

. X20SD1207

. 安全链

- [1 需求说明](#)
- [2 实现方式](#)
 - [2.1 !\[\]\(38441ceaa711016e0bf2ad46ad394ff4_img.jpg\) 注意事项](#)
 - [2.2 !\[\]\(6e027340d4263908f264926b1ad81c5e_img.jpg\) 适用场景](#)
- [3 测试代码](#)
 - [3.1 测试硬件版本信息](#)
 - [3.2 验证流程](#)

1 需求说明

- 贝加莱安全模块运行过程中触发了自检异常，会导致模块进入 FAILSAFE 状态，并无法直接通过安全链确认复位，必须断电重启后安全链硬件才能重新确认安全链。
- 例如：
- 贝加莱安全模块例如 X20SD1207，可运行的温度为0~60°C
 - [X20SD1207 | B&R Industrial Automation \(br-automation.com\)](#)
 -

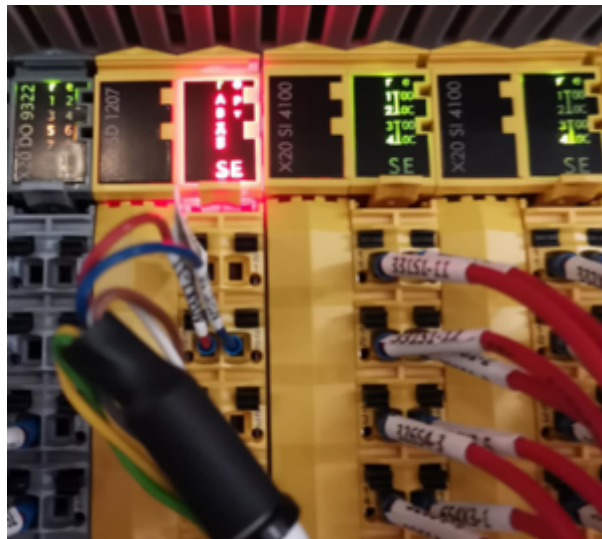
Ambient conditions	
Temperature	
Operation	
Horizontal mounting orientation	0 to 60°C
Vertical mounting orientation	0 to 50°C
Derating	See section "Derating".
Storage	-40 to 85°C
Transport	-40 to 85°C

- 若环境温度远超允许运行的环境温度，例如86°C，则模块会提示超温报警，在 Logger 日志中记下如下条目。

Severity	Time	ID	Entered by	Description	ASCII Data
5 Error	2023-10-16 15:29:55.409777	98818	DdxIoSafetyLogger	Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x00000A12
6 Error	2023-10-16 15:29:55.405758	102914	DdxIoSafetyLogger	Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x00000A12
7 Error	2023-10-16 15:29:55.405137	98818	DdxIoSafetyLogger	Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x00000A12
8 Error	2023-10-16 15:29:55.401601	102914	DdxIoSafetyLogger	Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x00000A12
9 Information	2023-10-16 15:29:55.401133	110385	DdxIoSafetyLogger	Safe connection to module lost	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0x00000001
0 Error	2023-10-16 15:29:55.397656	102914	DdxIoSafetyLogger	Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x00000A12
1 Warning	2023-10-16 15:29:55.397135	110404	DdxIoSafetyLogger	state change to pre-operational	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0x00000000
2 Error	2023-10-16 15:29:55.394208	102914	DdxIoSafetyLogger	Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x00000A12
3 Error	2023-10-16 15:29:55.393136	99846	DdxIoSafetyLogger	error voltage monitoring	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0xFFFFFFFF
4 Error	2023-10-16 15:29:55.389634	121092	DdxIoSafetyLogger	internal error exchange data	IF3.ST2.IF1.ST2: Info0=0x0001, Info1=0x00000E97A
5 Error	2023-10-16 15:29:55.389132	99850	DdxIoSafetyLogger	Temperature error	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0x00000056
6 Warning	2023-10-16 15:29:49.197138	99858	DdxIoSafetyLogger	Warning module temperature	IF3.ST2.IF1.ST2: Info0=0x0055, Info1=0x00000055
7 Warning	2023-10-16 15:29:43.005142	99858	DdxIoSafetyLogger	Warning module temperature	IF3.ST2.IF1.ST2: Info0=0x0055, Info1=0x00000055

10进制数为86

- 在这种情况下，X20SD1207模块进入了 FAILSAFE 状态，即便环境温度恢复正常，仍无法通过安全链确认来恢复功能正常。
- 模块大致的 LED 情况如下图所示



★需求：在一些特殊场景，需要贝加莱安全模块在进入异常后，能够强制复位

2 实现方式

- 新出的安全模块固件（2020年后），可以通过远程复位的方式重置安全模块的状态，使模块从 FAILSAFE 状态恢复正常。
- FAILSAFE（故障保护状态）的确认，通过在程序中使用 AsIOAcc 函数异步访问 X2X 总线上的模块寄存器来实现。
- 这将使安全模块恢复正常，并使安全链程序恢复至处于运行状态（operating state）（无需确认）

2.1 注意事项

- 如果由于安全模块内置计数器溢出而导致故障保护功能失效，则故障保护的外部确认是合理的。
- 无法确认其他原因导致的失败状态。
- 存在硬件错误将由远程复位确认的风险，并导致安全故障在不同的状态下累积。

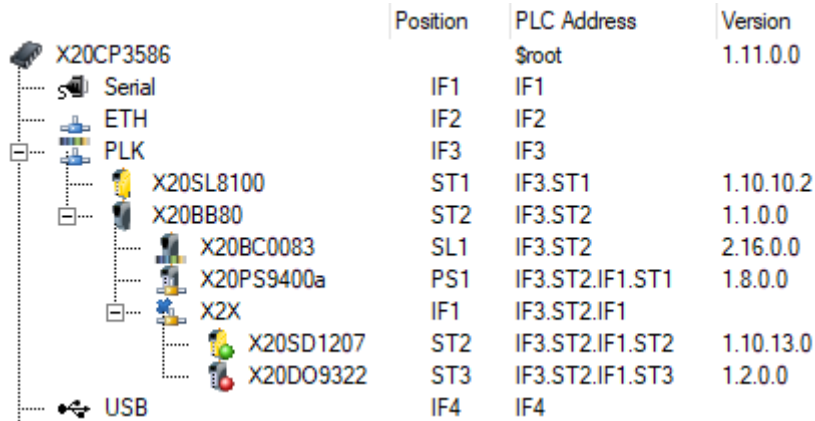
2.2 适用场景

- 安全模块报错信息为：
 - "Cross communication error"
 - "Temperature error"
- 安全模块断电上电后恢复正常运行，模块硬件层面上没有损坏。

3 测试代码

使用 StructureText 代码编写

硬件拓扑



```
1 PROGRAM _CYCLIC
2   (*----- 触发复位程序 -----*)
3   IF bTest THEN
4     bTest := FALSE;
5     uStep := 1;
6   END_IF
7   (*----- 指定需要复位的安全模块位置 -----*)
8   sDeviceName := 'IF3.ST2.IF1.ST2';
9   (*----- 安全链复位状态机 -----*)
10  CASE uStep OF
11    1: (*-- 通过AsIOAccwrite函数, 先给0x1341,0x1343寄存器写16#55 --*)
12      AsIOAccwrite_0(enable := TRUE, pDeviceName := ADR(sDeviceName),
13        pChannelName :=ADR('0x1341') , value := 16#55);
14      IF AsIOAccwrite_0.status<> 65535 THEN
15        IF AsIOAccwrite_0.status = 0 THEN
16          STATUS1 :=TRUE;
17        END_IF;
18      END_IF;
19      AsIOAccwrite_1(enable := TRUE, pDeviceName := ADR(sDeviceName),
20        pChannelName :=ADR('0x1343') , value := 16#55 );
21      IF AsIOAccwrite_1.status<> 65535 THEN
22        IF AsIOAccwrite_1.status = 0 THEN
23          STATUS2 :=TRUE;
24        END_IF;
25      END_IF;
26      IF (STATUS1 = TRUE) AND (STATUS2 = TRUE) THEN
27        STATUS1 :=FALSE;
28        STATUS2 :=FALSE;
29        uStep := 2;
30      END_IF
31    2: (*-- 通过AsIOAccwrite函数, 再给0x1341,0x1343寄存器写16#AA --*)
32      AsIOAccwrite_0(enable := TRUE, pDeviceName := ADR(sDeviceName),
33        pChannelName :=ADR('0x1341') , value := 16#AA);
34      IF AsIOAccwrite_0.status<> 65535 THEN
35        IF AsIOAccwrite_0.status = 0 THEN
36          STATUS1 :=TRUE;
37        END_IF;
```

```

35         END_IF;
36         ASIOAccWrite_1(enable := TRUE, pDeviceName := ADR(sDeviceName),
pChannelName :=ADR('0x1343') , value := 16#AA );
37         IF ASIOAccWrite_1.status<> 65535 THEN
38             IF ASIOAccWrite_1.status = 0 THEN
39                 STATUS2 :=TRUE;
40             END_IF;
41         END_IF;
42         IF (STATUS1 = TRUE) AND (STATUS2 = TRUE) THEN
43             STATUS1 :=FALSE;
44             STATUS2 :=FALSE;
45             uStep := 0;
46         END_IF
47     END_CASE
48 END_PROGRAM

```

3.1 测试硬件版本信息

- Automation Studio version : AS4.7
- Automation Runtime version: H4.73
- Hardware Firmware version: X20SD1207 1.10.14.1

3.2 验证流程

- 加热 X20SD1207 模块的环境温度到86度
- X20SD1207模块进行入 FailSafe 状态
- 等待环境温度降到60℃以下，此时 X20SD1207仍处于 FailSafe 状态
- 执行测试代码，给 bTest 变量设置为1，触发功能执行
- X20SD1207被复位
- 日志内容，可以看到模块故障后，执行功能，模块最后进入到 operation 状态，安全链恢复正常

Severity	Time	ID	Entered by	Origin	Description	ASCLData
Information	2023-11-02 02:26:38.365130	110403	Dboxio Safety Logger		state change to operational	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0x0001014F
Information	2023-11-02 02:26:29.360000	106775	Dboxio Safety Logger		Parameter checksum sizes do not match	IF3.ST1: Info0=0x0000, Info1=0x00010000
Warning	2023-11-02 02:19:10.301000	114825	Dboxio Safety Logger		safety module missing or nodeguarding failed	IF3.ST1: SafeMODULE ID=2, Info1=0, Info2=0x0000
Warning	2023-11-02 02:18:06.468000	110433	Dboxio Safety Logger		counter for SPDO errors has increased (uP1)	IF3.ST1: Info0=3, Info1=3
Warning	2023-11-02 02:18:06.468000	110432	Dboxio Safety Logger		counter of invalid safety frames has increased	IF3.ST1: Info0=1, Info1=1
Warning	2023-11-02 02:18:06.468000	110434	Dboxio Safety Logger		Connection statistic counter has changed.	IF3.ST1: Info0=1, Info1=1
Error	2023-11-02 02:17:58.647887	98818	Dboxio Safety Logger		Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x000000A12
Error	2023-11-02 02:17:58.647887	102914	Dboxio Safety Logger		Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x000000A12
Error	2023-11-02 02:17:58.647150	98818	Dboxio Safety Logger		Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x000000A12
Error	2023-11-02 02:17:58.644067	102914	Dboxio Safety Logger		Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x000000A12
Information	2023-11-02 02:17:58.643185	110385	Dboxio Safety Logger		Safe connection to module lost	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0x000000001
Error	2023-11-02 02:17:58.639672	102914	Dboxio Safety Logger		Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x000000A12
Warning	2023-11-02 02:17:58.639174	110404	Dboxio Safety Logger		state change to pre-operational	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0x000000000
Error	2023-11-02 02:17:58.636111	102914	Dboxio Safety Logger		Error Cross Communication	IF3.ST2.IF1.ST2: Info0=0x0005, Info1=0x000000A12
Error	2023-11-02 02:17:58.635155	99846	Dboxio Safety Logger		error voltage monitoring	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0xFFFFFFFF
Error	2023-11-02 02:17:58.631664	121082	Dboxio Safety Logger		Internal error-exchange data	IF3.ST2.IF1.ST2: Info0=0x0004, Info1=0x0002001A
Error	2023-11-02 02:17:58.631137	99850	Dboxio Safety Logger		Temperature error	IF3.ST2.IF1.ST2: Info0=0x0000, Info1=0x000000056
Warning	2023-11-02 02:17:52.439177	99858	Dboxio Safety Logger		Warning module temperature	IF3.ST2.IF1.ST2: Info0=0x0055, Info1=0x000000055
Warning	2023-11-02 02:17:46.247139	99858	Dboxio Safety Logger		Warning module temperature	IF3.ST2.IF1.ST2: Info0=0x0055, Info1=0x000000055
Warning	2023-11-02 02:17:40.055106	99858	Dboxio Safety Logger		Warning module temperature	IF3.ST2.IF1.ST2: Info0=0x0055, Info1=0x000000055
Warning	2023-11-02 02:17:33.863234	99858	Dboxio Safety Logger		Warning module temperature	IF3.ST2.IF1.ST2: Info0=0x0055, Info1=0x000000055
Warning	2023-11-02 02:17:27.671196	99858	Dboxio Safety Logger		Warning module temperature	IF3.ST2.IF1.ST2: Info0=0x0055, Info1=0x000000055
Warning	2023-11-02 02:17:21.479176	99858	Dboxio Safety Logger		Warning module temperature	IF3.ST2.IF1.ST2: Info0=0x0055, Info1=0x000000055