AHBC-CAN500/24V Hall Effect Transducer

Features

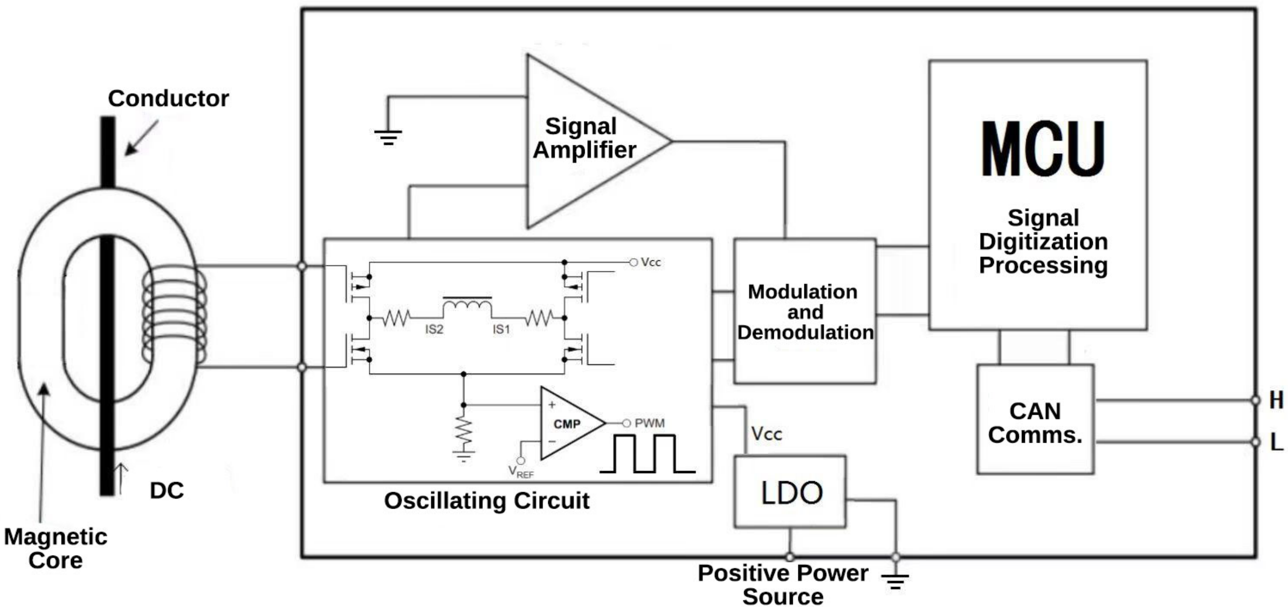
- Good Linearity
  - Linearity Error ＜0.1%
- Wide Voltage Supply
  - Supply Voltage: +18V to +28V
- Power Protection Function
  - Automatic Overvoltage Protection
- High Accuracy
  - Accuracy：0.2%
  - Temperature Drift＜50ppm
- Digital Communication
  - High-Speed CAN 2.0 Interface
- Operating Temperature：-40℃ to +105℃

Application

- EV Battery Management System (BMS)
- EV Battery Distribution Unit (BDU)
- EV High-Voltage Distribution Unit (PDU)
- Industrial Lithium Battery Energy Management
- Land-Based Tank Backup Power

Overview

The AHBC-CAN500/24V power sensor is a high-precision DC current sensor primarily installed on battery busbars to monitor charging and discharging currents. Utilizing fluxgate technology, it offers high precision and low hysteresis. With a zero-offset current less than 10mA, it maintains low zero offset and high accuracy even after exposure to large currents up to 1000A . This sensor is ideal for power battery monitoring, high-precision current measurement, and battery management systems, meeting the SOC estimation accuracy requirement of less than 10% as per national standard QCT897-2011. All functionalities comply with automotive-grade standards.



Technical Parameter（Power Supply Voltage Uc=24V）

Limit Parameters

Parameter	Symbol	Specs	Unit	Condition
Overvoltage	Uc	35	V	400ms
Overvoltage	Uc	32	V	1min
Min. Operating Voltage	Uc	18	V	Can operate but can't measure
Max. OperatingVoltage	Uc	28	V	Can operate but can't measure
Clearance	D_{CI}	7	mm	
Creepage Distance	D_{cp}	7.2	mm	
Insulation Resistance	R_{IS}	500	MΩ	500V，1min
IP Rating		IP56		
AC Insulation Test Voltage		5	kV	50Hz，1min
DC Insulation Test Voltage		5	kV	1min

Standard Parameters

Parameter	Symbol	Specs			Unit	Condition
		Min.	Typical Value	Max.		
Rated Measuring Current	I_{PN}	-500		500	A	
Max Measuring Current	I_{PM}	-600		600	A	
Supply Voltage	Uc	18	24	28	V	
Operating Current @Ip=0A	Ic		30		mA	Uc=12V,T=25℃
Operating Current @IPM	Ic		160		mA	Uc=12V,T=25℃
Linearity Error	L	-0.1		0.1	%	±3σ Full Temp. Range
Zero Offset@Ip=0A	Io	-10		10	mA	±3σ Full Temp. Range
Accuracy@Ip=±40A	X_G	-60		60	mA	±3σ Full Temp. Range
Operating Temperature	T_A	-40		105	℃	
Zero Offset Temperature Drift	T_{off}		0		mA/K	
Gain Temperature Drift	T_{gain}	-50		50	ppm/K	±3σ Full Temp. Range
Output Noise	Noise	-10		10	dB	

CAN Bus Electrical Parameters

CAN2.0

CAN Oscillator Tolerance: 0.27%

Baud Rate: 250 kbps

External Resistor: 120Ω

Data Mode: Big-endian Mode

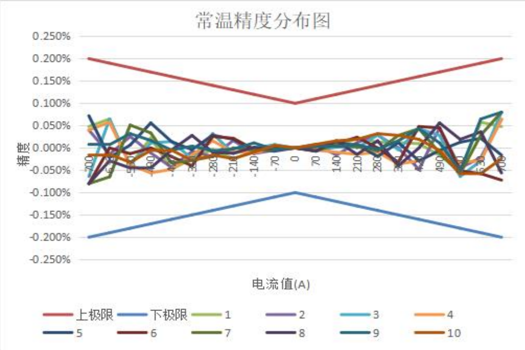
Data Format

Message Description	CAN ID	Data length	Message launch type	Signal description	Signal name	Start bit	Length
Return Current IP (mA)	0X3C2	8 bytes	Cyclic transmitted message 10ms cycle	IP Value: 80000000H=0mA 7FFFFFFFH=-1mA 80000001H=1mA	IP-VALUE	24	32
				Error indication 0 = Normal 1 = Failure	ERROR INDICATION	32	1
				Error Information	CSM_FAIL	33	7
				NAME	PRODUCT_NAME	48	16
				CRC-8 POLY: 8+X2+X+1	CRC_8	56	8

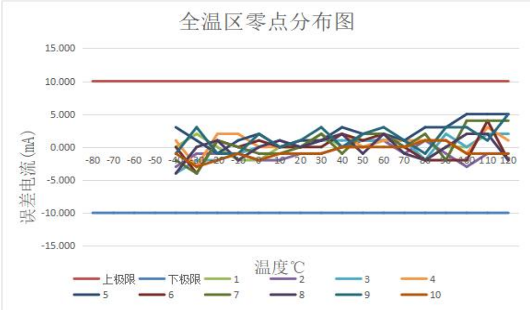
Error Info.

Error Description	IP VALUE	ERROR INDICATION	ERROR INFORMATION
Failure Error	FFFF FFFFH	1	40H
Current Exceeds 600A	FFFF FFFFH	1	41H
Over-frequency Oscillation for more than 10ms (>2.5kHz)	FFFF FFFFH	1	44H
Magnetic Core Not Oscillating for More Than 20ms	FFFF FFFFH	1	46H
Entering Fault Mode	FFFF FFFFH	1	47H
No Signal for More Than 100ms	FFFF FFFFH	1	49H
Overvoltage (>32V)	FFFF FFFFH	1	4AH

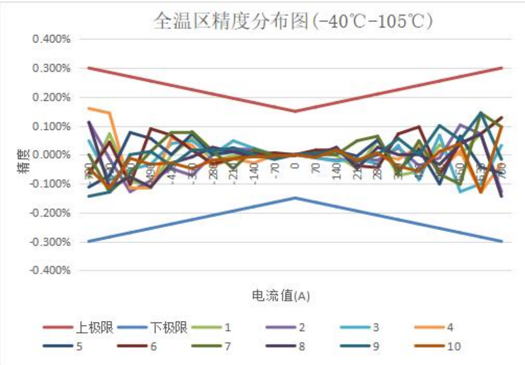
Normal Temperature Accuracy Distribution Chart



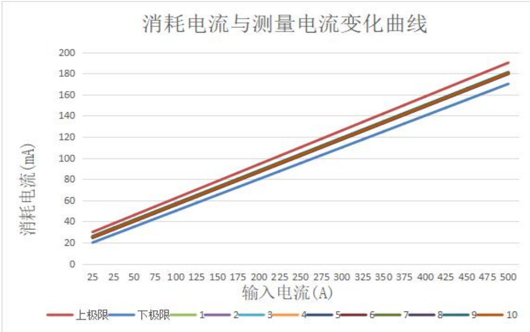
Zero Point Distribution Chart Across Full Temperature Range



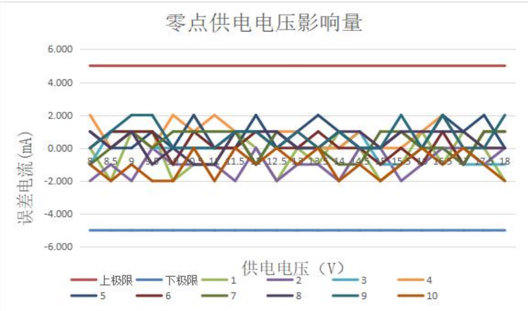
Accuracy Distribution Chart Across Full Temperature Range



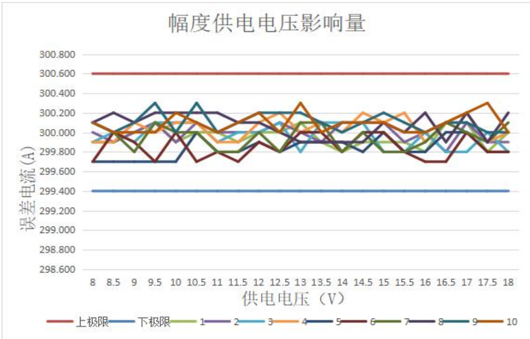
Current Consumption vs. Measured Current Variation Curve



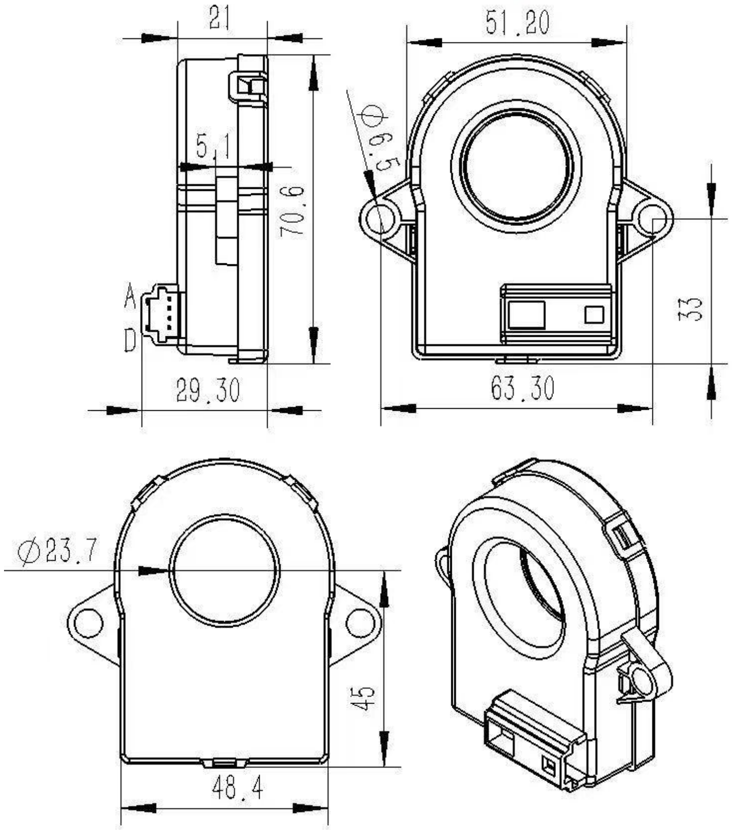
Zero Point Power Supply Voltage Influence



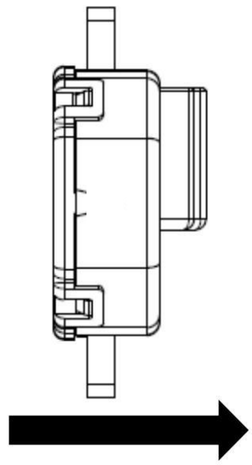
Amplitude Voltage Influence



Mechanical Size



Ip [Forward Current Direction]



PIN NO	Function
D	VCC
C	GND
B	CAN_H
A	CAN_L

Mechanical Features

Characteristic	Rating	Unit
General Tolerance	± 0.5	mm
Other Tolerances Apply	GB/T 1804-2000-M	
Fixed Hole Size	Φ6.5	mm
Fastening Screws	M6	
Recommended Tightening Torque	1.8(±10%)	N.m
Connector	Tyco AMP 1473672	
Housing Material	PBT GF30	
Weight	80	g
PIN Material	Tin-Plated Brass	
IP Rating	IP56	

Performance Parameter Definition:

Static Output Voltage (Vovo): The sensor's output voltage Vowo in the absence of a significant magnetic field B=0G. -BR: The static output voltage Vowo has a constant ratio with the supply voltage Vcc; VQvo=Vcc/2.

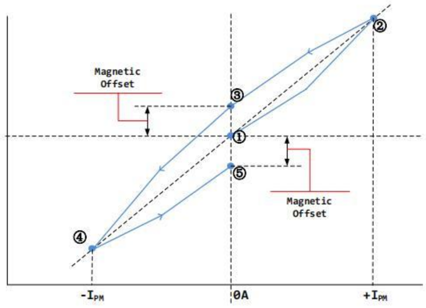
Sensitivity (Sens): Sens is the slope of the reference output line Vour =Vcc/2+2×Ip/Ip_Max, indicating how the output changes with the current. The relationship with current is: Sens = 2/Ip_Max.

Offset with Temperature: Due to tolerances in internal components, stress, and thermal factors, the zero point may shift under operating temperature conditions.

Sensitivity with Temperature: Due to the influence of internal temperature compensation coefficients, sensitivity may deviate from the expected value at room temperature across the entire operating temperature range.

Electrical Offset Voltage: This is the error caused by the noise generated by the HALL element and the internal operational amplifier ’ s gain, referred to as the offset voltage.

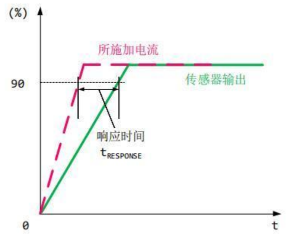
Magnetic Offset: When the primary current transitions from its maximum value to zero, due to the magnetic hysteresis phenomenon in the sensor's magnetic core material, an error is produced at the output, referred to as magnetic offset voltage.

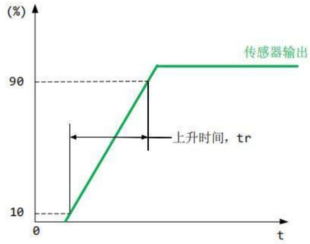


Offset Voltage: Offset voltage is the output voltage when the primary current is zero, ideally VQvo=2.50. Therefore, the difference between Vovo and the ideal value is called the total offset voltage error. This offset error can be attributed to electrical offset voltage (due to the resolution of the internal QVO adjustment in the ASIC), magnetic offset, temperature drift, and temperature-induced hysteresis.

Response Time: The sensor ’ s response time refers to the interval between when the applied current reaches 90% of its final value and when the sensor output reaches the corresponding value of the applied current.

Rise Time: The sensor's rise time is the interval between the sensor output reaching 10% and 90% of its final value.





Zero Point Ratiometricity Error (QVO Ratiometricity Error): This refers to the deviation of the sensor's zero output from the theoretical value when the supply voltage Vcc varies from 5V to 4.75V < Vcc < 5. 25V. The formula is defined as follows:

$$\boldsymbol{E_r = (1 - \frac{\frac{V_{QVO(V_{CC1})}}{V_{QVO(5V)}}}{VCC1\ \ /5}) \times 100\%}$$

Linearity Error: Non-linearity is an indicator of the linearity of the sensor IC across the full current measurement range. Here, the endpoint straight line is used as the reference working line:

$$Lin_{ERR} = \frac{\Delta L_{max}}{Y_{FS}} \times 100\%$$

where:
LinERR: Sensor ’ s endpoint linearity error.
ΔLmax: The absolute maximum deviation between the arithmetic mean of multiple measurements at the same calibration point and the corresponding point on the reference straight line during forward and reverse measurements.

Notes:

1. **Incorrect wiring may cause sensor damage**. After connecting the sensor to a 5V power supply, the measured current passes through the sensor in the direction of the arrow, and the corresponding voltage value can be measured at the output terminal.
2. **-BR Mode**: The zero output voltage $Vovo = \frac{Vcc}{2}$, with a fixed gain of 2V, and the output curve is:

$$V_{our} = \frac{Vcc}{2} + 2 \times \frac{Ip}{Ip_{Max}}$$

   Changes in the supply voltage within a certain range will cause V_{our} to change. For example, if Vcc ranges from 4.75V to 5.25V, the static output voltage $Vovo$ at 0A will range from 2.375V to 2.625V. The gain does not change with Vcc, and is fixed at 2V, so the full-scale output range of $Vour(IP_{Max})$ will be 4.375V to 4.625V.
3. **-BF Mode**: When $Vcc = 4.75 - 5.25V$, the zero output voltage is fixed at 2.5V, with a fixed gain of 2V. The output curve is:

$$V_{our} = 2.5 + 2 \times \frac{Ip}{Ip_{Max}}$$