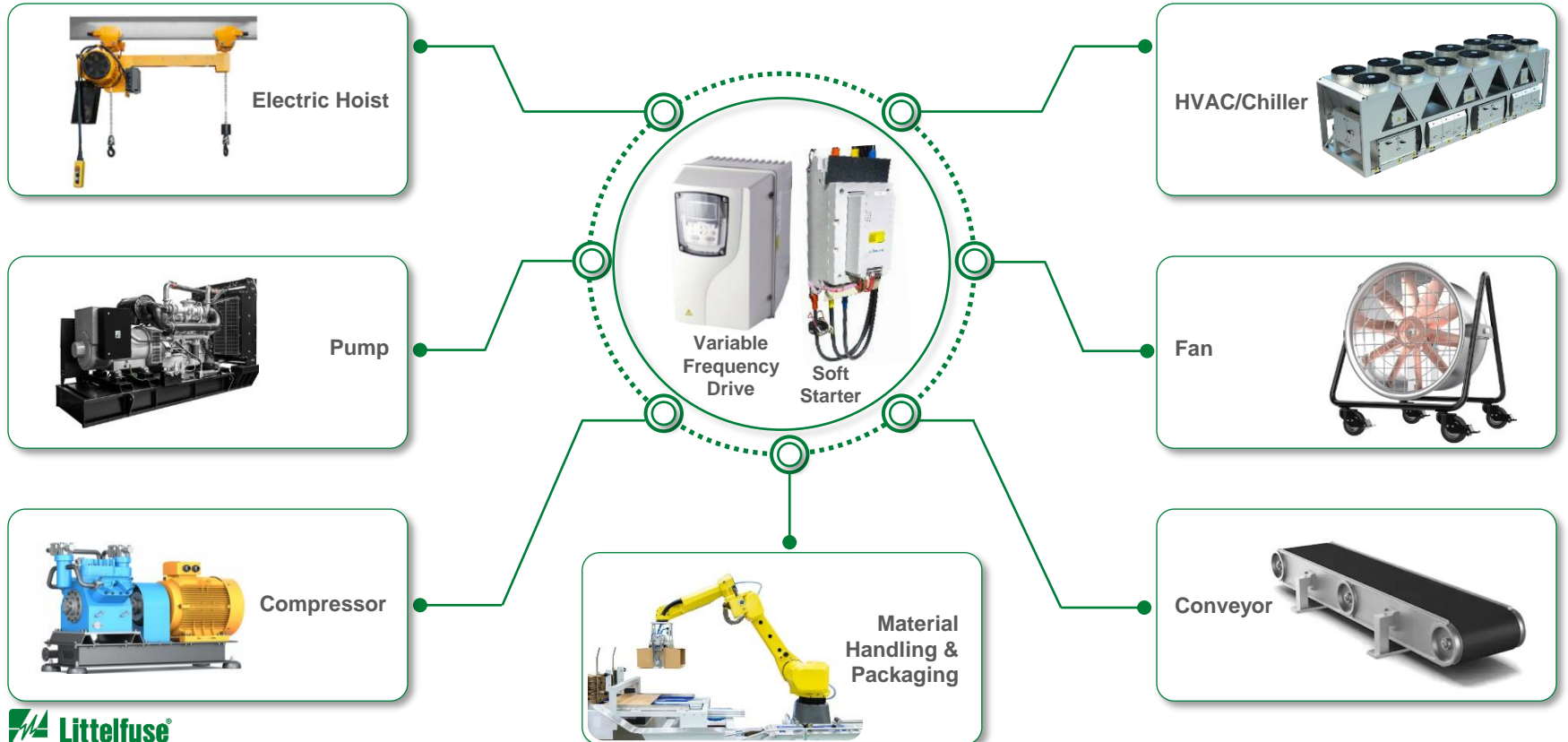


General Industrial &
Electrical Equipment



Expertise Applied | Answers Delivered

Variable Frequency Drives and Soft Starters in industrial applications: help improve energy efficiency



Variable Frequency Drives and Soft Starters architectures and application usages

Variable Frequency Drive (VFD)



- Controls AC motor speed and torque by varying motor input voltage and frequency
- Can be programmed to vary the speed of the motor based on factors such as flow, pressure, etc.
- Control over motor speed and torque
- Performance often more important than cost and size
- Energy saving is principal advantage
- Examples of applications: elevators, escalators, crushers, mixers, etc.

Soft Starter



- Offers smooth start and stop operation for a motor
- Gets bypassed by a contractor overload circuit as motor reaches its full speed
- Initial cost is lower than a variable frequency drive
- Effectively reduces inrush current during motor start
- No harmonics are generated after start-up
- Examples of applications: conveyors, pumps, and other belt-driven applications

Variable Frequency Drives and Soft Starters market overview

Market Trends

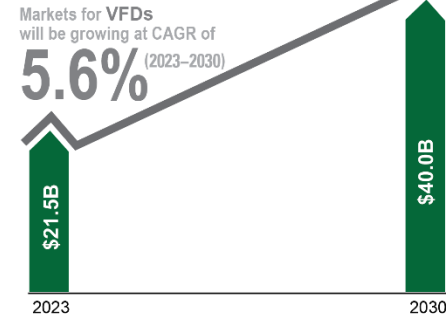
Variable Frequency Drive (VFD)

- The global VFD market is projected to grow @ 5.6% CAGR between 2023 and 2030
- Market is expected to reach \$40B by 2030
- Low-power range (6–40 kW) type dominated the power range segment in terms of revenue share
- A key factor driving the growth is the need for higher energy efficiency
- Energy savings estimated to be over 20%
- Integrating IoT with VFDs for remote monitoring and controlling the devices

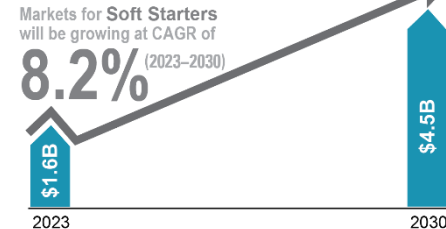
Soft starter

- The global soft starter market is expected to grow at 8.2% CAGR between 2023 and 2030
- Market is expected to reach \$4.5B by 2030
- Increased use of industrial pumps and fans are key driving factors

VFDs market will be growing at a CAGR 5.6% (2023-'30)



Soft starters market will be growing at a CAGR 8.2% (2023-'30)



Littelfuse solutions for low voltage motor drives (VFDs and Soft Starters)

AC input protection

AC Fuse, Fuseholder, MOV



Input rectifier and brake

Rectifier Module,
Brake Chopper Module



Inverter

Fuse, TVS Diode,
IGBT Module, NTC



Auxiliary power supply

Si/SiC MOSFET, Gate Driver,
TVS Diode



Switches

DIP, Rotary, Slide,
Snap, Tactile



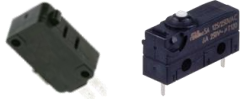
Click on the link to learn more about Littelfuse solutions for '[Low Voltage Motor Drives](#)'



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C&K® Switches for low voltage motor drives (VFDs and Soft Starters)

Enclosure detection Snap Switches, Detect



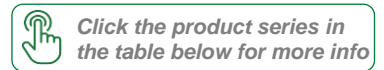
Inverter & drives DIP, Rotary, Slide, Tactile



Motor control Rotary Switch

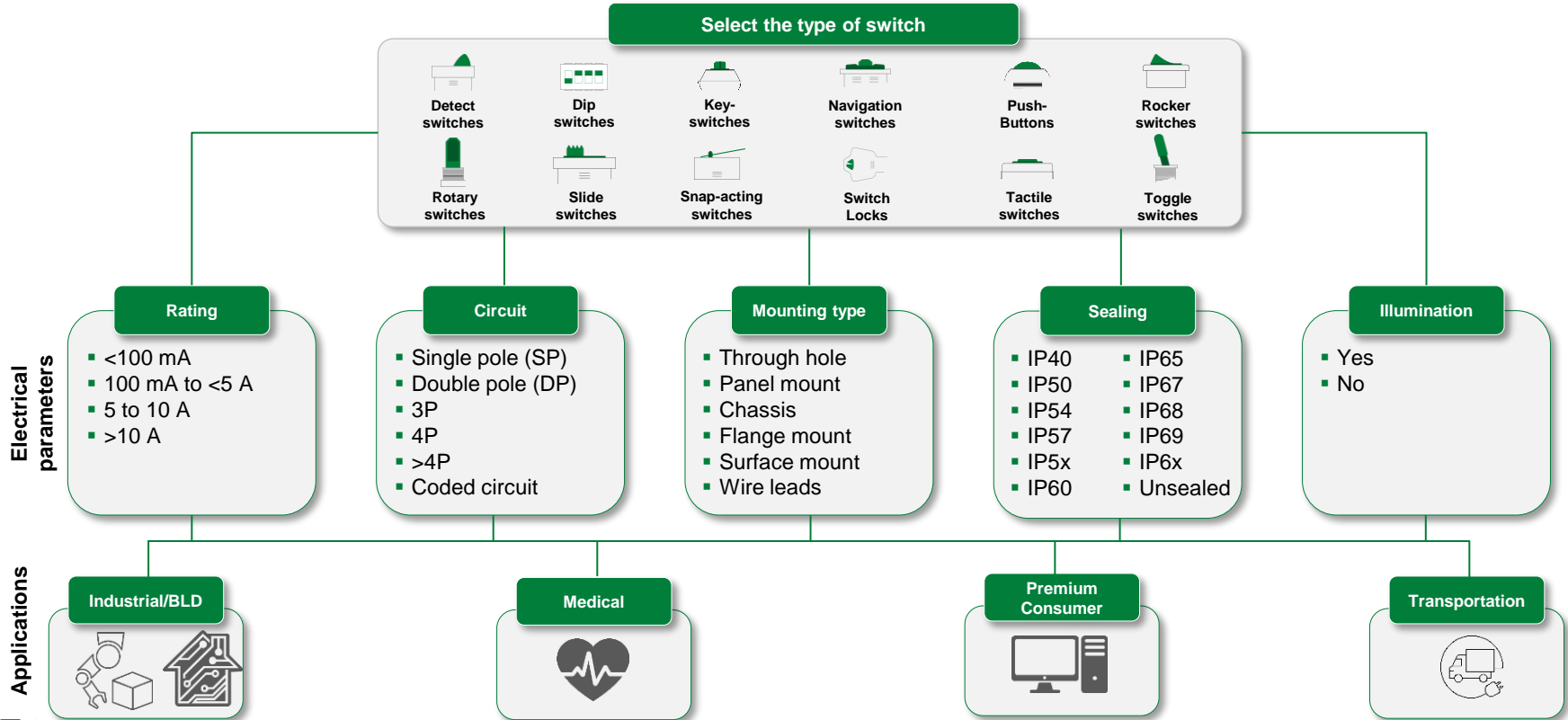


C&K® Switches features and benefits for low voltage motor drives & soft starters



Switch type	Function in application	Product series	Benefits	Features	
1	DIP	<ul style="list-style-type: none"> Inverter configuration, motor frequency Encoder settings, MMI Servo/vector control selection Bus termination, network address 	TDA	Bifurcated contact for increased electrical reliability; process sealed for surface mount soldering and washable processing	Half-pitch DIP switch; RoHS compliant; bifurcated contact; process sealed for surface mount soldering and washable processing
			RTE	Robust design with a robust metal cover; a wide range of coding options; compact size; resistance to harsh environments	Compact size with metal cover; RoHS compliant; large choice of coding; vertical or reverse versions available; IP54 sealed
2	Slide	<ul style="list-style-type: none"> Input/output signal selection (V/A) Encoder settings, MMI Servo/vector control selection 	AYZ	Features low-profile slide switches available in single and double pole, as well as double and triple throw models	Low profile; suitable for reflow soldering; single and double pole models; double and triple throw models; flameproof (UL94V-0 tested)
3	Tactile	MMI	KSC2 , KSC3 , KSC4	High number of actuations, haptic selection and haptic homogeneity integration support; rated IP67 and above; new Electrical Height (EH version) for easier integration calculations	Possible to combine high force (4-10N); high tactile ratio and long lifetime (up to 10M cycles); range of possible haptics to best fit the targeted use; Electrical Height (EH) version available
4	Snap	Door interlock switch	TE , TM , LC , LCS	Mid-size snap-acting switch; offer a broad range of operating forces; wide variety of actuator & terminal styles; cost-effective solutions; easy to integrate LC/LCS sealed series offer in a compact size; a long lifecycle; high electrical capacity; a quick connect solution with options for wire lead or PC mounting	Power (ratings up to 21 A); lever option; mounting options; long over travel, sealing up to IP67
5	Rotary	Mode selection, on/off switch	A Rotary , M	A series are 1–4 pole; long-lasting and high quality; positive detent, shorting, and non-shorting contacts; multi-pole and multi-position options M Series offers the most common 30° and 36° indexing options; stainless steel actuator as a high-end solution	Multi-pole and multi-position; shorting and non-shorting contacts; panel and PCB mounting; UL certification; SP and DP function; sealing up to IP67

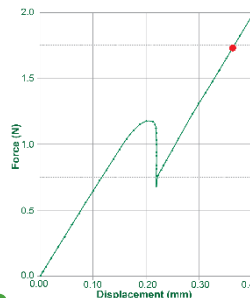
Selecting a Switch



C&K customization expertise

Enhance user experience

- Customized Haptic Switches
 - Desirable appearance, feel & sound
- Decorative solutions
 - Custom graphics, logos, & textures
- Lighting
 - Backlight accenting & light piping to enhance your product appearance

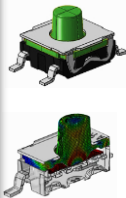


Design & manufacturing tools

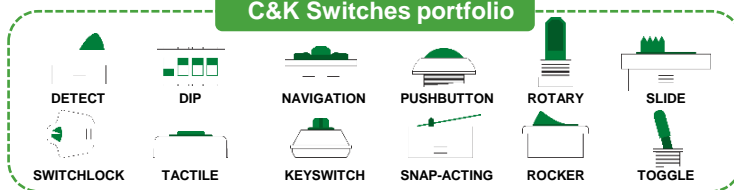
- 3-D CAD modeling
- Mold flow analysis
- FEA
- Dynamic motion analysis
- High-speed photography
- Fixed & dynamic X-ray
- Thermal imaging
- SEM/FTIR
- Sound chamber and force/displacement tester

Value added services

- Designing switches into modules & assemblies
- Multi-function & multi-axis switching
- Integrating switches and electronics
- Provides wire harnesses, terminated wires, integrated connectors, or header pins



C&K Switches portfolio



Quality & reliability

- Develop & manufacture sealed switches to meet either IP67 or IP68 standard
- Harsh environmental compatibility
- Sweat resistance testing
- SO₂ and SO₄ gas testing

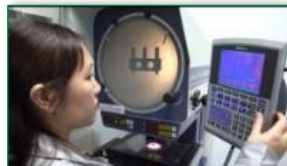


Design products to meet customer requirements for haptic touch, look, sound, & other unique features

C&K manufacturing excellence

Dole, France

- Vertically integrated, R&D (400 employees, defect rate < 0.5ppm)
- Proprietary equipment & methods
- Custom molds, dies & assembly machines
- Quality certifications (ISO 9001:2008, ISO 14001:2004, ISO 50001, TS 16949:2009, ESCC - MIL-NASA)



Huizhou, China

- Vertically-integrated, R&D capabilities (800 employees, 60 lines, defects rate < 2ppm)
- Auto-assembly & Auto-inspection machines (80 sets, 90% In-house designed, cycle time 0.8s to 2s)
- Quality certifications (ISO 9001:2008, ISO 14001:2004, TS 16949:2009)

Workshops

- 90% tooling designed and manufactured internally
- Stamping Workshops (Dole and Huizhou)
- Molding Workshops (Dole and Huizhou)
- Plating Workshops (Dole)
- Assembly Workshops (Dole and Huizhou)



Hung Yen, Vietnam

- Built in 2019 (47 lines, 250 employees, and defects rate < 2ppm)
- Manual assembly lines with semi-automated machines and tools (Cycle time 2s, lean work cells, in-line QA processes)
- Quality certifications (ISO 9001:2015)

Striving for complete customer satisfaction through state of art manufacturing facility & defect free performance



Additional information can be found at [Littelfuse.com](https://www.littelfuse.com)

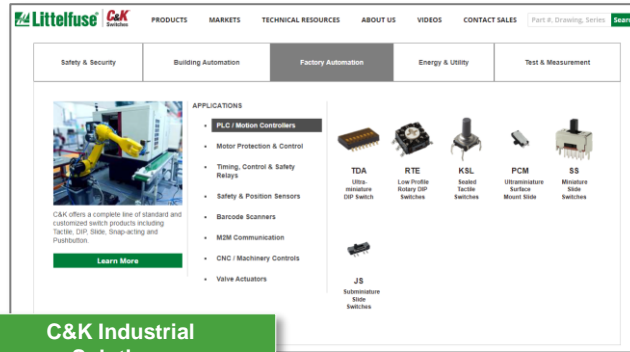
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C&K Switches Selection Guide



Switch Solutions for Factory Automation Flyer

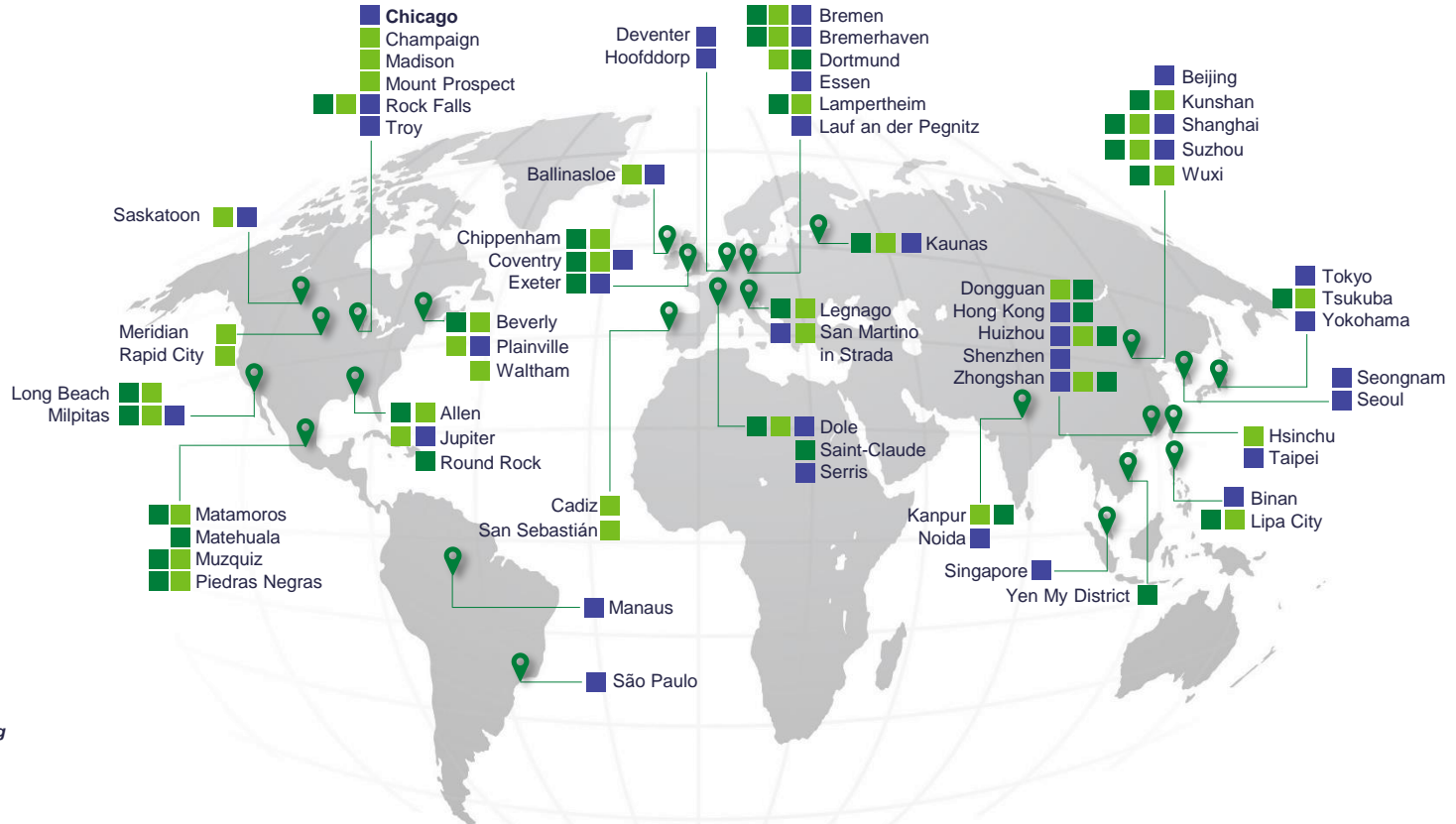


C&K Industrial Solutions



Scan me

Local resources supporting our global customers



Legend

- Sales
- R&D
- Manufacturing

Partner for tomorrow's electronic systems

Broad Product Portfolio

We are an industrial technology manufacturing company empowering a sustainable, connected, and safer world.

Testing Capabilities

We help customers get products to market faster, and we offer certification testing to global regulatory standards.

Application Expertise

Our engineers partner directly with customers to help speed up product design and meet their unique needs.

Compliance and Regulation

We help customers during the design process to consider requirements set by global regulatory authorities.

Global Customer Service

Our global customer service team is with you to anticipate your needs and ensure a seamless experience.

Global Manufacturing

Our high-volume manufacturing is committed to the highest quality standards.





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