How to Program Siemens Step 7 to Get MGate 4101-MB-PBS' Diagnostic Information

Moxa Technical Support Team <u>support@moxa.com</u>

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How to Contact Moxa

Tel: +886-2-8919-1230 Fax: +886-2-8919-1231



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1 Description of Application

When an error, such as a disconnection or no response, occurs in the Modbus connection while the MGate 4101-MB-PBS is in Modbus Master mode, the MGate, however, will continue sending polling requests. After three requests have been sent without a response, the MGate will then enter diagnostic mode. In this mode, the MGate sends diagnostic packets periodically to PROFIBUS master. Upon receiving the correct response, the MGate will go back to normal operations.



For example, let's assume two Modbus commands are mapped to two PROFIBUS modules that will be used in the PLC program. If the two Modbus commands don't get a response, then the MGate 4101-MB-PBS will send a PROFIBUS diagnostic package to the master. If the Modbus command is still failing after a dwell time of three seconds, then the MGate 4101-MB-PBS will trigger the next diagnostic package transmission.

Device	Modbus	PROF	IBUS I	/O Mapping	,					
Qu	ickLink		Auto Maj	pping				Page1		Paging
Modbus	(Read/M	/rite:0/	0 bytes)				PROFIL	BUS Slave (Input/Oupu	ut:0/0 bytes)
Name	Enable	SID	D Func Addr Len Inter Addr Poll Interva		Poll Interval	Name I/O Mod CID Inter Addr				
			Mod	bus Co	mmand	1	Pro	fibus M	lodule :	1
			Mod	bus Co	mmand	12	Profibus Module 2			

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The diagnostic packet format is shown in the table below:

Byte	Parameter	Notes
1	Length	The length of diagnostic packet
2	Page	The paging number where the problematic data is
	number	located
3	Module	The PROFIBUS IO module number where the
		problematic data is located

For instance, if the diagnose packet is 03 01 02, then it means the problematic data is located on page one of the second PROFIBUS IO module.

If you use Siemens PLC Step 7 PLC program develop environment, the values of the diagnostic packets will be displayed on the hardware's diagnostic screen. Though this is useful during the programming phase, it is not efficient for operators or maintenance engineers, since they need to have the PLC source file and have to log in to the PLC again to check the value on the hardware's diagnose screen. Instead, those diagnostic package can rather be read via a PLC program and displayed directly on SCADA or HMI systems.

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This a more intuitive way to know diagnose messages. This tech note demonstrates how to program in Siemens Simatic Step 7 to retrieve the MGate's diagnostic information.

IS:	Error		Note	orce job	
Pe	aformance Data	Comm	unication	Stacks	Identification
Gene	eral Diagn	ostic Buffer	Memory	Scan Cycle Time	Time System
vents	: 🗖 /	Filter settings active	e 🗖 Ti	me including CPU/local ti	me difference
No.	Time of day	Date	Event		-
1	01:51:27.502 PM	07/17/2017	Module prob	lem or maintenance nece	ssary
2	01:51:27.487 PM	07/17/2017	Module prob	lem or maintenance nece	ssary
3	01:51:24.482 PM	07/17/2017	Module prob	lem or maintenance nece	ssary
4	01:51:24.467 PM	07/17/2017	Module prob	lem or maintenance nece	ssary
5	01:51:21.461 PM	07/17/2017	Module prob	lem or maintenance nece	ssary
6	01:51:21.446 PM	07/17/2017	Module prob	lem or maintenance nece	ssary
7	01:51:18.441 PM	07/17/2017	Module prob	lem or maintenance nece	ssary 🔻
etails	on event: 1 of	10		Event ID:	16# 3942
loduk nput a Iser ir Nagno loduk	e problem or mainte e type: Distributed I, address: 2043 iformation available ostic interrupt from s e/submodule fault	nance necessary /0s ubstitute			L L L L L L L L L L L L L L L L L L L
S	ave As	Settings	Go To	1	Help on Event

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2 System Topology

In the topology below, we use Siemens S7-300 PLC to communicate with the MGate 4101-MB-PBS. The MGate 4101-MB-PBS acts as a Modbus RTU Master to communicate with the Modbus Slave simulator running on the PC.



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3 Modbus Setting

The PC runs MGate Manager to configure the MGate 4101-MB-PBS. Under the **Modbus** setting, check RTU Master Mode.

Device Modbus PROFIBUS I	O Mapping			
Mode © RTU Slave Mode	Serial Port Baudrate	115200 🔻	Protocol Slave ID	1
RTU Master Mode	Parity	None 🔻	Response Time-out (ms)	200
ASCII Slave Mode	Data bits	8 👻	Max. Retry	0
ASCII Master Mode	Stop bit	1 •		
	Flow Control	None 👻		
	FIFO	Enable 💌		
	Interface	RS232 -		

Under the **IO Mapping** setting, add two **Modbus Read** commands that poll Slave ID1 and ID2. Mapping these two commands to two "Input:2 bytes" PROFIBUS modules.

Device Modbus PROFIBUS IO Mapping												
QuidLink Auto Mapping Page1												
Modbus (Read/Write:4/0 bytes)									PROFIBUS Slave (Input/Output:4/0 bytes)			
Name	Enable	SID	Func	Addr	Len	Inter Addr	Poll Interval		Name	I/O Mod	CID	Inter Addr
	Cyclic	1	3	0	1	0	1000	11		Input:2 bytes	0x11	0
	Cyclic	2	3	0	1	2	1000			Input: 2 bytes	0x11	2

The PC runs the **Modbus Slave** simulator. Create Slave ID1 and Slave ID2 to respond to the MGate 4101-MB-PBS's polling. In this situation, the MGate is in **Normal** mode.

Modbus Slave - ID2	
File Edit Connection Se	tup Display View Window Help
D 🛎 🖬 🎒 🛅 💆 .	ė ? №
D1 = 03 D = 1: F = 03 00000 1 2	D = 2: F = 03 00000 0 1 2
For Help, press F1.	Port 19: 115200-8-N-1

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4 Siemens PLC Setting

 Under HW Config, add the MGate PROFIBUS Slave to the PROFIBUS topology. Add two "Input: 2 Bytes" modules.



 Under S7 Program->Blocks, add OB1 and OB82 organization block objects. Also, add DB13 and DB82 data-block objects.

SIMATIC Manager - [Diag4101	C:\Share\Diag4101]]		
File Edit Insert PLC Vie	ew Options Windo	ow Help		
D 🛩 🎛 🛲 X 🗈 🛍	🚵 😨 💁 º º	🗽 🏥 🏢 🗈 🛛 < No	Filter > 💌 🕅	7 器 🎯 🖷 🗖 🗂
Diag4101	🖄 System data	g-081 g(1882 <mark>@</mark> [DB13]	🚍 D882

3. Set DB82's Symbolic Name as "DB_DIAG".

Properties - Data Block			×
General - Part 1 General	- Part 2 Calls Attributes		
Name:	DB82		
Symbolic Name:	DB_DIAG		-
Symbol Comment:			-
Created in Language:	DB		
Project Path:	Diag4101\SIMATIC 300 Statio (1)\Blocks\DB82	n\CPU315-2 PN/DP(1)\S7 Program	
Storage location of project:	C:\Share\Diag4101		-
Date created:	Code 04/28/2017 03:13:47 PM	Interface	
Last modified:	04/28/2017 04:37:51 PM	04/28/2017 04:37:51 PM	
Comment:			*
ОК		Cancel Help	

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Edit DB82 object as below:

🔣 LAD/ST	K LAD/STL/FBD - [DB82 "DB_DIAG" Diag4101\SIMATIC 300 Station\CPU315-2 PN/DP(1)\\DB82]									
🕞 File	File Edit Insert PLC Debug View Options Window Help									
0 🛩 🕯	🗅 📂 🏪 🚑 🐰 🗈 🛍 🗠 🕫 🕼 加 🔽 🗣 64 !<< >! 🗖 🔯 🕅									
Address		Name	Туре	Initial value	Comment					
0.	0		STRUCT							
+0.	0	Stationsstatus1	BYTE	B#16#0	Byte0					
+1.	0	Stationsstatus2	BYTE	B#16#0	Byte1					
+2.	0	Stationsstatus3	BYTE	B#16#0	Byte2					
+3.	0	Master_PROFIBUS_Adresse	BYTE	B#16#0	Byte3					
+4.	0	ID_High	BYTE	B#16#0	Byte4					
+5.	.0 ID_Low		BYTE	B#16#0	Byte5					
+6.	0	Diag_Length	BYTE	B#16#0	Byte6					
+7.	7.0 Page		BYTE	B#16#0	Byte7					
+8.	0	Module	BYTE	B#16#0	Byte8					
=10.	0		END_STRUCT							

This object that is 9 bytes will store the MGate Diagnose Packet response.

4. Set DB13's Symbolic Name as "DB_SFC13"

Properties - Data Block		×
General - Part 1 General	- Part 2 Calls Attributes	1
Name:	DB13	
Symbolic Name:	DB_SFC13	
Symbol Comment:		
Created in Language:	DB	
Project Path:	Diag4101\SIMATIC 300 Station (1)\Blocks\DB13	n\CPU315-2 PN/DP(1)\S7 Program
Storage location of project:	C:\Share\Diag4101	
Date created:	Code 04/28/2017 03:15:59 PM	Interface
Last modified:	04/28/2017 04:45:57 PM	04/28/2017 04:45:57 PM
Comment:		*
ОК		Cancel Help

Edit DB13 object as below:

LAD/STL	/FBD - [DB13 "DB_ dit Insert PLC D	SFC13" Diag4101\SIM ebug <u>V</u> iew <u>O</u> ption	/IATIC 300 Station\/ s <u>W</u> indow <u>H</u> elp	CPU315-2 PN/DP(1)\\DB13]					
🗋 🖆 🏪 🛃 🐉 🗈 🎕 🗠 🗢 🕼 🏜 🔁 🏪 🚳 !!< >! 🔲 🛄 🕅									
Address	Name	Туре	Initial value	Comment					
0.0		STRUCT							
+0.0	SFC13_Request	BOOL	FALSE						
+0.1	SFC13_Busy	BOOL	FALSE						
+2.0	SFC13_LADDR	WORD	W#16#0						
+4.0	SFC13_RET_VAL	INT	0						
+6.0	Module1_Error	BOOL	FALSE						
+6.1	Module2_Error	BOOL	FALSE						
=8.0		END_STRUCT							

Addresses $0 \sim 5$ will store SFC 13 response. We will store PROFIBUS module status in Address 6.0 and 6.1 after receiving the diagnostic packet.

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 OB82 setting: OB82 handles the I/O Point Fault interruption. When the MGate 4101-MB-PBS diagnosis is received, the Siemens PLC will trigger this interruption. In this state, we set "DB_SFC13." SFC13_Request bit to Trigger SFC 13 to read PROFIBUS diagnosis.



- 6. **OB1 setting:** In Network 1, when "**DB_SFC13".SFC13_Request** is enabled, we call
 - SFC13 to read diagnosis.



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The SFC 13 function block is under Libraries->Standard Library->System Function Blocks.



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In Network 2 and Network 3, we check **"DB_DIAG".Module** byte to indicate the status of module 1 and module 2 should the MGate 4101-MB-PBS detect a Modbus command error.



In Network 4, we reset "DB_SFC13".Module1_Error, and "DB_SFC13".Module2_Error when I0.0 bit is triggered.



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5 Communication Test

1) Create Variable Table

Create the Variation Table below and go online:

2		ם 🛥 🕻	6		° <u>∎</u> ≌ <u></u> №?	<u></u>	<u> 47</u> 661
k	.VA	T_1 @Dia	ag41(01\SIMATIC 300 Station\CPU31	5-2 PN/DP(1)\S7	Program(1) ON	LINE
	1	Address		Symbol	Display format	Status value	Modify value
1							
2		DB13.DBW	2	"DB_SFC13".SFC13_LADDR	HEX	W#16#07FB	
3		DB13.DBW	4	"DB_SFC13".SFC13_RET_VAL	HEX	W#16#7000	
4		DB13.DBB	8		HEX	20	
5		DB13.DBB	6		HEX	B#16#00	
6		MW 100			HEX	W#16#0000	
7		I 0.0			BOOL	false	true
8		DB13.DBX	6.0	"DB_SFC13".Module1_Error	BOOL	false	
9		DB13.DBX	6.1	"DB_SFC13".Module2_Error	BOOL	false	
10							

When the MGate 4101-MB-PBS is in normal mode, then the statuses of

"DB_SFC13".Module1_Error and "DB_SFC13".Module2_Error are shown as false.

2) Close Modbus Slave ID 2 Test:

We close Modbus Slave ID 2 simulator to let the MGate 4101-MB-PBS enter diagnostic mode. We can see the status of **"DB_SFC13".Module2_Error** is true.

1	Address		Symbol	Display format	Status value	Modify value
1						
2	DB13.DBW	2	"DB_SFC13".SFC13_LADDR	HEX	W#16#07FB	
3	DB13.DBW	4	"DB_SFC13".SFC13_RET_VAL	HEX	W#16#7000	
4	DB13.DBB	8		HEX	<u>Þ4</u>	
5	DB13.DBB	6		HEX	B#16#02	
6	MW 100			HEX	W#16#0003	
7	I 0.0			BOOL	false	true
8	DB13.DBX	6.0	"DB_SFC13".Module1_Error	BOOL	false	
9	DB13.DBX	6.1	"DB_SFC13".Module2_Error	BOOL	true	

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3) Close Modbus Slave ID 1 Test:

We close Modbus Slave ID 1 simulator. We can see the status of **"DB_SFC13".Module1_Error** is true.

	1	Address		Symbol	Display format	Status value	Modify va
1							
2		DB13.DBW	2	"DB_SFC13".SFC13_LADDR	HEX	W#16#07FB	
3		DB13.DBW	4	"DB_SFC13".SFC13_RET_VAL	HEX	W#16#7000	
F.		DB13.DBB	8		HEX	<mark>۵۵</mark>	
;		DB13.DBB	6		HEX	B#16#03	
;		MW 100			HEX	W#16#003F	
·		I 0.0			BOOL	false	true
3		DB13.DBX	6.0	"DB_SFC13".Module1_Error	BOOL	true	
5		DB13.DBX	6.1	"DB_SFC13".Module2_Error	BOOL	true	

4) Back to Normal Mode Test:

We open Modbus Slave ID 1 and ID2 simulator to respond the MGate 4101-MB-PBS's polling. The MGate 4101-MB-PBS will go back to **n**ormal mode. But the statuses of

"DB_SFC13".Module1_Error and "DB_SFC13".Module2_Error are still true.

We can set I0.0 bit to reset the status of Module1_Error and "DB_SFC13".Module2_Error.