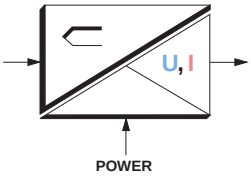
Configurable Temperature Measuring Transducers for Thermocouple Type J,K
MCR-TE-JK-...

- **Temperature range can be set using DIP switches**
- **ZERO/SPAN adjustment**
- **Open circuit detection**
- **Available with electrically isolated input**



1. Description

MCR-TE temperature measuring transducers convert thermocouple signals (IEC 584-1/EN 60 584-1), types J (Fe-CuNi) and K (NiCr-Ni), into electrically standardized analog signals.

Cold junction compensated connection terminals are available for the accurate detection of sensor signals. The switchable cold junction enables external cold junction or differential temperature detection. Standardized voltage and current signals are available on the output side. An additional service is provided by the thermal open circuit indication via LEDs. The output circuit provides a corresponding analog signal.

Devices with current or voltage output and with an electrically isolated input are available.

Temperature measuring transducers for themocouple type K and J, current output 0…20 or 4…20 mA or voltage output 0…10 V.

The various temperature ranges 0…400°C (32…752°F), 0…800°C (32…1472°F), 0…1000°C (32…1832°F), 0…1200 °C (32…2192°F) can be set using DIP switches.

The devices are configured as desired and are always adjusted upon delivery. In addition, the adjustment potentiometers, which can be accessed on the front, offer the option of carrying out a measured distance adjustment (ZERO/SPAN) of ± 5%. If no specification has been made in the order key on the last page, the devices are delivered with the default setting (type K, 0…1000°C (32…1832°F) and 0…10 V or 4…20 mA).

To remove disturbing pulses, the functional earth contact, integrated in the housing, connects the signal ground of the module electronics to the DIN rail, which is at ground potential. This means that the shield can be easily installed on the module and the use of an additional earth terminal is no longer required.

Modules are connected to symmetrical EN 50 022 DIN rails using plug-in COMBICON connectors.

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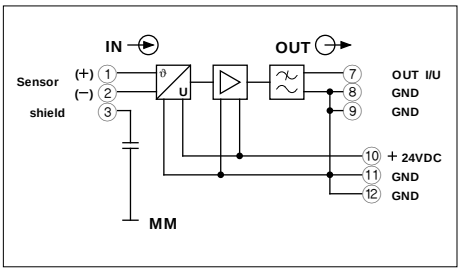
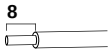
2. Technical Data



MCR-TE-JK-…

with signal conversion: Thermocouple type J, K;
0…400°C/0…800°C/0…1000°C/0…1200°C
(32…752°F/32…1472°F/32…1832/32…2192°F)
0…10 V, 0…20 mA or 4…20 mA

Housing width 17.5 mm (0.689 in.)



	fixed [mm²]	flexible	AWG
Connection data	0.2-2.5	0.2-2.5	24-14

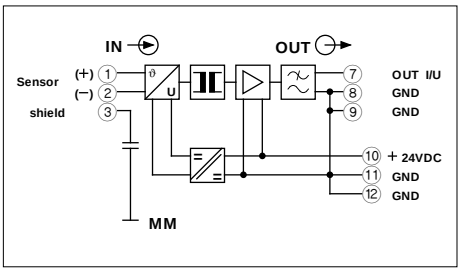
Description	Output signal U_A/I_A
MCR temperature measuring transducer, for thermocouple type J, K; Input:0-400°C (32-725°F), 0-800°C (32-1472°F), 0-1000°C (32-1832°F), 0-1200°C (32-2192°F)	0...10 V 0(4)...20 mA

Type	**Order No.**	Pcs.P kt.
MCR-TE-JK-U[1)]	**28 10 53 1**	1
MCR-TE-JK-I[1)]	**28 10 54 4**	1

[1)] Specify configuration (see order key on the last page)

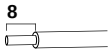
Technical Data		**MCR-TE-JK-U**	**MCR-TE-JK-I**
Input			
Input		Thermocouple type J, K;	
Temperature range		0…400°C, 0…800°C, 0…1000°C and 0…1200°C (32…752°F, 32…1472°F, 32…1832°F and 32…2192°F)	
Connection method		Plug-in screw-clamp connection	
Output			
Output signal		0...10 V	0(4)...20 mA
Maximum output signal		15 V	30 mA
Load		≥ 10 kΩ	≤ 500 Ω
Output signal on open circuit		> 11 V	> 22 mA
General Data			
Supply voltage		18...30 V DC	18...30 V DC
Maximum current consumption		20 mA	50 mA
Transmission error:	Type K	≤ 1.2% of the final value	
	Type J	< 2.0% of the final value (At 0...400°C and 0...800°C [32…752°F and 32…1472°F]) < 2.5% of the final value (At 0…1000°C and 0...1200°C [32…1832°F and 32…2192°F])	
Temperature coefficient		≤ 0.02%/K	
Cold junction error		± 2.5°C (36.5°F) typical, 4.0°C (39.2°F) maximum	
Adjustment:	ZERO	± 60 K	
	SPAN	± 5% F.S.	
Limit frequency		30 Hz	
Step-response (10-90%)		11.5 ms	
Test voltage:	Input/output	–	–
	Input/supply	–	–
Ambient temperature range		- 20°C to + 65°C (-4°F to 149°F)	

Configurable Temperature Measuring Transducers for Thermocouple Type J,K – MCR-TE-JK...



MCR-TE-JK-…-E

with signal conversion: Thermocouple type J, K;
0…400°C/0…800°C/0…1000°C/0…1200°C
(32…752°F/32…1472°F/32…1832/32…2192°F)
0…10 V, 0…20 mA or 4…20 mA



	fixed [mm²]	flexible	AWG
Connection data	0.2-2.5	0.2-2.5	24-14

Housing width 17.5 mm (0.689 in.)

Description	Output signal U_A/I_A
MCR temperature measuring transducer, As above. Input electrically isolated	0...10 V 0(4)...20 mA

Type	Order No.	Pcs. Pkt.
MCR-TE-JK-U-E[1)]	**28 10 51 5**	1
MCR-TE-JK-I-E[1)]	**28 10 52 8**	1

[1)] Specify configuration (see order key on the last page)

Technical Data		MCR-TE-JK-U-E	MCR-TE-JK-I-E
Input			
Input		Thermocouple type J, K;	
Temperature range		0…400°C, 0…800°C, 0…1000°C and 0…1200°C (32…752°F, 32…1472°F, 32…1832°F and 32…2192°F)	
Connection method		Plug-in screw-clamp connection	
Output			
Output signal		0...10 V	0(4)...20 mA
Maximum output signal		15 V	30 mA
Load		≥ 10 kΩ	≤ 500 Ω
Output signal on open circuit		> 11 V	> 22 mA
General Data			
Supply voltage		18...30 V DC	18...30 V DC
Maximum current consumption		20 mA	50 mA
Transmission error:	Type K	≤ 1.2% of the final value	
	Type J	< 2.0% of the final value (At 0...400°C and 0...800°C [32…752°F and 32…1472°F]) < 2.5% of the final value (At 0…1000°C and 0...1200°C [32…1832°F and 32…2192°F])	
Temperature coefficient		≤ 0.02%/K	
Cold junction error		± 2.5°C (36.5°F) typical, 4.0°C (39.2°F) maximum	
Adjustment:	ZERO	± 60 K	
	SPAN	± 5% F.S.	
Limit frequency		30 Hz	
Step-response (10-90%)		11.5 ms	
Test voltage:	Input/output	1.5 kV, 50 Hz, 1 minute	
	Input/supply	1.5 kV, 50 Hz, 1 minute	
Ambient temperature range		- 20°C to + 65°C (-4°F to 149°F)	

CE

Conforms to the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC

EMC (electromagnetic compatibility)		
Noise immunity in accordance with 50082-2		
• Electrostatic discharge (ESD)	EN 61000-4-2	8 kV air discharge[2)]
• Electromagnetic HF field Amplitude modulation Pulse modulation	 ENV 50140 ENV 50140	 3 V/m[3)] 3 V/m[3)]
• Fast transients (burst)	EN 61000-4-4	Input/output/supply: 2 kV/5 kHz[2)]
• Surge current load (surge)	ENV 50142	Input/output: 2 kV/42 Ω[2)]
• Conducted interference	ENV 50141	Input/output/supply: 10 V[1)]
Noise emission in accordance with EN 50081-2	EN 55011	Class A

EN 61000 corresponds to IEC 1000/
EN 55011 corresponds to CISPR11

[1)]Criterion A: normal operating characteristics within the specified limits.
[2)]Criterion B: temporary adverse effects on the operating characteristics, which the device corrects itself.

Class A: industrial application without special installation measures

MCR-TE-JK... – Configurable Temperature Measuring Transducer for Thermocouple Type J,K

① Plug-in screw-clamp terminals (COMBICON)

② Zero/span potentiometer

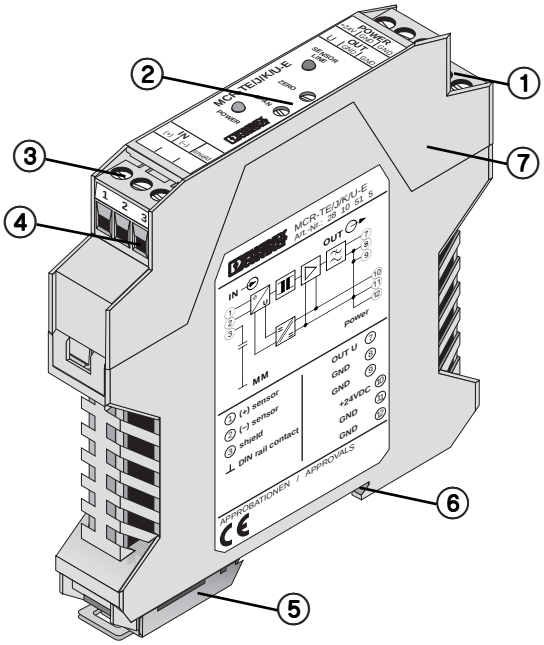
③ Plug-in screw-clamp terminals (COMBICON)

④ Shield connection (on terminal 3)

⑤ Metal lock for fastening on the DIN rail

⑥ Functional earth contact

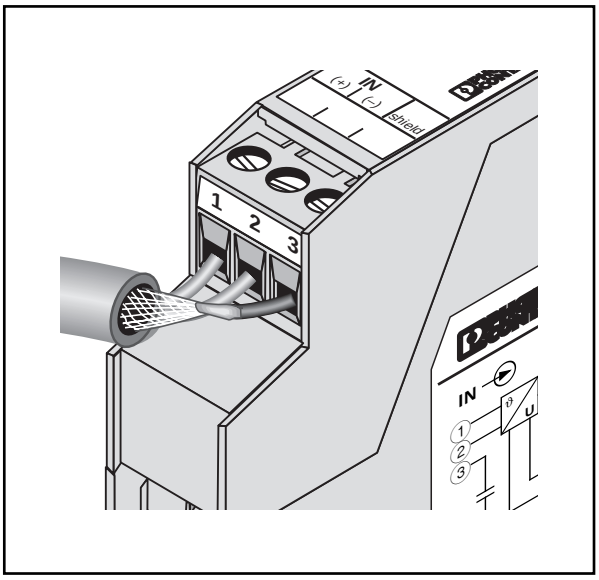
⑦ Housing cover, can be removed for DIP switch setting



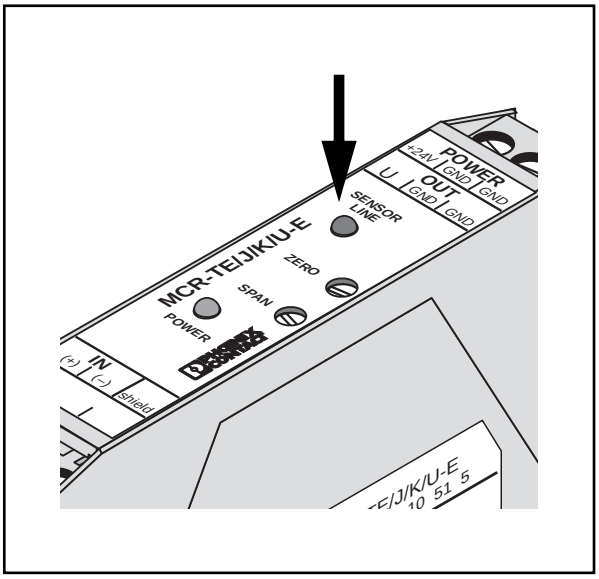
3. Connection and Operating Instructions

Sensor Type	Temperature Range
Type K (NiCr/Ni) Type J (Fe/CuNi)	0 ... 400°C (32…752˚F) 0 ... 800°C (0…1472˚F) 0 ... 1000°C (0…1832˚F) 0 ... 1200°C (32…2192˚F)

Shield clamp "3" is connected with a capacitor using the function earth contact to the **DIN rail, which is at ground potential**. Any disturbing pulses that occur are diverted.

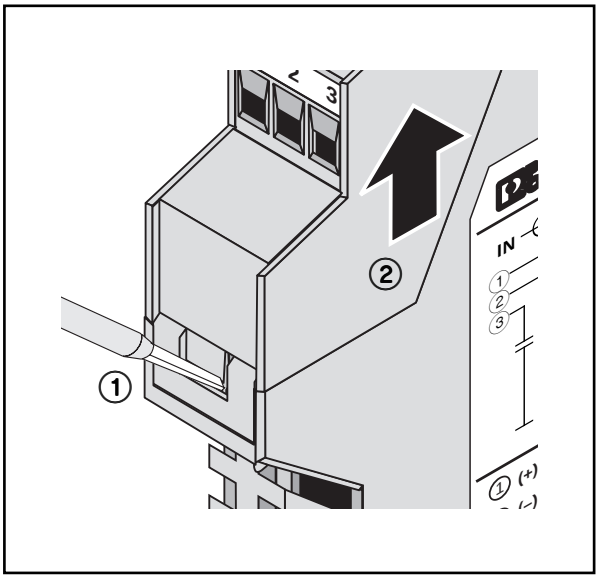


If an **open circuit** occurs, the output is overridden and the red "Sensor Line" LED lights up.



Opening the Device

The locked housing cover is released on both sides using a screwdriver①. The housing cover and electronics can only be pulled out about 3 cm (1.181 in.) ②.



4. Configuration

The basic settings of your device (sensor type, temperature range, cold junction) can be set using a labeled DIP switch inside the housing corresponding to the configuration table.

Note: Zero/span adjustment must be carried out after every input, temperature range or output change.

4.1. Zero/Span Adjustment

Required device:
Calibration source volt or amp meter

a) Connect a 24 V supply voltage to terminals "10" and "11". The "Power" and "Sensor Line" LEDs must light up.

Allow the module to warm up for 12 minutes before starting the adjustment procedure.

b) Connect the calibration source to the input terminals IN+ "1" and IN- "2" and specify a voltage of 0 mV. The "Sensor Line" LED should no longer be lit.

c) Two potentiometers are available on the front side of the module for adjustment:
ZERO: zero point adjustment
SPAN: final value adjustment

d) Zero point adjustment:

- Specify a default value depending on the sensor type using the calibration source (see table: Zero point adjustment).
- Set the output signal value (U_{OUT} or I_{OUT}) using the zero potentiometer.

e) Final value adjustment

- Specify a default value depending on the sensor type and temperature range using the calibration source (see table: Final value adjustment).
- Set the output signal value (U_{OUT} or I_{OUT}) using the span potentiometer.

Note: Repeat points d) and e).
Zero/span adjustment is completed.

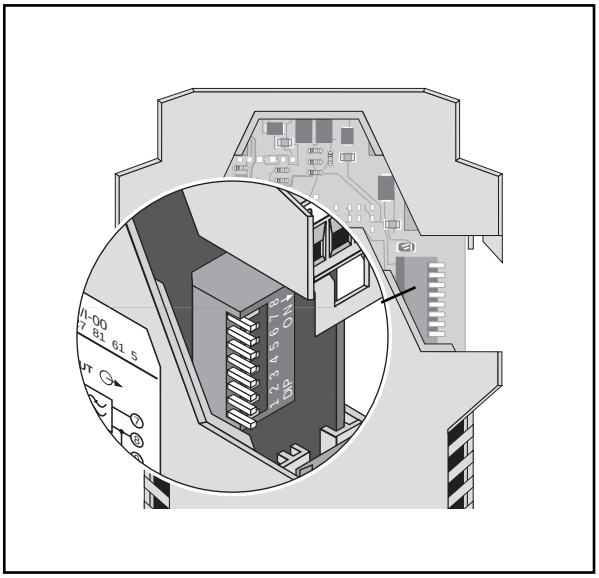


Table: Configuration

DIP Switch		S1	S2	S3	S4	S5	S6	S7	S8
Input	Type K	OFF							
	Type J	ON							
Temperature Range	0 ... 400°C (32…752°F)		OFF	OFF	OFF				
	0 ... 800°C (32…1472°F)		ON	OFF	OFF				
	0 ... 1000°C (32…1832°F)		ON	OFF	ON	OFF	OFF		
	0 ... 1200°C (32…2192°F)		ON	ON	OFF			OFF	OFF
Cold Junction									
Output	0 ... 10 V								
	0 ... 20 mA							OFF	ON
	4 ... 20 mA							ON	OFF

Table: Zero point adjustment

			Output Range		
			0 ... 10 V	0 ... 20 mA	4 ... 20 mA
Sensor Type	Temperature Range	Default Value	U_{OUT} (± 2 mV)	I_{OUT} (±3 µA)	I_{OUT} (±3 µA)
Type K	0...400°C (32…752°F)	39 µV	25 mV	50 µA	4040 µA
	0...800°C (32…1472°F)		12 mV	25 µA	4020 µA
	0...1000°C (32…1832°F)		10 mV	20 µA	4016 µA
	0...1200°C (32…2192°F)		8 mV	17 µA	4013 µA
Type J	0...400°C (32…752°F)	50 µV	25 mV	50 µA	4040 µA
	0...800°C (32…1472°F)		12 mV	25 µA	4020 µA
	0...1000°C (32…1832°F)		10 mV	20 µA	4016 µA
	0...1200°C (32…2192°F)		8 mV	17 µA	4013 µA

Table: Final value adjustment

			Output Range	
Sensor Type	Temperature Range	Default Value	0 ... 10 V	0 (4)... 20 mA
			U_{OUT} (± 2 mV)	I_{OUT}(± 3 µA)
Type K	0...400°C (32…752°F)	16.34 mV	10000 V	20000 mA
	0...800°C (32…1472°F)	33.07 mV		
	0...1000°C (32…1832°F)	41.35 mV		
	0...1200°C (32…2192°F)	49.28 mV		
Type J	0...400°C (32…752°F)	21.69 mV	10000 V	20000 mA
	0...800°C (32…1472°F)	44.84 mV		
	0...1000°C (32…1832°F)	56.85 mV		
	0...1200°C (32…2192°F)	68.39 mV		

4.2. Cold Junction Adjustment

If you have ordered a device with an activated cold junction, it is already adjusted. Evaluation of differential temperatures: the cold junction adjustment is not required, since the cold junction must be switched off. Detection of absolute temperatures: the cold junction must be switched on and is adjusted as follows:

- Put DIP switches S5 and S6 into the ON position.
- Measure the temperature T_{clamp} [°C] in the clamping part of input signal terminal "3".
- Calculate the measured temperature T_{clamp} according to the calculation instructions in the output value (U_{off}, or I_{off}) (see equations: output range 0...10 V or 0...20 mA).

The specifications for the calculation (measuring range, $T_{correction}$) can be found in the table: Specifications for adjustment calculation.

Specifications for Adjustment Calculation			
Sensor Type	Temperature Range	Measuring Range	$T_{correction}$
Type K	0...400°C (32…752°F)	400 K	0.5 K
	0...800°C (32…1472°F)	800 K	1.0 K
	0...1000°C (32…1832°F)	1000 K	1.0 K
	0...1200°C (32…2192°F)	1200 K	0.5 K
Type J	0...400°C (32…752°F)	400 K	1.5 K
	0...800°C (32…1472°F)	800 K	2.2 K
	0...1000°C (32…1832°F)	1000 K	2.6 K
	0...1200°C (32…2192°F)	1200 K	2.7 K

• Output range 0…10 V

$$U_{off} = \frac{10\ V \bullet (T_{clamp} - T_{correction})}{\text{Measuring range}}$$

• Output range 0…20 mA

$$I_{off} = \frac{20\ mA \bullet (T_{clamp} - T_{correction})}{\text{Measuring range}}$$

• Output range 4…20 mA

$$I_{off} = 4\ mA + \frac{16\ mA \bullet (T_{clamp} - T_{correction})}{\text{Measuring range}}$$

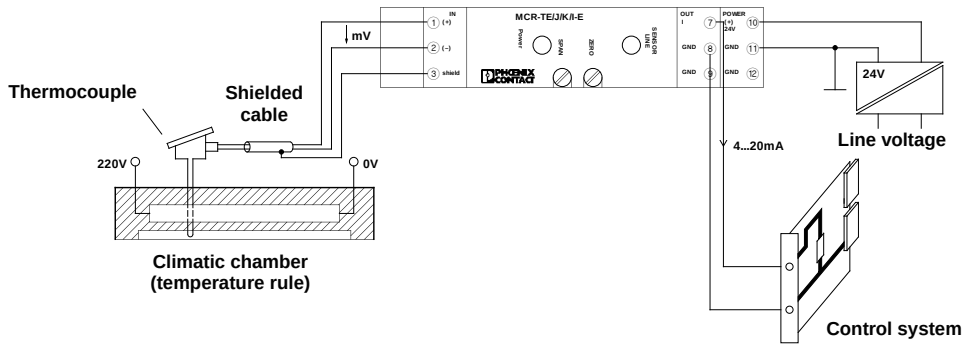
5. Order Key for the Configurable Thermocouple Measuring Transducers MCR-TE-JK...

Standard configuration		Sensor type [2]		Cold junction compensation [2]		Temperature range [2]		Output signal [2]
MCR-TE-JK-I	/	**K**	/	**1**	/	**3**	/	**2**
MCR-TE-JK-U **MCR-TE-JK-U-E** **MCR-TE-JK-I** **MCR-TE-JK-I-E**		**J** ≙ Type J **K** ≙ Type K		**0** ≙ switched off **1** ≙ switched on		**1** ≙ 0-400°C (32-752°F) **2** ≙ 0-800°C (32-1472°F) **3** ≙ 0-1000°C (32-1832°F) **4** ≙ 0-1200°C (32-2192°F)		**1** ≙ 0-20 mA **2** ≙ 4-20 mA

[2]) If no specification is given, the devices are delivered with the standard configuration (type K, 0-1000°C [32-1832°F] and 0-10 V or 4-20 mA).

6. Application Example

Temperature measurement of a climatic chamber



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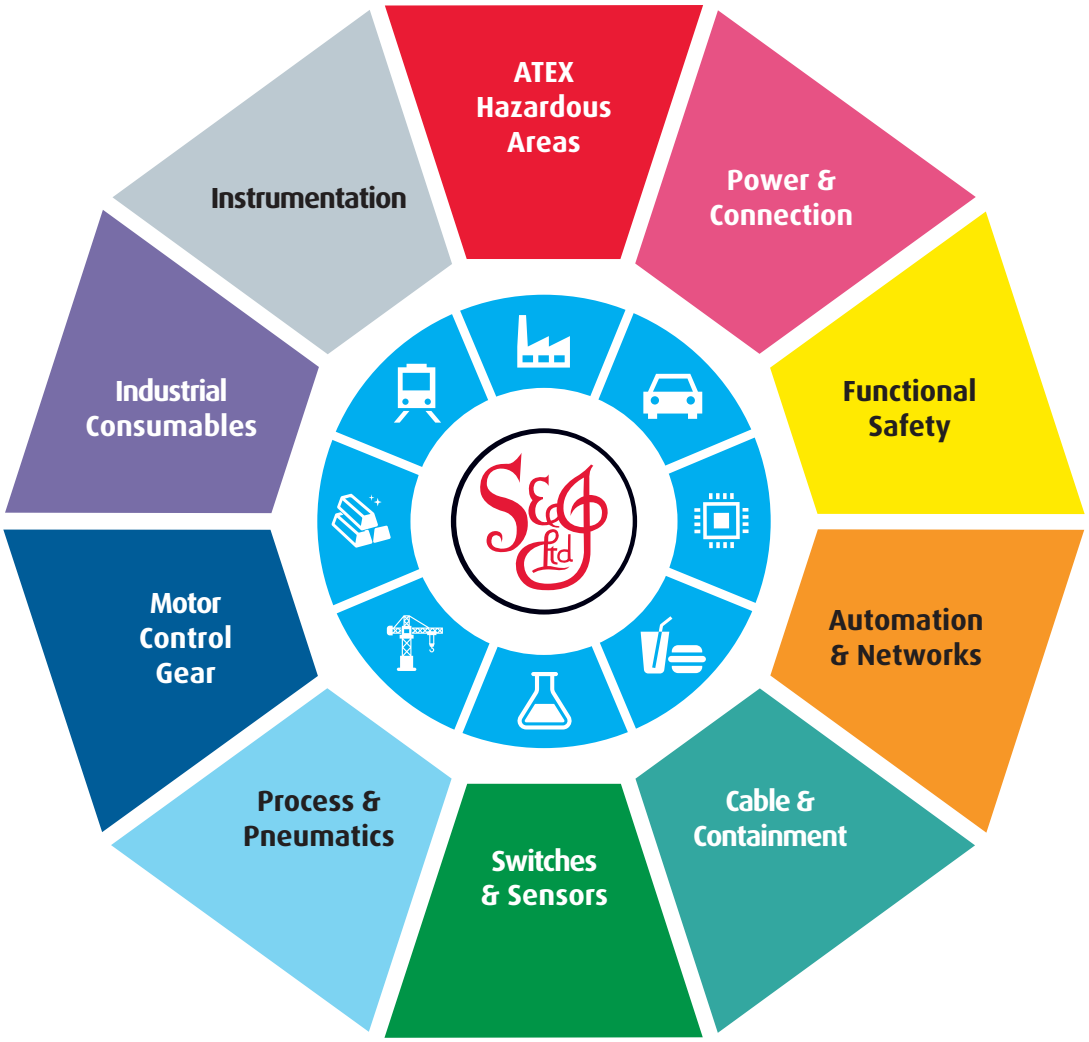

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