

SCD3-CC Series

3-Pole Solid-State Contactors



Description

The SCD3-CC series of 3-pole solid-state contactors (SSCs) offers a dependable solution for 3-Phase applications. Designed to meet industry standards, the Littelfuse SCD3-CC series provides consistent performance for everyday use.

- **Reliable Operation:** The SCD3-CC series ensures stable performance, making it a solid choice for general 3-phase applications.
- **IP20 Connection Options:** available with push-in connection for faster, tool-free wiring, or with screw terminals featuring removable protection. Both ensure IP20 safety for secure and reliable installation.
- **3-Leg Switching:** Optimized for Grounded Wye (Star, 4-wire) and Open Delta (6-wire) configurations, where switching all three phases ensures safe and effective control of 3-phase loads with neutral connection or independent loads.
- **Ready-to-Use Product:** DIN-rail mounting heatsink already attached, removing the need for thermal calculations or separate assembly, making installation faster and simpler.

Features & Benefits

FEATURES	BENEFITS
Zero Cross Switching	Reduces electrical noise and minimizes voltage spikes during switching, enhancing overall system stability
Compliance with International Standards (CE, UKCA)	Ensures that the Solid-State Contactor (SSC) has undergone rigorous testing, providing enhanced safety and product quality
Efficient Design with High Quality	Engineered to accommodate a diverse range of applications and load types, offering flexibility and utility in various engineering projects

Applications

- Packaging & plastic machinery such as shrink tunnels, sealing machines, injection molding, and blow molding
- Industrial ovens such as reflow ovens, climatic chambers, and drying ovens
- HVAC systems such as commercial units with independent phase-neutral heaters
- Medical & laboratory equipment such as autoclaves, sterilizers, and test chambers
- Food & beverage equipment such as fryers, ovens, coffee machines, and mixers
- General industrial equipment with grounded wye (star) or open delta wiring

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Ordering Information

CATALOG NUMBER	OUTPUT MAX CURRENT	OUTPUT VOLTAGE	OUTPUT SWITCHING STYLE	OUTPUT OVERVOLTAGE PROTECTION	INPUT VOLTAGE RANGE	COMPLIANCE
SCD3-CCUZM-025VC-N	25 A	24-520 V ac	Zero Cross	Varistor	24-255 V ac/dc	cULus, CE, UKCA

Input/Control Specifications¹

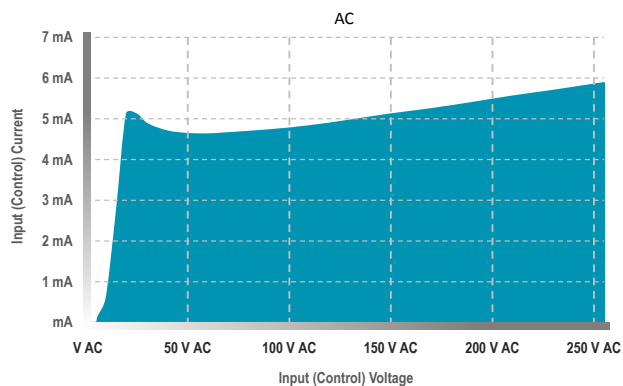
GENERAL DATA				
SYMBOL	PARAMETER	RANGE	VALUE	UNIT
U _c	Input (Control) Voltage*	Maximum	255	V ac/dc
		Nominal	48 - 120 - 240	V ac/dc
		Minimum	24	V ac/dc
U _{rv}	Reverse Voltage	Maximum	-	-
U _{c on}	Turn-On Voltage (Pick-up/Engage/Activation Voltage)	Minimum	24	V ac/dc
U _{c off}	Turn-Off Voltage (Drop Out/Release/Deactivation Voltage)	Nominal	2	V ac/dc
I _c	Input (Control) Current	Maximum	<7	mA
		Minimum	5 (ac) / 4 (dc)	mA
-	Input Impedance	Nominal	Current Regulated	-
T _{on}	Turn-On Time (U _e typ, 50Hz)	Maximum	10ms	1/2 Cycle
T _{off}	Turn-Off Time (U _e typ, 50Hz)	Maximum	10ms	1/2 Cycle

* Increase Min voltage by 1V for operations from -20 to -40 °C.

Input Current vs Input Voltage Graphs (For Power Supply Selection)

To ensure the Solid-State Contactor (SSC) operates efficiently and reliably, it is essential to understand the relationship between input voltage and input current. The following input current graphs provide detailed information on the current consumption of our SSCs across the specified input voltage range (24-255 V ac). This data is crucial for selecting an appropriate power supply and ensuring the Contactor functions within its safe operating limits. Proper understanding of current consumption is vital for the optimal performance of your application.

24-255 VAC/DC Input



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Output/Load Specifications¹

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
-	Output Configuration	-	-	SPST-NO	-
f	Operating Frequency	-	Minimum Nominal Maximum	0.1 50 – 60 200	Hz
Ue	Operating Voltage	47-63Hz	Minimum Nominal Maximum	24 120 - 240 - 400 520	Vrms
U _{sync}	Zero Cross Level (Zero Voltage Turn-on)	-	Maximum	35	V
U _a	Latching Voltage	At U _e Nominal	Minimum	10	V
V	On-State Voltage Drop	At Rated Current	Maximum	$0,9 + 0,014 \times I_e$	Vrms
V _{to}	Threshold Voltage (Power Loss Calculations only)	T _{vj} = 150 °C	Maximum	0.90	V
r _t	On state dynamic resistance (Power Loss Calculations only)	T _{vj} = 150 °C	Maximum	14.0	mΩ
U _p	Transient Over-Voltage* (Peak/Blocking/Non-Repetitive Voltage)	-	Maximum	1600	V _{pk}
I _{tsm}	Transient Over-Current (Surge/Overload/Non-Repetitive Current)	Max 1 Cycle T _p = 10ms	Minimum Nominal	380 500	A _{pk}
I _{lk}	Leakage Current (Off-State)	At Rated Voltage	Maximum	1	mA _{rms}
dv/dt	Critical dv/dt (Off-State)	At Maximum Rated Voltage	Minimum	500	V/μsec
di/dt	Non-repetitive di/dt	-	Maximum	50	A/μsec
I ² _t	I ² _t Value for Fusing	½ Cycle at 50/60Hz (T _{vj} =45 °C)	Minimum Nominal	720 1250	A ² sec
P _f	Minimum Power Factor	At Maximum Load	Minimum	0.8	-
P _d	Power Dissipation	@ Rated Current	Maximum	$0,81 \times I_e + 0,014 \times I_e^2$	W
R _{thj/c}	Thermal Resistance Junction to Case (R _{jc})	-	Maximum	1.1	°C/W

* Output will self trigger between 450-600V_{pk} not suitable for capacitive loads.

The maximum continuous current values given in this datasheet are specified for resistive loads (AC-1), which are mainly used for heating control. In addition, AC-3 values are provided for motor control.

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
I _e (AC-51 // AC-1)	Load Current (Continuous) – Heating Elements (AC-1)	At 40 °C	Maximum*	25	Arms
			Minimum	0.005	Arms

* Heat sinking required, see derating curves.

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
I _e (AC-53 // AC-3)	Load Current (Continuous) – Motor Loads (AC-3)	At 40 °C	Maximum*	5	Arms
			Minimum	0.005	Arms

* Heat sinking required, see derating curves.

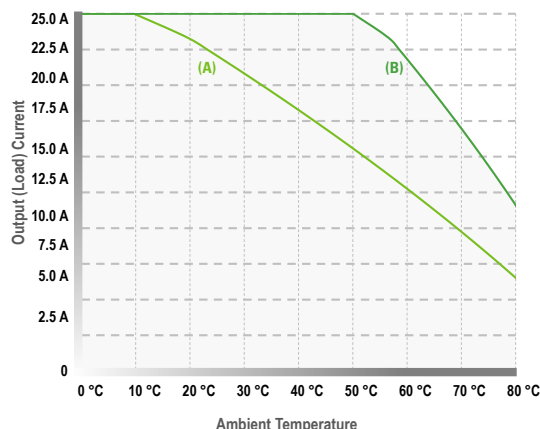
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Thermal Derating Curves (To Determine Maximum Load At Different Temperatures)

The following thermal derating curves show the maximum continuous load current the Solid-State Contactor (SSC) can manage at different ambient temperatures with its factory-installed heatsink. These curves help ensure correct application and reliable operation.

25A Versions Graph



(A): Natural Convection (B): Forced Convection > 1m/s

Considerations – Switching Type

Heating Elements (AC-1): In applications requiring precise temperature management, solid-state contactors (SSCs) play a crucial role. Specifically, the Resistive Zero Cross Switching type of SSC is commonly employed to regulate heaters based on signals from a temperature controller.

This technology proves particularly valuable in scenarios where high-frequency switching occurs—such as when a heater cycles on and off frequently over short intervals for extended periods.

Motors (AC-3): In applications requiring the control of motors or other inductive loads, solid-state contactors (SSCs) designed for AC-3 loads are essential. Specifically, the Zero Cross Switching type of SSC optimized for Inductive loads is recommended for motor applications, as it ensures smooth operation and reduces wear on motor windings. This technology is particularly valuable in scenarios where inductive loads require frequent on/off cycling, such as in conveyor belts, pumps, or fans.

Considerations – Inrush Current

Heating Elements (AC-1): It's essential to recognize that variations exist between different types of heating elements, especially in hot or cold conditions. While it is generally expected that heating elements exhibit no inrush current, in certain heating elements cold conditions can lead to an inrush current equivalent to 1.4 times the nominal current. To mitigate this, we highly recommend oversizing the current rating. Doing so improves the Contactor's thermal endurance and extends its operational lifespan. So, when selecting an SSC, consider using one with a capacity approximately 1.4 times that of the heater or operating the SSC at only 75%-80% of its maximum capacity.

Motors (AC-3): Motors and other inductive loads are characterized by high inrush currents during startup, often several times higher than the nominal running current. To simplify the selection process and avoid oversizing errors, the continuous load current values specified under the AC-3 ratings in the previous table already account for these conditions. By using the AC-3 values, users ensure that the solid-state contactor is properly rated to handle the inrush and provide reliable operation for motor loads.

NOMINAL SSC CURRENT RATING	MAXIMUM RECOMMENDED HEATER CURRENT	HEATER POWER AT 120 VAC	HEATER POWER AT 240 VAC	HEATER POWER AT 400 VAC	HEATER POWER AT 480 VAC	HEATER POWER AT 600 VAC
25 A	20 A	~4.2 kW	~8.3 kW	~13.9 kW	~16.6 kW	~20.8 kW

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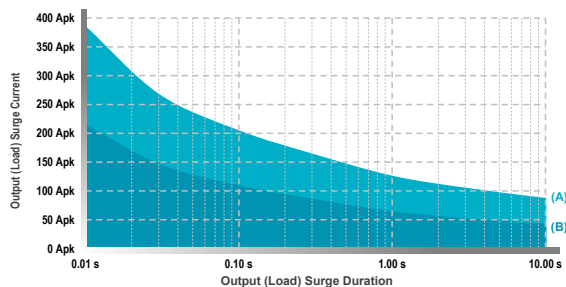
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Output Surge Current Withstand Graphs (For Transient Protection)

To ensure the Solid-State Contactor (SSC) can handle sudden increases in current without damage, it is essential to understand its surge current capacity. The following surge current graphs illustrate the maximum surge current that our SSCs can withstand over various durations. This information is crucial for selecting an SSC that can endure transient overcurrent events, ensuring the reliability and safety of your electrical system. Proper understanding of surge current capacity helps in preventing equipment failure and maintaining optimal performance in your application.

The graphs include a Single Pulse Surge Current curve used to define the protection offered by fuses, helping in the selection of appropriate protective devices. Additionally, it is important to ensure that the Repetitive Surge Current curve is not exceeded during normal operation, as frequent overload currents can decrease the life expectancy of the SSC. Therefore, caution is advised to maintain the longevity and reliability of the SSC.

25A Versions



(A) **Single Pulse Surge:** Initial SSC internal temperature at 25°C (cooler state from minimal or no operation).

(B) **Repetitive Surges:** Initial SSC internal temperature 90°C (warmer state from continuous operation).

General Specifications¹

GENERAL DATA					
SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
-	LED for Input (Control) Status Indicator	-	-	Continuously ON Green LED, when control input is applied	-
Ui	Isolation (Dielectric Strength)	Input to Output (50/60 HZ)	Nominal	4000	Vrms
		Input/Output to Ground (50/60 HZ)	Nominal	4000	
Ri	Insulation Resistance	@ 500 V DC	Minimum	1	GΩ
-	Coupling Capacitance	Input/Output	Maximum	0.8	pF
Uimp	Impulse Withstand Voltage	-	Nominal	4000	Vrms
-	Short Circuit Current Rating (SCCR)	-	-	5	kA
-	Endurance according to American Standard UL508	-	Typical	6,000	Cycles
-	MTTFd (Mean Time to Dangerous Failure) (Calculated in accordance with the guidelines for safety-related parts of control systems, as specified by the international standard ISO 13849-1)	-	-	37	Years
-	MTBF* (Mean Time Between Failures) (Calculated in accordance with the Military Handbook Guidelines for Reliability Prediction of Electronic Equipment, as specified by the US Department of Defense Standard MIL-HDBK-217)	@ 40 °C ambient	-	28	Years
		@ 60 °C ambient	-	21	

*All parameters at 50% power rating and 100% duty cycle.

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General Specifications¹ (Continued)

ENVIRONMENTAL DATA					
SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
-	Vibration (Test conducted in accordance with the Vibration Environmental Testing Guidelines of the International Standard IEC 60068-2-6)	5-100Hz	Nominal	10	g
-	Shock (Test conducted in accordance with the Shock Environmental Testing Guidelines of the International Standard IEC 60068-2-27)	11ms	Nominal	30 / 50	g
Tamb	Ambient Temperature - Operating (Working)*	No icing, no condensation	Maximum Minimum	100 (212) -40 (-40)	°C (°F) °C (°F)
Tstg	Ambient Temperature - Storage	No icing, no condensation	Maximum Minimum	125 (257) -40 (-40)	°C (°F) °C (°F)
HR	Relative Ambient Humidity (Per international standard IEC/EN 60068-2-78)	Non-condensing @ 40 °C	Nominal	40 to 85	%
-	Pollution Degree	Non-conductive pollution with condensation possibilities	Nominal	2	-

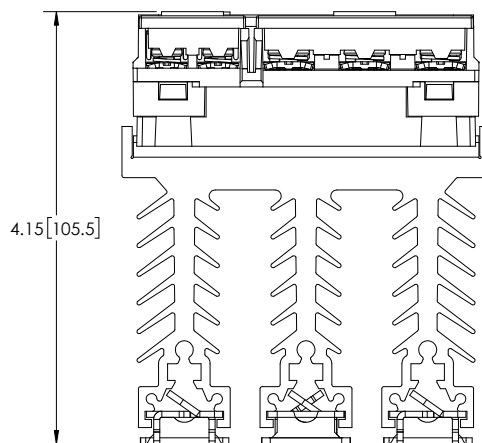
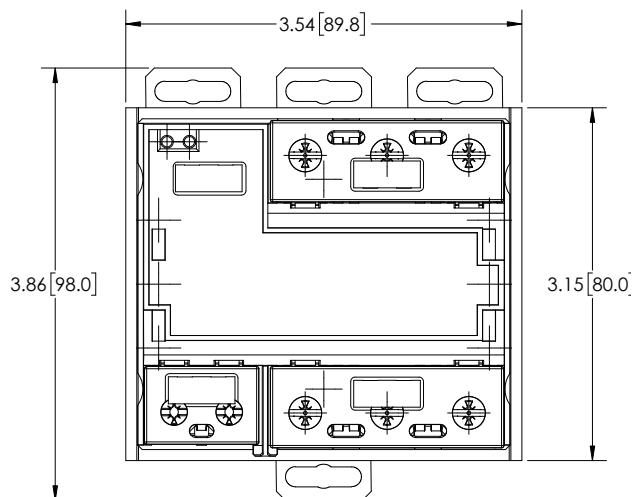
* AC input option minimum operating temperature is -20 to 80 °C (-4 to 176 °F).

MECHANICAL DATA					
SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
-	Product Weight	-	Typical	200 (0.44)	g (lbs)
-	Housing Material (In accordance with the American Standard UL- 94 for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances)	-	-	Plastic UL 94 V-0	-
-	Baseplate Material	-	-	Aluminum, Tinned-plated	-
-	Touch Protection Level (Test conducted in accordance with the IP Code of Degrees of Protection Testing Guidelines of the International Standard IEC 60529)	-	-	IP20	-
-	Screw Torque Range	Input (Control) Terminals	Minimum	1.2 (11)	Nm (in-lb)
			Maximum	2.0 (18)	
		Output (Load) Terminals	Minimum	2 (18)	Nm (in-lb)
			Maximum	3 (26)	
-	Screw Thread Size	Input Terminals	-	M4 x 12mm	-
		Output Terminals	-	M5 x 13mm	-

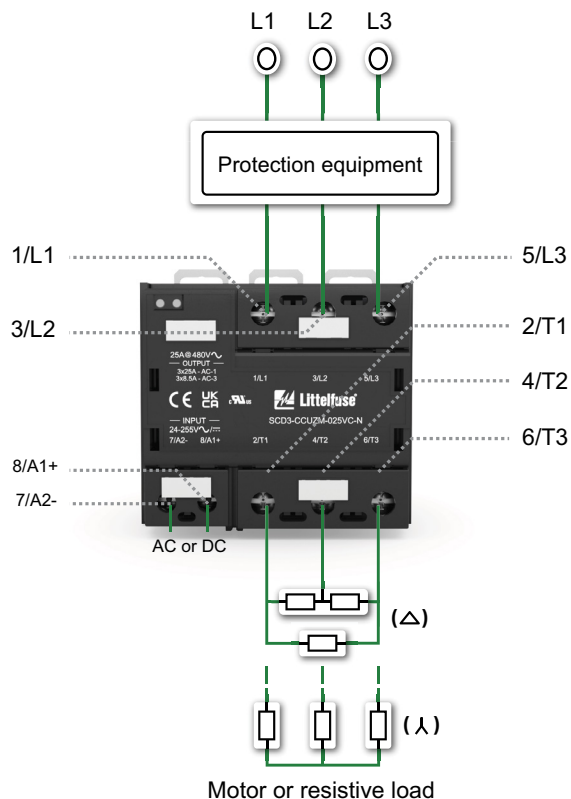
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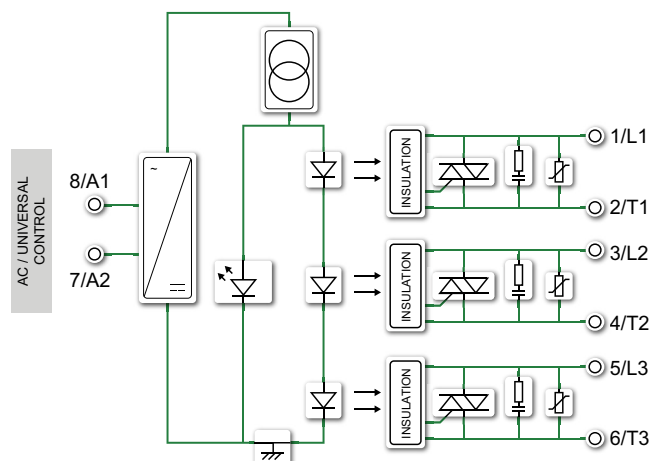
Product Dimensions [Millimeters]



Wiring Diagram



Equivalent Circuit Block



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Short-Circuit Protection by Fuse

To safeguard solid-state Contactors (SSCs) against load short circuits, the use of fuses is essential, especially fast-acting ones. Here are the key considerations:



- **Fuse Selection:** The I^2t value (energy withstand capability) of the fuse should be less than half of the I^2t value of the Contactor. Standard fuses are inadequate because they cannot react swiftly enough to prevent fault currents from exceeding the maximum levels that thyristors (used in SSCs) can handle. Therefore, we strongly recommend employing ultra-fast fuses.
- **Fuse Placement:** Position the fuse in front of the SSC in the circuit. In 3-leg SSCs, this means one fuse per phase (three in total). This strategic placement ensures that if the Contactor must unexpectedly break the earth insulation (due to overheating, case damage, or leakage with the heatsink), the fuse will protect the entire circuit from firing.
- **Resource for Fuse Options:** For the most suitable fuse options, consider checking the [Littelfuse website](https://www.littelfuse.com).

Standards Conformity & Certifications

Product Safety Certifications

Products tested, compliant and certified to the following standards that states the requirements for electrical products to ensure they are safe for consumers to use.

CERTIFICATION BODY MARK	CERTIFICATION BODY NAME	CERTIFICATION DESCRIPTION	STANDARDS COVERED BY THE CERTIFICATION
	cRUus	North American certificate of compliance with the Safety requirements for Industrial Control Equipment	 UL508 American Standard of Safety for Industrial Control Equipment.  CAN/CSA C22.2 No.14-18 Canadian Standard of Safety for Industrial Control Equipment.
	CE	Conformity with the European safety, health, and environmental protection requirements	 LVD Directive 2014/35/EU EU Directive of Safety for Low Voltage Gear Equipment. In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3  EMC Directive 2014/30/EU EU Directive of Electromagnetic Compatibility. In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3  RoHS Directive 2015/863/EU EU Directive of Hazardous Substances Restriction. In accordance with the Assessment of electrical and electronic products with respect to the restriction of Hazardous substances Guidelines of the International Standard IEC 63000
	UKCA	Conformity with the UK product safety regulations	 SI 1101 UK Regulations of Safety for Electrical Equipment In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3  SI 1091 UK Regulations of Electromagnetic Compatibility. In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3  SI 3032 UK Regulations of Hazardous Substances Restriction. In accordance with the Assessment of electrical and electronic products with respect to the restriction of Hazardous substances Guidelines of the International Standard IEC 63000

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EMC Compliance (Electro-Magnetic Compatibility)

Radiated Emissions

-	STANDARD NAME	STANDARD DESCRIPTION	STANDARD NUMBER	LEVELS
	Radiated RF	Radio interference field emission (radiated)	International Standard CISPR 11	Class A: 30M – 1GHz
	Conducted RF	Radio interference voltage emissions (conducted)	International Standard CISPR 11	Class A (with external filter): 150k – 30MHz

Immunity

-	STANDARD NAME	STANDARD DESCRIPTION	STANDARD NUMBER	LEVELS
	ESD	Immunity to Electrostatic Discharge (ESD)	International Standard IEC 61000-4-2	Level 3: -Contact Discharge: ± 6 kV -Air Discharge: ± 8 kV -Performance Criteria: A
	Radiated RF	Immunity to Radiated Radio Frequency	International Standard IEC 61000-4-3	Level 3: 10 V/m (80MHz-2GHz) Level 2: 3 V/m (2GHz-6GHz) Performance Criteria: A
	Burst	Immunity Electrical Fast Transients (Burst)	International Standard IEC 61000-4-4	2 kV Performance Criteria: B
	Surge	Immunity to Electrical Surges	International Standard IEC 61000-4-5	2 kV Performance Criteria: B
	Conducted RF	Immunity to Conducted Radio Frequency	International Standard IEC 61000-4-6	Level 3: 10V/m (0.15 - 80 MHz) Performance Criteria: A
	Dips	Immunity to Voltage Dips	International Standard IEC61000-4-11	-0% for 0.5, 1 cycle, Performance Criteria A -40% for 10/12 cycles, Performance Criteria A -70% for 25/30 cycles, Performance Criteria A -80% for 250/300 cycles, Performance Criteria A
	Interruptions	Immunity to Voltage Interruptions	International Standard IEC 61000-4-11	0% for 250/300 cycles, Performance Criteria B

While these products are designed to meet high industrial standards for Class A equipment, ensuring robust performance in demanding environments, they may cause radio interference when used in domestic settings. To mitigate this, additional noise reduction measures, such as filters or shielding, may be necessary. Ensure that the entire setup where the SSC is installed complies with all relevant EMC regulations required by the application.

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Environmental Compliance²

Products comply to the following environmental standard requirements for electrical products to ensure they are safe for consumers to use.

-	STANDARD NAME	STANDARD DESCRIPTION	STANDARD NUMBER
	RoHS	Conformity with the European Restriction of Hazardous Substances in electrical and electronic products	European Directive 2015/863/EU (IEC 63000)
	REACH	Conformity with the Registration, Evaluation, Authorization and Restriction of Chemicals regulation to ensure safe use of chemicals	European Directive 1907/2006
	WEEE	Conformity with the Waste Electrical and Electronic Equipment regulation to ensure proper disposal and recycling of e-waste	Regulation 2002/96/EC

Notes:

¹All parameters at 25 °C unless otherwise specified.

²The environmental compliance data reflects the most current information available and adheres to our rigorous standards for quality and sustainability. These specifications are valid from the product's initial release and are subject to change with ongoing improvements.

Warning Information

Caution: Material Damage, Electric Shock, and Arc Flash Hazard. Before installing or working with this equipment, take the following precautions:

1. **Disconnect all power:** Ensure that all power sources are disconnected.

2. **Verify connections:** Double-check all connections.

Failure to adhere to these instructions may lead to **serious injury or damage** of equipment.

Disclaimer Notice – Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at www.littelfuse.com/product-disclaimer.