

# SF2N-4PT 电阻式温度输入模块

## 用户手册

### 注意:

在开始使用之前, 请仔细阅读操作指示、注意事项, 以减少意外的发生。负责产品安装、操作的人员必须经严格培训, 遵守相关行业的安全规范, 严格遵守本手册提供的相关设备注意事项和特殊安全指示, 按正确的操作方法进行设备的各项操作。

## 1 接口描述

### 1.1 接口说明

SF2N-4PT 的扩展电缆接口和用户端子均有盖板, 外观如图 1-1 所示。打开各盖板后便露出扩展电缆接口和用户端子, 如图 1-2 所示。

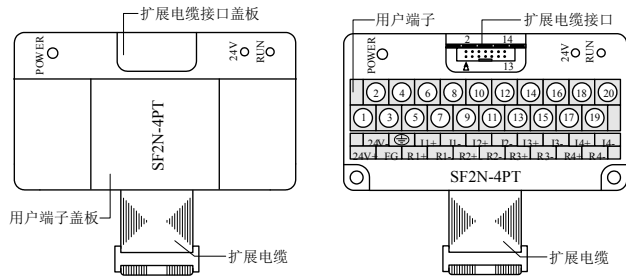


图 1-1 模块接口外观图 图 1-2 接模块接口端子图

SF2N-4PT 通过扩展电缆接入系统, 扩展电缆接口用于系统其他扩展模块的连接, 具体方法参见

### 1.2 接入系统。

SF2N-4PT 用户端子的定义见表 1-1。

表 1-1 用户端子定义表

序号	标注	说明	序号	标注	说明
1	24V+	模拟电源 24V 正极	11	R2-	第 2 通道热电阻信号负极输入端
2	24V-	模拟电源 24V 负极	12	I2-	第 2 通道热电阻信号辅助负极输入端
3	FG	屏蔽地	13	R3+	第 3 通道热电阻信号正极输入端
4	⊕	接地端	14	I3+	第 3 通道热电阻信号辅助正极输入端
5	R1+	第 1 通道热电阻信号正极输入端	15	R3-	第 3 通道热电阻信号负极输入端
6	I1+	第 1 通道热电阻信号辅助正极输入端	16	I3-	第 3 通道热电阻信号辅助负极输入端
7	R1-	第 1 通道热电阻信号负极输入端	17	R4+	第 4 通道热电阻信号正极输入端
8	I1-	第 1 通道热电阻信号辅助负极输入端	18	I4+	第 4 通道热电阻信号辅助正极输入端
9	R2+	第 2 通道热电阻信号正极输入端	19	R4	第 4 通道热电阻信号负极输入端
10	I2+	第 2 通道热电阻信号辅助正极输入端	20	I4	第 4 通道热电阻信号辅助负极输入端

### 1.2 接入系统

通过扩展电缆, 可将 SF2N-4PT 与 SF2N 系列 PLC 主模块或其他扩展模块连结在一起。其扩展电缆接口也可用于连接 SF2N 系列的其他相同型号或不同型号的扩展模块。如图 1-3 所示。

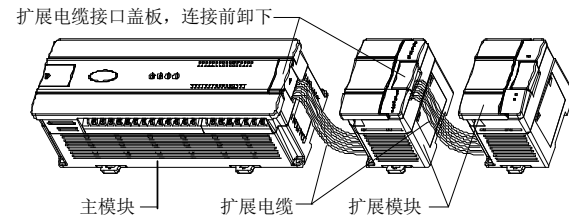


图 1-3 与主模块和其他扩展模块的连接示意图

### 1.3 布线说明

用户端子布线要求, 如图 1-4 所示。

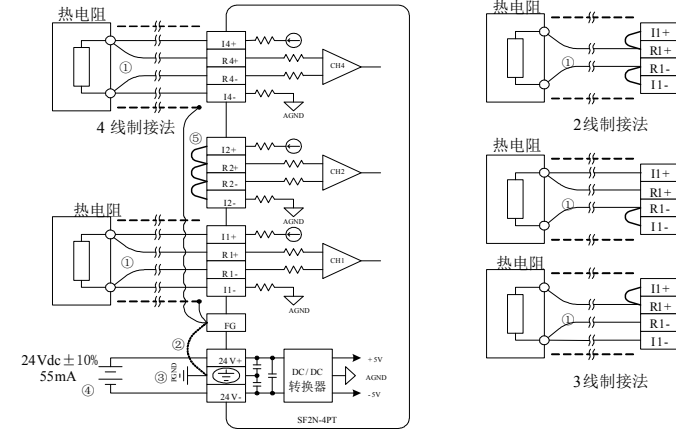


图 1-4 用户端子布线示意图

图中的①~⑤表示布线时必须注意的 5 个方面:

- 热电阻信号通过屏蔽电缆接入。电缆应远离电源线或其他可能产生电气干扰的电线。与热电阻连接的电缆说明如下:
  - 热电阻传感器 (类型为 Pt100、Cu100、Cu50) 可以采用 2、3、4 线制接法, 以 4 线制接法精度最高、3 线制次之、2 线制最差。当导线长度大于 10m 时, 建议采用 4 线连接, 以消除导线电阻误差。
  - 为了减少测量误差, 及避免受到噪声干扰, 建议使用长度小于 100m 的连接电缆。测量误差是由于连接电缆的阻抗引起的, 而且在同一模块中的不同通道产生的测量误差可能不一致, 因此需要对每个通道进行特性调整, 具体操作参见 3 特性设置。
- 如果存在过多的电气干扰, 连接屏蔽地 FG 到模块接地端 PG。
- 将模块的接地端 PG 良好接地。
- 模拟供电电源可以使用主模块输出的 24Vdc 电源, 也可以使用其它满足要求的电源。
- 将不使用通道的正负端子短接, 以防止在这个通道上检测出错误数据。

## 2 使用说明

### 2.1 电源指标

表 2-1 电源指标

项目	指标
模拟电路	24Vdc (-15%~+20%) 最大允许纹波电压 5% 55mA (来自主模块或外部电源)
数字电路	5Vdc、72mA (来自主模块)

### 2.2 性能指标

表 2-2 性能指标

项目	指标	
	摄氏 (°C)	华氏 (°F)
输入信号	热电阻类型: Pt100、Cu100、Cu50 通道数量: 4	

项目	指标			
	摄氏 (°C)		华氏 (°F)	
转换速度	(15±2%) ms×4 通道 (不使用的通道不转换)			
额定温度范围	Pt100	-150°C~+600°C	Pt100	-238°F~+1112°F
	Cu100	-30°C~+120°C	Cu100	-22°F~+248°F
	Cu50	-30°C~+120°C	Cu50	-22°F~+248°F
数字输出	12 位 A/D 转换; 温度值以 16 位二进制补码存储			
	Pt100	-1500~+6000	Pt100	-2380~+11120
	Cu100	-300~+1200	Cu100	-220~+2480
最低分辨率	Cu50	-300~+1200	Cu50	-220~+2480
	Pt100	0.2°C	Pt100	0.36°F
	Cu100	0.2°C	Cu100	0.36°F
精度	满量程的±1%			
隔离	模拟电路和数字电路之间用光电耦合器进行隔离。模拟电路与模块输入 24Vdc 电源内部隔离。模拟通道之间不隔离			

### 2.3 缓冲区

SF2N-4PT 与主模块之间通过通讯缓冲区 (BFM) 交换信息。用户设置后台软件界面后, 主模块会自动将信息写入 SF2N-4PT 的 BFM, 由此对 SF2N-4PT 的状态进行设置。主模块会自动将 SF2N-4PT 上报的信息显示在后台软件界面上, 见图 4-1~图 4-4。

SF2N-4PT 的通讯缓冲区具体内容见表 2-3。

表 2-3 缓冲区内容

BFM	内容	缺省值	读写属性
#100	CH1 的平均温度		R
#101	CH2 的平均温度		R
#102	CH3 的平均温度		R
#103	CH4 的平均温度		R
#200	CH1 的当前温度		R
#201	CH2 的当前温度		R
#202	CH3 的当前温度		R
#203	CH4 的当前温度		R
#300	故障状态字 1		R
#301	故障状态字 2		R
#600	热电阻类型及温度模式选择 0	0x0000	RW
#700	CH1 将被平均的温度点数	8	RW
#701	CH2 将被平均的温度点数	8	RW
#702	CH3 将被平均的温度点数	8	RW
#703	CH4 将被平均的温度点数	8	RW
#900	CH1-D0	0	RW
#901	CH1-A0	0	RW
#902	CH1-D1	6000	RW
#903	CH1-A1	6000	RW
#904	CH2-D0	0	RW
#905	CH2-A0	0	RW
#906	CH2-D1	6000	RW
#907	CH2-A1	6000	RW
#908	CH3-D0	0	RW
#909	CH3-A0	0	RW
#910	CH3-D1	6000	RW
#911	CH3-A1	6000	RW
#912	CH4-D0	0	RW
#913	CH4-A0	0	RW
#914	CH4-D1	6000	RW
#915	CH4-A1	6000	RW
#4094	模块软件版本信息	0x1000	R
#4095	模块的识别码	0x5041	R

说明:

- CH1 表示第 1 通道, CH2 表示第 2 通道, CH3 表示第 3 通道, CH4 表示第 4 通道。

2. 读写属性意义: R 表示只读属性, 向只读单元进行写操作无效。RW 表示可读可写属性。若读取不存在的单元, 将会获得 0 值。

3. BFM#200~BFM#203: 温度当前值单元。这个数值以 0.1°C 或 0.1°F 为单位 (取决于 BFM#600 的值), 比如 1000 表示 100°C (或 1000 表示 100°F, 由 BFM#600, BFM#601 的值确定), 温度的平均值存储到 BFM#100~BFM#103。

4. BFM#300: 故障状态字 1 单元, 其错误状态信息见表 2-4。

表 2-4 BFM#300 的错误状态信息

BFM#300 位状态	开 (1)	关 (0)
b0: 系统错误	b1 或 b2 中任何一个为 1 (所有通道 A/D 转换中止)	无错误
b1: 通道特性设置错误	在 BFM 中的通道特性数据不正常或者调整错误	通道特性数据正常
b2: 电源故障	24Vdc 电源故障	电源正常
b3: 硬件故障	A/D 转换器或其它硬件故障	硬件正常
b4~b9: 保留		
b10: 数字范围错误	A/D 转换数字输出值小于-2048 或大于 2047	数字输出值正常
b11: 平均采样错误	平均采样数不小于 257, 或者不大于 0 (使用原有有效值)	平均正常 (1~256 之间)
b12~b15: 保留		

5. BFM#301 的状态信息见表 2-5。

表 2-5 BFM#301 的状态信息

通道	位	1	0
1	b0	第 1 通道温度低于下限	第 1 通道正常
	b1	第 1 通道温度高于上限	第 1 通道正常
2	b2	第 2 通道温度低于下限	第 2 通道正常
	b3	第 2 通道温度高于上限	第 2 通道正常
3	b4	第 3 通道温度低于下限	第 3 通道正常
	b5	第 3 通道温度高于上限	第 3 通道正常
4	b6	第 4 通道温度低于下限	第 4 通道正常
	b7	第 4 通道温度高于上限	第 4 通道正常
保留	b8~b15	-	-

6. BFM#600: 模式设定单元。用于设定第 1 通道到第 4 通道的工作模式。具体对应关系如图 2-1 所示。

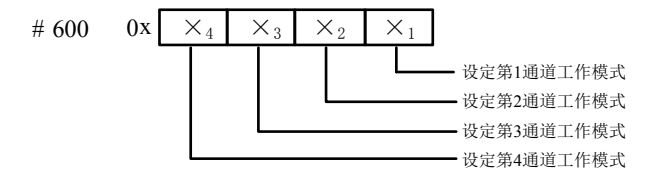


图 2-1 模式设定单元与通道对应关系

字符值所表示的信息如表 2-6 所示。每个通道的转换时间为 15ms, 当有通道设置为关闭时, 对应的通道不执行 A/D 转换, 总的转换时间将减少。

表 2-6 数值与模式对应关系

序号	× 值	对应模式
1	0	Pt100 热电阻, 数字量单位为 0.1°C
2	1	Pt100 热电阻, 数字量单位为 0.1°F
3	2	Cu100 热电阻, 数字量单位为 0.1°C
4	3	Cu100 热电阻, 数字量单位为 0.1°F
5	4	Cu50 热电阻, 数字量单位为 0.1°C
6	5	Cu50 热电阻, 数字量单位为 0.1°F
7	6~F	通道关闭

7. BFM#700~BFM#703: 平均采样次数设定单元。平均采样次数范围为 1~256。若输入的数超出了此范围, 将使用缺省值 8。

8. BFM#900~BFM#915: 通道特性设置数据缓存器, 使用两点法设置通道特性。D0、D1 表示通道输出的数字量, 单位是 0.1°C; A0、A1 表示通道实际输入温度值, 单位是 0.1°C。每通道占用 4 个单元。

请注意，特性参数中均以 0.1℃ 为数据单位，对于华氏度（°F）参数，请按下述表达式进行转换成摄氏度后写入特性设置中：

$$\text{摄氏}^{\circ}\text{C} = 5/9 \times (\text{华氏}^{\circ}\text{F} - 32)$$

9. BFM#4094：模块软件版本信息单元。自动显示在后台软件 SF2N-4PT 配置界面中的**模块版本**栏，见图 4-1。

10. BFM#4095：模块识别码单元。SF2N-4PT 的识别码是 0x5041。可编程序控制器中的用户程序可以在程序中使用这个号码，以在传输和接收数据之前确认此扩展模块。

### 3 特性设置

SF2N-4PT 的输入通道特性为通道模拟输入温度 A 与通道数字输出 D 之间的线性关系，可由用户设置。每个通道可以理解为图 3-1 中所示的模型。由于其为线性特性，因此只要确定两点 P0 (A0, D0)、P1 (A1, D1)，即可确定通道的特性。其中，D0 表示模拟量输入为 A0 时通道输出数字量，D1 表示模拟量输入为 A1 时通道输出数字量。

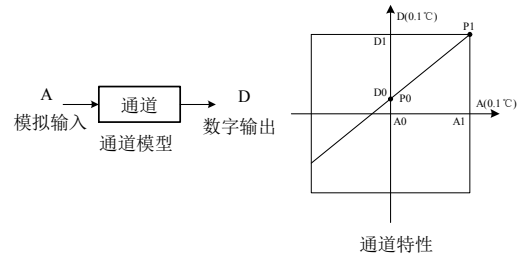


图 3-1 SF2N-4PT 通道特性示意图

测量误差是由于连接电缆的阻抗引起的，用户可以通过设定通道特性来消除此类误差。

考虑到用户使用的简便性，且不影响功能的实现，将 A0、A1 的值固定为当前模式下，模拟量的 0 点和 6000（单位是 0.1℃），也就是说图 3-1 中 A0 为 0.0℃，A1 为 600.0℃，用户对此两项设置的写入无效。

若不更改各通道的 D0、D1 值，仅设置通道的模式（BFM#600），那么，每种模式对应的特性都如同图 3-2 所示。

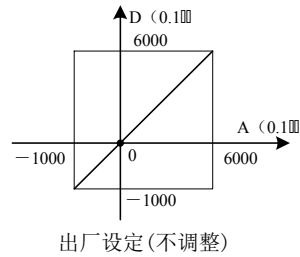


图 3-2 不更改各通道的 D0、D1 值，各种模式对应通道特性

注意：当模式设置为 1 或 3，即输出以华氏度（0.1°F）为单位时，在输出数据区（BFM#100~#103，#200~#203）相应单元将读出以 0.1°F 为单位的温度值。但在通道特性设置区（BFM#900~#915）中的数据仍然以摄氏度（0.1℃）为单位。也就是说在通道特性设置区中（BFM#900~#915）的数据只能以摄氏度（0.1℃）为单位。在下面更改 D0、D1 数值时要注意这一点。

若更改通道的 D0、D1 数值，即可更改通道特性，D0 可在 -1000~1000（0.1℃）之间任意设定，D1 可在 5000~7000（0.1℃）之间任意设定，若设定值超出此范围，SF2N-4PT 不会接收，并保持原有有效设置。

若实际使用时 SF2N-4PT 测量值偏高 5℃（41°F）时，通过设定特性调整的两点 P0(0, -50)，P1(6000, 5950)可消除误差，参见图 3-3 实例。

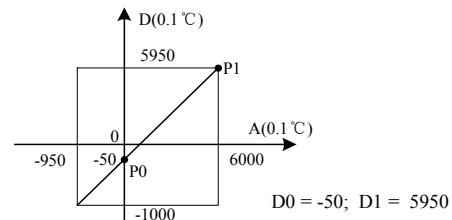


图 3-3 特性更改实例

## 4 应用示例

### 4.1 基本应用

如下例所示，SF2N-4PT 连接在扩展模块的 0 号位置，使用第 1 通道接入 Pt100 型热电阻输出摄氏度温度，第 2 通道接入 Cu100 型热电阻输出摄氏度温度，第 3 通道接入 Cu50 型热电阻输出华氏度温度，关闭第 4 通道，平均值点数设为 4，并且用数据寄存器 D1、D2、D3 接收平均值转换结果。设置的方法如图 4-1 至图 4-4 所示。进一步详细说明参见《SF2N 系列可编程控制器编程参考手册》。

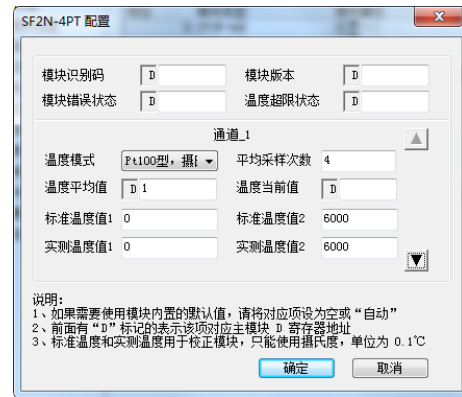


图 4-1 基本应用通道一设置

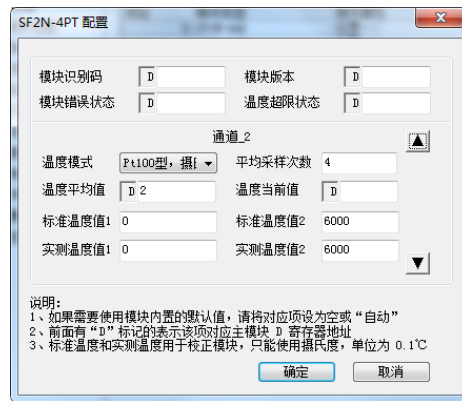


图 4-2 基本应用通道二设置

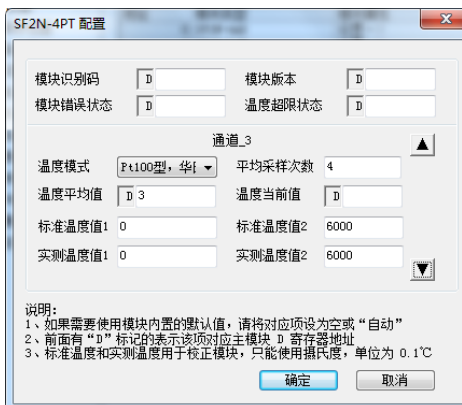


图 4-3 基本应用通道三设置

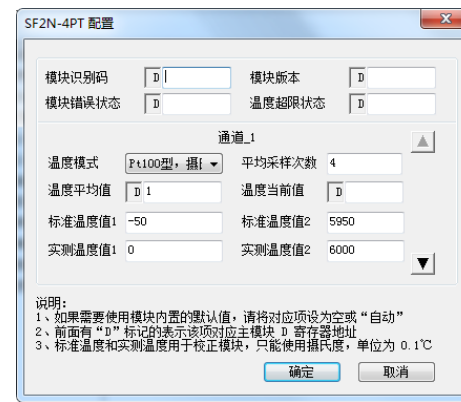


图 4-4 通道特性更改设置

### 4.2 特性更改

SF2N-4PT 连接在扩展模块的 0 号位置，使用其第 1 通道接入 Pt100 型热电阻输出摄氏度温度，第 2 通道接入 Cu100 型热电阻输出摄氏度温度，第 3 通道接入 Cu50 型热电阻输出华氏度温度，关闭第 4 通道。均实现图 3-3 中的特性（若实际使用时 SF2N-4PT 测量值偏高 5℃[41°F]）。此时第 1 通道在实际测量温度为 600℃时，输出为 6000；第 2 通道在实际测量温度为 120℃时，输出温度为 1200；第 3 通道在实际测量温度为 248°F 时，输出温度为 2480。用数据寄存器 D1、D2、D3 接收平均值转换结果。更改的方法如图 4-4 所示。需要注意的是特性更改都是以摄氏度为单位。且设置更改值的范围在 ±1000（±100℃）以内。

## 5 运行检查

### 5.1 例行检查

1. 检查模拟输入布线是否满足要求（参考 1.3 布线说明）。
2. 检查 SF2N-4PT 扩展电缆是否可靠插入扩展电缆接口。
3. 检查 5V 及 24V 电源是否过载。注意：SF2N-4PT 数字部分的电源来自主模块，通过扩展电缆提供。
4. 检查应用程序，确保应用中选择的是正确的操作方法及参数范围。
5. 置 SF2N 主模块为 RUN 状态。

### 5.2 故障检查

如果 SF2N-4PT 运行不正常，请检查下列项目：

- 检查 POWER 指示灯状态

点亮：扩展电缆连接正确；

熄灭：检查扩展电缆连接情况及主模块情况。

- 检查模拟布线

- 检查 24V 指示灯状态

点亮：24Vdc 电源正常；

熄灭：24Vdc 电源可能有故障，若 24Vdc 电源正常，则是 SF2N-4PT 故障。

- 检查 RUN 指示灯状态

高速闪烁：SF2N-4PT 运行正常；

慢速闪烁或熄灭：检查后台软件中 SF2N-4PT 配置界面中**错误状态**一栏中的信息。

### 用户须知

1. 保修范围指可编程控制器本体。
2. **保修期为十八个月**，保修期内正常使用情况下，产品发生故障或损坏，我公司免费维修。
3. **保修期起始时间为产品制造出厂日期**，机器编码是判断保修期的唯一依据，无机器编码的设备按过保处理。
4. 即使在保修期内，如发生以下情况，将收取一定的维修费用：
  - 不按用户手册操作导致的机器故障；
  - 由于火灾、水灾、电压异常等造成的机器损坏；
  - 将可编程控制器用于非正常功能时造成的损坏。
5. 服务费按实际费用计算，如另有合同，以合同优先的原则处理。
6. 请您务必保留此卡，并在保修时出示给维修单位。
7. 如您有问题可与代理商联系，也可直接与我公司联系。

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# SF2N-4PT RTD Module

## User Manual

### Note:

To reduce the chance of accident, please carefully read the operating instructions and safety precautions prior to use. Only adequately trained personnel shall install or operate this product. In operation, strict compliance with applicable safety rules in the industry, the operating instructions and safety precautions in this book is required.

## 1 Port Description

### 1.1 Port

The extension port and user port of SF2N-4PT are both protected by a cover, as shown in Figure 1-1. Removing the covers reveals the extension port and user port, as shown in Figure 1-2.

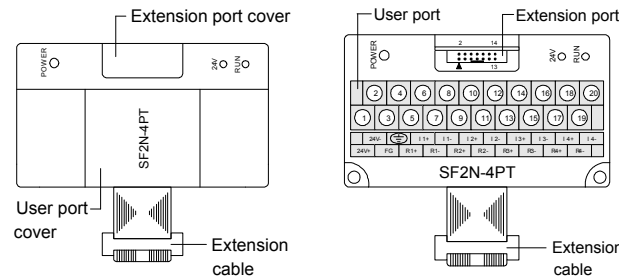


Figure 1-1 SF2N-4PT appearance Figure 1-2 SF2N-4PT ports

The extension cable connects SF2N-4PT to the system, while the extension port connects SF2N-4PT to another extension module of the system. For details on connection, see 1.2 Connecting Into System.

The user port of SF2N-4PT is described in Table 1-1.

Table 1-1 User port description

Terminal	Name	Description
1	24V+	Analog power supply 24V+
2	24V-	Analog power supply 24V-
3	FG	Shielding ground
4	GND	GND
5, 9, 13, 17	R1+	Positive thermal-resistor signal input of CH1 ~ CH4
6, 10, 14, 18	I1+	Auxiliary positive thermal-resistor signal input of CH1 ~ CH4
7, 11, 15, 19	R1-	Negative thermal-resistor signal input of CH1 ~ CH4
8, 12, 16, 20	I1-	Auxiliary negative thermal-resistor signal input of CH1 ~ CH4

### 1.2 Connecting Into System

Through the extension cable, you can connect SF2N-4PT to SF2N series basic module or other extension modules. While through the extension port, you can connect other SF2N series extension modules to SF2N-4PT. See Figure 1-3.

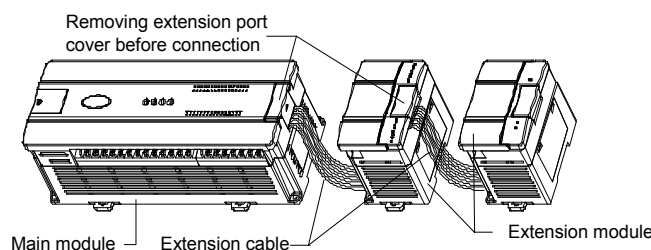


Figure 1-3 Connecting into system

### 1.3 Wiring

Figure 1-4 shows the wiring of the user port.

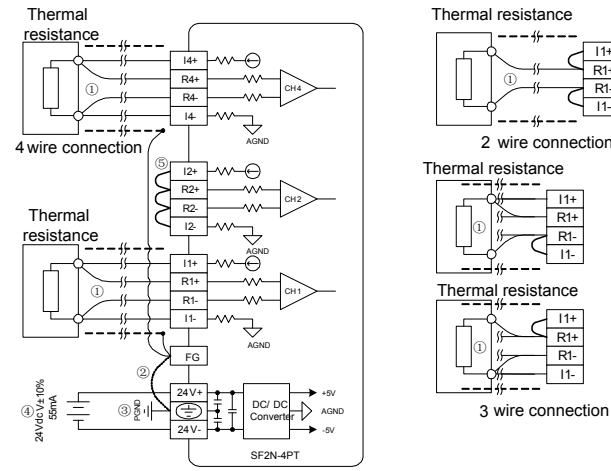


Figure 1-4 Wiring of SF2N-4PT user port

The circled 1~5 stands for the five points to be observed during wiring.

1. Use shielded cables to input the thermal-resistor signal. Route them separate from power cable or any cable that may generate EMI. The requirements on the thermal-resistor signal input cable also include:
  - 1) The thermal resistance sensor (Pt100, Cu100 or Cu50) can use 2-, 3-, or 4-wire system, the ascending measurement precisions. When the cable is longer than 10m, the 4-wire system is recommended.
  - 2) To reduce the measurement error and avoid EMI, the cable should be shorter than 100 meters. The measurement error is due to the connecting cable's impedance, and the error may differ with different channels even within the same module. Consequently we need to adjust the characteristics of each channel. See 3 Setting Characteristics for details.
2. If strong EMI exists, connect the shielding ground FG to the PG terminal.
3. Properly ground module PG terminal.
4. The basic module's 24Vdc auxiliary output power or other qualified power supplies can be used as the power source for the analog circuit.
5. Short the unused channel as shown in the figure.

## 2 Indices

### 2.1 Power Supply

Table 2-1 Power supply

Item	Specification
Analog circuit	24Vdc (-15% ~ +20%), maximum allowable ripple voltage 5% 55mA (from basic module or external power supply)
Digital circuit	5Vdc, 72mA (from basic module)

### 2.2 Performance

Table 2-2 Performance

Item	Specification			
	Celsius (°C)		Fahrenheit (°F)	
Input signal	Thermal resistance type: Pt100, Cu100 and Cu50 Channel No.: 4			
Conversion speed	(15 ± 2%) ms × 4 channel (no conversion for unused channels)			
Rated temperature range	Pt100	-150°C ~ 600°C	Pt100	-238°F ~ 1112°F
	Cu100	-30°C ~ 120°C	Cu100	-22°F ~ 248°F
	Cu50	-30°C ~ 120°C	Cu50	-22°F ~ 248°F
Digital output	12-bit A/D conversion. The temperature readings are stored as 16-bit two's complement			
	Pt100	-1500 ~ 6000	Pt100	-2380 ~ 11120
	Cu100	-300 ~ 1200	Cu100	-220 ~ 2480
	Cu50	-300 ~ 1200	Cu50	-220 ~ 2480
Lowest resolution	Pt100	0.2°C	Pt100	0.36°F
	Cu100	0.2°C	Cu100	0.36°F
	Cu50	0.2°C	Cu50	0.36°F

Item	Specification	
	Celsius (°C)	Fahrenheit (°F)
Precision	±1% of full range	
Isolation	Between analog circuit and digital circuit: photocoupler.	
	Between analog circuit and input 24Vdc power: internal isolation. Between analog channels: none	

### 2.3 Buffer Memory

SF2N-4PT exchanges data with the basic module through Buffer Memory (BFM). After SF2N-4PT is set through the host software, the basic module will write data into SF2N-4PT BFM to set the state of SF2N-4PT, and display the data from SF2N-4PT on the host software interface. See figures 4-1 ~ 4-4.

Table 2-3 describes the contents of BFM of SF2N-4PT.

Table 2-3 BFM content

BFM	Content	Default	Property
#100	Average temperature of CH1		R
#101	Average temperature of CH2		R
#102	Average temperature of CH3		R
#103	Average temperature of CH4		R
#200	Present temperature of CH1		R
#201	Present temperature of CH2		R
#202	Present temperature of CH3		R
#203	Present temperature of CH4		R
#300	Error state word 1		R
#301	Error state word 2		R
#600	Thermal resistance type and temperature mode select 0	H0000	RW
#700	Sampling times for average of CH1	8	RW
#701	Sampling times for average of CH2	8	RW
#702	Sampling times for average of CH3	8	RW
#703	Sampling times for average of CH4	8	RW
#800	Characteristic setting confirmation command 0	H0000	RW
#900	CH1-D0	0	RW
#901	CH1-A0	0	RW
#902	CH1-D1	6000	RW
#903	CH1-A1	6000	RW
#904	CH2-D0	0	RW
#905	CH2-A0	0	RW
#906	CH2-D1	6000	RW
#907	CH2-A1	6000	RW
#908	CH3-D0	0	RW
#909	CH3-A0	0	RW
#910	CH3-D1	6000	RW
#911	CH3-A1	6000	RW
#912	CH4-D0	0	RW
#913	CH4-A0	0	RW
#914	CH4-D1	6000	RW
#915	CH4-A1	6000	RW
#4094	Module software version	0x1000	R
#4095	Module ID	H5041	R

Explanation:

1. CH1 stands for channel 1; CH2, channel 2; CH3, channel 3, and so on.
2. Property explanation: R means read only. An R element cannot be written. RW means read and write. Reading from a non-existent element will get 0.
3. BFM#200 ~ BFM#203: present temperature. This value uses the unit of 0.1°C or 0.1°F (as determined by BFM#600). For example, 1000 means 100°C (or 100°F, as determined by BFM#600 and BFM#601). The average temperature is stored in BFM#100 ~ BFM#103.
4. BFM#300: Error state word 1. See Table 2-4 for its error state information.

Table 2-4 BFM#300 error state information

Bit status of BFM#300	ON (1)	OFF (0)
b0: system error	b1 or b2 is 1 (A/D conversion of all channels stopped)	Normal
b1: channel characteristic setting error	Channel characteristics setting error in BFM	Channel characteristics setting normal
b2: power supply failure	24Vdc power failure	Power supply normal
b3: hardware fault	Fault with A/D convertor or other hardware	Hardware normal
b4 ~ b9: reserved	-	-
b10: digital range error	A/D conversion digital output exceeds the range of -2048 ~ 2047	Digital output value normal
b11: average sampling times setting error	Setting outside normal range (in this case, the previous valid setting will be restored)	Setting within normal range: 1~256
b12 ~ b15: reserved	-	-

5. See Table 2-5 for the state information of BFM#301.

Table 2-5 BFM#301 state information

Channel	Bit	1	0
1	b0	CH1 temperature below lower limit	CH1 normal
	b1	CH1 temperature above upper limit	CH1 normal
2	b2	CH2 temperature below lower limit	CH2 normal
	b3	CH2 temperature above upper limit	CH2 normal
3	b4	CH3 temperature below lower limit	CH3 normal
	b5	CH3 temperature above upper limit	CH3 normal
4	b6	CH4 temperature below lower limit	CH4 normal
	b7	CH4 temperature above upper limit	CH4 normal
Reserved	b8 ~ b15	-	-

6. BFM#600: channel mode setting, used to set the working modes of CH1 ~ CH4. See Figure 2-1 for their correspondence.

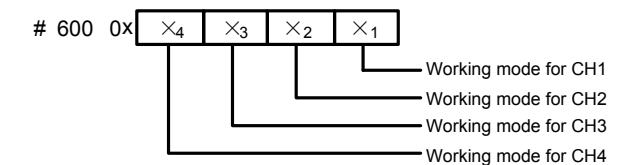


Figure 2-1 Mode setting element vs. channel

See Table 2-6 for the meaning of "X". Each channel's conversion time is 15ms. When a channel is closed, the channel will not perform A/D conversion, reducing the total conversion time.

Table 2-6 Meanings of X in the format

SN	Value of X	Corresponding mode
1	0	Pt100 thermal resistance, digital signal unit: 0.1°C
2	1	Pt100 thermal resistance, digital signal unit: 0.1°F
3	2	Cu100 thermal resistance, digital signal unit: 0.1°C
4	3	Cu100 thermal resistance, digital signal unit: 0.1°F
5	4	Cu50 thermal resistance, digital signal unit: 0.1°C
6	5	Cu50 thermal resistance, digital signal unit: 0.1°F
7	6 ~ F	Channels closed

7. BFM#700 ~ BFM#703: average sampling times setting. Range: 1 ~ 256. If the setting is outside this range, the default value 8 will be used.
8. BFM#900 ~ BFM#915: channel characteristics settings, which are set using two-point method. D0 and D1, in 0.1°C unit, represent the channel's digital outputs, while A0 and A1, also in 0.1°C unit, the actual temperature inputs. Each channel occupies 4 words.  
Note: the characteristic parameters are all in 0.1°C unit. As for those parameters in Fahrenheit unit, convert them into Celsius unit through the following format before writing them into the characteristic setting:  
Celsius = 5/9 × (Fahrenheit - 32)
11. BFM#4094: module software version, displayed automatically as **Module Version** in **SF2N-4PT Configuration** dialogue box of the host software, as shown in Figure 4-1.



12. BFM#4095: module ID. The ID of SF2N-4PT is 0x5041. The user program in PLC can use this ID to identify the module before transceiving data.

### 3 Setting Characteristics

The input channel characteristics of SF2N-4PT are the user adjustable linear relationship between the channel's analog input A and digital output D. Each channel can be considered as the model shown in Figure 3-1. As it is of linear characteristic, the channel characteristic can be defined by two points: P0 (A0, D0) and P1 (A1, D1), where D0 is the channel digital output corresponding to analog input A0, and D1 is the channel digital output corresponding to analog input A1.

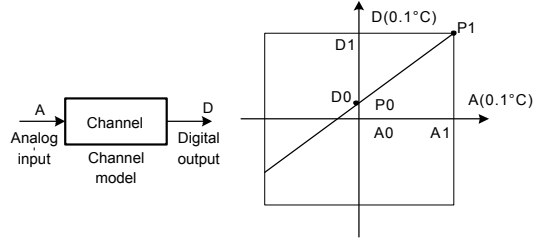
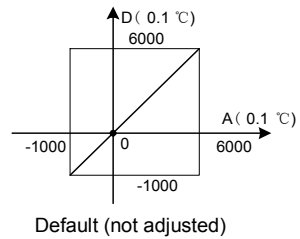


Figure 3-1 SF2N-4PT channel characteristic

The measurement error is caused by the impedance of the connecting cable. You can correct it by setting the channel characteristic.

To simplify the operation process without affecting functions, A0 and A1 are respectively fixed to the analog 0 and 6000 (in 0.1°C unit) in the current mode. That is to say, in Figure 3-1, A0 is 0.0°C and A1 is 600°C, which are not adjustable.

If you set the channel mode (BFM#600) without changing D0 and D1 of the corresponding channel, the channel characteristic vs. mode should be as shown in Figure 3-2.



Default (not adjusted)

Figure 3-2 Characteristics vs. mode without changing D0 and D1

Note: When the mode is set to 1 or 3, or say, when the output is in 0.1°F unit, the temperature data read from the output data zone (BFM#100~#103, #200~#203) will be in 0.1°F unit, but the data in the channel characteristics setting zone (BFM#900~#915) will still be in 0.1°C unit. That is to say, the data in the channel characteristics setting zone (BFM#900~#915) can only be in 0.1°C unit. Keep this in mind when changing the values of D0 and D1.

You can change the characteristics by changing D0 and D1. The setting range of D0 is -1000 ~ +1000 (0.1°C); D1, 5000~7000 (0.1°C). If the setting is outside this range, SF2N-4PT will not accept it, but maintain the original valid setting. Figure 3-3 provides for your reference an example of characteristics adjustment when the measured value is 5°C (41°F) higher the actual value.

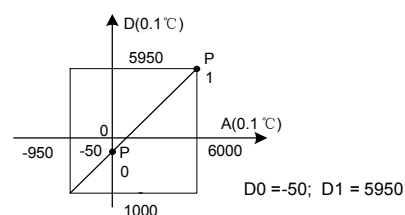


Figure 3-3 Change characteristic

## 4 Application Example

### 4.1 Basic Application

Example: The SF2N-4PT module address is 0. Connect CH1 to Pt100 thermal resistance to output Celsius data, CH2 to Cu100 thermal resistance to output Celsius data, and CH3 to Cu50 to output Fahrenheit data and close CH4. Set the average sampling times to 4, and use data registers D1, D2 and D3 to receive the average value. See Figure 4-1 ~ Figure 4-4 for the setting method. For further details, see *SF2N Series PLC Programming Manual*.

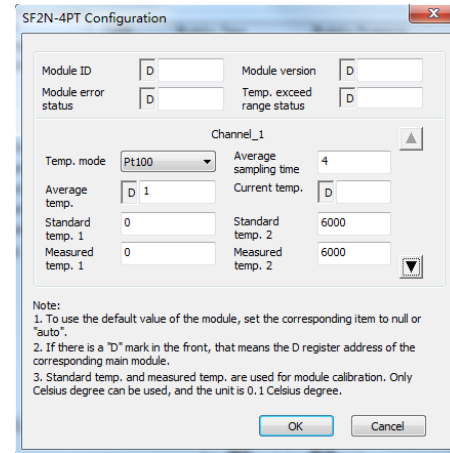


Figure 4-1 Setting CH1

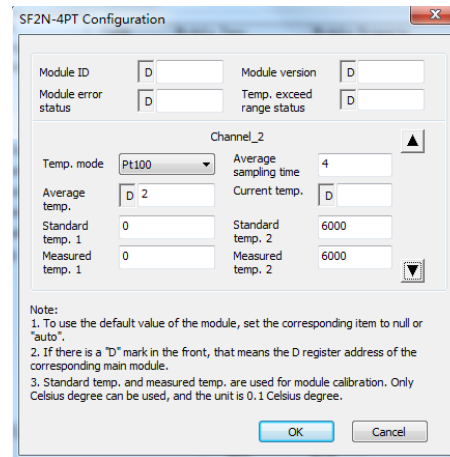


Figure 4-2 Setting CH2

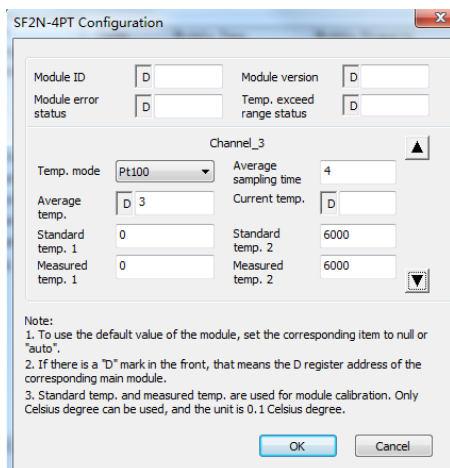


Figure 4-3 Setting CH3

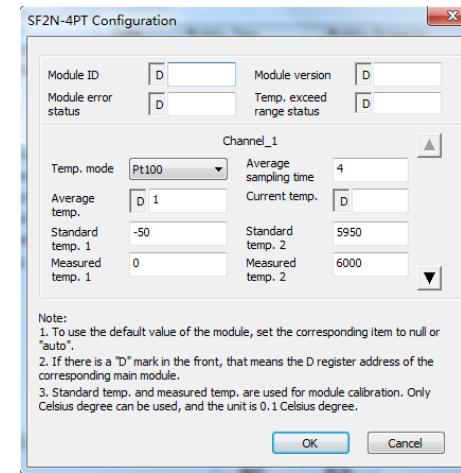


Figure 4-4 Changing characteristic

### 4.2 Changing Characteristics

Example: The SF2N-4PT module address is 0. Connect CH1 to Pt100 thermal resistance to output Celsius data, CH2 to Cu100 thermal resistance to output Celsius data, CH3 to Cu50 to output Fahrenheit data and close CH4. They all have the characteristics shown in Figure 3-3 (the SF2N-4PT measured temperature is 5°C/41°F higher than the actual one). In this case, CH1, 2 and 3 will output respectively 6000, 1200 and 2480 at the actual measured temperature of 600°C, 120°C and 248°F. Use data registers D1, D2 and D3 to receive the average value. The channel characteristic adjusting method is shown in Figure 4-4. Note that the unit is Celsius, and the adjusting range is within ±1000 (±100°C).

## 5 Operation Inspection

### 5.1 Routine Inspection

1. Check that the analog input wiring meets the requirement (see 2.4 *Wiring*).
2. Check that the extension cable is properly inserted into the extension port of the basic module.
3. Check that the 5V and 24V power supplies are not overloaded. Note that the digital circuit of SF2N-4PT is powered by the basic module through the extension cable.
4. Check the application, and make sure the operation method and parameter range are correct.
5. Set the SF2N basic module to RUN state.

### 5.2 Inspection Upon Fault

In case of abnormality, check the following items:

- The status of the POWER indicator  
ON: the extension cable is properly connected;  
OFF: check the extension cable connection and the basic module.
- The wiring of analog input
- The status of the 24V indicator  
ON: 24Vdc power supply normal;  
OFF: 24Vdc power supply faulty, or SF2N-4PT faulty.
- The RUN indicator  
Flashing quickly: SF2N-4PT normal.  
OFF or flashing slowly: Check the **Error Status** in **SF2N-4PT Configuration** dialogue box through the host software.

## Notice

1. The warranty range is confined to the PLC only.
2. **Warranty period is 18 months**, within which period conducts free maintenance and repairing to the PLC that has any fault or damage under the normal operation conditions.
3. **The start time of warranty period is the delivery date of the product**, of which the product SN is the sole basis of judgment. PLC without a product SN shall be regarded as out of warranty.
4. Even within 18 months, maintenance will also be charged in the following situations:
  - Damages incurred to the PLC due to mis-operations, which are not in compliance with the User Manual;
  - Damages incurred to the PLC due to fire, flood, abnormal voltage, etc;
  - Damages incurred to the PLC due to the improper use of PLC functions.
5. The service fee will be charged according to the actual costs. If there is any contract, the contract prevails.
6. Please keep this paper and show this paper to the maintenance unit when the product needs to be repaired.
7. If you have any question, please contact the distributor or our company directly.

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