Fluxgate Current Sensor RIS500

RIS SERIES FLUXGATE CURRENT SENSOR

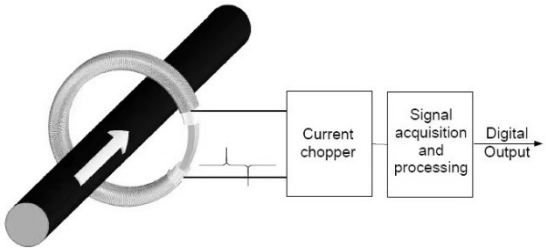
The RIS series of current sensors employs cutting-edge fluxgate technology, ensuring exceptional precision in current detection while maintaining minimal bias. Additionally, these sensors incorporate a robust galvanic isolation that effectively segregates high and low voltage domains. The fluxgate sensor operates on a singular channel power supply configuration and offers a Controller Area Network (CAN) output interface. This design aligns seamlessly with vehicle-level product specifications, rendering it highly compatible with applications such as New Energy Vehicles (NEV), Plug-in Hybrid Electric Vehicles (PHEV), Charging Infrastructure, and Energy Storage Systems, among others.

| Features

- Panel Mounting
- Unipolar 12V battery power supply
- High speed CAN output (up to 500kbps)
- Configurable internal digital low-pass frequency filter
- Configurable CAN speed and CAN ID
- UL508 compatibility
- CE Certification
- IP42 Level Ingress Protection

| Advantages

- High accuracy: total error < 0.5% [-40°C~85°C], normal error [25°C] <0.3%
- Offset below 10mA
- Low Zero Temperature Shift
- High galvanic separation
- Wide operation voltage range
- Stable CAN communication
- Both installation and application to meet market devices and easy to be changeover



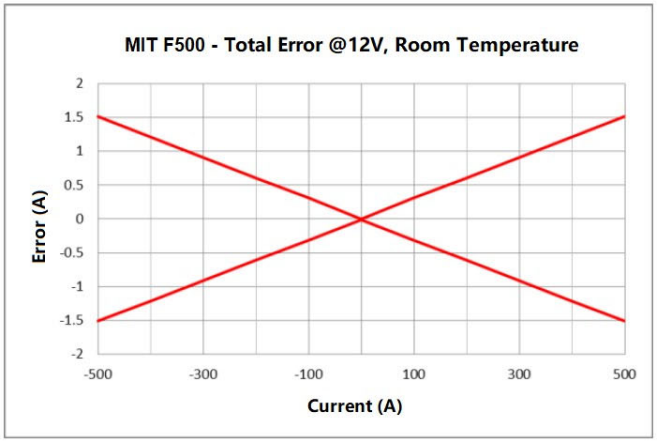
| Specification

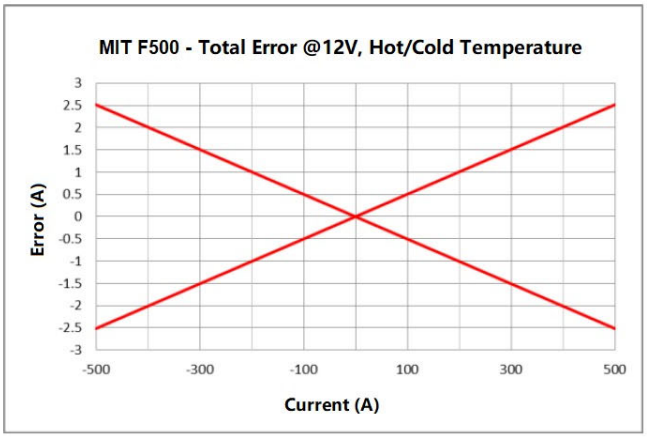
❖ Electrical Parameters

Category	Parameters	Symbol	Unit	Min	Typical	Max
Basic	Supply voltage	Uc	V	8	13.5	16
	Start-up voltage	Uc	V	6		
	Current consumption @Ip=0A	Ic	mA		40	45
	Current consumption @Ip=500A	Ic	mA		140	160
	Ambient operation temperature	TA	℃	-40		85
Performance in operating	Primary nominal DC or RMS current	IPN	A	-500		500
	Current clamping value		A	-530		530
	Voltage clamping value Max@ Uc increases		V		18	
	Voltage clamping value Max@ Uc decreases		V		17.35	
	Voltage clamping value Min@ Uc increases		V		7.72	
	Voltage clamping value Min@ Uc decreases		V		7.27	
	Linearity error	ℰL	%		0.1	
	Output noise		mA		±10	
	Start-up time	Tstart	ms		20	
	Setting time after overload		ms		20	
Absolute max rating (not operating)	Load dump overvoltage	Uc	V		32	
	Over-voltage	Uc	V		24	
	Reverse polarity	Uc	V		-16	
	Minimum supply voltage	Uc min	V		6	
	Maximum supply voltage	Uc max	V		18	
	Creepage distance	dcp	mm		7.2	
	Clearance	dcl	mm		6.95	
	RMS voltage for AC insulation test	Ud	KV		2.5	
	Insulation resistance	Rins	Mohm		500	
	IP level				IP42	

❖ Overall Accuracy

IP (A)	Total error @ 25 °C (A)	Total error @ -40°C~85°C (A)
-500	±1.5	±2.5
0	±0.01	±0.01
500	±1.5	±2.5





❖ CAN Output

- CAN protocol 2.0B
- Bit order: big endian (Motorola)
- CAN oscillator tolerance: 0.27%
- Integrates 120Ω termination resistor inside sensor
- No sleep capability

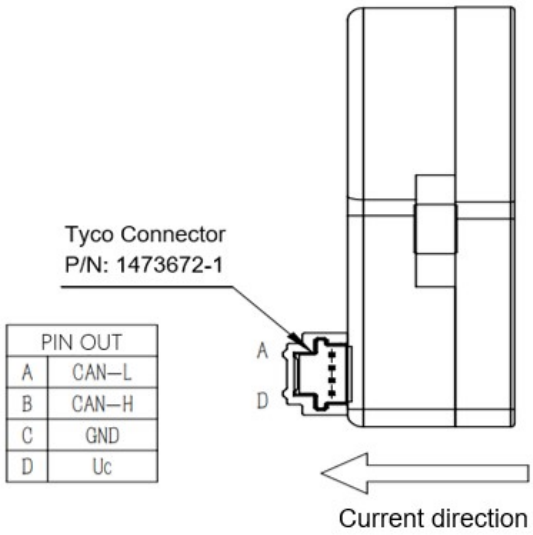
Message description	Can ID[1]	Data length	Message launch type[1]	Signal description	Signal name	Start bit	End bit
Return current IP (mA)	0x3C2	8 bytes	Cyclic transmitted message 50ms cycle	IP value: 80000000h=0mA 7FFFFFFFh=-1mA 80000001h=1mA	IP_VALUE	0	31
				Error indication (1 bit) 0 = Normal, 1 = Failure	ERROR_INDICATION	32	32
				Error information (7 bits)	Error information	33	39
				not defined[1]	VACANT_DATA_3 BYTE	40	63

[1] Parameters are configurable.

❖ Error Management

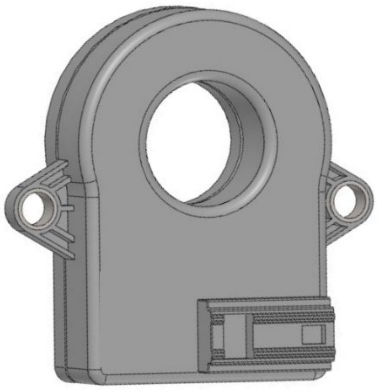
Failure Mode	IP Value	Error Indication	Error Information
Overcurrent Detection IP > Approximate 580 A	0x FFFF FFFF	1	0x41
Fluxgate has no oscillation for more than 20 ms	0x FFFF FFFF	1	0x42
Clock deviation	0x FFFF FFFF	1	0x44
Supply voltage is out of range	0x FFFF FFFF	1	0x46

❖ Connector



RIS-500 Operating Instruction

Open-loop fluxgate current sensor



Content

1 Introduction

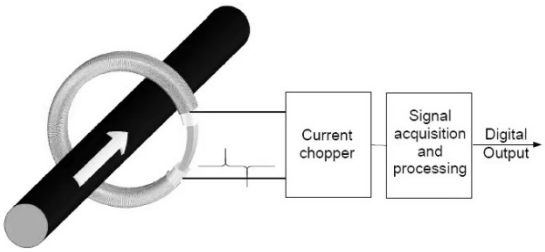
Rincon Power RIS-500 series are based on fluxgate technology with high accuracy and low bias-current detection capability, meanwhile with galvanic isolation feature between high and low voltages. RIS-500 is driven by single channel power supply and outputs CAN message. It is suitable for NEV, PHEV, Charging Station, Energy Storage System, etc.

This document is a guide for using the RIS-500 series current senor. When need arises for detailed parameters, please refer to datasheet.

2 Dimension and Installation

2.1 Installation and connection overview

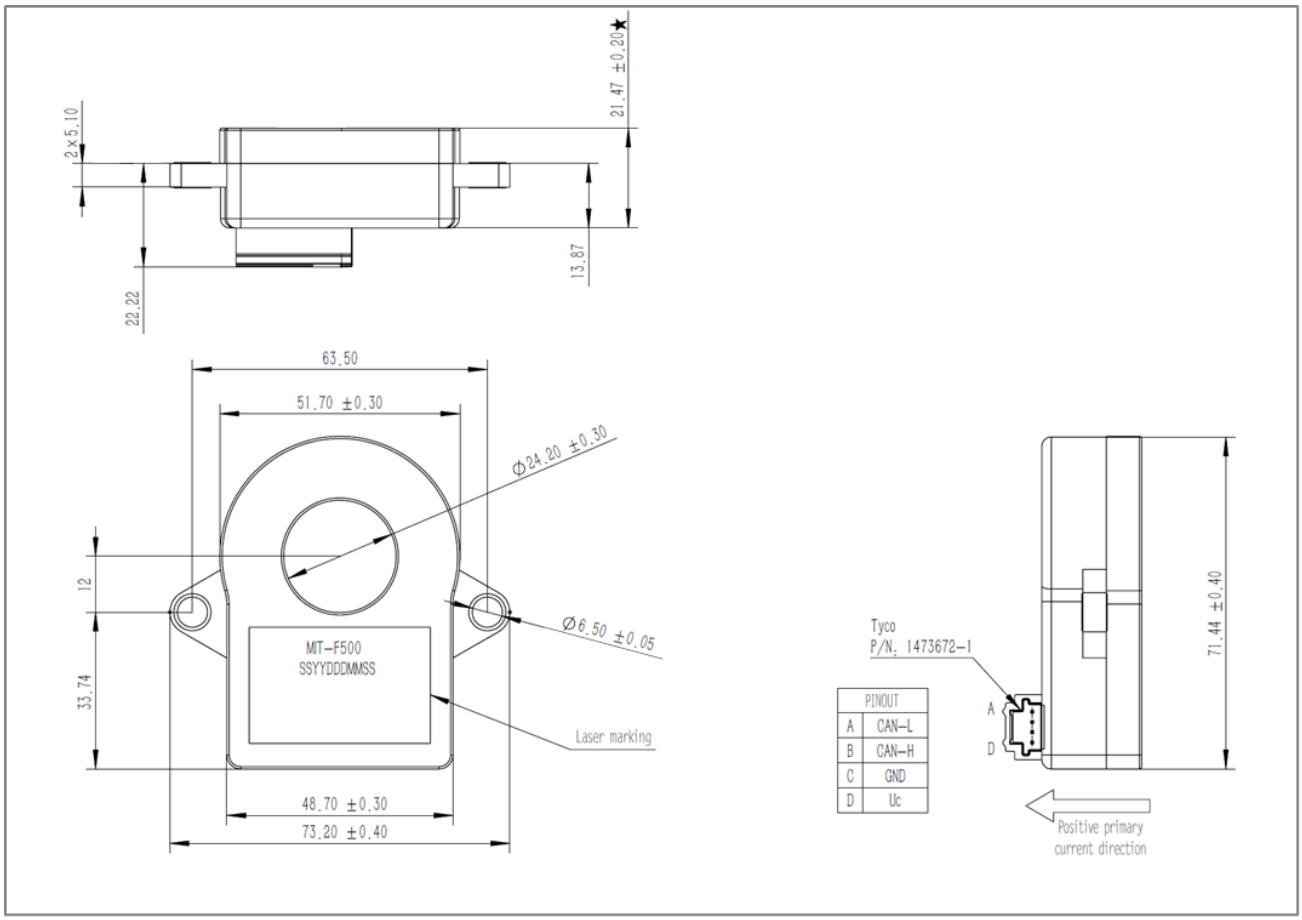
The fluxgate current sensor measures the current in the busbar that passes through the sensor hole. The recommended busbar dimension is <Φ24mm.



The sensor is designed for panel mounting with two mounting holes at a distance of 63.5mm. Please refer to the below dimensions to ensure the busbar can passes through the center of the sensor hole, in order to get a best measurement accuracy.
Mounting screw M6, recommended torque 8±1.5Nm.

Please check the current direction, and confirm the positive current direction is in accordance with the that illustrated in the below drawing (at the bottom right corner).

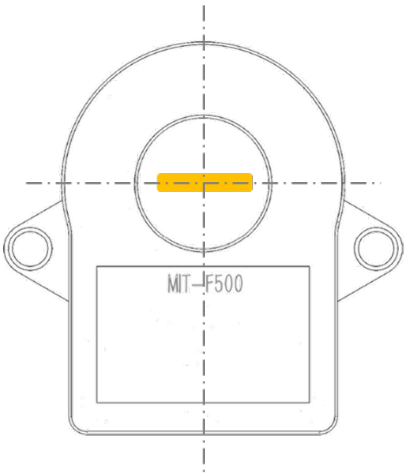
The power/signal port mates with TE 1473672-1, and the pin definition is as in the below drawing (at the bottom right corner). The sensor is power by 8~16V DC.



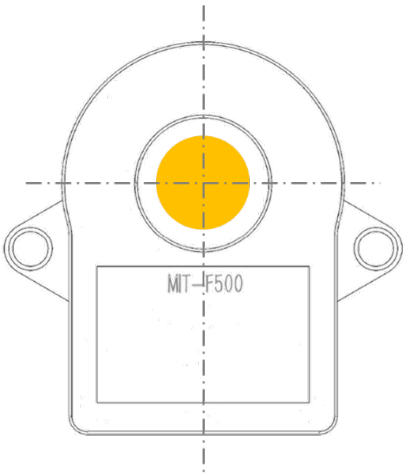
2.2 Installation influence and recommendation

When the primary current flows through the conductor, a magnetic field will be generated, and RIS500 senses the magnetic field and converts to output current values. The primary current conductor is typically cable or busbar. The RIS500 series are designed based on high accuracy technology. If the primary conductor and the RIS500 are not installed in a proper relative position to each other, the high accuracy may be affected.

Based on the test results, we strongly recommend customer to put conductor in the center area of the sensor hole as shown in the figure below.

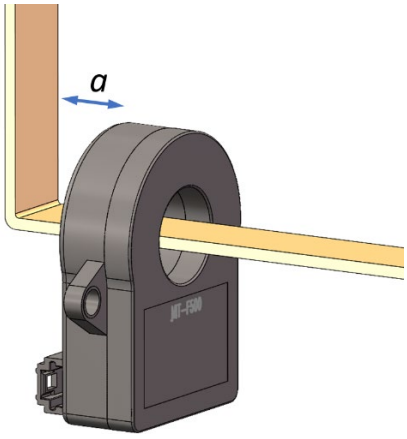


Busbar

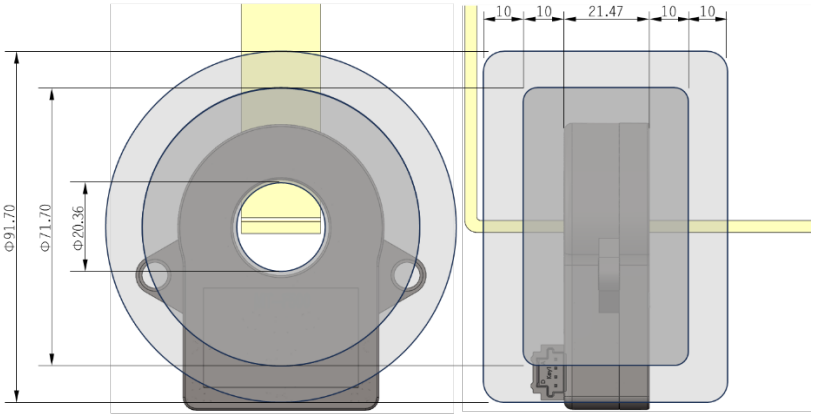


Round cross-section cable

The long straight copper bar across the center of the sensor hole is the best. If a bended busbar is used, e.g. L-shape busbar, the corresponding magnetic field around the bended bar will affect the sensor accuracy. Please make sure the busbar doesn't go through the shadow area as shown in the figure below.



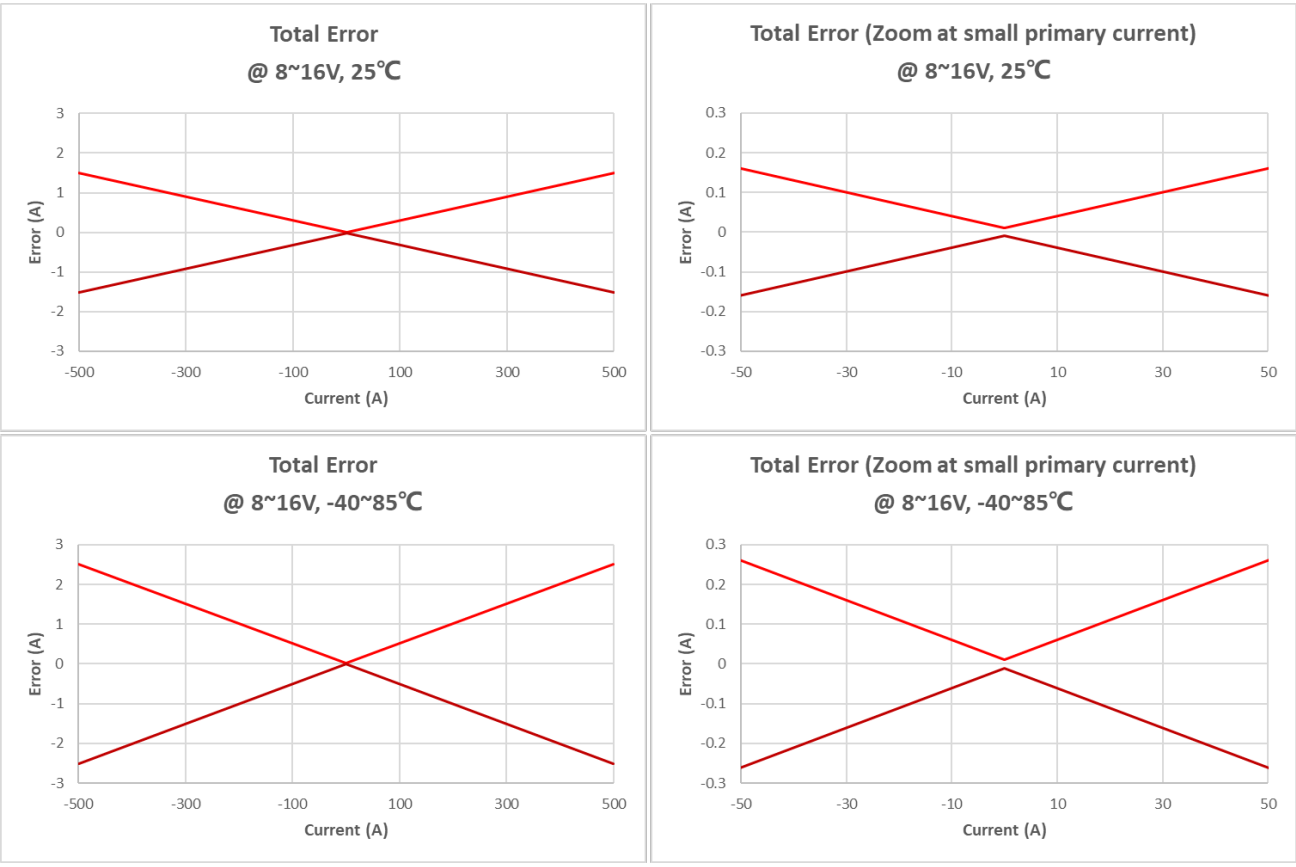
a ⩾ 10mm.
Recommend *a* ⩾ 20mm.



Forbidden busbar area (accuracy not guaranteed)
Not recommended busbar area (accuracy degraded)

3 Accuracy

The RIS-500 error limit is defined as the chart below. The error limit is proportional to the primary current, and the noise at 0A is ±10mA。



The error limits at the full-scale and zero point, as examples, are as in the below table.

Ip (A)	Total error @ 25 °C (A)	Total error @ -40°C~85°C (A)
-500	±1.5	±2.5
0	±0.01	±0.01
500	±1.5	±2.5

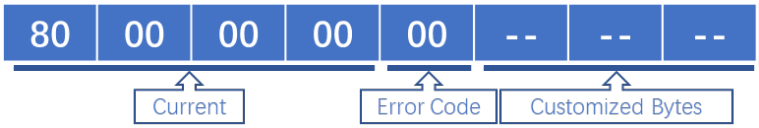
4 CAN Message

The RIS-500 series provide CAN output, following CAN 2.0B protocol. The sensor integrates 120Ω terminal resistor inside, which can be customized to remove.

CAN communication parameters, such as Baud rate, CAN ID, message interval, are configurable. Please refer to section 5 for the configuration instruction.
Default CAN parameters:

- Baud rate 500kpbs;
- CAN ID 0x3C2;
- Message interval 10ms.

One CAN message contains 8 bytes, including the information of: current, error code, and customized bytes.



Below table is the matrix of the definition of each part of the message bytes.

Message discription	Can ID	Data length	Message launch type	Signal discription	Signal name	Start bit	End bit
Return current Ip (mA)	0x3C2[1)]	8 bytes	Cyclic transmitted message 10ms[1)] cycle	Ip value: 80000000h=0mA 7FFFFFFFh=-1mA 80000001h=1mA	IP_VALUE	0	31
				Error indication (1 bit) 0 = Normal, 1 = Failed	ERROR_INDICATION	32	32
				Error information (7 bits)	ERROR_INFORMATION	33	39
				Not defined[1)]	CUSTOMIZED_3 BYTE	40	63

Note: [1)] Parameters are configurable.

The error codes and error information, as listed in the below table, are to provide an auxiliary indication about the reason for the malfunction when the sensor cannot work in the normal state.

Failure Mode	I_P Value	Error Indication	Error Information
Overcurrent Detection Ip > Approximate 580 A	0x FFFF FFFF	1	0x41
Fluxgate has no oscillation for more than 20 ms	0x FFFF FFFF	1	0x42
Clock deviation	0x FFFF FFFF	1	0x44
Supply voltage is out of range	0x FFFF FFFF	1	0x46

5 CAN Configuration

The RIS-500 series provide the option to configure CAN settings to facilitate the potential need in customer applications.

5.1 What you need -

- CAN interface tool to PC, e.g. PCAN-USB
- A PC that can connect to the sensor via the CAN interface tool
- DC power (8~16V) and proper harness (with the TE 1473672-1 connector and correct pin definition, please refer to Section2)

5.2 Connect the sensor to DC power and PC

Connect the sensor to DC power, and link the sensor to PC through the CAN interface tool. Make sure the sensor is correctly connected to the PC by the CAN interface tool, and the PC can receive the CAN messages sent from the sensor.

Some quick check if no message received:

- Sensor is powered on.
- The pin definition of the connector is correct.
- The CAN interface tool is correctly connected to the sensor harness, and to the PC. In some cases the CAN interface need powered on as well, please check its manual.
- 120Ω terminal resistor exists in the CAN bus.
- The Baud rate of the CAN interface tool is set in accordance with the sensor. The default Baud rate of the new RIS500 is 500kpbs, however it can ever be changed and you can try 250 or 125kpbs if you don't know exactly.

5.3 CAN configuration directions

Use your PC to send a CAN message to set/change the sensor's CAN configuration.

5.3.1 Setting the CAN Baud rate.

- Set the Baud rate to 500kpbs

PC to Sensor:	CAN ID 0x4FF	03	11	FF	FF	FF	FF	FF	FF
Sensor response:	CAN ID 0x3FF	03	11	FF	FF	FF	FF	FF	FF

- Set the Baud rate to 250kpbs

PC to Sensor:	CAN ID 0x4FF	03	22	FF	FF	FF	FF	FF	FF
Sensor response:	CAN ID 0x3FF	03	22	FF	FF	FF	FF	FF	FF

- Set the Baud rate to 125kpbs

PC to Sensor:	CAN ID 0x4FF	03	33	FF	FF	FF	FF	FF	FF
Sensor response:	CAN ID 0x3FF	03	33	FF	FF	FF	FF	FF	FF

Note: The new Baud rate configuration will take effect only after being powered on again.

5.3.2 Setting the CAN ID.

- Set to a new standard frame CAN ID

  PC to Sensor: CAN ID 0x4FF

  Sensor response: CAN ID 0x3FF

04	01	NEW ID	FF	FF	FF	FF
04	01	NEW ID	FF	FF	FF	FF

- Set to a new extended frame CAN ID

  PC to Sensor: CAN ID 0x4FF

  Sensor response: CAN ID 0x3FF

04	02	NEW ID	FF	FF
04	02	NEW ID	FF	FF

5.3.3 Setting the CAN message interval

The minimum CAN message interval is 10ms. When need to set to N*10ms interval, use the below direction.

PC to Sensor: CAN ID 0x4FF

Sensor response: CAN ID 0x3FF

05	01	N	FF	FF	FF	FF	FF
05	01	N	FF	FF	FF	FF	FF