Littelfuse®

Expertise Applied | Answers Delivered

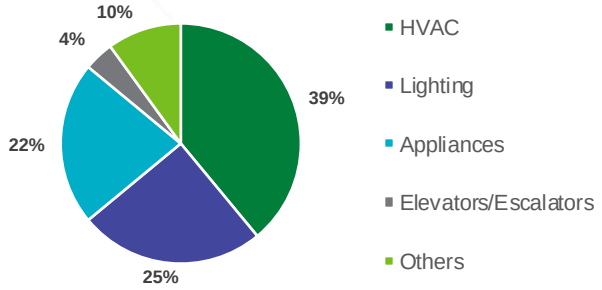
AC Protection and Motor Control in HVAC

Building Automation

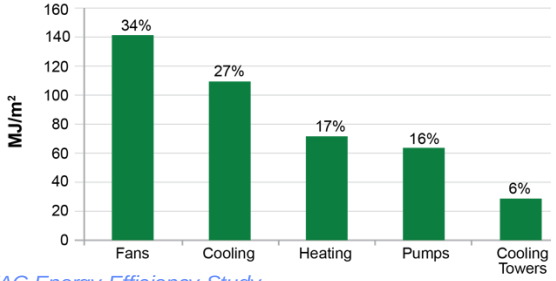
REV0920

Smart HVAC system is key to improving energy efficiency in commercial and industrial buildings

Typical energy consumption in a commercial building *

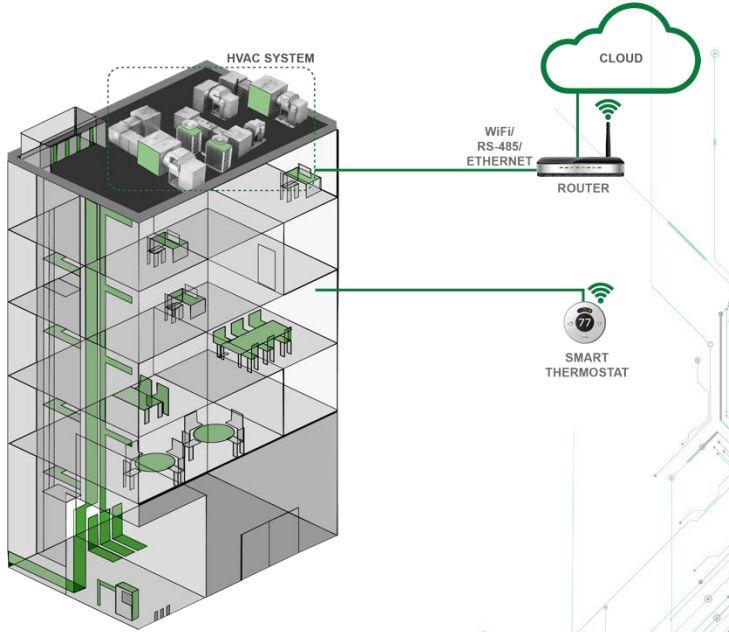


Typical energy consumption of HVAC systems *



** Source:* *HVAC Energy Efficiency Study*

Smart HVAC system



Improving motor efficiency and reliability is key to optimizing HVAC energy consumption

AC units make up the largest portion of the HVAC market

Market trends and drivers

Global AC unit shipments are expected to increase from 110 million units in 2020 to 140 million units in 2024

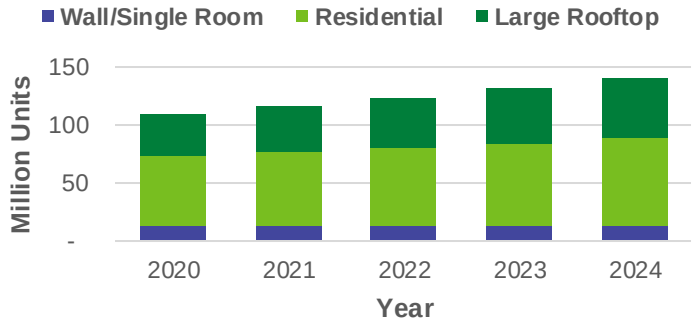
APAC region is the largest market and is expected to be the main growth region over the next several years

The large rooftop segment will outpace residential and wall/single room segments, driven by new healthcare, education, government, office, and retail facilities

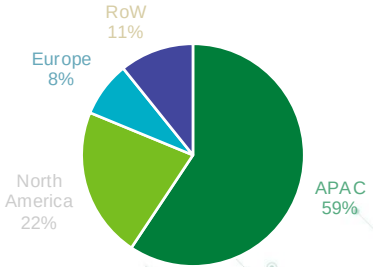
Increased awareness of the importance of Indoor Air Quality (IAQ) is driving growth globally

Government-driven initiatives to adopt energy-efficient AC systems to reduce energy consumption will fuel growth, especially in Asia-Pacific region

Market trends and drivers



Volume by region



Source: *HVAC System Market (Market and Markets, 2018), marking estimates*

Littelfuse
Expertise Applied | Answers Delivered

Littelfuse-recommended products for HVAC systems

Control unit

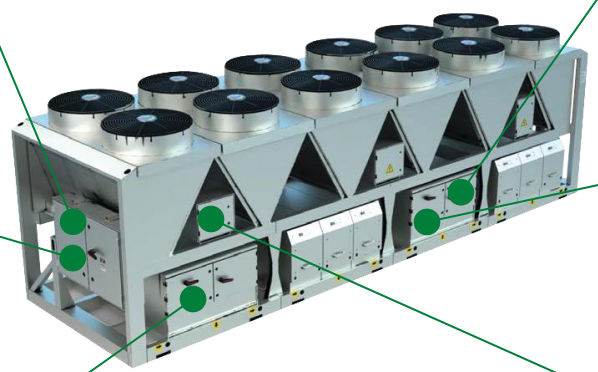
- Fuses
- SPD, SIDACtor® + MOV, TVS diode
- Current and voltage monitors
- Solid state relay
- Reed sensor

Rectifier

- Rectifier module

Inverter

- IGBT module
- NTC
- TVS diode
- Semiconductor fuses



Communication interface

- Diode array *

User interface

- Polymer ESD suppressor

Analog front end

- TVS diode

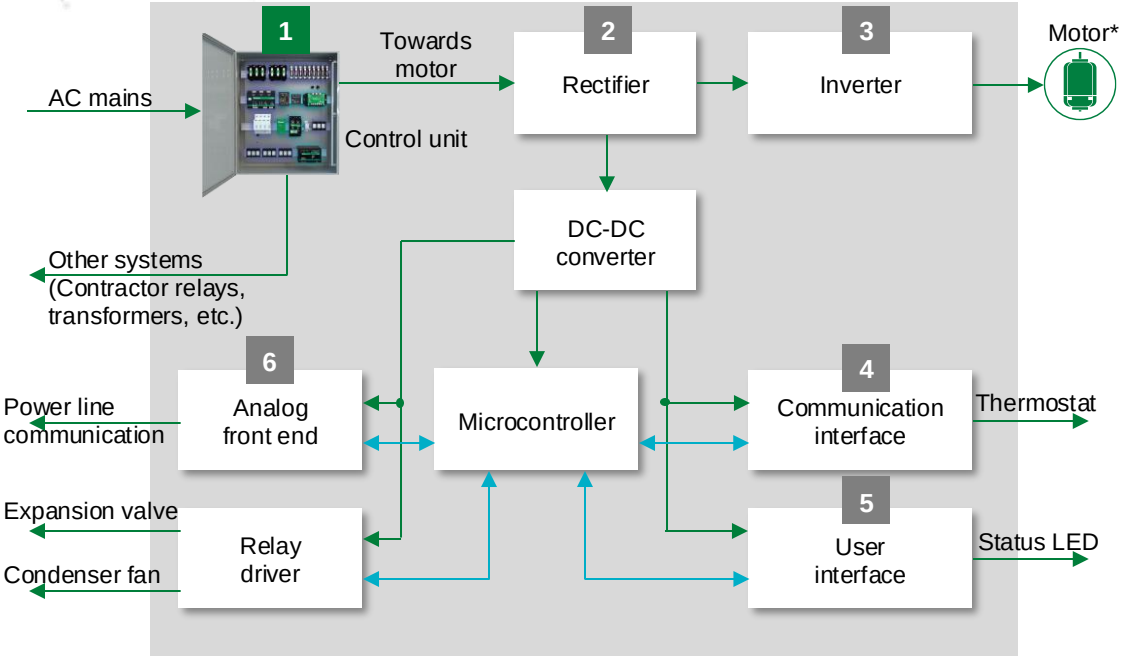
** This is recommended for compact designs where clearance between the antenna and the casing is < 2 mm*

Littelfuse
Expertise Applied | Answers Delivered

Protect Control Sense

Click on the product series in the table below for more info

HVAC system block diagram



* *There are three motor control systems for an air conditioning system: 1. Compressor motor 2. Condenser fan 3. Indoor fans*

	Technology	Product series
1	UL class fuse	CCMR, KLDR, KLKR, KLKD, FLNR, FLSR, JLLN, JLLS, JTD
	Type 2 surge protection device	SPD2
	SIDACtor® + MOV	Pxxx0FNL, Pxxx0ME + UltraMOV
	TVS diode	High Voltage AK , LTKAK
	Three-phase voltage monitor	460, 201A, 250A, 455
	AC current transducers & sensor	TCSA20, LSRX-C, LSRX
	Time delay relay	TMV, CT1, TRU1, TS1, TH1, TDUH, TDUB
	Solid state relay	CPC40055ST, CPC1998J
	Reed sensor	59140, 57140

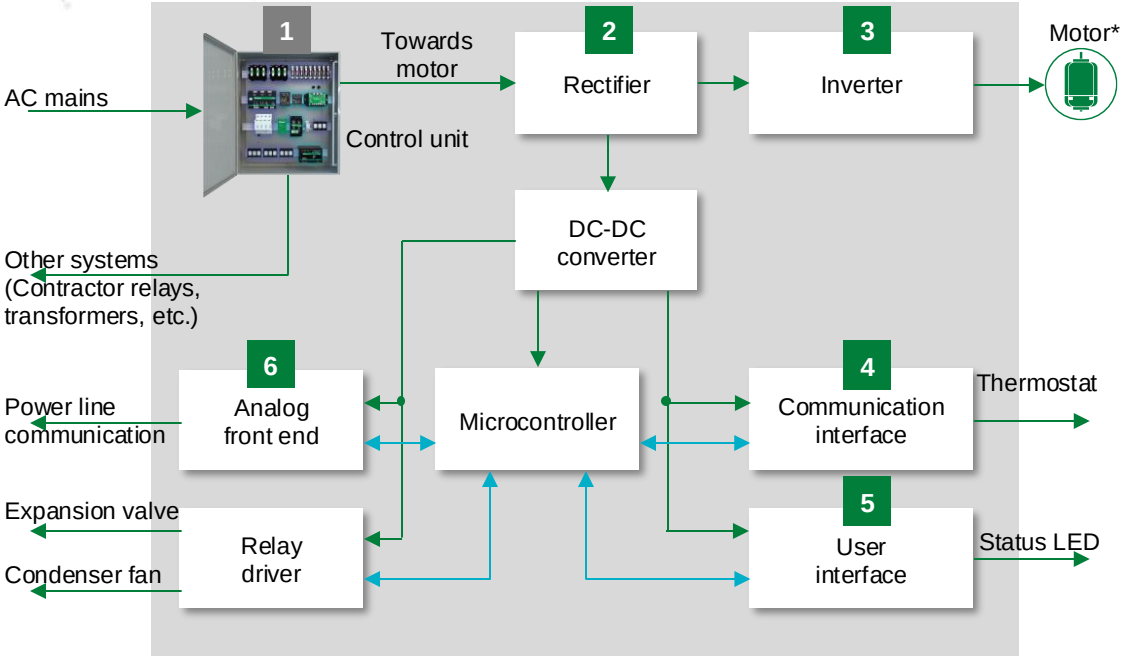
Click on the product series in the table below for more info

Benefits of Littelfuse products

	Technology	Function in application	Product series	Benefits	Features
1	UL class fuse	Protects HVAC system from overload and short circuit	CCMR, KLDR, KLKR, KLKD, FLNR, FLSR, JLLN, JLLS, JTD	Chosen over breakers due to their higher amperages; quicker response time; easy coordination; and no calibration required.	Voltage range 0 – 600 V and current ratings from 1 – 1200 A
	Type 2 surge protection device	Protects from power fluctuations or surges	SPD2	Withstand high-energy transients to prevent disruption, downtime, and degradation or damage to equipment	20 kA nominal interrupting rating and 50 kA maximum interrupting rating
	SIDACtor® + MOV	Low clamp protection for AC power line	Pxxx0FNL, Pxxx0ME + UltraMOV	Lower clamping provides robust protection to downstream components such as capacitors, bridge, and other electronics	Lower clamping voltage, lower leakage current (NA level)
	TVS diode	Protects power line from transient surge transient	High Voltage AK , LTKAK	Good clamping and fast response time for high-energy transient protection	High power TVS 8/20 µs rating from 1 kA to 20 kA in axial-lead or SMT form factor
	Three-phase voltage monitor	Protects compressors and blower motors	460, 201A, 250A, 455	Protects motors from adverse voltage conditions that can cause damage to the motor windings	Universal range from 190 to 480 V_{AC} or 475 to 600 V_{AC} and 50/60 Hz
	AC current transducers & sensor	Used as an AC current-proof relay to indicate if a motor is operating	TCSA20, LSRX-C, LSRX	Varies the effective resistance of its output in direct proportion to the current flowing in the conductor it is monitoring	Monitors 0 – 20 A (TCSA20); energizes the output contact whenever 4.5 A or greater is present (LSRX-C, LSRX)
	Time delay relay	Delays the blower from turning on or off after the demand has been met	TMV, CT1, TRU1, TS1, TH1, TDUH, TDUB	Provides flexibility for use in all systems; quick and easy installation for old and new systems	Universal AC-DC operating voltage, solid state output and total encapsulation for protection against shock, vibration, and humidity
	Solid state relay	Isolation switch	CPC40055ST, CPC1998J	Allows for space saving while driving highest load current; high noise immunity prevents disruptions in communication and control signals	Blocking voltage up to 800 V and load current up to 20 A_{RMS}; input-to-output isolation – 2500 V_{RMS}
	Reed sensor	Provides open/close detection to protect from physical harm or equipment damage	59140, 57140	Hermetically sealed; suitable for humid, wet or contaminated environments	Application-specific customization available, wide range of sensitivity available

Click on the product series in the table below for more info

HVAC system block diagram



* *There are three motor control systems for an air conditioning system: 1. Compressor motor 2. Condenser fan 3. Indoor fans*

	Technology	Product series
2	Rectifier module	MDD, VUO,MDMA
3	IGBT module	MIXA, MIXG
	TVS diode	SMBJ, SMCJ
	High-speed fuse	OS, PSR
	NTC	USUR1000, SM
4	Diode array **	SP3213
5	Polymer ESD suppressor	PGB10603, PGB10402
6	TVS diode	15KPA

** *This is recommended for compact designs where clearance between the antenna and the casing is < 2 mm*

Littelfuse
Expertise Applied | Answers Delivered

Click on the product series in the table below for more info

Benefits of Littelfuse products

	Technology	Function in application	Product series	Benefits	Features
2	Rectifier module	Converts AC line voltage supplied to the drive to DC	MDD, VUO, MDMA	Allows for low heat signature during operation	Package with DCB ceramic; very low forward voltage drop and low leakage current
3	IGBT module	Switches power supplies	MIXA, MIXG	Allows for low power consumption and fast response	Rugged design with thin wafer technology; short circuit rated for 10 µsec; low gate charge; low EMI and competitive low $V_{CE(SAT)}$
	TVS diode	IGBT gate protection	SMBJ, SMCJ	Provides active clamping based on the DC power line voltage and IGBT V_{CE} voltage	Critical for IGBT active clamping during an IGBT turn-off event and helps in operating an IGBT in a safe and active mode
	High-speed fuse	Protects semiconductor devices in inverter	QS, PSR	Lower I^2t performance allows for quick response to protect devices from higher heat energy	QS: 500 – 700 V_{AC}, 450 – 700 V_{DC}, 35 – 800 A; PSR: 550 – 1300 V_{AC}, 500 – 1000 V_{DC}, 40 – 2000 A
	NTC	Semiconductor Temperature Measurement	USUR1000, SM	Allows for high precision temperature measurement in harsher environments	UL Recognized with ring lug mounting; SM NTCs is in hermetically sealed MELF package suitable for operation up to 220° C
4	Diode array	Protects wireless chipsets from ESD induced by user	SP3213	Allows for space savings; retains signal integrity of high-speed communication lines	Space efficient 0201 form-factor; third-party compliance; low capacitance
5	Polymer ESD suppressor	Protects the Wi-Fi chipset from user-induced ESD events	PGB10603, PGB10402	Provides robust system operation and retains signal integrity of high-speed communication lines	Ultra-low capacitance; compact form factor; low leakage current; fast response time
6	TVS diode	Overvoltage protection	15KPA	Lower clamping allows for robust system operation, protecting downstream electronics from damage	Fast response time; excellent clamping capability; 15 kW peak pulse capability

Select standards for HVAC systems

Standard	Title	General scope	Region
UL 508 A	Standard for safety (Industrial control panels)	Industrial control panels intended for general industrial use, operating from a voltage of 1000 volts or less. This equipment is intended for installation in ordinary locations, in accordance with the National Electrical Code, ANSI/NFPA 70, where the ambient temperature does not exceed 40° C (104° F) maximum	NA
UL 1995	Standard for safety for heating and cooling equipment	These requirements apply to the following stationary equipment for use in nonhazardous locations rated greater than 600 volts up to 7200 V, and remotely controlling assemblies for such equipment) heat pumps, for heating and cooling with or without factory, or field-installed electric resistance heaters, or hot water or steam heating coils) air conditioners for cooling with or without factory, or field-installed electric resistance heaters, or hot water or steam heating coils	NA
IEC 61000-4-2	Testing – Electrostatic Discharge (ESD)	This standard is made to check the capability of the equipment to survive repetitive electrical fast transients and bursts	Global

Additional information can be found on Littelfuse.com

HVAC Capability Brochure

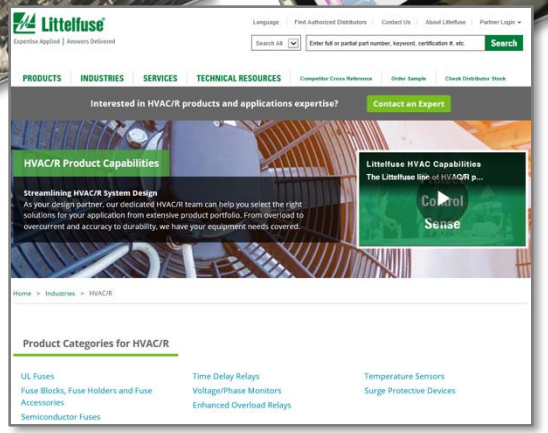
Sensor Selection Guide

Industrial Fuses Catalog

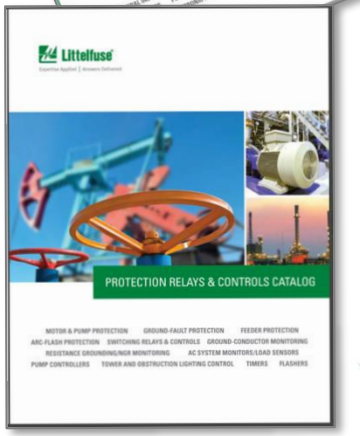
Power Semiconductor Selection Guide

Click on images to open the catalog

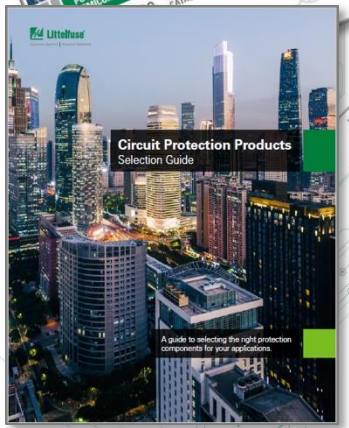
Interactive HVAC Guide



Power Relay & Control Catalog

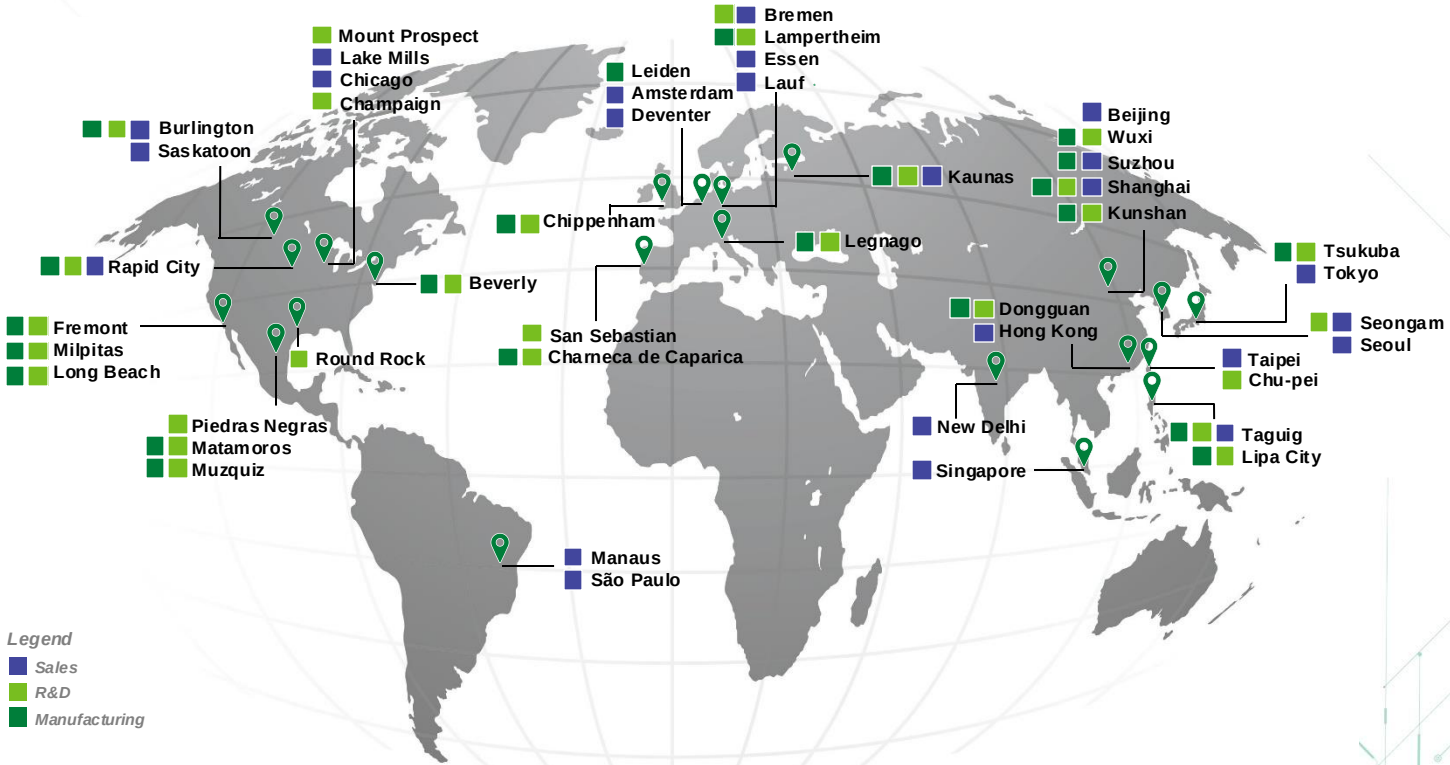


Circuit Protection Selection Guide



Littelfuse
Expertise Applied | Answers Delivered

Local resources supporting our global customers



Littelfuse
Expertise Applied | Answers Delivered

Partner for tomorrow’s electronic systems

Broad product portfolio

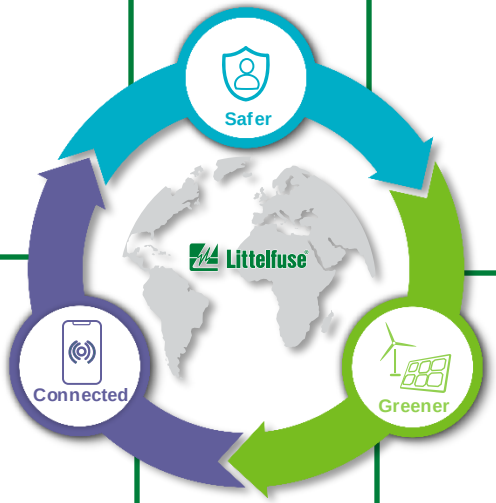
A global leader with a broad product portfolio, covering every aspect of protection, sensing, and control

Application expertise

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

Global customer service

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



Compliance & regulatory expertise

We help customers in the design process to account for requirements set by global regulatory authorities

Testing capabilities

To help customers get products to the market faster, we offer certification testing to global regulatory standards

Global manufacturing

High-volume manufacturing that is committed to the highest quality standards

Littelfuse
Expertise Applied | Answers Delivered

Littelfuse®

Expertise Applied | Answers Delivered

IXYS

A Littelfuse Technology

Littelfuse.com