

# Current Sensor

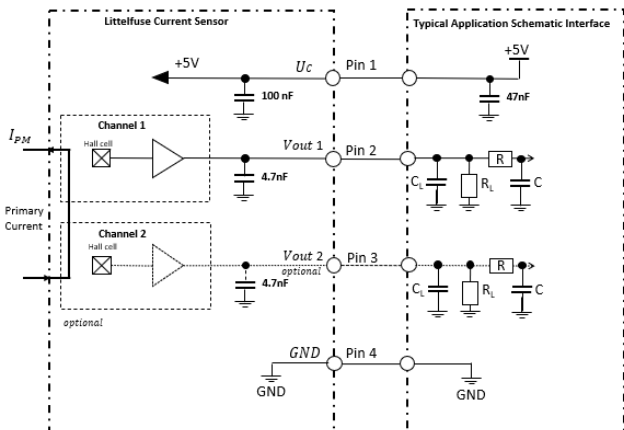
## CH1B02xB



### Description

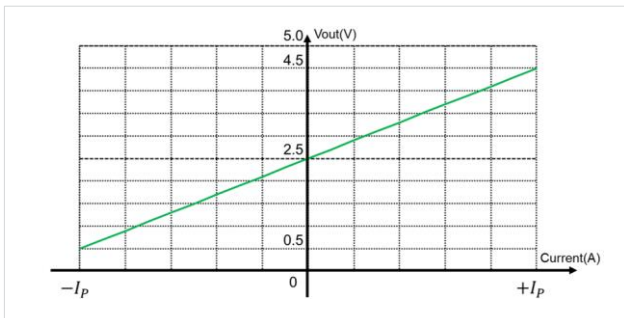
Littelfuse CH1B02xB current sensor is an open-loop Hall Effect device which provides a ratiometric output signal proportional to the magnetic flux density generated by a C-core concentrator. The sensor is offered in three configurations: standard connector, standard connector with cable retainer, and with CPA equipped connector.

### Typical Application Diagram



\* CL: 1 - 4.7nF EMC protection (optional).  
 \* RC Low pass filter (optional).  
 \* RL > 10 KΩ.

### Output Characteristics



### Features

- Analog ratiometric output
- +5V DC unipolar power supply
- Operating temp. range: -40°C ... +125°C
- Open-loop Hall effect
- Single or dual channel output
- ASIL-QM
- Current measurement: up to ±1500A

### Applications

- Battery Management system
- DC/DC Converter
- Power Distribution Unit
- DC Link

### Benefits

- High accuracy, non-intrusive solution
- Low thermal offset drift
- Low thermal sensitivity drift

### Mechanical Characteristics

- Case Material: PBT-GF30, UL94-V0
- Mass: 60.5 g ± 5%
- Busbar: Cu-ETP
- Protection degree: IP4X (IEC 60529)

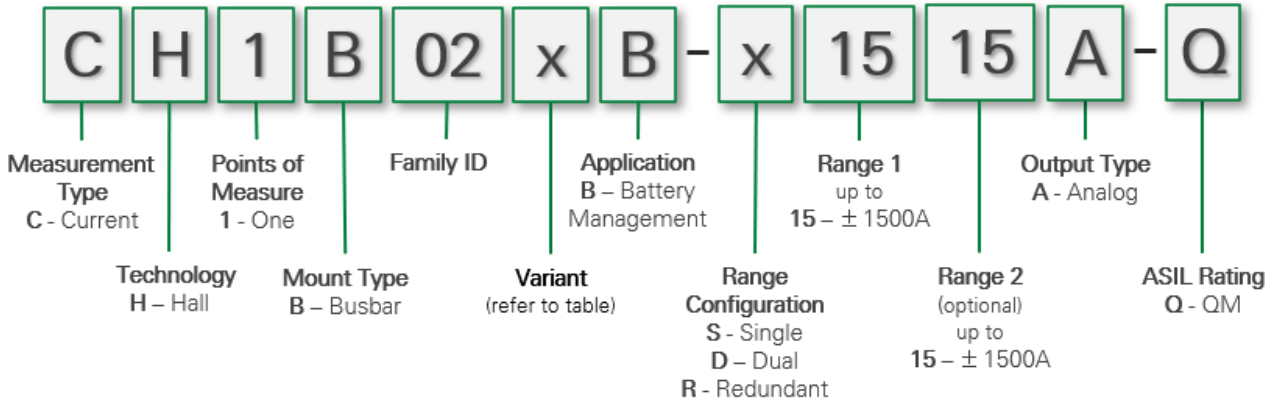
### Mating Connector

- CH1B020B / CH1B021B  
Molex DuraClik 5-way – info pg.3-4
- CH1B022B  
Tyco 4-way with CPA – info pg.5


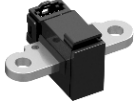
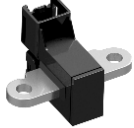
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### Littelfuse Current Sensor P/N Convention



### Product Variants

Part Name	Config	Ref. Image
CH1B020B	Standard	
CH1B021B	Cable Retainer	
CH1B022B	CPA Connector	

### Current Range Definition

Littelfuse offers customized calibration ranges.

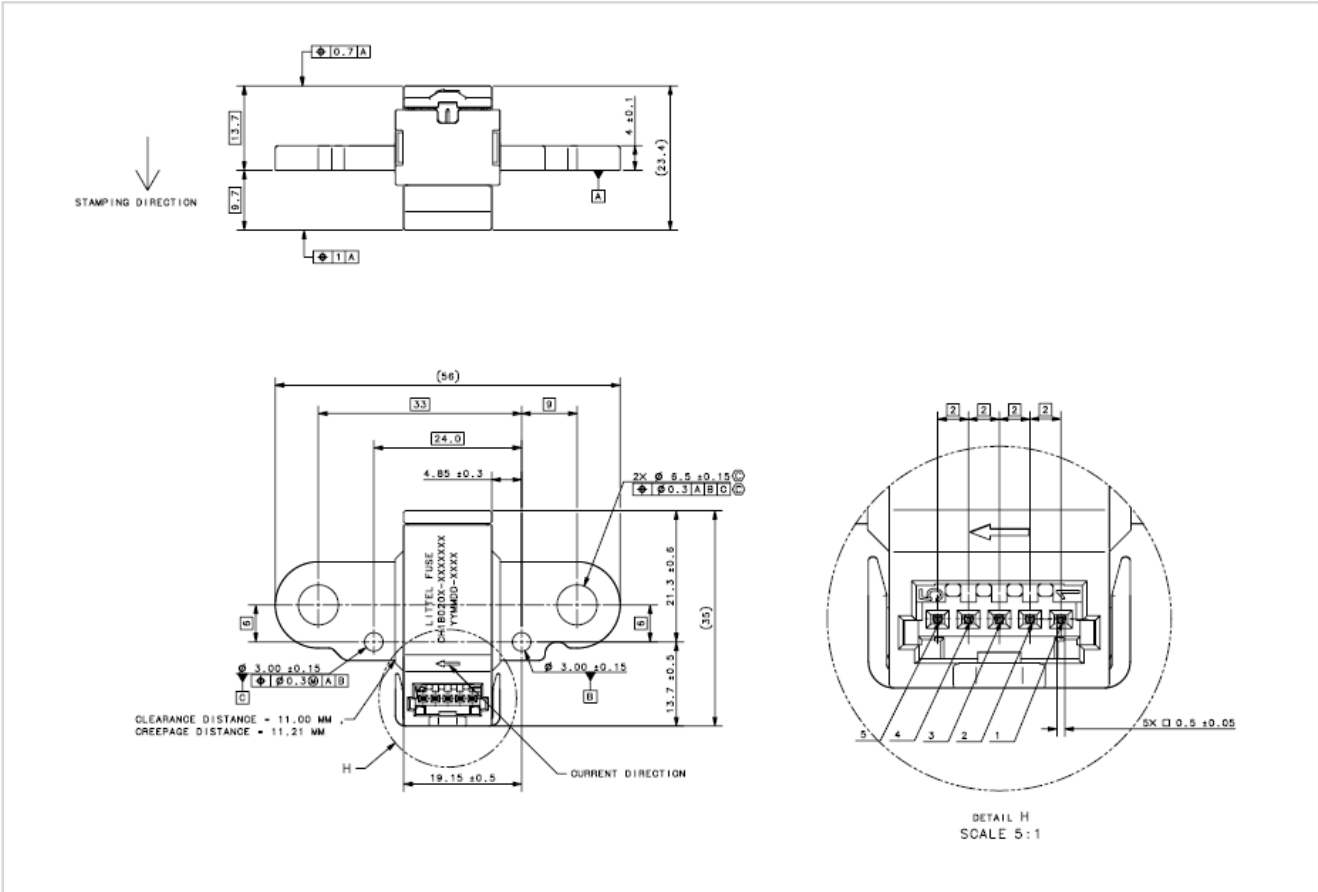
### Naming Examples:

Type Name	Current Range Chanel 1	Current Range Chanel 2
CH1B02xB-S04A-Q	±400 A	N/A
CH1B02xB-S15A-Q	±1500 A	N/A
CH1B02xB-D0110A-Q	±100 A	±1000 A
CH1B02xB-D0215A-Q	±200 A	±1500 A
CH1B02xB-R0808A-Q	±800 A	±800 A
CH1B02xB-R1515A-Q	±1500 A	±1500 A

# Current Sensor CH1B02xB

## Current Sensor Dimensions (in mm)

### CH1B020B



### Remark

$V_{out} > V_o$  , when  $I_p$  flows in the positive direction (see current direction arrow on drawing).

### Mating Connector

- Molex DuraClik 5-Way – ISL Version
- Housing 5W, Black: 5601230501
- Retainer 5W Gray: 5601250500
- Terminal: 5601240101

### Pinout

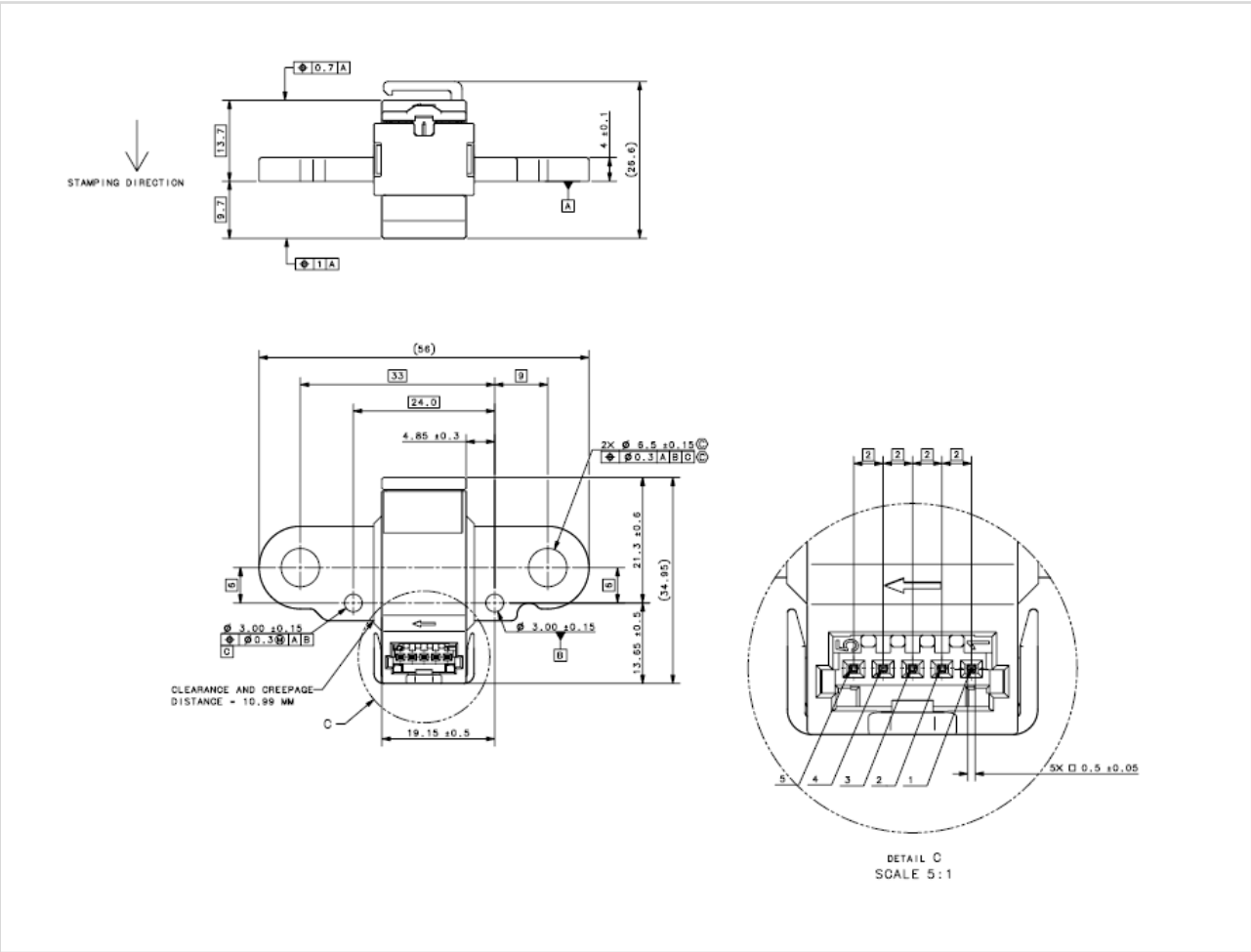
Pin No.	Signal	Description
1	VCC	+5V Power supply
2	OUTPUT 1	Channel 1 OUT
3	GND	Ground
4	OUTPUT 2	Channel 2 OUT
5	NO CONN	Not Connected

# Current Sensor

## CH1B02xB

### Current Sensor Dimensions (in mm)

#### CH1B021B



**Remark**

$V_{out} > V_o$  , when  $I_p$  flows in the positive direction (see current direction arrow on drawing).

#### Mating Connector

- Molex DuraClik 5-Way – ISL Version
- Housing 5W, Black: 5601230501
- Retainer 5W Gray: 5601250500
- Terminal: 5601240101

#### Pinout

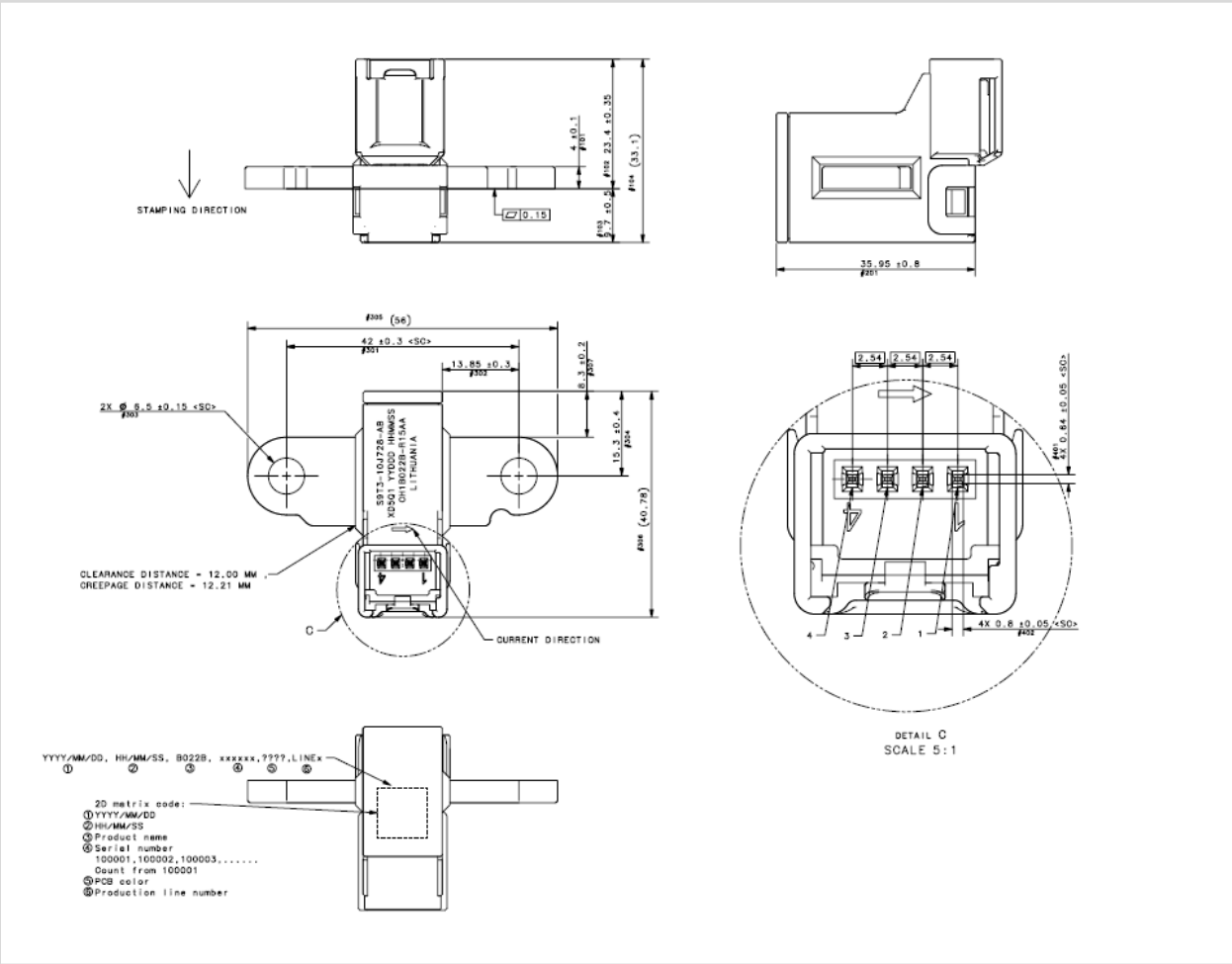
Pin No.	Signal	Description
1	VCC	+5V Power supply
2	OUTPUT 1	Channel 1 OUT
3	GND	Ground
4	OUTPUT 2	Channel 2 OUT
5	NO CONN	Not Connected

# Current Sensor

## CH1B02xB

### Current Sensor Dimensions (in mm)

#### CH1B022B



#### Remark

$V_{out} > V_o$  , when  $I_p$  flows in the positive direction (see current direction arrow on drawing).

#### Mating Connector

- TE 4-Way – Generation Y
- Housing with CPA: 2035360-2
- Terminal: 1924955-1

#### Pinout

Pin No.	Signal	Description
1	VCC	+5V Power supply
2	OUTPUT 1	Channel 1 OUT
3	OUTPUT 2	Channel 2 OUT
4	GND	Ground

# Current Sensor

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### Absolute Maximum Ratings (non-operating)

Parameter	Symbol	Min	Typ.	Max	Units	Comments
Maximum Supply Voltage	$U_{CMAX}$	-0.3		10	V	
Maximum Output Current	$I_{CMAX}$	-10		10	mA	
Ambient Storage Temperature	$T_{ST}$	-40		+125	°C	
Insulation Resistance	$R_{INS}$	500			MΩ	500V DC, 60s
Dielectric voltage	$I_{LEAK}$			1	mA	2.5 kV AC, 50Hz, 1min
Creepage distance	$D_{CREE}$		12.21		mm	
Clearance	$D_{CLEA}$		12		mm	
Comparative tracking index	$CTI$		0 PLC		-	UL746A

### Mechanical Product Properties

Parameter	Symbol	Level	Standard	Comments
Flammability Class		V0	UL94	
Protection Degree		IP 4X	IEC 60529	

# Current Sensor

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### Common Characteristics in Normal Range

Parameter	Symbol	Min	Typ.	Max	Units	Comments
Supply Voltage	$U_C$	4.75	5	5.25	V	
Current Consumption	$I_C$		11	15	mA	Single channel only
Current Consumption	$I_C$		22	30	mA	w/ Dual or Redundant channel
Operating Ambient Temperature	$T_A$	-40		+125 <sup>1</sup>	°C	
Output Voltage	$V_{out}$	$V_{out} = (U_C/5) \times (V_O + I_p \times S_{th})$			V	
Output Offset Voltage	$V_o$		2.5		V	$U_C = 5V, I_p = 0 A$
Clamping Voltage Lower	$V_{CL}$		0.3		V	$U_C = 5V, T_A = 25^\circ C$
Clamping Voltage Upper	$V_{CU}$		4.7		V	$U_C = 5V, T_A = 25^\circ C$
Power-on Time	$t_{po}$			1	ms	
Response Time	$t_r$			15	us	
Supply Capacitance	$C_{SUP}$	47	100		nF	Capacitors need to be located near supply pin
Load Capacitance	$C_L$		2.2		nF	
Load Resistance	$R_L$		25		kΩ	
Linearity Error	$\epsilon_L$		±0.8		%FS	$U_C = 5V, \text{ over temp}$
Offset Error	$\epsilon_o$		±15		mV	$U_C = 5V, T_A = 25^\circ C, I_A = 0A$
Sensitivity Error	$\epsilon_s$		±1		%	$U_C = 5V, \text{ over temp}$

<sup>1</sup> Practical operating ambient temperature depending on RMS current profile. Maximum permissible busbar surface temperature: ≤ 150°C.

# Current Sensor

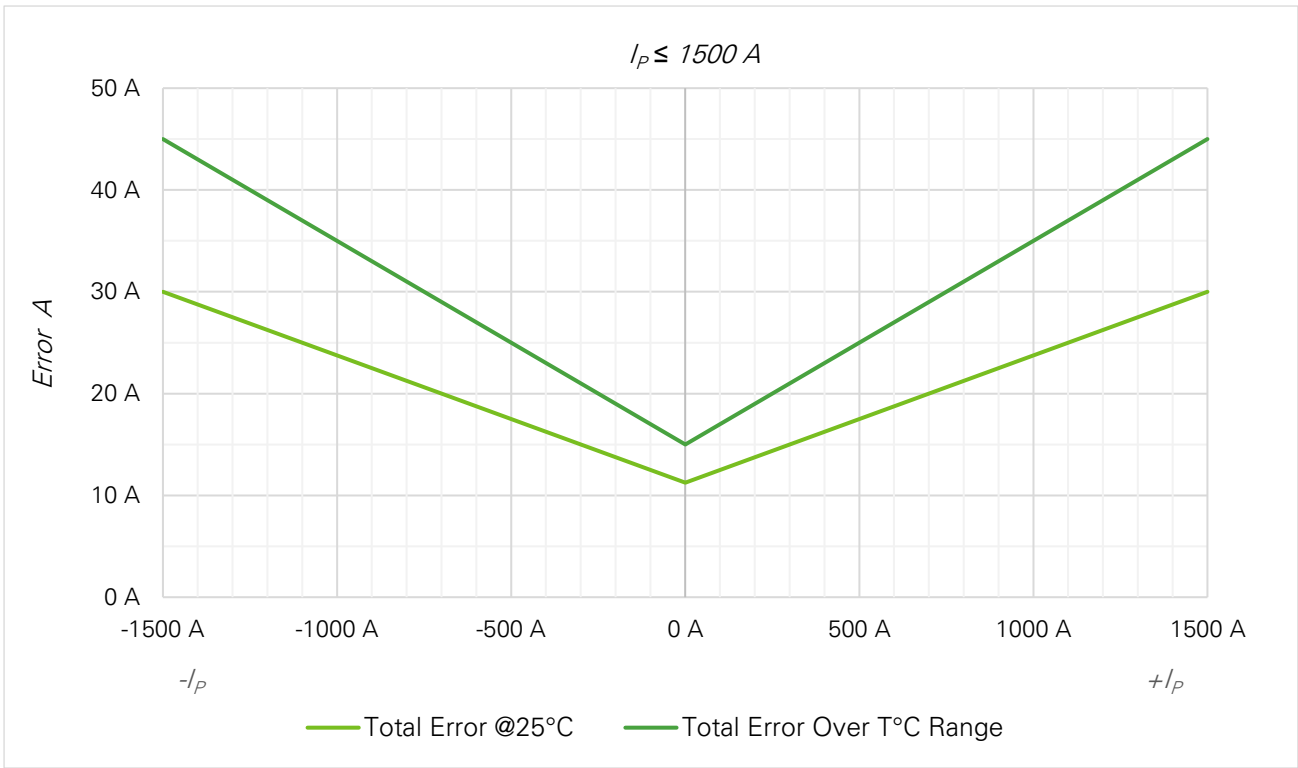
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Littelfuse offers customized calibrations.  
 Performance data below is applicable for a ±1500A calibration.

Parameter	Symbol	Min	Typ.	Max	Units	Comments
Primary Current	$I_p$	-1500		+1500	A	
Sensitivity	$S_{th}$		1.33		mV/A	$U_c = 5\text{ V}$

### Total Error



Primary Current $\pm I_p$	Sensitivity	Total Error @25°C		Total Error @Trange	
		%	A	%	A
+1500 A	1.33	±2.00 %	±30.00 A	±3.0 %	±45.0 A
0	1.33	±0.75 %	±11.25 A	±1.0 %	±15.0 A
-1500 A	1.33	±2.00 %	±30.00 A	±3.0 %	±45.0 A

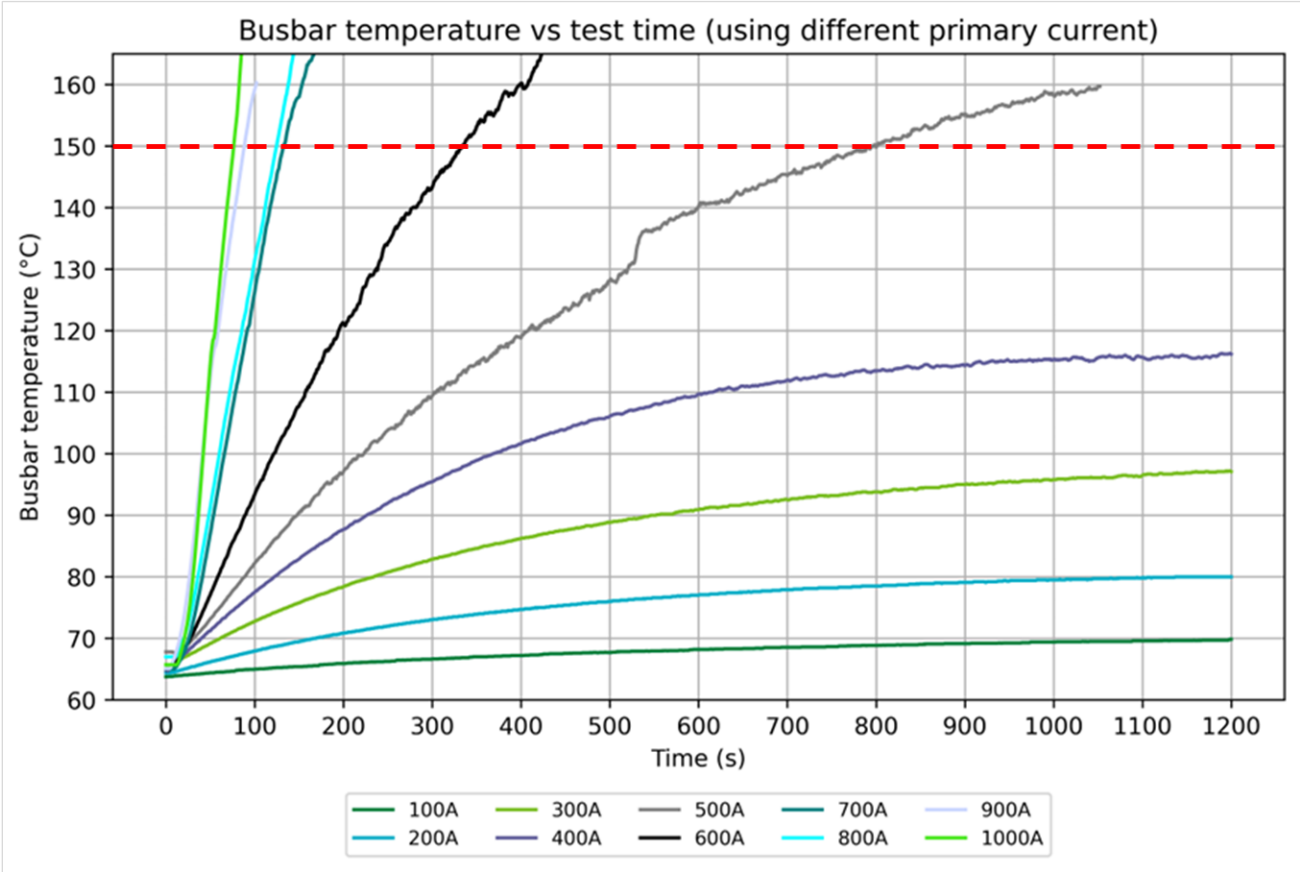
$Error\ in\ current\ (A) = Total\ Error\ \% * I_p$



# Current Sensor

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### Continuous Current Performance (Busbar Heat Rise)



**Test Conditions:**

Ambient temperature: 65 °C, without cooling

Temperature monitoring: Record 1 data point per second. Test stopped when Temperature is stabilized at 150°C.

# Current Sensor

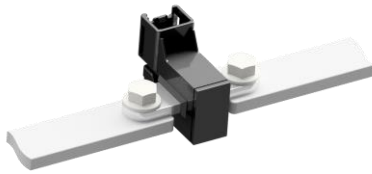
## CH1B02xB

### Recommendations for Use

#### Setup Recommendation

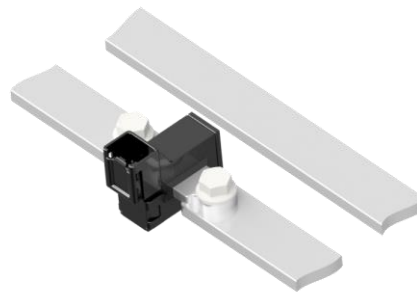
Mounting and spacing recommendations are common for all component family members listed in this datasheet. Example shown is CH1B025B.

##### Busbar Mounting:



- Mount with ISO M6 serrated flange screw or bolt, or with M6 fastener screw or bolt combined with lock washer.
- Assembly torque:  $7\text{N}\cdot\text{m} \pm 10\%$
- It is recommended to pre-tighten mounting fasteners both sides of the integral busbar prior to applying final assembly torque.
- Recommended mating busbar cross section: 5x20mm

##### Adjacent Busbar Spacing:



- The distance between sensor busbar and adjacent busbar is recommended to be more than:
  - 20 mm @ 1500 A
  - 10 mm @ 1000 A
- Adjacent busbar should not pass directly above or below current sensor housing.
- Busbar layout should be reviewed with Littelfuse for compatibility.

#### Handling

- Handling of sensors should be minimized by maintaining parts within packaging until point of assembly.
- Contact with sensor terminals should be avoided.
- To avoid potential damage, adherence to ESD handling best practices is recommended.
- Dropped parts should be scrapped regardless of evidence of external damage.

# Current Sensor

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### Validation Test Specification

Group / Test	Reference	Test Condition
<b>Environmental</b>		
Low Temperature Operation	ISO 16750-4	24h; @-40 °C, power supply(continuous monitoring: offset (Vout and Vcc) at 1s intervals, zero primary current
High Temperature Operating Endurance (HTOE)	ISO 16750-4	96 h; power supply continuous monitoring: offset (Vout and Vcc),at 30ms intervals @ 125 °C, zero primary current
Temperature Step Test	ISO 16750-4: 2010 Section 5.2	20°C -> Tmin -> Tmax -> 20°C. Temperature step: 5 °C. Dwell time: TBD. Check DUT functionality at Umin, Unom, Umax at each temperature step.
High Temperature / High Humidity Endurance (HTHE)	IEC 60068-2-78	1000h, 85°C / 85% RH, power supplied (continuous monitoring Vcc) at 30ms intervals, zero primary current. Intermediate functional test at room temp at 500hrs.
Powered Thermal Cycle Endurance	ISO16750-4 §5.3.1 EN 60068-2-14, test Nb	125 cycles. 1000 h. DUT powered on, continous monitoring Vout and Vcc at 30ms intervals. Intermediate functional test at room temp at 500hrs.
Thermal Shock	ISO16750-4 §5.3.2 EN 60068-2-14	1000 h, -40 °C (30 min soak) / 125 °C (30 min soak), shift time ≤ 30s, 1000 cycles, with connectors installed. Intermediate functional test at room temp at 500hrs.
Composite Temperature /Humidity Cyclic	ISO 16750-4 §5.6.2.3 IEC 60068-2-38	10 cycles. Total duration 240h. Temperature: +65°C. DUT monitoring at 30ms intervals.
Dewing Test	ISO 16750-4:2010 Section 5.6.2.4 Test 3	5 cycles. Total duration 30 hours. Temperature: +80°C. DUT powered on, continous monitoring of Vout and Vcc at 30ms intervals.
<b>Ingress Protection</b>		
Dust	IEC 60529	per IEC 60529
<b>Mechanical</b>		
Mechanical Shock	ISO 16750-3 §4.2.2.2	(500 m·s <sup>-2</sup> ; 11 ms) 10 shocks per axe Half sinusoidal pulse. Continuous monitoring: offset(Vout and Vcc) at 1ms intervals, zero primary current.
Vibration in Temperature	ISO 16750-3 § 4.1.2.4 Test <b>IV</b> , passenger car, sprung masses	22 hours for each axis. RMS acceleration value of 96,6 m/s <sup>2</sup> . Continuous monitoring: offset(Vout and Vcc) at 30ms intervals, zero primary current. Temperature cycling from Tmin to Tmax.
Free Fall	ISO 16750-3 § 4.3	Test direction: ±X, ±Y, ±Z axis (6 directions), one sample per each axis; Drop floor: steel plate; Drop height: 1 meter. Temperature:+23 °C ± 5 °C.
<b>Electrical</b>		
Noise	Littelfuse VS	Sweep from DC to 1MHZ.
Power-on Time	Littelfuse VS	Vdd min to 90%Vout
Overvoltage	ISO 16750-2 §4.3	+6V for 60s
Output Short Circuit to Supply	ISO16750-2 §4.10	'VDC: 5 V; Connect all terminals to GND except for B+ terminal of connector; Connect all terminal to B+ except for GND terminal of connector.
Reverse Supply Voltage	ISO 16750-2 §4.7.2	-0.3V for 60s
Response Time	Littelfuse VS	90%Primary current to 90%Vout

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### Validation Test Specification (continued)

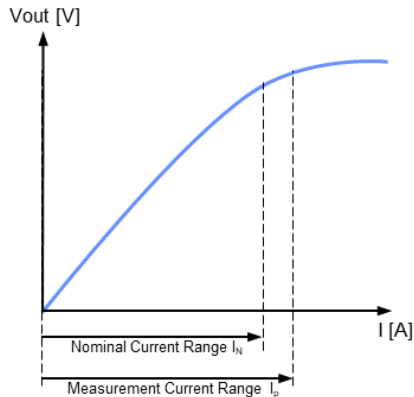
Group / Test	Reference	Test Condition
<b>Insulation and Dielectric Voltage</b>		
Insulation Resistance	ISO 16750-2 §4.12.2	Perform insulation resistance test ,then perform a CL-THC-Temperature / Humidity cycle test, at last perform insulation resistance test again; record the min value, test point: connector wires to busbar, samples shall remain 0.5h at room temperature after Composite temperature/humidity cyclic test: 1000V DC, 60s
Dielectric Withstand Voltage	IEC 60664; Part 1	Perform dielectric withstand voltage test ,then perform a CL-THC-Temperature / Humidity cycle test, at last perform dielectric withstand voltage test again; record the max value ;samples shall remain 0.5h at room temperature after Composite temperature/humidity cyclic test, 'test point: connector wire to busbar: 2.5 kV AC, 50Hz, 1min.
<b>EMC</b>		
Bulk Current Injection (BCI)	ISO 11452-4 Annex E.1.1, Table E.1 GMW3097; From 1 to 400 MHz.	Refer to EMC Test Plan - <i>EMC-8057</i>
Radiated Electromagnetic Immunity (ALSE)	ISO 11452-2	Refer to EMC Test Plan - <i>EMC-8057</i>
Radiated Emissions	CISPR25 (2008) Table 9	Refer to EMC Test Plan - <i>EMC-8057</i>
ESD Handling	ISO 10605 §7	Refer to EMC Test Plan - <i>EMC-8057</i>
<b>Connector</b>		
Terminal Push-out Force	GMW3191:2012 §4.5.2	Apply rearward pulling force to dislodge the terminal out of the header. Speed $50 \pm 10$ mm/min. Record the peak force required to displace the terminal 0.20 mm. Afterwards, connectors conditioned by being exposed to 95% to 98% RH at +40 °C for 6 hours. Push / pull tests shall be performed immediately following removal of the headers from the temperature/humidity chamber. Terminal width 0.5 mm and 0.5 mm (< 0.8 mm)
Connector to Connector Engagement Force	GMW3191:2012 §4.2.8/ USCAR25	Insert TPA into connector body at a uniform rate of $(50 \pm 10)$ mm/minute. Record peak force and graph force versus distance from initial position of TPA to connector body to final engaged position.
Locked Connector Disengagement Force	GMW3191:2012 §4.2.18	Pull the mated connectors apart at a rate of $(50 \pm 10)$ mm/minute. Record the force at which the connectors disengage.
Unlocked Connector Disengagement Force	GMW3191:2012 §4.2.19	Pull the mated connectors apart at a rate of $(50 \pm 10)$ mm/minute. Record the force at which the connectors disengage.

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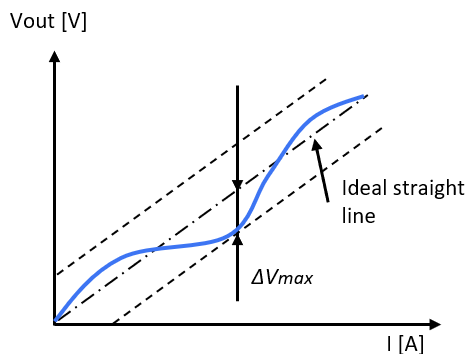
### Performance Parameter Definitions

#### Primary current definition ( $I_N, I_p$ )



#### Linearity error ( $\epsilon_L$ )

The maximum positive or negative discrepancy with a reference straight line  $V_{out} = f(I_p)$ .



$$\epsilon_L = \pm \frac{\Delta V_{max}}{V_{FS}} \times 100\%$$

$V_{FS}$ : full scope output voltage

#### Offset error ( $\epsilon_O$ )

The voltage drift of the measured sensor output  $V_{out}$  at 0A compared to the ideal value 2.5V (@ $V_C = 5V$ ) is called the total offset voltage error. This offset error can be attributed to the electrical offset, magnetic offset and related drift over temperature.

$$\epsilon_O = \pm \frac{V_{out} - V_O}{V_{FS}} \times 100\%$$

#### Sensitivity error ( $\epsilon_S$ )

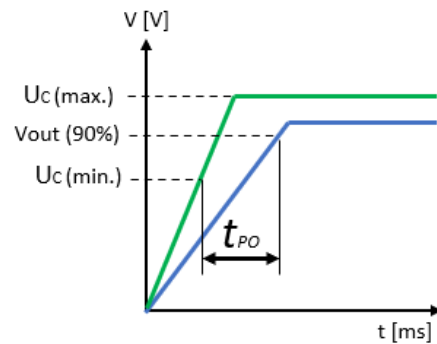
The sensor sensitivity error is the drift of sensor's ideal sensitivity.

$$\epsilon_S = \pm \frac{S - S_{th}}{S_{th}} \times 100\%$$

$S_{th}$ : theory sensitivity

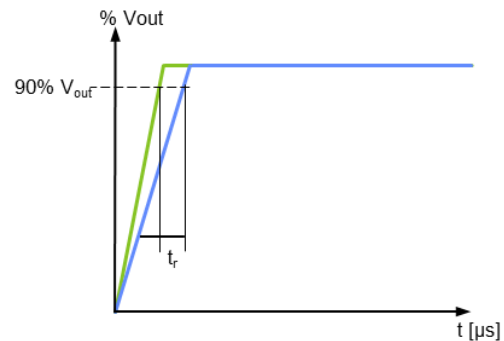
#### Power-on time ( $t_{po}$ )

The Power-on time is the duration from  $U_C$  (min.) to 90% of  $V_{out}$ .



#### Response time ( $t_r$ )

The time between the primary current signal and the output signal reaching at 90% of its final value.



### Typical, minimum and maximum values

Typical, minimum, and maximum values get determined during initial product characterization. Typical values representing the normal of statistical  $\pm 1\sigma$  interval (68.27% probability). Minimum and maximum values representing the Gaussian distribution boundaries of the  $\pm 3\sigma$  interval (99.73% probability).

# Current Sensor

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### Contact

Custom electrical and environmental specifications can be designed to meet any need, please contact Littelfuse Engineering for details.

Website: [www.littelfuse.com](http://www.littelfuse.com)  
Sales Support: [ALL\\_Autosensors\\_Sales@littelfuse.com](mailto:ALL_Autosensors_Sales@littelfuse.com)  
Technical Support: [ALL\\_Autosensors\\_Tech@littelfuse.com](mailto:ALL_Autosensors_Tech@littelfuse.com)

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Document version: [Preliminary Datasheet 1.2](#)

Date of print: 31JUL2024