

FSP4000/105 高精度电流传感器 FSI4kA-N

高精度电流测试解决方案/High accuracy current testing solutions

在诸多工业/实验室应用场景中，广泛采用非接触式电流传感器对交/直流电流进行高精度测量。上海飞轩推出的磁通门电流传感器具有高精度、高带宽及高稳定性等特点。同时，可针对用户需求提供适用于不同应用场景的产品定制化服务。

In many industrial/laboratory applications, non-contact current sensors are widely used to measure AC/DC current with high accuracy. The fluxgate current sensor from Freesor has the characteristics of high precision, high bandwidth and high stability. At the same time, it can provide customized product services for different application scenarios according to user needs.

在高精度电流测试领域，上海飞轩作为国内优秀的传感器供应商，为医疗行业、电力测试行业、轨道交通、科研实验室电流测量等提供了优质的解决方案。区别于传统的霍尔式电流传感器，上海飞轩磁通门系列电流传感器采用磁通门技术，主要面向高精度交/直流电流及脉冲电流的测试和测量领域；一次、二次电流实现电气隔离，带有工作正常指示及过载自恢复功能，有较高的安全可靠。高性能、高性价比的产品很好的满足了用户的需求，提供的传感器量程从 5A 到 24000A，准确度从 1ppm 到 1000ppm 的 AC/DC 电流传感器。

In the field of high-precision current testing, as an excellent sensor supplier in China, Freesor provides high-quality solutions for the medical industry, power testing industry, rail transit, scientific research laboratory current measurement, etc. Different from the traditional Hall type current sensor, Freesor fluxgate series current sensor adopts fluxgate technology, mainly for high-precision AC/DC current and pulse current testing and measurement field; The primary and secondary current realize electrical isolation, with normal working indication and overload self-recovery function, with high safety and reliability. High-performance, cost-effective products well meet the needs of users, providing sensor ranges from 5A to 24000A, accuracy from 1ppm to 1000ppm AC/DC current sensors.

产品特性/Product feature

磁通门技术，高精度、高稳定性电流测量

Fluxgate technology, high precision, high stability current measurement

应用于非接触式场合，易于安装

For non-contact applications, easy to install

极低的温度系数

Very low temperature coefficient

低偏置电流

Low bias current

具有饱和检测及自恢复功能

It has the function of saturation detection and self-recovery

高带宽，最高可达 DC~800kHz (@±3dB)

High bandwidth, up to DC~800kHz(@±3dB)

应用领域/Application fields

新能源领域：锂电池化成分容、电池充放电测试系统 反馈器件、电机测试等

粒子加速领域：高精度电源的采样反馈器件

医疗行业：MRI 的电源采样反馈

轨道交通领域：变流器等高精度、大电流的测试

实验室应用：配合功率分析仪进行高精度功率测量、对计量级别电流进行可靠测试

仪器仪表领域：仪器仪表中电流测量的反馈器件

New energy field: lithium battery components, battery charging and discharging test system feedback devices, motor testing, etc

Particle acceleration field: Sampling feedback devices for high accuracy power supplies

Medical industry: Power sampling feedback for MRI

Rail transit field: converters and other high accuracy, high current testing

Laboratory application: High accuracy power measurement with power analyzer, reliable testing of metering level current

Instrumentation field: Feedback devices for current measurement in instrumentation



安全特性/ Security feature

| 参数 (Parameter) | 符号 (Symbol) | 单位 (Unit) | 最小 (Min) | 标称 (Type) | 最大 (Max) | 备注 (Comment) |
|--------------------------------------------|----------------|--------------|-------------|--------------|-------------|-----------------|
| 耐受电压 Withstand voltage | U_d | kV | -- | 2.5 | -- | 50/60Hz, 1min |
| 瞬态隔离电压 Transient isolation voltage | U_S | kV | -- | 5 | -- | |
| 相对漏电起痕指数 Relative leakage marking index | CTI | V | -- | 600 | -- | 无冷凝 |

一般特性/General feature

| 参数 (Parameter) | 符号 (Symbol) | 单位 (Unit) | 最小 (Min) | 标称 (Type) | 最大 (Max) | 备注 (Comment) |
|---------------------------------------|----------------|--------------|-------------|--------------|-------------|-----------------|
| 工作温度范围 Operating temperature range | T_A | °C | -25 | -- | 60 | |
| 储存温度范围 Storage temperature range | T_S | °C | -40 | -- | 85 | |
| 相对湿度 Relative humidity | RH | % | 10 | -- | 80 | 无冷凝 |
| 质量 Weight | m | kg | -- | 7 | -- | |

电气特性 测试条件（环境温度 25°C，供电电压±24V） Electrical characteristics test conditions (ambient temperature 25°C, power supply voltage ±24V)

| 参数 (Parameter) | 符号 (Symbol) | 单位 (Unit) | 最小 (Min) | 标称 (Type) | 最大 (Max) | 备注 (Comment) |
|--------------------------------------|----------------|--------------|-------------|--------------|-------------|-----------------|
| 额定原边直流电流 Rated primary DC current | $I_{PN\ DC}$ | A | -4000 | -- | 4000 | |
| 额定原边交流电流 Rated primary AC | I_{PN} | A | -- | -- | 2829 | |

| | | | | | | |
|---------------------------------------------------------|-----------------|------------|----------|--------|----------|---------------------|
| current | | | | | | |
| 测量范围 Measuring range | I_{PM} | A | -4000 | -- | 4000 | |
| 测量电阻 Measuring resistance | R_M | Ω | 0 | -- | 1 | |
| 副边电流 Secondary side current | I_S | A | -1 | -- | 1 | |
| 过载能力 ^① Overload capacity | | kA | -7 | -- | 7 | @100ms 脉冲 |
| 电流变比 Current ratio | K_N | | -- | 1:4000 | -- | |
| 供电电压 Supply voltage | U_C | V | ± 23 | -- | ± 25 | |
| 电流消耗 Current Consumption | I_C | mA | -- | -- | 50 | 总消耗需累计 I_S |
| 输出噪声 0... 10Hz ^② Output noise 0... 10Hz | V_{no} | ppm | -- | -- | 2 | |
| 输出噪声 0... 100Hz ^② Output noise 0... 100Hz | | | -- | -- | 5 | |
| 输出噪声 0... 1kHz ^② Output noise 0... 1kHz | | | -- | -- | 10 | |
| 零点失调电流 ^② Offset current | I_{OE} | ppm | -20 | -- | 20 | |
| 温度漂移系数 ^② Temperature drift coefficient | TCI_{OE} | ppm/K | -0.2 | -- | 0.2 | |
| 零点偏置稳定性 ^② Zero bias stability | | ppm/month | -3 | -- | 3 | |
| 线性度 ^② Linearity | ε_L | ppm | -20 | -- | 20 | |
| 总体准确度 ^② Overall accuracy | X_G | ppm | -100 | -- | 100 | |
| 电流跟随速度 Current following speed | di/dt | A/ μs | 100 | -- | -- | |
| 带宽 ($\pm 3dB$) Frequency bandwidth(-3dB) | BW | kHz | -- | 60 | -- | 小信号, @0.5% I_{PM} |

注①:测试信号为单脉冲, 过冲后传感器会进入自恢复状态, 状态指示灯灭, 需要约 50ms 恢复到正常工作状态。

Note 1: The test signal is a single pulse. After overshooting, the sensor will enter the self-recovery state, and the status indicator will be off. It takes about 50ms to restore to the normal working state.

注②: ppm 数据均参考副边输出信号满度对应的 IPN。

Note 2 : ppm data refer to IPN corresponding to the subside output signal full degree.

DB9 接口定义/DB9 Interface definition

| 引脚 | 1 | 3 | 4 | 2、7 | 5 | 6 | 8 | 9 |
|----|--------|-----|-----|-----|------|--------|--------------|------|
| 定义 | Return | GND | GND | NC | -Vcc | Output | Valid Output | +Vcc |

传感器的 DB9 端口，1 脚为传感器二次输出测量低端；6 脚为传感器二次输出测量高端；9 脚、4 脚、5 脚分别为传感器供电电源的正、地、负；8 脚、3 脚为状态监测端的高、低(地)；2 脚、7 脚为空。

The DB9 port of the sensor, pin 1 is the lower end of the sensor's secondary output measurement; 6 pin for the sensor secondary output measurement high-end; Pin 9, pin 4 and pin 5 are the positive, ground and negative of the sensor power supply respectively. Pin 8 and pin 3 are the high and low (ground) of the condition monitoring end; Feet 2 and 7 are empty.

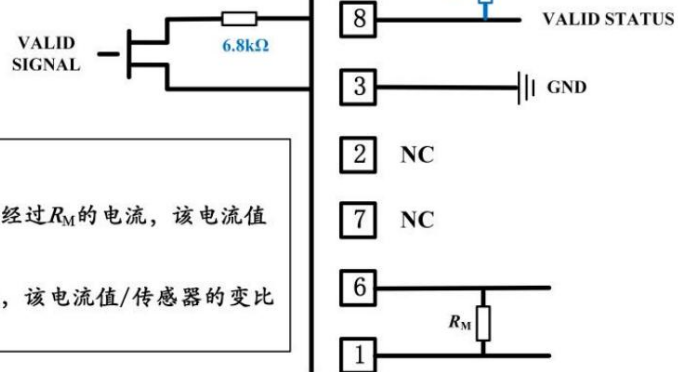
传感器的使用及状态监测端口/Sensor usage and condition monitoring port

传感器的接线图及监测端使用

DB-9 输出 8 和 3 为传感器的工作状态检测端口，如用户需要时，可按照图中的接线方法进行连接：

检测 8 口的电压输出，若为 24V 左右，则传感器的工作状态异常。

检测 8 口的电压输出，若为 $\frac{6.8k\Omega}{6.8k\Omega + R_L} \times (24V - 0.7V) + 0.7V$ 则工作正常。



DB-9 输出 6 和 1 为传感器的二次输出：

使用电阻 R_M 时：测量 R_M 两端电压，换算经过 R_M 的电流，该电流值/传感器的变比可得一次电流 I_P ；

不使用电阻 R_M 时：直接测量 R_M 两端电压，该电压值/传感器的变比可得一次电流 I_P ；

当需要使用传感器的状态监测接口，需要注意的是：DB-9 的 8 脚与 3 脚之间为 OD 门电流，最高可承受 40V 电压。

When you need to use the sensor's condition monitoring interface, it should be noted that the OD gate current is between pin 8 and pin 3 of the DB-9, which can withstand a maximum voltage of 40V.

传感器使用注意事项 Precautions for using sensors

- 原边电流与机身箭头指示方向一致时，输出为正；

- 测量小电流时，原边导体尽量置于线孔的中心位置；
- 本产品为标准品，若需其他变比或技术指标请与厂家联系；
- 本公司保留对本手册修改的权利，恕不另行通知。
- When the current on the primary side is consistent with the direction indicated by the arrow on the fuselage, the output is positive;
- When measuring small current, the primary conductor should be placed in the center of the line hole as far as possible;
- This product is a standard product, if you need other ratios or technical indicators, please contact the manufacturer;
- The Company reserves the right to amend this manual without prior notice.

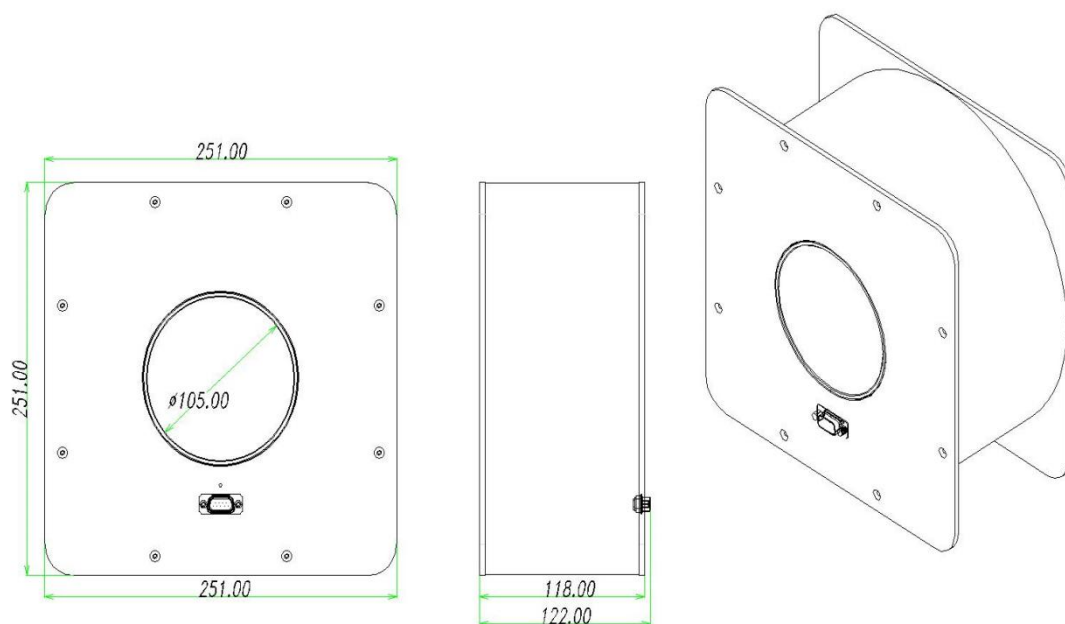
包装清单 Packing list

| 序号 S.N. | 名称 Name | 型号 Type | 数量 Quantity | 备注 Remark |
|------------|-----------------------------------------------------------------|------------|----------------|--------------|
| 1 | 电流传感器 Current Sensor | FSI4kA-N | 1 | |
| 2 | 说明书及合格证 Specification and certificate of qualification | / | 1 | |

选配清单 Optional list

| 序号 S.N. | 名称 Name | 型号 Type | 数量 Quantity | 备注 Remark |
|------------|------------------------------------------------|------------|----------------|--------------|
| 1 | 电流传感器-供电电源 Current sensor - Power supply | FSP24D20-N | | 1 |

传感器机械尺寸图 Mechanical dimensions of the sensor 单位: mm Unit:mm



- 机械尺寸图的最大允许误差: $\pm 1\text{mm}$
- 安装孔的孔径: 垂直安装孔 $\Phi 6.5\text{mm} \times 4$ 水平安装孔 $\Phi 6.5\text{mm} \times 6$
- 原边电流孔径: $\Phi 70\text{mm}$

- Maximum allowable error of mechanical dimensional drawing: $\pm 1\text{mm}$
- Mounting hole aperture: vertical mounting hole $\Phi 6.5\text{mm} \times 4$ Horizontal mounting hole $\Phi 6.5\text{mm} \times 6$
- Primary current aperture: $\Phi 70\text{mm}$