SF2N-5AM 模拟量输入/输出模块

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-5AM 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。

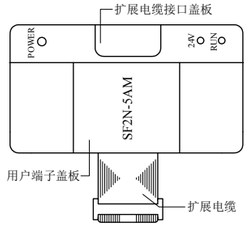


图 1-1 模块接口外观图

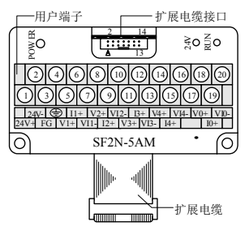


图 1-2 模块接口端子图

SF2N-5AM 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-5AM 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	V3+	第 3 通道电压信号输入端
2	24V–	模拟电源 24V 负极	12	I3+	第 3 通道电流信号输入端
3	FG	屏蔽地	13	VI3–	第 3 通道信号输入端
4	PG	接地端	14	V4+	第 4 通道电压信号输入端
5	V1+	第 1 通道电压信号输入端	15	I4+	第 4 通道电流信号输入端
6	I1+	第 1 通道电流信号输入端	16	VI4–	第 4 通道信号输入端
7	VI1–	第 1 通道信号输入端	17	•	空脚
8	V2+	第 2 通道电压信号输入端	18	VO+	输出通道电压信号输出端
9	I2+	第 2 通道电流信号输入端	19	IO+	输出通道电流信号输出端
10	VI2–	第 2 通道信号输入端	20	VIO–	输出通道公共地端

说明：对每个通道而言，电压与电流信号不能同时输入，当测量电流信号时，请将通道电压信号输入端与电流信号输入端短接。

1.2 接入系统

通过扩展电缆，可将 SF2N-5AM 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。

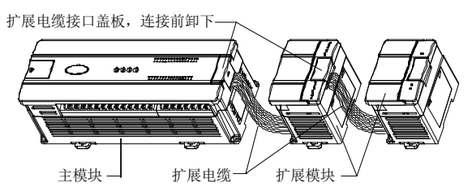


图 1-3 与主模块和其他扩展模块的连接示意图

1.3 布线说明

用户端子布线要求，如图 1-4 所示。

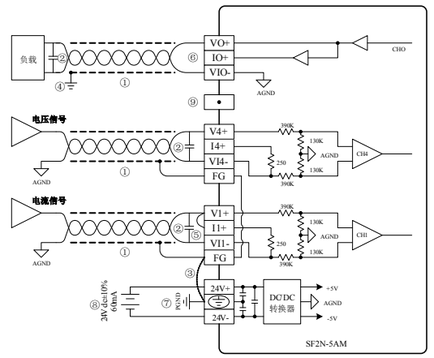


图 1-4 用户端子布线示意图

图中的①～⑨表示布线时必须注意的 9 个方面：

1．模拟输入/输出建议使用双绞屏蔽电缆。电缆应远离电源线或其他可能产生电气干扰的电线。

2．如果输入/输出信号有电气噪声或电压波动，可以接一个平滑电容器（0.1μF～0.47μF/25V）。

3．如果存在过多的电气干扰，连接屏蔽地 FG 到模块接地端 PG。

4．在输出电缆的负载端使用单点接地。

5．如果当前通道使用电流输入，请短接该通道的电压输入端与电流输入端。

6．若将电压输出短路或将电流负载连接到电压输出端，可能会损坏 SF2N-5AM。

7．将模块的接地端 PG 良好接地。

8．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。

9．不要使用用户端子上的空脚。

2 使用说明

2.1 电源指标

表 2-1 电源指标

项目	说明
模拟电路	24Vdc（–15%～+20%），最大允许纹波电压 5%，90mA（来自主模块或外部电源）
数字电路	5Vdc、72mA（源于主模块）

2.2 性能指标

表 2-2 性能指标

项目		指标
转换速度	AD 转换速度	15ms/通道（常速），8ms/通道（高速）
	DA 转换速度	2ms/通道（最快）
模拟输入量程	电压输入	–10～+10Vdc，输入阻抗 1MΩ。**警告：当输入电压超过±15Vdc 时，此单元有可能损坏**
	电流输入	–20～+20mA，，输入阻抗 250Ω。**警告：当输入电流超过±32mA 时，此单元有可能损坏**
模拟输出量程	电压输出	–10～+10Vdc（外部负载阻抗为不小于 2kΩ）
	电流输出	0～+20mA（外部负载阻抗不大于 520Ω）
数字输出		默认设置：–2000～+2000 设置范围：–10000～+10000
数字输入		默认设置：–2000～+2000 设置范围：–10000～+10000
分辨率	电压输入	5mV
	电流输入	10μA
	电压输出	5mV
	电流输出	10μA
精度	模拟输入	满量程的±1%
	模拟输出	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-5AM 与主模块之间通过通讯缓冲区（BFM）交换信息。用户设置好后台软件界面后，主模块会自动将信息写入 SF2N-5AM 的缓冲区，由此对 SF2N-5AM 的状态进行设置。主模块会自动将 SF2N-5AM 上报的信息显示在后台软件界面上，见图 4-1～图 4-2。

SF2N-5AM 的缓冲区具体内容见表 2-3。

表 2-3 缓冲区内容

BFM 地址	内容	通道说明和缺省值	读写属性
#000	CHO 通道数据	输出通道	RW
#100	CH1 通道平均值	输入通道	R
#101	CH2 通道平均值	输入通道	R
#102	CH3 通道平均值	输入通道	R
#103	CH4 通道平均值	输入通道	R
#200	CH1 通道当前值	输入通道	R
#201	CH2 通道当前值	输入通道	R
#202	CH3 通道当前值	输入通道	R
#203	CH4 通道当前值	输入通道	R
#300	模块故障状态字		R
#600	输入通道模式字	0x0000	RW
#650	输出通道模式字	0x0000	RW
#700	CH1 平均值点数	8	RW
#701	CH2 平均值点数	8	RW
#702	CH3 平均值点数	8	RW
#703	CH4 平均值点数	8	RW
#900	CHO-D0	0（输出模式 0）	RW
#901	CHO-A0	0（输出模式 0）	R
#902	CHO-D1	2000（输出模式 0）	RW
#903	CHO-A1	10000（输出模式 0）	R
#904	CH1-D0	0（输入模式 0）	RW
#905	CH1-A0	0（输入模式 0）	R
#906	CH1-D1	2000（输入模式 0）	RW
#907	CH1-A1	10000（输入模式 0）	R
#908	CH2-D0	0（输入模式 0）	RW
#909	CH2-A0	0（输入模式 0）	R
#910	CH2-D1	2000（输入模式 0）	RW
#911	CH2-A1	10000（输入模式 0）	R
#912	CH3-D0	0（输入模式 0）	RW
#913	CH3-A0	0（输入模式 0）	R
#914	CH3-D1	2000（输入模式 0）	RW
#915	CH3-A1	10000（输入模式 0）	R
#916	CH4-D0	0（输入模式 0）	RW
#917	CH4-A0	0（输入模式 0）	R
#918	CH4-D1	2000（输入模式 0）	RW
#919	CH4-A1	10000（输入模式 0）	R
#2000	AD 转换速度切换命令	0（15ms/通道）	RW
#2100	通道复位命令	0x0000	RW
#4094	模块软件版本信息	0x1000	R
#4095	模块的识别码	0x3141	R

说明：

1．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#300 的状态信息见表 2-4。

表 2-4 BFM#300 的状态信息

BFM#300 位状态	开（1）	关（0）
b0：错误	b1、b2 中任一为 ON。所有通道 AD、DA 转换停止	无错误
b1：偏移、增益错误	BFM 中的通道特性参数数据不正常或者发生设置错误	偏移或增益数据正常
b2：电源故障	24Vdc 电源故障	电源正常
b3：硬件故障	AD、DA 转换器或其它硬件故障	硬件正常
b10：数字范围错误	1．AD 转换数字输出值小于–2048 或大于+2047 2．DA 数字输入值超出指定范围	数字输入/输出值正常
b11：平均采样错误	平均采样数不小于 4097，或者不大于 0（使用缺省值 8）	平均正常（1～4096 之间）

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

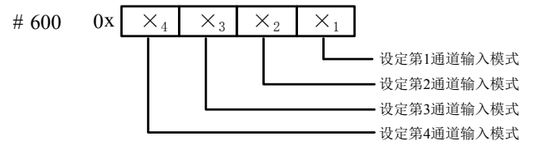


图 2-1 模式设定单元与通道对应关系

字符值所表示的信息如表 2-5 所示。

表 2-5 数值与模式对应关系

×值	对应模式
0	–10V～+10V 电压输入模式
1	–5V～+5V 电压输入模式或–20mA～+20mA 电流输入模式
3	通道关闭

举例，若对#600 单元写入“0x0103”，将完成如下设置：

1）第 1 通道关闭。

2）第 3 通道的输入量程：–5V～+5V 或–20mA～+20mA（注意电压与电流的配线不同，参见 *1.3 布线说明*）。

3）第 2 通道、4 的输入量程：–10V～+10V。

5．BFM#650：输出模式设定单元。由其 4 位十六进制数字 $0x\times_4\times_3\times_2\times_1$ 中的最后一位 $\times_1$ 控制。BFM#650 中数值与模式对应关系如表 2-6 所示。

表 2-6 数值与模式对应关系

位号	值	信息
$\times_1$	0	–10V～+10V 电压输出模式
	1	0～20mA 电流输出模式
	2	4～20mA 电流输出模式
$\times_2$～$\times_4$	保留	

6．BFM#700～BFM#703 作为通道的平均采样次数的设定缓存区，提供 1～4096 供用户选择。缺省值为 8，对应于正常速度；高速操作可选择 1。

7．BFM#900～BFM#919 为通道增益、偏移设置数据缓存器。使用两点法设置通道增益、偏移。D0、D1 表示通道输出的数字量，A0、A1 表示通道实际输入。A0、A1 数据的单位是 mV 或 μA，每通道占用 4 个字。考虑到方便用户的设置，同时并不影响功能的实现，将 A0、A1 的值固定为模拟量的 0 值和最大值，用户对此两项设置的更改无效。

注意：若通道模拟输入通道输入为电流信号（–20mA～+20mA），当前通道应选择模式 1，由于通道内部测量基于电压信号，因此，电流信号由通道的电流输入端 250Ω 电阻转换为电压信号（–5V～5V），当前通道对应的特性设置区域中的 A1 值仍然以 mV 为单位，即 5000mV，也就是 20mA×250Ω=5000mV。

8．在 BFM#2000 中写入 0 或 1 就可以改变 AD 转换的速度。0 为正常速度 15ms/通道；1 为高速 8ms/通道。当此单元被写入后，BFM#1～#2 将立即设置到缺省值，这一操作将不考虑它们原有的数值。这一点，在编程时需要注意。当更改转换速度后，可根据需要重新设置 BFM#700～#703。

9．BFM#4094 为模块软件版本信息。自动显示在后台软件的 SF2N-5AM 配置界面上的**模块版本**栏，见图 4-2。

10．BFM#4095 为模块识别码。SF2N-5AM 的识别码是 0x3141。可编程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

3.1　模拟输入通道特性设置

SF2N-5AM 的模拟输入通道特性为通道模拟输入量 A 与输出数字量 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。

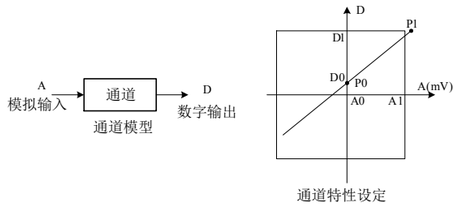


图 3-1　SF2N-5AM 的输入通道特性示意图

考虑到用户使用的简便性，同时并不影响功能的实现，将 A0、A1 的值固定为当前模式下，模拟量的 0 值和最大值，也就是说图 3-1 中 A0 为 0，A1 为当前模式下的模拟输入的最大值，对通道模式字（BFM#601）进行更改时，A0、A1 会根据模式自动更改，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#601），那么，每种模式对应的特性如图 3-2 所示。其中，图 3-2 中的 A 为出厂设定。

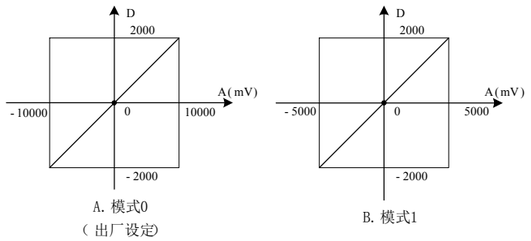


图 3-2　输入通道各种模式默认的通道特性

若更改通道的 D0、D1 数值，即可更改通道特性。D0、D1 可在–10000～+10000 之间任意设定，若设定值超出此范围，SF2N-5AM 不会接收，并保持原有有效设置，图 3-3 为特性更改举例，请参考。

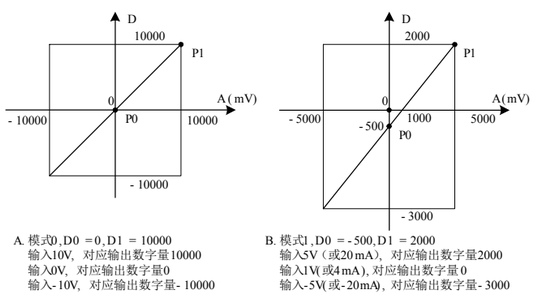


图 3-3　输入通道特性更改举例

3.2　模拟输出通道特性设置

SF2N-5AM 的模拟输出通道特性为通道模拟输出量 A 与通道数字输入量 D 之间的线性关系，可由用户设置。每个通道可以理解为图 3-4 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 表示模拟量输出为 A0 时通道输入数字量，D1 表示模拟量输出为 A1 时通道输入数字量。

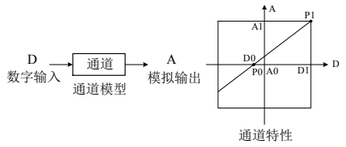


图 3-4　SF2N-5AM 的输出通道特性示意图

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 值和最大值。也就是说图 3-4 中 A0 为 0，A1 为当前模式下的模拟输出的最大值。对通道模式字（BFM#600）进行更改时，A0、A1 会根据模式自动更改，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如图 3-5 所示。其中，图 3-5 中的 A 为出厂设定。

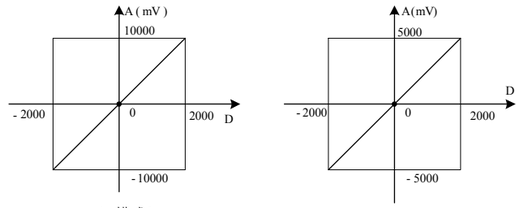


图 3-5　输出通道各种模式默认的通道特性

若更改通道的 D0、D1 数值，即可更改通道特性，D0、D1 可在–10000～10000 之间任意设定。若设定值超出此范围，SF2N-5AM 不会接收，并保持原有有效设置，图 3-6 为特性更改举例，请参考。

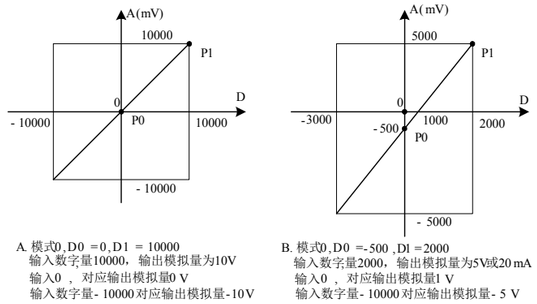


图 3-6　输出通道特性更改举例

4　应用示例

4.1　基本应用

例：SF2N-5AM 模块地址为 1（扩展模块的编址方法，参见《SF2N 系列可编程控制器用户手册》），使用其第 1、2、3、4 通道，输入电压信号（–10V～10V），输入通道平均值点数设为 4，并且用数据寄存器 D1、D2、D3、D4 接收平均值转换结果；输出通道置模式 0，输出电压信号 10V，使用 D5 单元。如图 4-1，设置扩展模块的类型；然后如图 4-2，设置扩展模块实际使用的参数。图示为设置第 1 通道和输出通道的参数，同样的方法分别设置其它 3 个输入通道。

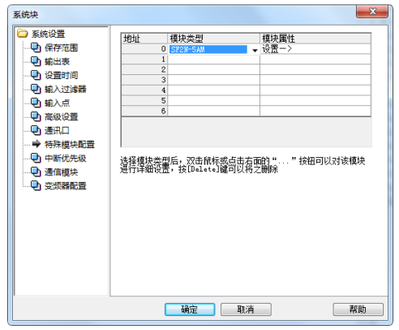


图 4-1　设置扩展模块类型

图 4-2　设置扩展模块参数

参数设置完成后，需要经过编译、下载才能生效。可以通过监控表或者在用户程序中使用 MOV 指令来赋值和查看这些 D 元件中的值。

MOV D5 2000　即是让输出通道输出 10V 的用户程序。

进一步详细说明参见《SF2N 系列可编程控制器编程参考手册》。

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（参见 *1.3　布线说明*）。

2．检查 SF2N-5AM 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-5AM 数字部分的电源来自主模块，通过扩展电缆供应。

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-5AM 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-5AM 故障。

●检查“RUN”指示灯状态

高速闪烁：SF2N-5AM 运行正常；

慢速闪烁或熄灭：检查后台软件中 SF2N-5AM 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。

总　　部：山东深川变频科技股份有限公司
客户热线：400-812-8821
技术支持：400-812-6621
质量反馈：400-812-0778
投　　诉：400-812-6125
网　　址：www.chinsc.com

SF2N-5AM Analog I/O Module

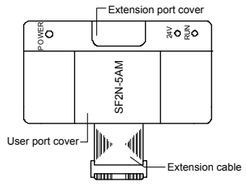
User Manual

Thank you for using programmable logic controller (PLC). Before using the SF2N series PLC product, please carefully read this booklet so as to better understand it, fully use it, and ensure safety.

1 Port Description

1.1 Port

The extension port and user port of SF2N-5AM 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.



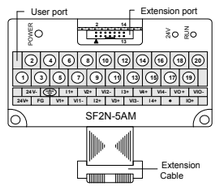


Figure 1-1 SF2N-5AM appearance *Figure 1-2 Ports*

The extension cable connects SF2N-5AM to the system, while the extension port connects SF2N-5AM to another extension module of the system. For details on connection, see *1.2 Connecting Into System.*

The user port of SF2N-5AM 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	Shileding ground
4	PG	Protection ground
5, 8, 11, 14	V1+~V4+	CH1 ~CH4 voltage input
6, 9, 12, 15	I1+ ~ I4+	CH1 ~ CH4 current input
7, 10, 13, 16	VI1- ~ VI4-	CH1 ~ CH4 signal input
17	•	NC
18	VO+	Output channel voltage output
19	IO+	Output channel current output
20	VIO-	Common GND of output channel

Note: an input channel cannot receive both voltage signals and current signals at the same time. If you intend to use a channel for current signal measurement, short its voltage input terminal and current input terminal.

1.2 Connecting Into System

Through the extension cable, you can connect SF2N-5AM to SF2N series basic module or other extension modules. While through the extension port, you can connect other SF2N series extension modules to SF2N-5AM. See Figure 1-3.

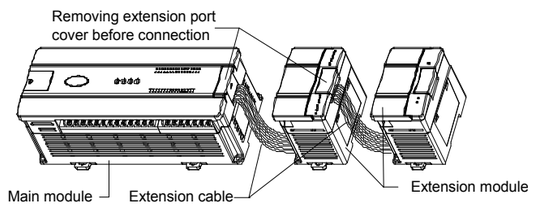


Figure 1-3 Connecting SF2N-5AM to the basic module

1.3 Wiring

The wiring of user port is shown in Figure 1-4.

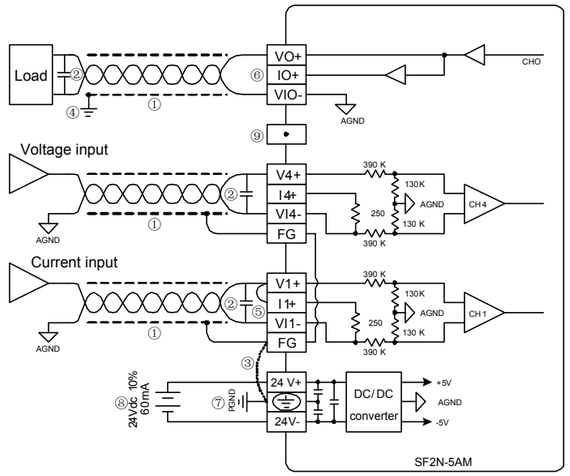


Figure 1-4 Wiring of SF2N-5AM user port

The circled 1 ~ 9 stands for the six points to be observed during wiring:

1. It is recommended to use shielded twisted pair for the analog input and output. Route them separate from power cables or any cables that may generate EMI.

2. If the I/O signal has electric noise or voltage fluctuation, it is advisable to connect a smoothing capacitor (0.1μF~0.47μF/25V).

3. If strong EMI exists, connect the FG and PG terminals together.

4. Each load of the PLC should be grounded separately.

5. If a channel is used for current input, short its voltage input terminal and current input terminal.

6. Shorting the voltage output terminals or connecting current load to the voltage output terminals may damage SF2N-5AM.

7. Properly ground the module's PG terminal.

8. The basic module's 24Vdc output power or any qualified external power supply can be used as the power source of the module's analog circuit.

9. Do not use the NC terminal of the user port.

2 Indices

2.1 Power Supply

Table 2-1 Power supply

Item	Description
Analog circuit	24Vdc (-15%~20%), maximum allowable ripple voltage 5%, 90mA (from basic module or external power supply)
Digital circuit	5Vdc 50mA (from basic module)

2.2 Performance

Table 2-2 Performance

Item		Index
Conversion speed	AD conversion	15ms/channel (normal), 8ms/channel (high speed)
	DA conversion	2ms/channel (max.)
Analog input range	Voltage	-10~10Vdc (input impedance 1MΩ) *Warning: this module can be damaged if the input voltage exceeds ±15Vdc
	Current	-20~20mA (input impedance 250Ω) *Warning: this module can be damaged if the input current exceeds ±32mA
Analog output range	Voltage	-10~10Vdc (external load impedance ≥2kΩ)
	Current	0~20mA (external load impedance ≤520Ω)
Digital output		Default: -2000 ~ 2000 Setting range: -10000 ~ 10000

Item		Index
Digital input		Default: -2000 ~ 2000 Setting range: -10000 ~ 10000
Resolution	Voltage input	5mV
	Current input	10 μ A
	Voltage output	5mV
	Current output	10 μ A
Accuracy	Analog input	±1% of full range
	Analog output	±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-5AM exchanges data with the basic module through Buffer Memory (BFM). After SF2N-5AM is set through the host software, the basic module will write data into SF2N-5AM BFM to set the state of SF2N-5AM and display the data from SF2N-5AM on the host software interface. See Figure 4-1 and Figure 4-1.

Table 2-3 describes the contents of SF2N-5AM BFM.

Table 2-3 BFM Contents

BFM	Contents	Description and default	Property
#000	CHO channel data	Output channel	RW
#100	Average value of CH1	Input channel	R
#101	Average value of CH2	Input channel	R
#102	Average value of CH3	Input channel	R
#103	Average value of CH4	Input channel	R
#200	Current value of CH1	Input channel	R
#201	Current value of CH2	Input channel	R
#202	Current value of CH3	Input channel	R
#203	Current value of CH4	Input channel	R
#300	Module error state word		R
#600	Input channel model word	0x0000	RW
#650	output channel model word	0x0000	RW
#700	Average sampling times of CH 1	8	RW
#701	Average sampling times of CH2	8	RW
#702	Average sampling times of CH3	8	RW
#703	Average sampling times of CH4	8	RW
#900	CHO-D0	0 (output mode 0)	RW
#901	CHO-A0	0 (output mode 0)	R
#902	CHO-D1	2000 (output mode 0)	RW
#903	CHO-A1	10000 (output mode 0)	R
#904	CH1-D0	0 (input mode 0)	RW
#905	CH1-A0	0 (input mode 0)	R
#906	CH1-D1	2000 (input mode 0)	RW
#907	CH1-A1	10000 (input mode 0)	R
#908	CH2-D0	0 (input mode 0)	RW
#909	CH2-A0	0 (input mode 0)	R
#910	CH2-D1	2000 (input mode 0)	RW
#911	CH2-A1	10000 (input mode 0)	R
#912	CH3-D0	0 (input mode 0)	RW
#913	CH3-A0	0 (input mode 0)	R
#914	CH3-D1	2000 (input mode 0)	RW
#915	CH3-A1	10000 (input mode 0)	R
#916	CH4-D0	0 (input mode 0)	RW
#917	CH4-A0	0 (input mode 0)	R
#918	CH4-D1	2000 (input mode 0)	RW
#919	CH4-A1	10000 (input mode 0)	R
#2000	AD conversion speed switchover	0 (15ms/CH)	RW
#2100	Channel reset	0x0000	RW
#4094	Module software version	0x1000	R
#4095	Module ID	0x3141	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. Status information of BFM#300 is shown in Table 2-4.

Table 2-4 BFM#300 status information

Bit status of BFM#300	ON (1)	OFF (0)
b0: error	b1 or b2 is ON, AD/DA conversion of all channels stopped	No error
b1: deviation, gain error	Channel characteristics setting error in BFM	Deviation/gain data normal
b2: power supply failure	24Vdc power supply failed	Power supply normal
b3: hardware fault	AD/DA converter or other hardware faulty	Hardware normal
b10: digital range error	1. Digital output after AD conversion outside the range of -2048 ~ +2047; 2. Digital input for DA conversion outside specified range	Digital input/output value normal
b11: average sampling times setting error	Setting outside normal range (in this case, the default 8 will be used)	Setting within normal range: 1~4096

4. BFM#600: input mode selection, used to set the input modes of CH1 ~ CH4. See Figure 2-1 for their correspondence.

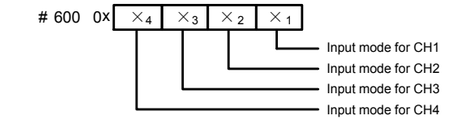


Figure 2-1 Mode setting element vs. channel

The exact meaning of the X in the channel mode is shown in Table 2-5.

Table 2-5 Meaning of X in input mode

Value of X	Information
0	-10V ~ +10V voltage input mode
1	-5V~+5V voltage input or -20mA~+20mA current input mode
3	Channel closed

For example, if #600 is written as '0x0103', the setting will be like this:

- Input channel 1 closed;
- Input channel 3 mode: -5V ~ +5V or -20mA ~ 20mA (note the wiring difference in voltage and current, see *1.3 wiring*);
- Input CH2, and CH4 mode: -10V ~ +10V.

5. BFM#650: output mode selection, controlled by the X1 in the 4-bit hexadecimal number $0x\times_4\times_3\times_2\times_1$. The meaning of X is as follows:

Table 2-6 Meaning of X in output mode

Bit	Value	Information
X_1	0	-10V ~ +10V voltage output mode
	1	0 ~ 20mA current output mode
	2	4 ~ 20mA current output mode
X_2 ~ X_4	Reserved	

6. BFM#700 ~ BFM#703: average sampling times setting; setting range: 1~4096. Default: 8 (normal speed); choose 1 if high speed is needed.

7. BFM#900 ~ 919: channel gain and deviation settings, which are set using two-point method. D0 and D1 represent channel digital output, A0 and A1 represent actual channel input. A0 and A1 are in mV or μA, and each channel occupies 4 words. To simplify the setting operation without affecting functions, A0 and A1 are respectively fixed to 0 and the max value. Users cannot change them.

Note: If the channel input is current signal (-20mA~20mA), the present channel mode should be set to 1. Because the channel's internal measurement is based on voltage signal, current signals should be converted into voltage signals (-5V~5V) by the 250Ω resistor at the current input terminal of the channel. The A1 in the channel's characteristics setting is still in mV unit, i.e., 5000mV (20mA × 250Ω = 5000mV).

8. BFM#2000: AD conversion speed setting. 0: 15ms/channel (normal speed); 1: 8ms/channel (high speed). Setting BFM#2000 will restore BFM#1 ~ #2 to

the default, which should be noted in programming. If necessary, you can reset BFM#700 ~ #703 after changing the conversion speed.

9. BFM#4094: module software version, displayed automatically as **Module Version** in **SF2N-5AM Configuration** dialogue box of the host software, as shown in Figure 4-2.

11. BFM#4095: module ID. ID of SF2N-5AM is 0x3141. The user program in PLC can use this ID to identify the module before transceiving data.

3 Characteristic Setting

3.1 Setting Analog Input Channel Characteristics

The input channel characteristic of SF2N-5AM is the linear relationship between the channel's analog input A and digital output D. It can be set by the user. 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 just two points: P0 (A0, D0) and P1 (A1, D1), where D0 is the channel's digital output corresponding to analog input A0, and D1 is the channel's digital output corresponding to analog input A1.

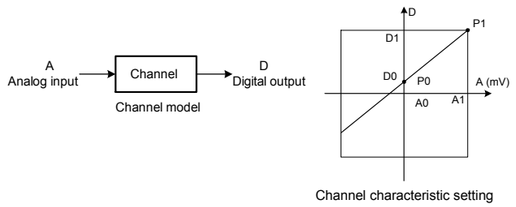


Figure 3-1 SF2N-5AM input channel characteristic

To simplify the operation process without affecting functions, A0 and A1 are respectively fixed to 0 and the maximum value in the present mode. That is to say, in Figure 3-1, A0 is 0 and A1 is the maximum analog input in the present mode. A0 and A1 will change according to the mode when BFM#601 is changed. Users cannot change their values.

If you just set the channel mode (BFM#601) without changing the D0 and D1 of the corresponding channel, the channel characteristic vs. mode should be as shown in Figure 3-2. The A in Figure 3-2 is default.

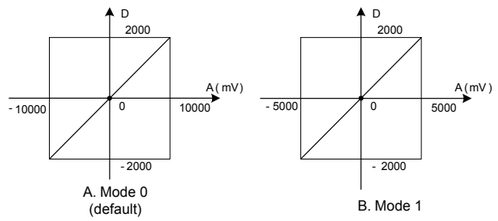
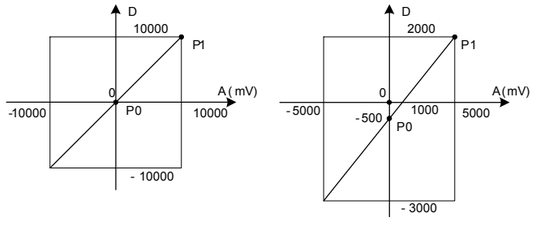


Figure 3-2 Default input channel characteristics in various modes

You can change the channel characteristic by changing D0 and D1. The setting range of D0 and D1 is -10,000 ~ 10,000. If the setting is outside this range, SF2N-5AM will not accept it, but maintain the original valid setting. Figure 3-3 provides for your reference an example of changing channel characteristics.



A	B
Mode 0, D0 = 0, D1 = 10,000	Mode 1, D0 = -500, D1 = 2000
Analog input 10V outputs 10,000	Analog input 5V (or 20mA) outputs 2000
Analog input 0V outputs 0	Analog input 1V (or 4mA) outputs 0
Analog input -10V outputs -10,000	Analog input -5V (or -20mA) outputs -3000

Figure 3-3 Changing input channel characteristics

3.2 Setting Analog Output Channel Characteristics

The analog output channel characteristic of SF2N-5AM is the linear relationship between the channel's analog output A and digital input D. It can be set by the user. Each channel can be considered as the model shown in Figure 3-4. Because it is of linear characteristic, the channel characteristic can be defined by just two points: P0 (A0, D0) and P1 (A1, D1), where D0 is the channel's digital input corresponding to analog output A0, and D1 is the channel's digital input corresponding to analog output A1.

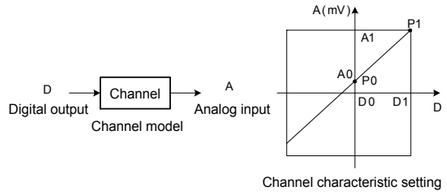


Figure 3-4 SF2N-5AM output channel characteristic

To simplify the operation process without affecting functions, A0 and A1 are respectively fixed to 0 and the maximum value in the present mode. That is to say, in Figure 3-4, A0 is 0 and A1 is the maximum analog output in the present mode. A0 and A1 will change according to the mode when BFM#600 is changed. Users cannot change their values.

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 3-5. The A in Figure 3-5 is default.

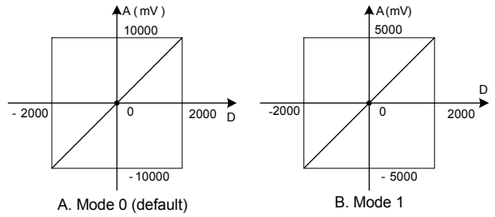
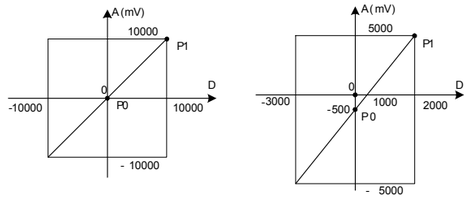


Figure 3-5 Default output channel characteristics in various modes

You can change the channel characteristic by changing D0 and D1. The setting range of D0 and D1 is -10,000 ~ 10,000. If the setting is outside this range, SF2N-5AM will not accept it, but maintain the original valid setting. Figure 3-6 provides for your reference an example of changing channel characteristics.



A	B
Mode 0, D0 = 0, D1 = 10,000	Mode 0, D0 = -500, D1 = 2000
Digital input 10,000 outputs 10V	Digital input 2000 outputs 5V (or 20mA)
Digital input 0 outputs 0V	Digital input 0 outputs 1V
Digital input -10,000 outputs -10V	Digital input -10,000 outputs -5V

Figure 3-6 Changing output channel characteristics

4 Application Example

4.1 Basic Application

Example: The SF2N-5AM module address is 1 (for the addressing of extension modules, see *SF2N Series PLC User Manual*). Use its channels 1, 2, 3 and 4 for voltage signal input (-10V~10V), set the average sampling times to 4, and use data registers D1, D2, D3 and D4 to receive the average value; set output channel to mode 0 to output 10V voltage signal, and use D5 element. Set extension module type as shown in Figure 4-1, and set actual parameters of extension module. Figure 4-2 shows the setting of input channel 1 and output channel 1. Set the other three input channels

respectively in the same way.

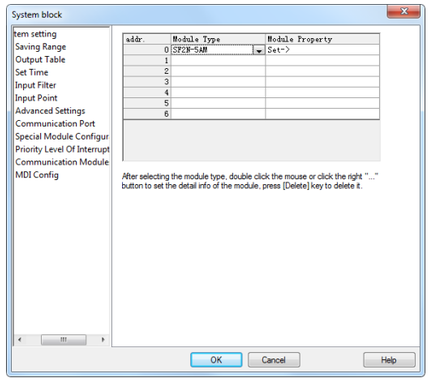


Figure 4-1 Setting special module type

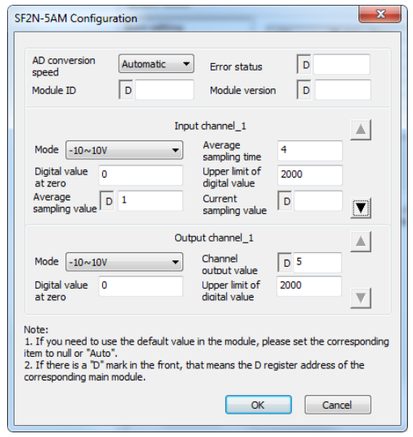


Figure 4-2 Setting special module parameters

To validate the parameter setting, you still need to compile and download the parameters. You can set and query D elements through the interface or by using the MOV instruction in user program.

MOV D5 2000 is a user program that makes the output channel output 10V.

For further details, see *SF2N Series PLC Programming Manual*.

5 Operation Inspection

5.1 Routine Inspection

1. Check that the wiring of analog input meets the requirements (see *1.3 wiring*).

2. Check that the extension cable of SF2N-5AM is properly inserted in the extension port.

3. Check that the 5V and 24V power supplies are not overloaded. Note: The digital circuit of SF2N-5AM 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 Fault Inspection

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 analog wiring

● the status of the 24V indicator

ON: 24Vdc power supply normal;

OFF: 24Vdc power supply possibly faulty, or SF2N-5AM is faulty.

● the status of the RUN indicator

Flash quickly: SF2N-5AM in normal operation;

Flash slowly or OFF: check the data in BFM#300.

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.

Company Center: Shandong Chinsc Drive Technology Co.,Ltd.
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