AUTOMOTIVE CURRENT TRANSDUCER
HAB 120-V

Introduction

The HABxxx-V Family is for the electronic measurement of DC, AC or pulsed currents in high power automotive applications with galvanic isolation between the primary circuit (high power) and the secondary circuit (electronic circuit).

The HABxxx-V family gives you the choice of having different current measuring ranges in the same housing (from ± 20 A up to ± 120 A).

Features

- Open Loop transducer using the Hall effect
- Unipolar + 5 V DC power supply
- Primary current measuring range up to ± 120 A
- Maximum RMS primary current limited by the busbar, the magnetic core or the ASIC temperature T° < + 150°C
- Operating temperature range: - 40°C < T° < + 125°C
- Output voltage: full ratiometric (in sensitivity and offset)
- Compact design.

Advantages

- Excellent accuracy
- Very good linearity
- Very low thermal offset drift
- Very low thermal sensitivity drift
- Wide frequency bandwidth
- No insertion losses.

Automotive applications

- Battery monitoring
- Starter Generators
- Inverters
- HEV application
- EV applications.

Principle of HABxxx-V Family

The open loop transducers uses a Hall effect integrated circuit.
The magnetic flux density **B**, contributing to the rise of the Hall voltage, is generated by the primary current $\mathbf{I_P}$ to be measured.
The current to be measured $\mathbf{I_P}$ is supplied by a current source i.e. battery or generator (Fig. 1).
Within the linear region of the hysteresis cycle, **B** is proportional to:

$$\mathbf{B}\ (\mathbf{I_P}) = \text{constant (a)} \times \mathbf{I_P}$$

The Hall voltage is thus expressed by:

$$\mathbf{V_H} = (\mathbf{R_H}/d) \times \mathbf{I} \times \text{constant (a)} \times \mathbf{I_P}$$

Except for $\mathbf{I_P}$, all terms of this equation are constant. Therefore:

$$\mathbf{V_H} = \text{constant (b)} \times \mathbf{I_P}$$

The measurement signal $\mathbf{V_H}$ amplified to supply the user output voltage or current.

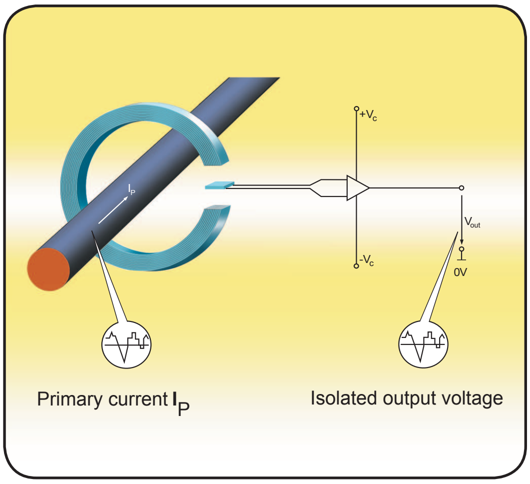

Fig. 1: Principle of the open loop transducer

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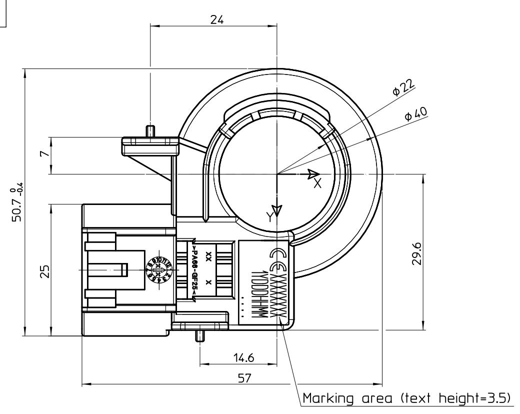
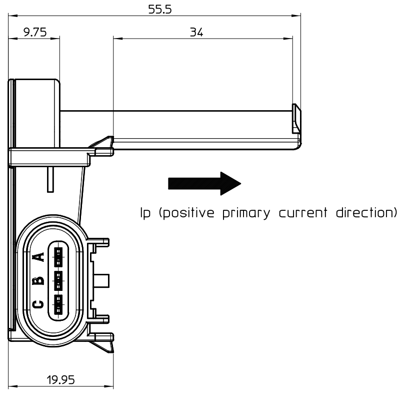
Dimensions HABxxx-V family (in mm.)

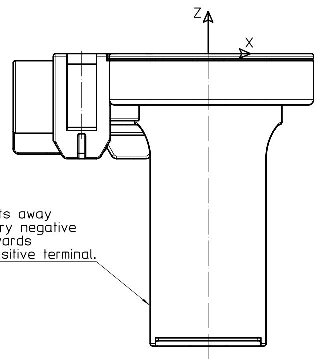




- Part number : XXXXXXXX
- Datecode : 1=Product Design Center (GVA). Y=Year. DDD=Day of the year. HH=Hour. MM=Minute.
- CE
- .... : identification code for jig

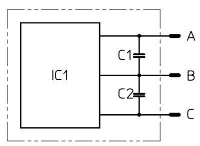
NOTES:

1-Sensor mates with Delphi harness connector p/n 15326808.
2-Clip slots accept self locking clip p/n 12186353-B, 12084149-B.
3-Case material=PA6,6--25% Glass Fiber Reinforced.
4-Terminals material=CuZn36 per NF EN 1652.Tin plated finished 3-5µ.
5-Estimed weight = 26 gr.
6-Color = Black.
7-Any sensor having undergone a fall of 20cm or more be isolated.



Tape tab points away from the battery negative terminal or towards the battery positive terminal.

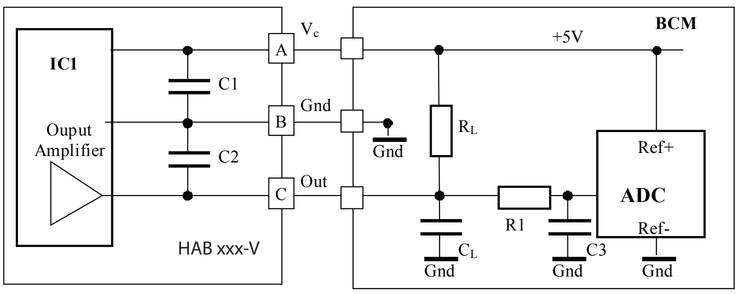
ELECTRICAL DIAGRAM



Components list	
IC1	Hall sensor ASIC
C1	Decoupling capacitor
C2	Decoupling capacitor

Pin out	
A	DC supply voltage
B	Ground
C	Output signal

System artitecture



HAB120-V components	
IC1	Hall sensor ASIC
C1	100 nF +/- 20% X7R
C2	10 nF +/- 20% X7R

BCM components	
R_L	Load Resistor
C_L	Load Capacitor
R1	Optional High impedance protection
C3	Optional Filtering Capacitor

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Absolute maximum ratings (not operating)

Parameter	Symbol	Unit	Specification			Conditions
			Min	Typical	Max	
Electrical Data						
Supply continuous over voltage	V_C	V			8.5	
Supply over voltage					14	1 min
Reverse voltage			-14			1 min @ T_A = 25°C
Output over voltage (continuous)	V_{out}	V			8.5	
Output over voltage					14	1 min @ T_A = 25°C
Output current (continuous)	I_{out}	mA	-10		10	
Output short-circuit duration	T_C	min			2	
Rms voltage isolation test	V_d	kV			2	IEC 60664-1
Electrostatic discharge voltage	V_{ESD}	kV			2	IEC 61000-4-2
Ambiant storage temperature	T_S	°C	- 40		125	

Operating characteristics

Parameter	Symbol	Unit	Specification			Conditions
			Min	Typical	Max	
Electrical Data						
Primary current	I_P	A	- 120		120	
Calibration current	I_{CAL}		- 60		60	@ T_A = 25°C
Supply voltage	V_C	V	4.5	5.00	5.5	
Output voltage [1]	V_{out}	V	$V_{OUT} = V_C/5 \times (2.5 + 0.017 \times I_P)$			@ V_C
Sensitivity [1]	G	mV/A		17.00		@ V_C = 5 V
Current consumption	I_C	mA		7	10	@ V_C = 5 V, - 40°C < T_A < 125 °C
Power up inrush current [2]					15	@ V_C < 3.5 V
Load resistance	R_L	kΩ	10			
Ouput internal resistance	R_{OUT}	Ω			10	
Capacitive loading	C_L	nF	1		100	
Ambiant operating temperature	T_A	°C	- 40		125	
Output drift versus power supply		%		0.5		
Frequency bandwidth [2]	BW	Hz		80		@ -3 dB
Output clamping voltage min	V_{SZ}	V	0.2	0.25	0.3	@ V_C = 5 V
Output clamping voltage max			4.7	4.75	4.8	@ V_C = 5 V
Output voltage noise peak-peak	$V_{no\ p\text{-}p}$	mV			10	
Resolution		mV		2.5		@ V_C = 5 V
Power up time		ms		25	110	
Setting time after over load		ms			25	

Notes: [1] The output voltage V_{OUT} is fully ratiometric.The offset and sensitivity are dependent on the supply voltage V_C relative to the following formula:

$$I_P = \left(V_{OUT} - \frac{V_C}{2}\right) \times \frac{1}{G} \times \frac{5}{V_C} \qquad \text{with G in (V / A)}$$

[2] During the power up phase.

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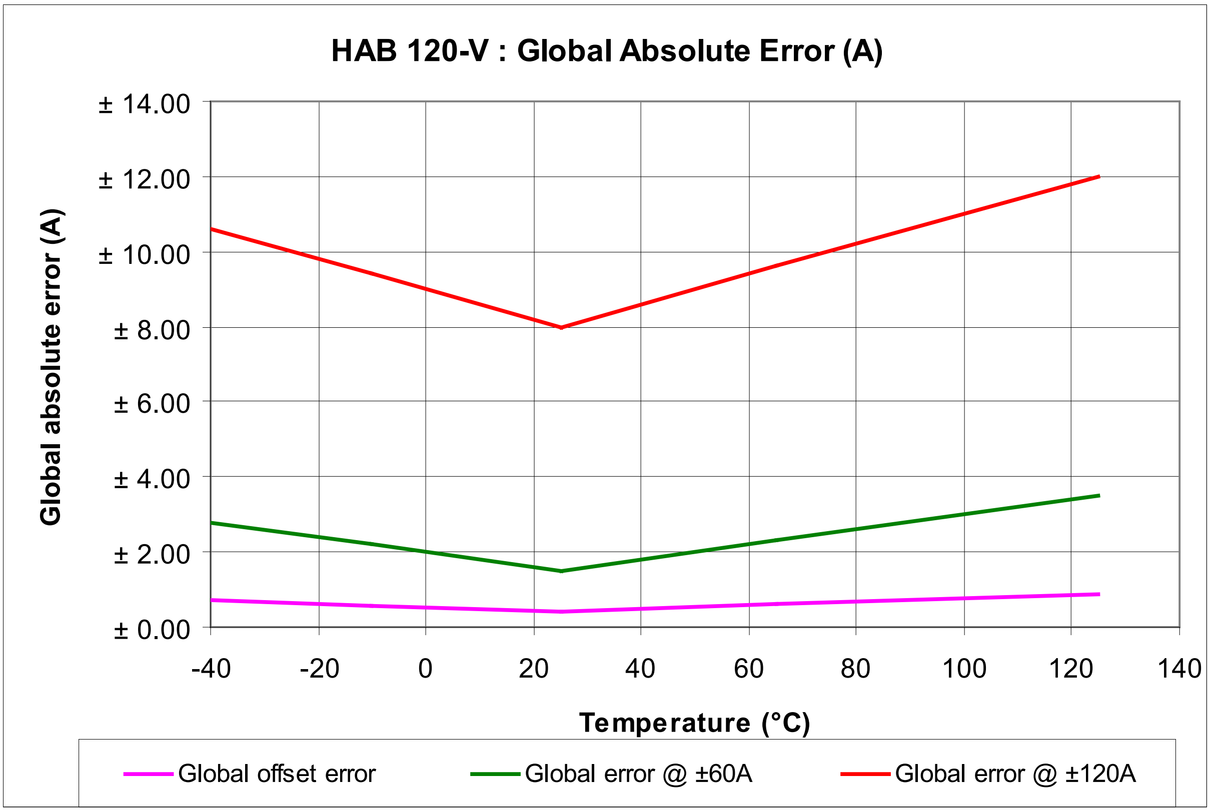
Accuracy

Parameter	Symbol	Unit	Specification			Conditions
			Min	Typ	Max	
Electrical Data						
Electrical offset current	I_{OE}	A		± 0.20		@ T_A = 25°C, @ V_C = 5 V
Magnetic offset current	I_{OM}			± 0.05		@ T_A = 25°C, @ V_C = 5 V, after ± I_P
Global offset current	I_O		- 0.4		0.4	@ T_A = 25°C, @ V_C = 5 V
			- 0.6		0.6	@ V_C = 5 V, - 10°C < T_A < 65°C
			- 0.9		0.9	@ V_C = 5 V, - 40°C < T_A < 125°C
Sensitivity error	ε_G	%		± 0.3		@ T_A = 25°C , I_P = ± 60 A
				±1.0		@ - 10°C < T° < 65°C, I_P = ± 60A
				± 2.0		@ - 40°C < T° < 125°C, I_P = ± 60A
Linearity error up to 60A	ε_L	%		± 0.2		of full range
Linearity error up to 80A				± 1.0		
Linearity error up to 120A				± 2.5		

Global Absolute Error (A)

	Global Absolute Error (A)				
Temperature	-40	-10	25	65	125
Global Offset Error	± 0.73	± 0.58	± 0.40	± 0.60	± 0.90
Global Error @±60A	± 2.80	± 2.20	± 1.50	± 2.30	± 3.50
Global Error @±120A	± 10.60	± 9.40	± 8.00	± 9.60	± 12.00



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PERFORMANCES PARAMETERS DEFINITIONS

Output noise voltage:

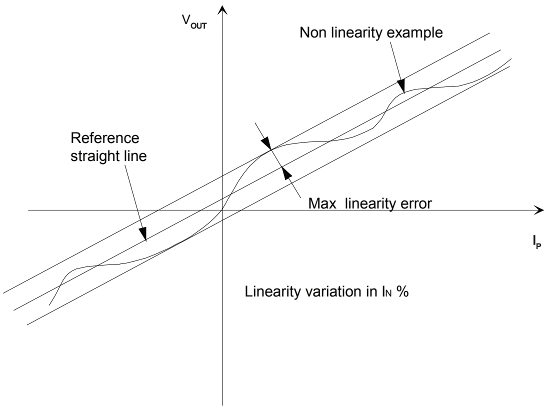
The output voltage noise is the result of the noise floor of the Hall elements and the linear I_C amplifier gain.

Magnetic offset:

The magnetic offset is the consequence of an over-current on the primary side. It's defined after an excursion of $I_{P\,max}$.

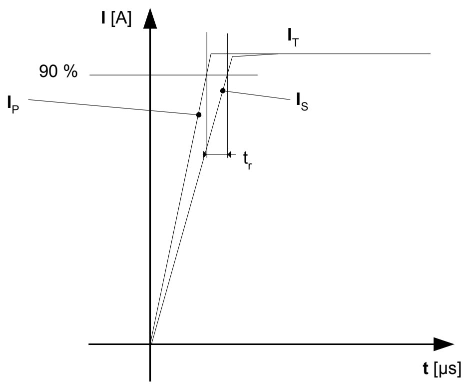
Linearity:

The maximum positive or negative discrepancy with a reference straight line $V_{OUT} = f\,(I_P)$.
Unit: linearity (%) expressed with full scale of $I_{P\,max}$.



Response time (delay time) t_r:

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



Typical:

Theorical value or usual accuracy recorded during the production.

Sensitivity:

The Transducer's sensitivity **G** is the slope of the straight line $V_{out} = f\,(I_P)$, it must establish the relation:
$V_{out}(I_P) = V_C/5\,(G \times I_P + 2.5)$ (*)

(*) For all symetrics transducers.

Offset with temperature:

The error of the offset in the operating temperature is the variation of the offset in the temperature considered with the initial offset at 25°C.
The offset variation I_{OT} is a maximum variation the offset in the temperature range:
$I_{OT} = I_{OE}\,max - I_{OE}\,min$
The Offset drift TCI_{OEAV} is the I_{OT} value divided by the temperature range.

Sensitivity with temperature:

The error of the sensitivity in the operating temperature is the relative variation of sensitivity with the temperature considered with the initial offset at 25°C.
The sensitivity variation G_T is the maximum variation (in ppm or %) of the sensitivity in the temperature range:
G_T = (Sensitivity max - Sensitivity min) / Sensitivity at 25°C.
The sensitivity drift TCG_{AV} is the G_T value divided by the temperature range.

Offset voltage @ $I_P = 0$ A:

Is the output voltage when the primary current is null. The ideal value of V_O is $V_C/2$ at $V_C = 5$ V. So, the difference of $V_O - V_C/2$ is called the total offset voltage error. This offset error can be attributed to the electrical offset (due to the resolution of the ASIC quiescent voltage trimming), the magnetic offset, the thermal drift and the thermal hysteresis.