FR1C H1252A Series

Current Sensor

Model Number:

FR1C 300 H1252A
FR1C 500 H1252A
FR1C 700 H1252A

This sensor features electrical isolation between its primary (high-voltage) and secondary (12V system) circuits, making it suitable for battery monitoring applications requiring high accuracy and low offset.

Features

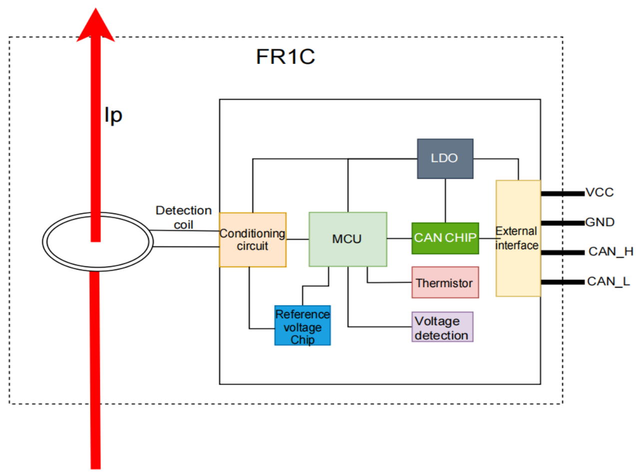
- Current sensor using fluxgate technology
- Over-current detection mechanism
- Unipolar +12V battery power supply
- Output signal: High speed CAN (up to 500Kbps)
- Configurable internal digital low-pass frequency filter
- Configurable CAN speed/CAN ID
- Ingress Protection: IP42
- Housing material complies with UL 94-V0
- Standards:
  - IEC 60664-1:2020
  - IEC 61800-5-1:2022
  - IEC 62109-1:2010

Applications

- Hybrid and electric vehicle battery pack
- Conventional lead-acid batteries
- Battery management

Working principle

A low-frequency fluxgate current sensor is made of a wound core which saturates under low induction. A current chopper switches the winding's current to saturate the magnetic core alternatively at ±B max with a fixed frequency. Fluxgate sensors use the change of the saturation's point symmetry to measure the primary current. Due to the principle of switching the current, all offsets (electric and magnetic) are canceled.



Safety

The use of sensors must comply with the IEC 61800-5-1standards.
Sensors must be placed in electronic or electrical equipment that meets application standards and safety requirements according to the instructions.

Caution, risk of electrical shock!

When sensors are working, certain parts may be subjected to dangerous voltages (such as the primary busbar and power supply), ignoring these can lead to damage and serious danger.

Sensors are built-in devices, and after installation, their conductive parts must be ensured not to be touched by the outside world. If necessary, a protective shell or shielding cover can be added. The main power supply must be able to be disconnected.

Product Naming Rules

F R 1 C · H x x x x x

- F: Fluxgate
- R: Round hole
- 1: Size
- C: CAN output
- ·: Measuring range
- H: Secondary output
- x: Supply voltage:
  - 1：12V
  - 2：24V
- x: Mounting holes:
  - 1：67.5-φ5 With bushing
  - 2：63.5-φ6.5 Bushingless
  - 3：67.5-φ6.8 With bushing
  - 4：63.5-φ6.8 With bushing
- x: Baud rate:
  - 2：250k
  - 5：500k
- x: ID
- x: Frame protocol

Model Selection Example

F	R	1	C	300	H	1	2	5	2	A
Fluxgate	Round hole	Size	CAN Output	Measuring range	Secondary output	12V	63.5-φ6.5 Bushingless	500k	0x3C2	CHIPSENSE Code

* The above are merely examples for model selection; please contact CHIPSENSE for other customization requirements.

Absolute maximum ratings (not operating)

Parameter	Symbol	Unit	Value
Supply voltage	V_C	V	+16
Primary conductor temperature	T_B	℃	100

※ Using beyond the above limits may cause permanent damage to the sensor.

Environmental and mechanical characteristics

Parameter	Symbol	Unit	Min	Typical	Max	Comment
Ambient operating temperature	T_A	℃	-40		85	
Ambient storage temperature	T_S	℃	-45		105	
Mass	m	g		68		

※ Long term exposure to the above limit environment may reduce the reliability of the product.

Insulation coordination

Parameter	Symbol	Unit	Value	Comment
Rms voltage for AC insulation test @50Hz,1min	V_d	kV	7.8	According to IEC 60664-1
Impulse withstand voltage 1.2/50µs	V_W	kV	14.5	According to IEC 60664-1
Clearance (pri.- sec.)	d_{Cl}	mm	31.5	
Creepage distance (pri.- sec.)	d_{Cp}	mm	42.5	
Comparative traking index	CTI	PLC	GroupⅡ	
Insulation resistance	R_{INS}	MΩ	500	@500 V - ISO 16750-2
Application example	-	-	1500V	Reinforced insulation,according to IEC 61800-5-1, IEC 62109-1CATⅢ，PD2
Application example	-	-	3000V	Basic insulation,according to IEC 61800-5-1, IEC 62109-1CATⅢ，PD2

FR1C 300 H1252A

※ With T_A = 25℃, V_C = +12V,unless otherwise noted.

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		±300		DC
Primary current measuring range	I_{PM}	A	-400		400	DC
Supply voltage	V_C	V	8	12 1)	16	
Current consumption	I_C	mA		46 82		@ I_P=0A @ I_P=300A
Sensitivity error	ε_G	%	-0.5		0.5	
Temperature of G	*TCG*	%/K	-0.05		0.05	@-40℃~85℃
Offset current	I_{OE}	mA	-10		10	
Linearity error 0…I_{PN}	ε_L	%	-0.1		0.1	
Accuracy@ I_{PN}	*X*	% of I_{PN}	-0.3 -0.5		0.3 0.5	@25℃ Exclusive I_{OE} @-40℃~85℃ Exclusive I_{OE}
Output noise		mA	-10		10	
Output frequency of CAN signal 2)		Hz		100		Depends on the filter implemented
Start-up time		ms		150		
Setting time after overload		ms		20		

Notes: 1) For the classical 12V Lead-acid battery system, the mean value of battery voltage becomes to 13.5V during charging.

2) Output frequency depends on the emission period of the frame without digital filter.

Electrical data

FR1C 500 H1252A

※ With T_A = 25℃, V_C = +12V,unless otherwise noted.

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		±500		DC
Primary current measuring range	I_{PM}	A	-530		530	DC
Supply voltage	V_C	V	8	12[1]	16	
Current consumption	I_C	mA		46 150		@ I_P=0A @ I_P=500A
Sensitivity error	ε_G	%	-0.5		0.5	
Temperature of G	TCG	%/K	-0.05		0.05	@-40℃~85℃
Offset current	I_{OE}	mA	-10		10	
Linearity error 0…I_{PN}	ε_L	%	-0.1		0.1	
Accuracy@ I_{PN}	X	% of I_{PN}	-0.3 -0.5		0.3 0.5	@25℃ Exclusive I_{OE} @-40℃~85℃ Exclusive I_{OE}
Output noise		mA	-10		10	
Output frequency of CAN signal [2]		Hz		100		Depends on the filter implemented
Start-up time		ms		150		
Setting time after overload		ms		20		

Notes: 1) For the classical 12V Lead-acid battery system, the mean value of battery voltage becomes to 13.5V during charging.

2) Output frequency depends on the emission period of the frame without digital filter.

Electrical data

FR1C 700 H1252A

※ With T_A = 25℃, V_C = +12V,unless otherwise noted.

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		±700		DC
Primary current measuring range	I_{PM}	A	-760		760	DC
Supply voltage	V_C	V	8	12 1)	16	
Current consumption	I_C	mA		46 220		@ I_P=0A @ I_P=700A
Sensitivity error	ε_G	%	-0.5		0.5	
Temperature of G	TCG	%/K	-0.05		0.05	@-40℃~85℃
Offset current	I_{OE}	mA	-10		10	
Linearity error 0…I_{PN}	ε_L	%	-0.1		0.1	
Accuracy@ I_{PN}	X	% of I_{PN}	-0.3 -0.5		0.3 0.5	@25℃ Exclusive I_{OE} @-40℃~85℃ Exclusive I_{OE}
Output noise		mA	-10		10	
Output frequency of CAN signal 2)		Hz		100		Depends on the filter implemented
Start-up time		ms		150		
Setting time after overload		ms		20		

Notes: 1) For the classical 12V Lead-acid battery system, the mean value of battery voltage becomes to 13.5V during charging.

2) Output frequency depends on the emission period of the frame without digital filter.

CAN Output specification

Software Version
Applicable: FR1C 300 H1252A

- CAN protocol 2.0B
- Bit order: big endian (Motorola)
- CAN oscillator tolerance: 0.27%
- No sleep mode capability
- 120Ω termination resistor to be added externally, internal CAN impedance = 4.8kΩ

Message Description	CAN ID	Name	Data Length (Nb bytes)	Type of frame	Message launch type	Signal description	Signal name	Start bit	Length
Return Current I_P (mA)	0x3C2	FR1C_IP	8	Standard	Cyclic message period 10±1 ms	*IP* Value: 80000000H=0mA 7FFFFFFFH=-1mA 80000001H=1mA	CSM_BAT_CURRENT	24	32
						Error information (7 bits)	CSM_FAIL	33	7
						Error indication (1 bit) 0 = Normal 1 = Failure	ERROR_INDICATION	32	1
						CAB (16 bits)	PRODUCT_NAME	48	16
						Software Revision (8 bit)	SW_Revision	56	8
Start/Stop CAN TX	0x6F0	TX_Control	8	Standard	Asynchronous received message	Set to 0x02	PCI	0	8
						0x28 (Stop CAN) / 0x29 (Start CAN)	BS	8	8
						Set to 0x02	STmin	16	8
						Set to 0xFFFF FFFF	VACANT_DATA_5 BYTES	56	40

Error Management

Failure Mode	I_P Value	Error Indication	Error Information
Overcurrent protection：I_P > 400A	0x FFFF FFFF	1	0x41
The fluxgate oscillator frequency is too high	0x FFFF FFFF	1	0x42
The fluxgate did not oscillate for a period exceeding 20 milliseconds	0x FFFF FFFF	1	0x43
Temperature anomaly	0x FFFF FFFF	1	0x44
Power supply anomaly	0x FFFF FFFF	1	0x46
Hardware Fault: ADC anomaly	0x FFFF FFFF	1	0x47
New data is unavailable	0x FFFF FFFF	1	0x49
Hardware Fault: DAC malfunction	0x FFFF FFFF	1	0x4A
Hardware fault: Abnormal reference voltage	0x FFFF FFFF	1	0x4B

CAN Output specification

Software Version
Applicable: FR1C 500 H1252A

- CAN protocol 2.0B
- Bit order: big endian (Motorola)
- CAN oscillator tolerance: 0.27%
- No sleep mode capability
- 120Ω termination resistor to be added externally, internal CAN impedance = 4.8kΩ

Message Description	CAN ID	Name	Data Length (Nb bytes)	Type of frame	Message launch type	Signal description	Signal name	Start bit	Length
Return Current I_P (mA)	0x3C2	FR1C_IP	8	Standard	Cyclic message period 10±1 ms	I_P Value: 80000000H=0mA 7FFFFFFFH=-1mA 80000001H=1mA	CSM_BAT_CURRENT	24	32
						Error information (7 bits)	CSM_FAIL	33	7
						Error indication (1 bit) 0 = Normal 1 = Failure	ERROR_INDICATION	32	1
						CAB (16 bits)	PRODUCT_NAME	48	16
						Software Revision (8 bit)	SW_Revision	56	8
Start/Stop CAN TX	0x6F0	TX_Control	8	Standard	Asynchronous received message	Set to 0x02	PCI	0	8
						0x28 (Stop CAN) / 0x29 (Start CAN)	BS	8	8
						Set to 0x02	STmin	16	8
						Set to 0xFFFF FFFF	VACANT_DATA_5 BYTES	56	40

Error Management

Failure Mode	I_P Value	Error Indication	Error Information
Overcurrent protection：I_P > 530A	0x FFFF FFFF	1	0x41
The fluxgate oscillator frequency is too high	0x FFFF FFFF	1	0x42
The fluxgate did not oscillate for a period exceeding 20 milliseconds	0x FFFF FFFF	1	0x43
Temperature anomaly	0x FFFF FFFF	1	0x44
Power supply anomaly	0x FFFF FFFF	1	0x46
Hardware Fault: ADC anomaly	0x FFFF FFFF	1	0x47
New data is unavailable	0x FFFF FFFF	1	0x49
Hardware Fault: DAC malfunction	0x FFFF FFFF	1	0x4A
Hardware fault: Abnormal reference voltage	0x FFFF FFFF	1	0x4B

FR1C H1252A Series

CHIPSENSE

CAN Output specification

Software Version
Applicable: FR1C 700 H1252A

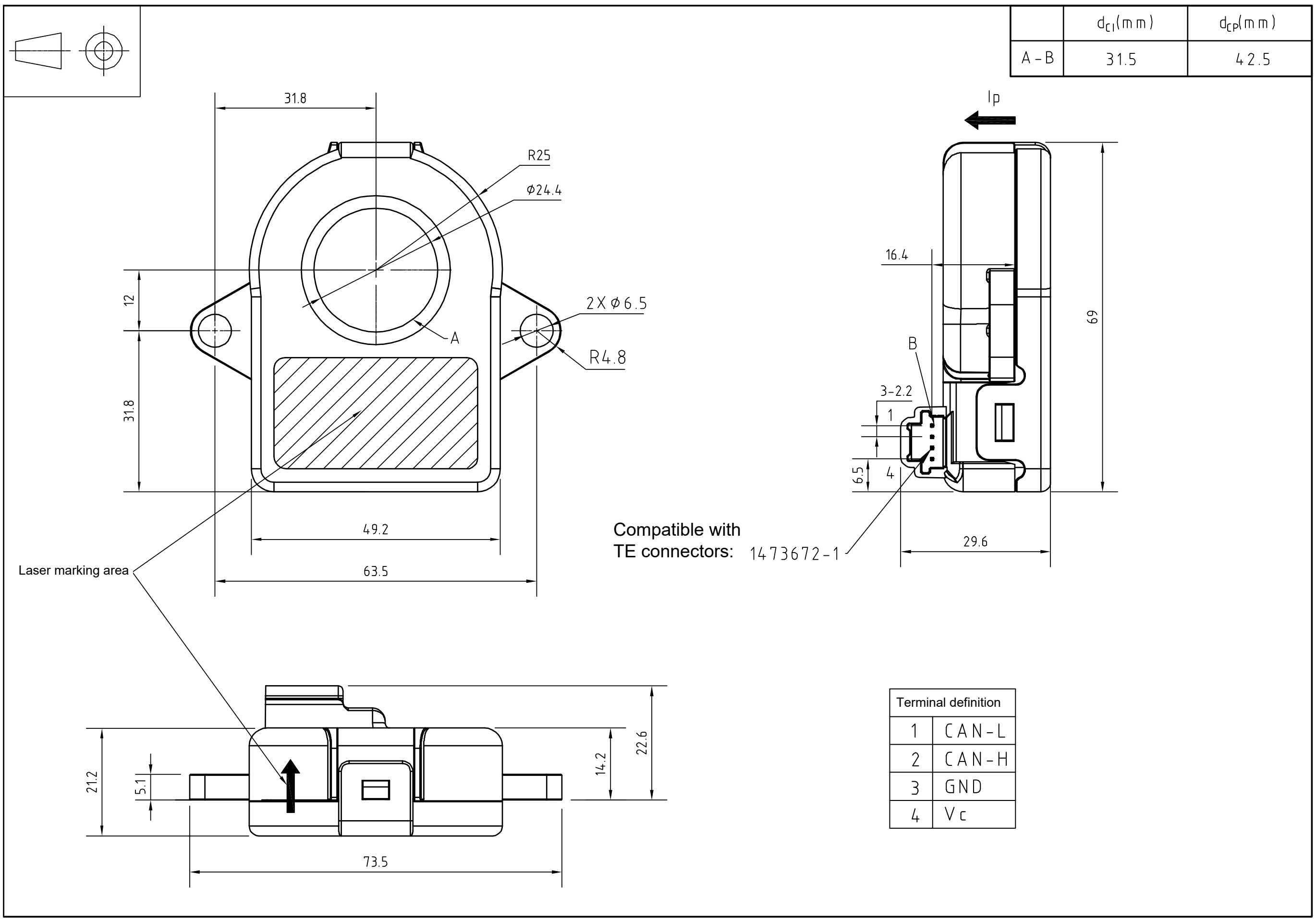
- CAN protocol 2.0B
- Bit order: big endian (Motorola)
- CAN oscillator tolerance: 0.27%
- No sleep mode capability
- 120Ω termination resistor to be added externally, internal CAN impedance = 4.8kΩ

Message Description	CAN ID	Name	Data Length (Nb bytes)	Type of frame	Message launch type	Signal description	Signal name	Start bit	Length
Return Current I_P (mA)	0x3C2	FR1C_IP	8	Standard	Cyclic message period 10±1 ms	*IP* Value: 80000000H=0mA 7FFFFFFFH=-1mA 80000001H=1mA	CSM_BAT_CURRENT	24	32
						Error information (7 bits)	CSM_FAIL	33	7
						Error indication (1 bit) 0 = Normal 1 = Failure	ERROR_INDICATION	32	1
						CAB (16 bits)	PRODUCT_NAME	48	16
						Software Revision (8 bit)	SW_Revision	56	8
Start/Stop CAN TX	0x6F0	TX_Control	8	Standard	Asynchronous received message	Set to 0x02	PCI	0	8
						0x28 (Stop CAN) / 0x29 (Start CAN)	BS	8	8
						Set to 0x02	STmin	16	8
						Set to 0xFFFF FFFF	VACANT_DATA_5 BYTES	56	40

Error Management

Failure Mode	I_P Value	Error Indication	Error Information
Overcurrent protection：I_P > 760A	0x FFFF FFFF	1	0x41
The fluxgate oscillator frequency is too high	0x FFFF FFFF	1	0x42
The fluxgate did not oscillate for a period exceeding 20 milliseconds	0x FFFF FFFF	1	0x43
Temperature anomaly	0x FFFF FFFF	1	0x44
Power supply anomaly	0x FFFF FFFF	1	0x46
Hardware Fault: ADC anomaly	0x FFFF FFFF	1	0x47
New data is unavailable	0x FFFF FFFF	1	0x49
Hardware Fault: DAC malfunction	0x FFFF FFFF	1	0x4A
Hardware fault: Abnormal reference voltage	0x FFFF FFFF	1	0x4B

Dimensions（in mm. 1 mm = 0.0394 inch）



	d_{CI}(mm)	d_{CP}(mm)
A-B	31.5	42.5

Terminal definition	
1	CAN-L
2	CAN-H
3	GND
4	Vc

Mechanical characteristics

✧ General tolerances	±0.5mm
✧ Compatible with TE connectors	1473672-1
✧ Primary side through-hole dimensions	Φ24.4mm
✧ Sensor mounting holes	Φ6.5mm x 2
✧ Recommended sensor mounting torque	M6 screw 3 N•m (Max)
✧ Recommended tightening torque	2.1 N•m(±10%)

Remarks

- ✧ When I_P flows in the direction of arrow,the voltage output is positive.
- ✧ The primary busbar temperature should not exceed 100℃.
- ✧ The test busbar should be positioned as close to the center of the mounting hole as possible.
- ✧ The sensor should be kept away from strong magnetic fields.