VIPA

SPEED7 | Operation List | Manual

HB00E_OPL_SP7 | Rev. 11/20

May 2011

For permission to reproduce or distribute, please contact:
VIPA, Gesellschaft für Visualisierung und Prozessautomatisierung mbH
Ohmstraße 4, D-91074 Herzogenaurach, Germany
Tel.: +49 (91 32) 744 -0
Fax.: +49 9132 744 1864
EMail: info@vipa.de
http://www.vipa.de

Note

Every effort has been made to ensure that the information contained in this document was complete and accurate at the time of publishing. Nevertheless, the authors retain the right to modify the information. This customer document describes all the hardware units and functions known at the present time. Descriptions may be included for units which are not present at the customer site. The exact scope of delivery is described in the respective purchase contract.

CE Conformity

Hereby, VIPA GmbH declares that the products and systems are in compliance with the essential requirements and other relevant provisions of the following directives:

- 2004/108/EC Electromagnetic Compatibility Directive
- 2006/95/EC Low Voltage Directive

Conformity is indicated by the CE marking affixed to the product.

Conformity Information

For more information regarding CE marking and Declaration of Conformity (DoC), please contact your local VIPA customer service organization.

Trademarks

VIPA, SLIO, System 100V, System 200V, System 300V, System 300S, System 400V, System 500S and Commander Compact are registered trademarks of VIPA Gesellschaft für Visualisierung und Prozessautomatisierung mbH.

SPEED7 is a registered trademark of profichip GmbH.

SIMATIC, STEP, SINEC, S7-300 and S7-400 are registered trademarks of Siemens AG.

Microsoft und Windows are registered trademarks of Microsoft Inc., USA.

Portable Document Format (PDF) and Postscript are registered trademarks of Adobe Systems, Inc.

All other trademarks, logos and service or product marks specified herein are owned by their respective companies.

Information product support

Contact your local VIPA Customer Service Organization representative if you wish to report errors or questions regarding the contents of this document. If you are unable to locate a customer service center, contact VIPA as follows:

VIPA GmbH, Ohmstraße 4, 91074 Herzogenaurach, Germany

Telefax:+49 9132 744 1204
EMail: documentation@vipa.de

Technical support

Contact your local VIPA Customer Service Organization representative if you encounter problems with the product or have questions regarding the product. If you are unable to locate a customer service center, contact VIPA as follows:

VIPA GmbH, Ohmstraße 4, 91074 Herzogenaurach, Germany

Telephone: +49 9132 744 1150/1180 (Hotline)
EMail: support@vipa.de

Contents

About this manual

This manual provides you with a comprehensive overview of the blocks integrated to the VIPA SPEED7 CPUs.

Described are command list, integrated OBs, SFBs, SFCs and the VIPA specific blocks.

Overview

Chapter 1: Instruction list

This chapter lists the available commands of the SPEED7 CPUs from VIPA. The instruction list intends to give you an overview over the commands and their syntax. The commands are sorted by topics in alphabetical order.

Chapter 2: Organization Blocks

Here the description of the integrated organization blocks of the VIPA SPEED7 CPUs may be found.

Chapter 3: Integrated SFBs

The description of the integrated function blocks of the VIPA SPEED7 CPUs may be found here.

Chapter 4: Integrated Standard FBs

Here the description of the integrated standard FBs of the SPEED7 CPUs from VIPA may be found. The description of the FBs of the VIPA library may be found at the chapter "VIPA specific blocks".

Chapter 5: Integrated Standard SFCs

Here the description of the integrated standard SFCs of the SPEED7 CPUs from VIPA may be found. The description of the SFCs of the VIPA library may be found at the chapter "VIPA specific blocks".

Chapter 6: VIPA specific blocks

In this chapter you find the description of the VIPA specific blocks that are exclusively used with CPUs from VIPA

Chapter 7: System Status Lists SSL

This chapter describes all the partial lists of the system status list, readable via SFC 51 RDSYSST or via Hardware configurator.

Objective and contents

This manual provides you with the instruction list and the description of the integrated blocks that are exclusively may be used with the SPEED7 CPUs from VIPA.

Target audience

The manual is targeted at users who have a background in automation technology.

Structure of the manual

The manual consists of chapters. Every chapter provides a self-contained description of a specific topic.

Guide to the document

The following guides are available in the manual:

- an overall table of contents at the beginning of the manual
- an overview of the topics for every chapter

Availability

The manual is available in:

- printed form, on paper
- in electronic form as PDF-file (Adobe Acrobat Reader)

Icons Headings

Important passages in the text are highlighted by following icons and headings:

Danger!
Immediate or likely danger.
Personal injury is possible.

Attention!
Damages to property is likely if these warnings are not heeded.

Note!
Supplementary information and useful tips.

Chapter 1 Instruction List

Overview

The following chapter lists the available commands of the SPEED7 CPUs from VIPA. The instruction list intends to give you an overview over the commands and their syntax. The commands are sorted by topics in alphabetical order.

Via the content the different topics are available.

The alphabetical instruction list gives you direct access to the instructions.

For the parameters are integrated in the instruction list, there is no extra parameter list.

Content

Alphabetical instruction list

Abbreviations

Abbreviation	Description
/FC	First check bit
2#	Binary constant
a	Byte address
ACCU	Register for processing bytes, words and double words
AR	Address registers, contain the area-internal or area-crossing addresses for the instructions addressed register-indirect
b	Bit address
B	area-crossing, register-indirect addressed byte
B (b1,b2)	Constant, 2byte
B (b1,b2,b3,b4)	Constant, 4byte
B#16#	Byte hexadecimal
BR	Binary result
c	Operand range
C	Counter
C#	Counter constant (BCD-coded)
CC0	Condition code
CC1	Condition code
D	area-crossing, register-indirect addressed double word
D#	IEC date constant
DB	Data block
DBB	Data byte in the data block
DBD	Data double word in the data block
DBW	Data word in the data block
DBX	Data bit in the data block
DI	Instance data block
DIB	Data byte in the instance DB
DID	Data double word in the instance DB
DIW	Data word in the instance DB
DIX	Data bit in the instance DB
DW#16#	Double word hexadecimal
f	Timer/Counter No.
FB	Function block
FC	Functions
g	Operand range
h	Operand range
I	Input (in the PII)
i	Operand range
i8	Integer (8bit)
i16	Integer (16bit)
i32	Integer (32bit)
IB	Input byte (in the PII)
ID	Input double word (in the PII)
IW	Input word (in the PII)
k8	Constant (8bit)
k16	Constant (16bit)
k32	Constant (32bit)

continued ...

... continue

Abbreviation	Description
L	Local data
L#	Integer constant (32bit)
LABEL	Symbolic jump address (max. 4 characters)
LB	Local data byte
LD	Local data double word
LW	Local data word
m	Pointer constant P#x.y (pointer)
M	Bit memory bit
MB	Bit memory byte
MD	Bit memory double word
MW	Bit memory word
n	Binary constant
OB	Organization block
OR	Or
OS	Stored overflow
OV	Overflow
p	Hexadecimal constant
P#	Pointer constant
PIQ	Process image of the outputs
PII	Process image of the inputs
PIB	Periphery input byte (direct periphery access)
PID	Periphery input double word (direct periphery access)
PIW	Periphery input word (direct periphery access)
PQB	Periphery output byte (direct periphery access)
PQD	Periphery output double word (direct periphery access)
PQW	Periphery output word (direct periphery access)
Q	Output (in the PIQ)
q	Real number (32bit floating-point number)
QB	Output byte (in the PIQ)
QD	Output double word (in the PIQ)
QW	Output word (in the PIQ)
r	Block no.
RLO	Result of (previous) logic instruction
S5T#	S5 time constant (16bit), loads the S5-Timer
SFB	System function block
SFC	System function
STA	Status
T	Timer (times)
T#	Time constant (16/32bit)
TOD#	IEC time constant
W	area-crossing, register-indirect addressed word
W#16#	Word hexadecimal

Differences between SPEED7 and 300V programming

General

The SPEED7-CPUs lean in the command processing against the S7-400 from Siemens and differs here to the S7-300 from Siemens.

These differences are listed below.

In the following, the S7-318 from Siemens is counted for the S7-400 series from Siemens.

Status register

In opposite to the System 300V, the SPEED7-CPUs, Siemens S7-400 and CPU 318 use the status register bits OR, STA, /ER.

If your user application is based upon the circumstance that the mentioned bits in the status register are always zero (like S7-300 from Siemens), the program is not executable at SPEED7-CPUs, Siemens S7-400 and CPU 318.

ACCU handling at arithmetic operations

The CPUs of the System 300V contain 2 ACCUs. At an arithmetic operation the content of the 2nd ACCU is not altered.

Whereas the SPEED7-CPUs provide 4 ACCUs. After an arithmetic operation (+I, -I, *I, /I, +D, -D, *D, /D, MOD, +R, -R, *R, /R) the content of ACCU 3 and ACCU 4 is loaded into ACCU 3 and 2.
This may cause conflicts in applications that presume an unmodified ACCU2.

RLO at jumps

The missing of the implementation of the start command bit /ER in the System 300V may cause, under certain circumstances, deviations in the command execution of bit commands between S7-300 and S7-400 res. SPEED7, especially at a jump to a bit conjunction chain.

Examples RLO at jumps

Example A:

```
       A I0.0
       A M1.1
       = M2.0        // RLO =1  Command end
       JU =J001      // jumps
       .....
       A M7.6
       A M3.0
       A M3.1
JO01:  A Q2.2        // after the jump...
                     // 300V further combines
                     // This command is used by VIPA SPEED7,
                     // Siemens S7-400 and CPU 318 as first request
```

Example B:

```
       A I0.0
       A M1.1
       = M2.0        // RLO =1  command end
       A Q3.3        // first request
       JU =J001      // jumps
       .....
       A M3.0
       A M3.1
JO01:  A M3.2        // after jump
       .....         // the CPUs further combine
```

BCD consistency

At setting a timer or counter, a valid BCD value must be present in AKKU1. The proof of this BCD value is in the System 300V only executed when timer or counter are taken over (edge change). The SPEED7-CPUs (like the S7-400 from Siemens) always execute the verification.

Example:

```
......
A I5.4
L MW20
S T30        // 300V only proofs if timer is actively
             // executed
             // SPEED7, Siemens S7-400 and CPU 318
             // always proof (also when no condition is
             // present)
......
```

Registers

ACCU1 ... ACCU4 (32bit)

The ACCUs are registers for the processing of byte, words or double words. Therefore the operands are loaded in the ACCUs and combined. The result of the instruction is always in ACCU1.

ACCU	Bit
ACCUx (x=1 ... 4)	Bit 0 ... bit 31
ACCUx-L	Bit 0 ... bit 15
ACCUx-H	Bit 16 ... bit 31
ACCUx-LL	Bit 0 ... bit 7
ACCUx-LH	Bit 8 ... bit 15
ACCUx-HL	Bit 16 ... bit 23
ACCUx-HH	Bit 24 ... bit 31

Address register AR1 and AR2 (32bit)

The address registers contain the area-internal or area-crossing addresses for the register-indirect addressed instructions. The address registers are 32bit wide.

The area-internal or area-crossing addresses have the following structure:

area-internal address:

00000000 00000bbb bbbbbbbb bbbbbxxx

area-crossing address:

10000yyy 00000bbb bbbbbbbb bbbbbxxx

Legend:
- b Byte address
- x Bit number
- **Y** Range ID (see chapter "Addressing examples")

Status word (16bit)

The values are analyzed or set by the instructions.

The status word is 16bit wide.

Bit	Assignment	Description
0	/FC	First check bit
1	RLO	Result of (previous) logic instruction
2	STA	Status
3	OR	Or
4	OS	Stored overflow
5	OV	Overflow
6	CC0	Condition code
7	CC1	Condition code
8	BR	Binary result
9 ... 15	not used	-

Addressing examples

Addressing example	Description
Immediate addressing	
L +27	Load 16bit integer constant "27" in ACCU1
L L#-1	Load 32bit integer constant "-1" in ACCU1
L 2#1010101010101010	Load binary constant in ACCU1
L DW#16#A0F0_BCFD	Load hexadecimal constant in ACCU1.
L 'End'	Load ASCII code in ACCU1
L T#500ms	Load time value in ACCU1
L C#100	Load counter value in ACCU1
L B#(100,12)	Load constant as 2byte
L B#(100,12,50,8)	Load constant as 4byte
L P#10.0	Load area-internal pointer in ACCU1
L P#E20.6	Load area-crossing pointer in ACCU1
L -2.5	Load real number in ACCU1
L D#1995-01-20	Load date
L TOD#13:20:33.125	Load time-of-day
Direct addressing	
A I 0.0	AND operation of input bit 0.0
L IB 1	Load input byte 1 in ACCU1
L IW 0	Load input word 0 in ACCU1
L ID 0	Load input double word 0 in ACCU1
Indirect addressing timer/counter	
SP T [LW 8]	Start timer; timer no. is in local data word 8
CU C [LW 10]	Start counter; counter no. is in local data word 10
Memory-indirect, area-internal addressing	
A I [LD 12] e.g.: LP#22.2 T LD 12 A I [LD 12]	AND instruction; input address is in local data double word 12 as pointer
A I [DBD 1]	AND instruction; input address is in data double word 1 of the DB as pointer
A Q [DID 12]	AND instruction; output address is in data double word 12 of the instance DB as pointer
A Q [MD 12]	AND instruction; output address is in bit memory double word 12 as pointer
Register-indirect, area-internal addressing	
A I [AR1,P#12.2]	AND instruction; input address is calculated "pointer value in address register 1 + pointer P#12.2"

continued ...

... continue

Register-indirect, area-crossing addressing			
For the area-crossing, register indirect addressing the address needs an additional range-ID in the bits 24-26. The address is in the address register.			
Range-ID	**Binary code**	**hex.**	**Area**
P	1000 0**000**	80	Periphery area
I	1000 0**001**	81	Input area
Q	1000 0**010**	82	Output area
M	1000 0**011**	83	Bit memory area
DB	1000 0**100**	84	Data area
DI	1000 0**101**	85	Instance data area
L	1000 0**110**	86	Local data area
VL	1000 0**111**	87	Preceding local data area (access to the local data of the calling block)

L B [AR1,P#8.0]	Load byte in ACCU1; the address is calculated "pointer value in address register 1 + pointer P#8.0"
A [AR1,P#32.3]	AND instruction; operand address is calculated "pointer value in address register 1 + pointer P#32.3"
Addressing via parameters	
A parameter	The operand is addressed via the parameter

Example for pointer calculation

Example when sum of bit addresses ≤ 7:

LAR1 P#8.2

A I [AR1,P#10.2]

Result: The input 18.4 is addressed
(by adding the byte and bit addresses)

Example when sum of bit addresses > 7:

L MD 0 at will calculated pointer, e.g. P#10.5

LAR1

A I [AR1,P#10.7]

Result: Addressed is input 21.4
(by adding the byte and bit addresses with carry)

Command	Operand	Parameter	Status word BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Math instructions

Fixed-point arithmetic (16bit)			Status word									Math instructions of two 16bit numbers. The result is in ACCU1 res. ACCU1-L.	
+I	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Add up two integers (16bit)	1
			-	-	-	-	-	-	-	-	-	(ACCU1-L)=(ACCU1-L)+(ACCU2-L)	
-I	-		-	Y	Y	Y	Y	-	-	-	-	Subtract two integers (16bit) (ACCU1-L)=(ACCU2-L)-(ACCU1-L)	1
*I	-											Multiply two integers (16bit) (ACCU1-L)=(ACCU2-L)*(ACCU1-L)	1
/I	-											Divide two integers (16bit) (ACCU1-L)=(ACCU2-L):(ACCU1-L) The remainder is in ACCU1-H	1
Fixed-point arithmetic (32bit)			*Status word*									Math instructions of two 32bit numbers. The result is in ACCU1.	
+D	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Add up two integers (32bit)	1
			-	-	-	-	-	-	-	-	-	(ACCU1)=(ACCU2)+(ACCU1)	
-D	-		-	Y	Y	Y	Y	-	-	-	-	Subtract two integers (32bit) (ACCU1)=(ACCU2)-(ACCU1)	1
*D	-											Multiply two integers (32bit) (ACCU1)=(ACCU2)*(ACCU1)	1
/D	-											Divide two integers (32bit) (ACCU1)=(ACCU2):(ACCU1)	1
MOD	-											Divide two integers (32bit) and load the rest of the division in ACCU1 (ACCU1)=remainder of [(ACCU2):(ACCU1)]	1
Floating-point arithmetic (32bit)			*Status word*									The result of the math instructions is in ACCU1. The execution time of the instruction depends on the value to calculate.	
+R	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Add up two real numbers (32bit)	1
			-	-	-	-	-	-	-	-	-	(ACCU1)=(ACCU2)+(ACCU1)	
-R	-		-	Y	Y	Y	Y	-	-	-	-	Subtract two real numbers (32bit) (ACCU1)=(ACCU2)-(ACCU1)	1
*R	-											Multiply two real numbers (32bit) (ACCU1)=(ACCU2)*(ACCU1)	1
/R	-											Divide two real numbers (32bit) (ACCU1)=(ACCU2):(ACCU1)	1
NEGR	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Negate the real number in ACCU1	1
			-	-	-	-	-	-	-	-	-		
ABS	-		-	-	-	-	-	-	-	-	-	Form the absolute value of the real number in ACCU1	1

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
Square root an square instructions (32bit)			*Status word*									The result of the instructions is in ACCU1. The instructions may be interrupted by alarms.	
SQRT	-		-	-	-	-	-	-	-	-	-	Calculate the Square root of a real number in ACCU1	1
SQR	-		-	Y	Y	Y	Y	-	-	-	-	Form the square of a real number in ACCU1	1
Logarithmic function (32bit)			*Status word*									The result of the logarithm function is in ACCU1. The instructions may be interrupted by alarms.	
LN	-		-	-	-	-	-	-	-	-	-	Calculate the natural logarithm of a real number in ACCU1	1
EXP	-		-	Y	Y	Y	Y	-	-	-	-	Calculate the exponential value of a real number in ACCU1 on basis e (=2.71828)	1
Trigonometrical functions (32bit)			*Status word*									The result of the trigonometrical function is in ACCU1. The instructions may be interrupted by alarms.	
SIN[1]	-		-	-	-	-	-	-	-	-	-	Calculate the sine of the real number	1
ASIN[2]	-		-	Y	Y	Y	Y	-	-	-	-	Calculate the arcsine of the real number	1
COS[1]	-											Calculate the cosine of the real number	1
ACOS[2]	-											Calculate the arccosine of the real number	1
TAN[1]	-											Calculate the tangent of the real number	1
ATAN[2]	-											Calculate the arctangent of the real number	1
Addition of constants												Addition of integer constants to ACCU1. The condition code bits are not affected.	
+	i8											Add an 8bit integer constant	1
+	i16											Add a 16bit integer constant	2
+	i32											Add a 32bit integer constant	3
Addition via address register												Adding a 16bit integer to contents of address register. The value is in the instruction or in ACCU1-L. Condition code bits are not affected	
+AR1	-											Add the contents of ACCU1-L to AR1	1
+AR1	m											Add a pointer constant to the contents of AR1	2
+AR2	-											Add the contents of ACCU1-L to those of AR2	1
+AR2	m											Add pointer constant to the contents of AR2	2

1 Specify the angle in radians; the angle must be given as a floating point value in ACCU 1.

2 The result is an angle in radians.

Command	Operand	Parameter	Status word BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Block instructions

Block call instructions			*Status word*										
CALL	FB r, DB r	0 ... 8191 0 ... 8191	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Unconditional call of a FB, with parameter transfer	
			-	-	-	-	-	-	-	-	-		
CALL	SFB r, DB r	0 ... 8191 0 ... 8191	-	-	-	-	0	0	1	-	0	Unconditional call of a SFB, with parameter transfer	
CALL	FC r											Unconditional call of a function, with parameter transfer	
CALL	SFC r											Unconditional call of a SFC, with parameter transfer	
UC	FB r FC r Parameter	0 ... 8191										Unconditional call of blocks, without parameter transfer FB/FC call via parameters	1/2
CC	FB r	0 ... 8191	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Conditional call of blocks, without parameter	1/2
	FC r		-	-	-	-	-	-	-	Y	-	transfer	
	Parameter		-	-	-	-	0	0	1	-	0	FB/FC call via parameters	
OPN	DB r	0 ... 8191	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Open a data block	1/2
	DI r		-	-	-	-	-	-	-	-	-	Open a instance data block	2
	Parameter		-	-	-	-	-	-	-	-	-	Open a data block via parameter	2
Block end instructions			*Status word*										
BE			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	End block	1
			-	-	-	-	-	-	-	-	-		
BEU			-	-	-	-	0	0	1	-	0	End block unconditionally	1
BEC			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	End block if RLO="1"	
			-	-	-	-	-	-	-	Y	-		
			-	-	-	-	Y	0	1	1	0		
Exchanging shared data block an instance data block												Exchanging the two current data blocks. The current shared data block becomes the current instance data block and vice versa. The condition code bits are not affected	
CDB												Exchange shared data block and instant data block	1

Command	Operand	Parameter	Status word BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Program display and null instruction instructions

Program display and null operation instructions				The status word is not affected.	
BLD	0 ... 255			Program display instruction: is treated by the CPU like a null operation instruction	1
NOP	0 1			Null operation instruction	1

Edge-triggered instructions

Edge-triggered instructions			*Status word*									Detection of an edge change. The current signal state of the RLO is compared with the signal state of the instruction or edge bit memory. FP detects a change in the RLO from "0" to "1" FN detects a change in the RLO from "1" to "0"	
FP	I/Q a.b	0.0 ... 2047.7	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Detecting the positive edge in the RLO. The bit addressed	2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	-	-	Y	-	in the instruction is the auxiliary edge bit memory	2
	L a.b	parameterizable	-	-	-	-	-	0	Y	Y	1		2
	DBX a.b	0.0 ... 65535.7											2
	DIX a.b	0.0 ... 65535.7											2
	c [AR1,m]												2
	c [AR2,m]												2
	[AR1,m]												2
	[AR2,m]												2
	Parameter												2
FN	I/Q a.b	0.0 ... 2047.7	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Detecting the negative edge in the RLO. The bit addressed	2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	-	-	Y	-	in the instruction is the auxiliary edge bit memory	2
	L a.b	parameterizable	-	-	-	-	-	0	Y	Y	1		2
	DBX a.b	0.0 ... 65535.7											2
	DIX a.b	0.0 ... 65535.7											2
	c [AR1,m]												2
	c [AR2,m]												2
	[AR1,m]												2
	[AR2,m]												2
	Parameter												2

Command	Operand	Parameter	Status word BR CC1 CC0 OV OS OR STA RLO /FC	Function	Length in words
				: Instruction depends on	
				: Instruction influences	

Load instructions

Load instructions				Loading address identifiers into ACCU1. The contents of ACCU1 and ACCU2 are saved first. The status word is not affected.	
L				Load ...	
	IB a	0.0 ... 2047		input byte	1/2
	QB a	0.0 ... 2047		output byte	1/2
	PIB a	0.0 ... 8191		periphery input byte	2
	MB a	0.0 ... 8191		bit memory byte	1/2
	LB a	parameterizable		local data byte	2
	DBB a	0.0 ... 65535		data byte	2
	DIB a	0.0 ... 65535		instance data byte	2
				... in ACCU1	2
	g [AR1,m]			register-indirect, area-internal (AR1)	2
	g [AR2,m]			register-indirect, area-internal (AR2)	2
	B [AR1,m]			area-crossing (AR1)	2
	B [AR2,m]			area-crossing (AR2)	2
	Parameter			via parameters	2
L				Load ...	
	IW a	0.0 ... 2046		input word	1/2
	QW a	0.0 ... 2046		output word	1/2
	PIW a	0.0 ... 8190		periphery input word	
	MW a	0.0 ... 8190		bit memory word	1/2
	LW a	parameterizable		local data word	2
	DBW a	0.0 ... 65534		data word	1/2
	DIW a	0.0 ... 65534		instance data word	1/2
				... in ACCU1-L	
	h [AR1,m]			register-indirect, area-internal (AR1)	2
	h [AR2,m]			register-indirect, area-internal (AR2)	2
	W [AR1,m]			area-crossing (AR1)	2
	W [AR2,m]			area-crossing (AR2)	2
	Parameter			via parameters	2

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Load instructions				Loading address identifiers into ACCU1. The contents of ACCU1 and ACCU2 are saved first. The status word is not affected.	
L				Load ...	
	ID a	0.0 ... 2044		input double word	1/2
	QD a	0.0 ... 2044		output double word	1/2
	PID a	0.0 ... 8188		periphery input double word	2
	MD a	0.0 ... 8188		bit memory double word	1/2
	LD a	parameterizable		local data double word	2
	DBD a	0.0 ... 65532		data double word	2
	DID a	0.0 ... 65532		instance data double word	2
				... in ACCU1-L	
	i [AR1,m]			register-indirect, area-internal (AR1)	2
	i [AR2,m]			register-indirect, area-internal (AR2)	2
	D [AR1,m]			area-crossing (AR1)	2
	D [AR2,m]			area-crossing (AR2)	2
	Parameter			via parameters	2
L				Load ...	
	k8			8bit constant in ACCU1-LL	1
	k16			16bit constant in ACCU1-L	2
	k32			32bit constant in ACCU1	3
	Parameter			Load constant in ACCU1 (addressed via parameters)	2
L	2#n			Load 16bit binary constant in ACCU1-L	2
				Load 32bit binary constant in ACCU1	3
L	B#8#p			Load 8bit hexadecimal constant in ACCU1-LL	1
	W#16#p			Load 16bit hexadecimal constant in ACCU1-L	2
	DW#16#p			Load 32bit hexadecimal constant in ACCU1	3
L	x			Load one character	
L	xx			Load two characters	2
L	xxx			Load three characters	
L	xxxx			Load four characters.	3
L	D# Date			Load IEC-date (BCD-coded)	3
L	S5T# time value			Load time constant (16bit)	2
L	TOD# time value			Load 32bit time constant (IEC-time-of-day)	3
L	T# time			Load 16bit time constant	2
	value			Load 32bit time constant	3
L	C# counter value			Load 16bit counter constant	2
L	P# bit pointer			Load bit pointer	3
L	L# Integer			Load 32bit integer constant	3
L	Real			Load real number	3

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Load instructions for timer and counter				Load a time or counter value in ACCU1, before the recent content of ACCU1 is saved in ACCU2. The status word is not affected.	
L	T f	0 ... 511		Load time value	1/2
	Timer p.			Load time value (addressed via parameters)	2
L	C f	0 ... 511		Load counter value	1/2
	Counter p.			Load counter value (addressed via parameters)	2
LD	T f	0 ... 511		Load time value BCD-coded	1/2
	Timer p.			Load time value BCD-coded (addressed via parameters)	2
LD	C f	0 ... 511		Load counter value BCD-coded	1/2
	Counter p.			Load counter value BCD-coded (addressed via parameters)	2

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Shift instructions

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
Shift instructions			*Status word*									Shifting the contents of ACCU1 and ACCU1-L to the left or right by the specified number of places. If no address identifier is specified, shift the number of places into ACCU2-LL. Any positions that become free are padded with zeros or the sign. The last shifted bit is in condition code bit CC1.	
SLW	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Shift the contents of ACCU1-L to the left	1
SLW	0 ... 15		-	-	-	-	-	-	-	-	-	Positions that become free are provided with zeros	
SLD	-		-	Y	Y	Y	-	-	-	-	-	Shift the contents of ACCU1 to the left	1
SLD	0 ... 32											Positions that become free are provided with zeros	
SRW	-											Shift the contents of ACCU1-L to the right	1
SRW	0 ... 15											Positions that become free are provided with zeros	
SRD	-											Shift the contents of ACCU1 to the right	1
SRD	0 ... 32											Positions that become free are provided with zeros	
SSI	-											Shift the contents of ACCU1-L to the right with sign	1
SSI	0 ... 15											Positions that become free are provided with the sign (bit 15)	
SSD	-											Shift the contents of ACCU1 to the right with sign	1
SSD	0 ... 32												
Rotation instructions			*Status word*									Rotate the contents of ACCU1 to the left or right by the specified number of places. If no address identifier is specified, rotate the number of places into ACCU2-LL.	
RLD	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Rotate the contents of ACCU1 to the left	1
RLD	0 ... 32		-	-	-	-	-	-	-	-	-		
RRD	-		-	Y	Y	Y	-	-	-	-	-	Rotate the contents of ACCU1 to the right	1
RRD	0 ... 32												
RLDA	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Rotate the contents of ACCU1 one bit position to the left, via CC1 bit	
			-	-	-	-	-	-	-	-	-		
RRDA	-		-	Y	0	0	-	-	-	-	-	Rotate the contents of ACCU1 one bit position to the right, via CC1 bit	

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Setting/resetting bit addresses

Set/Reset bit addresses			*Status word*									Assign the value "1" or "0" or the RLO to the addressed instructions.	
S			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Set ...	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	-	-	Y	-	input/output to "1"	1/2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	0	Y	-	0	set bit memory to "1"	1/2
	L a.b	parameterizable										local data bit to "1"	2
	DBX a.b	0.0 ... 65535.7										data bit to "1"	2
	DIX a.b	0.0 ... 65535.7										instance data bit to "1"	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	[AR1,m]											area-crossing (AR1)	2
	[AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2
R			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Reset ...	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	-	-	Y	-	input/output to "0"	1/2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	0	Y	-	0	set bit memory to "0"	1/2
	L a.b	parameterizable										local data bit to "0"	2
	DBX a.b	0.0 ... 65535.7										data bit to "0"	2
	DIX a.b	0.0 ... 65535.7										instance data bit to "0"	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	W [AR1,m]											area-crossing (AR1)	2
	W [AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2
=			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Assign ...	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	-	-	Y	-	RLO to input/output	1/2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	0	Y	-	0	RLO to bit memory	1/2
	L a.b	parameterizable										RLO to local data bit	2
	DBX a.b	0.0 ... 65535.7										RLO to data bit	2
	DIX a.b	0.0 ... 65535.7										RLO to instance data bit	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	[AR1,m]											area-crossing (AR1)	2
	[AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2

Command	Operand	Parameter	Status word BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Instructions directly affecting the RLO			*Status word*									The following instructions have a directly effect on the RLO.	
CLR			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Set RLO to "0"	1
			-	-	-	-	-	-	-	-	-		
			-	-	-	-	-	0	0	0	0		
SET			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Set RLO to "1"	1
			-	-	-	-	-	-	-	-	-		
			-	-	-	-	-	0	1	1	0		
NOT			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Negate RLO	1
			-	-	-	-	-	Y	-	Y	-		
			-	-	-	-	-	-	1	Y	-		
SAVE			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Save RLO into BR-bit	1
			-	-	-	-	-	-	-	Y	-		
			Y	-	-	-	-	-	-	-	-		

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Jump instructions

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
Jump instructions			*Status word*									Jump, depending on conditions. 8-bit operands have a jump width of (-128...+127), 16-bit operands of (-32768...-129) or (+128...+32767)	
JU	LABEL		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Jump unconditionally	1/2
			-	-	-	-	-	-	-	-	-		
			-	-	-	-	-	-	-	-	-		
JC	LABEL		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Jump if RLO="1"	1/2
JCN	LABEL		-	-	-	-	-	-	-	Y	-	Jump if RLO="0"	2
			-	-	-	-	-	0	1	1	0		
JCB	LABEL		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Jump if RLO="1"	2
			-	-	-	-	-	-	-	Y	-	Save the RLO in the BR-bit	
JNB	LABEL		Y	-	-	-	-	0	1	1	0	Jump if RLO="0"	2
												Save the RLO in the BR-bit	
JBI	LABEL		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Jump if BR="1"	2
JNBI	LABEL		Y	-	-	-	-	-	-	-	-	Jump if BR="0"	2
			-	-	-	-	-	0	1	-	0		
JO	LABEL		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Jump on stored overflow (OV="1")	1/2
			-	-	-	Y	-	-	-	-	-		
			-	-	-	-	-	-	-	-	-		
JOS	LABEL		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Jump on stored overflow (OS="1")	2
			-	-	-	-	Y	-	-	-	-		
			-	-	-	-	0	-	-	-	-		
JUO	LABEL		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Jump if "unordered instruction" (CC1=1 and CC0=1)	
JZ	LABEL		-	Y	Y	-	-	-	-	-	-	Jump if result=0 (CC1=0 and CC0=0)	1/2
JP	LABEL		-	-	-	-	-	-	-	-	-	Jump if result>0 (CC1=1 and CC0=0)	1/2
JM	LABEL											Jump if result<0 (CC1=0 and CC0=1)	1/2
JN	LABEL											Jump if result≠0 (CC1=1 and CC0=0) or (CC1=0) and (CC0=1)	1/2
JMZ	LABEL											Jump if result≤0 (CC1=0 and CC0=1) or (CC1=0 and CC0=0)	2
JPZ	LABEL											Jump if result≥0 (CC1=1 and CC0=0) or (CC1=0 and CC0=0)	2
JL	LABEL		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Jump distributor	2
			-	-	-	-	-	-	-	-	-	This instruction is followed by a list of jump instructions	
			-	-	-	-	-	-	-	-	-	The operand is a jump label to subsequent instructions in	
												this list. ACCU1-L contains the number of the jump instruction to be executed	
LOOP	LABEL											Decrement ACCU1-L and jump if ACCU1-L _ 0 (loop programming)	2

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Transfer instructions

Transfer instructions				Transfer the contents of ACCU1 into the addressed operand. The status word is not affected.	
T				Transfer the contents of ACCU1-LL to ...	
	IB a	0.0 ... 2047		input byte	1/2
	QB a	0.0 ... 2047		output byte	1/2
	PQB a	0.0 ... 8191		periphery output byte	1/2
	MB a	0.0 ... 8191		bit memory byte	1/2
	LB a	parameterizable		local data byte	2
	DBB a	0.0 ... 65535		data byte	2
	DIB a	0.0 ... 65535		instance data byte	2
	g [AR1,m]			register-indirect, area-internal (AR1)	2
	g [AR2,m]			register-indirect, area-internal (AR2)	2
	B [AR1,m]			area-crossing (AR1)	2
	B [AR2,m]			area-crossing (AR2)	2
	Parameter			via parameters	2
T				Transfer the contents of ACCU1-L to ...	
	IW	0.0 ... 2046		input word	1/2
	QW	0.0 ... 2046		output word	1/2
	PQW	0.0 ... 8190		periphery output word	1/2
	MW	0.0 ... 8190		bit memory word	1/2
	LW	parameterizable		local data word	2
	DBW	0.0 ... 65534		data word	2
	DIW	0.0 ... 65534		instance data word	2
	h [AR1,m]			register-indirect, area-internal (AR1)	2
	h [AR2,m]			register-indirect, area-internal (AR2)	2
	W [AR1,m]			area-crossing (AR1)	2
	W [AR2,m]			area-crossing (AR2)	2
	Parameter			via parameters	2

Command	Operand	Parameter	Status word (BR, CC1, CC0, OV, OS, OR, STA, RLO, /FC)	Function	Length in words
				: Instruction depends on	
				: Instruction influences	

Transfer instructions				Transfer the contents of ACCU1 into the addressed operand. The status word is not affected.	
T				Transfer the contents of ACCU1 to ...	
	ID	0.0 ... 2044		input double word	1/2
	QD	0.0 ... 2044		output double word	1/2
	PQD	0.0 ... 8188		periphery output double word	1/2
	MD	0.0 ... 8188		bit memory double word	1/2
	LD	parameterizable		local data double word	2
	DBD	0.0 ... 65532		data double word	2
	DID	0.0 ... 65532		instance data double word	2
	i [AR1,m]			register-indirect, area-internal (AR1)	2
	i [AR2,m]			register-indirect, area-internal (AR2)	2
	D [AR1,m]			area-crossing (AR1)	2
	D [AR2,m]			area-crossing (AR2)	2
	Parameter			via parameters	2
Load and transfer instructions for address register				Load a double word from a memory area or a register into AR1 or AR2.	
LAR1				Load the contents from ...	
	-			ACCU1	1
	AR2			address register 2	1
	DBD a	0 ... 65532		data double word	2
	DID a	0 ... 65532		instance data double word	2
	m			32bit constant as pointer	3
	LD a	parameterizable		local data double word	2
	MD a	0 ... 8188		bit memory double word	2
				... into AR1	
LAR2				Load the contents from ...	
	-			ACCU1	1
	DBD a	0 ... 65532		data double word	2
	DID a	0 ... 65532		instance data double word	2
	m			32bit constant as pointer	3
	LD a	parameterizable		local data double word	2
	MD a	0 ... 8188		bit memory double word	2
				... into AR2	
TAR1				Transfer the contents from AR1 to ...	
	-			ACCU1	1
	AR2			address register 2	1
	DBD a	0 ... 65532		data double word	2
	DID a	0 ... 65532		instance data double word	2
	LD a	parameterizable		local data double word	2
	MD a	0 ... 8188		bit memory double word	2

Command	Operand	Parameter	Status word BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
TAR2												Transfer the contents from AR2 to...	
	-											ACCU1	1
	DBD a	0 ... 65532										data double word	2
	DID a	0 ... 65532										instance data double word	2
	LD a	parameterizable										local data double word	2
	MD a	0 ... 8188										bit memory double word	2
TAR												Exchange the contents of AR1 and AR2	1
Load and transfer instructions for the status word			*Status word*										
L	STW		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Load status word in ACCU1	
	-		Y	Y	Y	Y	Y	0	0	Y	0		
			-	-	-	-	-	-	-	-	-		
T	STW		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Transfer ACCU1 (bits 0 ... 8) into status word	
	-		-	-	-	-	-	-	-	-	-		
			Y	Y	Y	Y	Y	-	-	Y	-		
Load instructions for DB number and DB length												Load the number/length of a data block to ACCU1. The old contents of ACCU1 are saved into ACCU2. The condition code bits are not affected	
L	DBNO											Load number of data block	1
L	DINO											Load number of instance data block	1
L	DBLG											Load length of data block into byte	1
L	DILG											Load length of instance data block into byte	1
ACCU transfer instructions, increment, decrement												The status word is not affected.	
CAW	-											Reverse the order of the bytes in ACCU1-L LL, LH becomes LH, LL	1
CAD	-											Reverse the order of the bytes in ACCU1 LL, LH, HL, HH becomes HH, HL, LH, LL	1
TAK	-											Swap the contents of ACCU1 and ACCU2	1
ENT												The contents of ACCU2 and ACCU3 are transferred to ACCU3 and ACCU4	
LEAVE												The contents of ACCU3 and ACCU4 are transferred to ACCU2 and ACCU3	
PUSH	-											The contents of ACCU1, ACCU2 and ACCU3 are transferred to ACCU2, ACCU3 and ACCU4	1
POP	-											The contents of ACCU2, ACCU3 and ACCU4 are transferred to ACCU1, ACCU2 and ACCU3	1
INC	0 ... 255											Increment ACCU1-LL	1
DEC	0 ... 255											Decrement ACCU1-LL	1

Command	Operand	Parameter	Status word BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Data type conversion instructions

Data type conversion instructions			Status word									The results of the conversion are in ACCU1. When converting real numbers, the execution time depends on the value.	
BTI	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Convert contents of ACCU1 from BCD to integer (16bit)	1
			-	-	-	-	-	-	-	-	-	(**B**CD **T**o **I**nt.)	
BTD	-		-	-	-	-	-	-	-	-	-	Convert contents of ACCU1 from BCD to integer (32bit).	1
												(**B**CD **T**o **D**oubleint.)	
DTR	-											Convert cont. of ACCU1 from integer (32bit) to Real number	1
												(32bit) (**D**oubleint. **T**o **R**eal)	
ITD	-											Convert contents of ACCU1 from integer (16bit) to integer	1
												(32bit) (**I**nt. **T**o **D**oubleint)	
ITB	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Convert contents of ACCU1 from integer (16bit) to BCD	1
			-	-	-	-	-	-	-	-	-	0 ... +/-999 (**I**nt. **T**o **B**CD)	
DTB	-		-	-	-	Y	Y	-	-	-	-	Convert contents of ACCU1 from integer (32bit) to BCD	1
												0 ... +/-9 999 999 (**D**oubleint. **T**o **B**CD)	
RND	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Convert a real number to 32bit integer	1
RND-	-		-	-	-	-	-	-	-	-	-	Convert a real number to 32bit integer	1
			-	-	-	Y	Y	-	-	-	-	The number is rounded next hole number	
RND+	-											Convert real number to 32bit integer	1
												It is rounded up to the next integer	
TRUNC	-											Convert real number to 32bit integer	1
												The places after the decimal point are truncated	
Complement creation			*Status word*										
INVI	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Forms the ones complement of ACCU1-L	1
INVD	-		-	-	-	-	-	-	-	-	-	Forms the ones complement of ACCU1	1
			-	-	-	-	-	-	-	-	-		
NEGI	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Forms the twos complement of ACCU1-L (integer)	1
NEGD	-		-	-	-	-	-	-	-	-	-	Forms the twos complement of ACCU1 (double integer)	1
			-	Y	Y	Y	Y	-	-	-	-		

Command	Operand	Parameter	Status word	Function	Length in words
			BR CC1 CC0 OV OS OR STA RLO /FC	: Instruction depends on : Instruction influences	

Comparison instructions

Comparison instructions with integer (16bit)			*Status word*									Comparing the integer (16bit) in ACCU1-L and ACCU2-L. RLO=1, if condition is satisfied.	
==I	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	ACCU2-L=ACCU1-L	1
<>I	-		-	-	-	-	-	-	-	-	-	ACCU2-L≠ACCU1-L	1
<I	-		-	Y	Y	0	-	0	Y	Y	1	ACCU2-L<ACCU1-L	1
<=I	-											ACCU2-L<=ACCU1-L	1
>I	-											ACCU2-L>ACCU1-L	1
>=I	-											ACCU2-L>=ACCU1-L	1
Comparison instructions with integer (32bit)			*Status word*									Comparing the integer (32bit) in ACCU1 and ACCU2. RLO=1, if condition is satisfied.	
==D	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	ACCU2=ACCU1	1
<>D	-		-	-	-	-	-	-	-	-	-	ACCU2≠ACCU1	1
<D	-		-	Y	Y	0	-	0	Y	Y	1	ACCU2<ACCU1	1
<=D	-											ACCU2<=ACCU1	1
>D	-											ACCU2>ACCU1	1
>=D	-											ACCU2>=ACCU1	1
Comparison instructions with 32bit real number			*Status word*									Comparing the 32bit real numbers in ACCU1 and ACCU2. RLO=1, is condition is satisfied. The execution time of the instruction depends on the value to be compared.	
==R	-		BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	ACCU2=ACCU1	1
<>R	-		-	-	-	-	-	-	-	-	-	ACCU2≠ACCU1	1
<R	-		-	Y	Y	Y	Y	0	Y	Y	1	ACCU2<ACCU1	1
<=R	-											ACCU2<=ACCU1	1
>R	-											ACCU2>ACCU1	1
>=R	-											ACCU2>=ACCU1	1

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Combination instructions (Bit)

Combination instructions with bit operands			*Status word*									Examining the signal state of the addressed instruction and gating the result with the RLO according to the appropriate logic function.	
A			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	AND operation at signal state "1"	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	Y	-	Y	Y	Input/output	1/2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	Y	Y	Y	1	Bit memory	1/2
	L a.b	parameterizable										Local data bit	2
	DBX a.b	0.0 ... 65535.7										Data bit	2
	DIX a.b	0.0 ... 65535.7										Instance data bit	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	[AR1,m]											area-crossing (AR1)	2
	[AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2
AN			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	AND operation of signal state "0"	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	Y	-	Y	Y	Input/output	1/2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	Y	Y	Y	1	Bit memory	1/2
	L a.b	parameterizable										Local data bit	2
	DBX a.b	0.0 ... 65535.7										Data bit	2
	DIX a.b	0.0 ... 65535.7										Instance data bit	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	[AR1,m]											area-crossing (AR1)	2
	[AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2
O			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	OR operation at signal state "1"	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	-	-	Y	Y	Input/output	1/2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	0	Y	Y	1	Bit memory	1/2
	L a.b	parameterizable										Local data bit	2
	DBX a.b	0.0 ... 65535.7										Data bit	2
	DIX a.b	0.0 ... 65535.7										Instance data bit	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	[AR1,m]											area-crossing (AR1)	2
	[AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Combination instructions with bit operands			*Status word*									Examining the signal state of the addressed instruction and gating the result with the RLO according to the appropriate logic function.	
ON			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	OR operation at signal state "0"	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	-	-	Y	Y	Input/output	1/2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	0	Y	Y	1	Bit memory	1/2
	L a.b	parameterizable										Local data bit	2
	DBX a.b	0.0 ... 65535.7										Data bit	2
	DIX a.b	0.0 ... 65535.7										Instance data bit	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	[AR1,m]											area-crossing (AR1)	2
	[AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2
X			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	EXCLUSIVE-OR operation at signal state "1"	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	-	-	Y	Y	Input/output	2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	0	Y	Y	1	Bit memory	2
	L a.b	parameterizable										Local data bit	2
	DBX a.b	0.0 ... 65535.7										data bit	2
	DIX a.b	0.0 ... 65535.7										Instance data bit	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	[AR1,m]											area-crossing (AR1)	2
	[AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2
XN			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	EXCLUSIVE-OR operation at signal state "0"	
	I/Q a.b	0.0 ... 2047.7	-	-	-	-	-	-	-	Y	Y	Input/output	2
	M a.b	0.0 ... 8191.7	-	-	-	-	-	0	Y	Y	1	Bit memory	2
	L a.b	parameterizable										Local data bit	2
	DBX a.b	0.0 ... 65535.7										Data bit	2
	DIX a.b	0.0 ... 65535.7										Instance data bit	2
	c [AR1,m]											register-indirect, area-internal (AR1)	2
	c [AR2,m]											register-indirect, area-internal (AR2)	2
	[AR1,m]											area-crossing (AR1)	2
	[AR2,m]											area-crossing (AR2)	2
	Parameter											via parameters	2

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
Combination instructions with parenthetical expressions			*Status word*									Saving the bits BR, RLO, OR and a function ID (A, AN, ...) at the nesting stack. For each block 7 nesting levels are possible.	
A(			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	AND left parenthesis	1
AN(			Y	-	-	-	-	Y	-	Y	Y	AND-NOT left parenthesis	1
O(			-	-	-	-	-	0	1	-	0	OR left parenthesis	1
ON(												OR-NOT left parenthesis	1
X(												EXCLUSIVE-OR left parenthesis	1
XN(												EXCLUSIVE-OR-NOT left parenthesis	1
)			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Right parenthesis, popping an entry off the nesting stack,	1
			-	-	-	-	-	-	-	Y	-	gating RLO with the current RLO in the processor	
			Y	-	-	-	-	Y	1	Y	1		
ORing of AND operations			*Status word*									The ORing of AND operations is implemented according the rule: AND before OR.	
O			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	OR operations of AND functions according the rule:	1
			-	-	-	-	-	Y	-	Y	Y	AND before OR	
			-	-	-	-	-	Y	1	-	Y		

Command	Operand	Parameter	Status word BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
Combination instructions with timer and counters			*Status word*									Examining the signal state of the addressed timer/counter an gating the result with the RLO according to the appropriate logic function.	
A			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	AND operation at signal state	
	T f	0 ... 511	-	-	-	-	-	Y	-	Y	Y	Timer	1/2
	C f	0 ... 511	-	-	-	-	-	Y	Y	Y	1	Counter	1/2
	Timer p.											Timer addressed via parameters	2
	Counter p.											Counter addressed via parameters	
AN			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	AND operation at signal state	
	T f	0 ... 511	-	-	-	-	-	Y	-	Y	Y	Timer	1/2
	C f	0 ... 511	-	-	-	-	-	Y	Y	Y	1	Counter	1/2
	Timer p.											Timer addressed via parameters	2
	Counter p.											Counter addressed via parameters	
O			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	OR operation at signal state	
	T f	0 ... 511	-	-	-	-	-	-	-	Y	Y	Timer	1/2
	C f	0 ... 511	-	-	-	-	-	0	Y	Y	1	Counter	1/2
	Timer p.											Timer addressed via parameters	2
	Counter p.											Counter addressed via parameters	
ON			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	OR operation at signal state	
	T f	0 ... 511	-	-	-	-	-	-	-	Y	Y	Timer	1/2
	C f	0 ... 511	-	-	-	-	-	0	Y	Y	1	Counter	1/2
	Timer p.											Timer addressed via parameters	2
	Counter p.											Counter addressed via parameters	
X			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	EXCLUSIVE-OR operation at signal state	
	T f	0 ... 511	-	-	-	-	-	-	-	Y	Y	Timer	2
	C f	0 ... 511	-	-	-	-	-	0	Y	Y	1	Counter	2
	Timer p.											Timer addressed via parameters	2
	Counter p.											Counter addressed via parameters	
XN			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	EXCLUSIVE-OR operation at signal state	
	T f	0 ... 511	-	-	-	-	-	-	-	Y	Y	Timer	2
	C f	0 ... 511	-	-	-	-	-	0	Y	Y	1	Counter	2
	Timer p.											Timer addressed via parameters	2
	Counter p.											Counter addressed via parameters	

Command	Operand	Parameter	Status word BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Combination instructions using AND, OR and EXCLUSIVE OR			*Status word*									Examining the specified conditions for their signal status, and gating the result with the RLO according to the appropriate function.	
A			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	AND operation at signal state "1"	
	==0		Y	Y	Y	Y	Y	Y	-	Y	Y	Result=0 (CC1=0) and (CC0=0)	1
	>0		-	-	-	-	-	Y	Y	Y	1	Result>0 (CC1=1) and (CC0=0)	1
	<0											Result<0 (CC1=0) and (CC0=1)	1
	<>0											Result≠0 ((CC1=0) and (CC0=1)) or ((CC1=1) and (CC0=0))	1
	<=0											Result<=0 ((CC1=0) and (CC0=1)) or ((CC1=0) and (CC0=0))	1
	>=0											Result>=0 ((CC1=1) and (CC0=0)) or ((CC1=1) and (CC0=0))	1
	UO											unordered (CC1=1) and (CC0=1)	1
	OS											OS=1	1
	BR											BR=1	1
	OV											OV=1	1
AN			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	AND operation at signal state "0"	
	==0		Y	Y	Y	Y	Y	Y	-	Y	Y	Result=0 (CC1=0) and (CC0=0)	1
	>0		-	-	-	-	-	Y	Y	Y	1	Result>0 (CC1=1) and (CC0=0)	1
	<0											Result<0 (CC1=0) and (CC0=1)	1
	<>0											Result≠0 ((CC1=0) and (CC0=1)) or ((CC1=1) and (CC0=0))	1
	<=0											Result<=0 ((CC1=0) and (CC0=1)) or ((CC1=0) and (CC0=0))	1
	>=0											Result>=0 ((CC1=1) and (CC0=0)) or ((CC1=1) and (CC0=0))	1
	UO											unordered (CC1=1) and (CC0=1)	1
	OS											OS=0	1
	BR											BR=0	1
	OV											OV=0	1
O			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	OR operation at signal state "1"	
	==0		Y	Y	Y	Y	Y	-	-	Y	Y	Result=0 (CC1=0) and (CC0=0)	1
	>0		-	-	-	-	-	0	Y	Y	1	Result>0 (CC1=1) and (CC0=0)	1
	<0											Result<0 (CC1=0) and (CC0=1)	1
	<>0											Result≠0 ((CC1=0) and (CC0=1)) or ((CC1=1) and (CC0=0))	1
	<=0											Result<=0 ((CC1=0) and (CC0=1)) or ((CC1=0) and (CC0=0))	1
	>=0											Result>=0 ((CC1=1) and (CC0=0)) or ((CC1=1) and (CC0=0))	1
	UO											unordered (CC1=1) and (CC0=1)	1
	OS											OS=1	1
	BR											BR=1	1
	OV											OV=1	1

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Combination instructions using AND, OR and EXCLUSIVE OR			*Status word*									Examining the specified conditions for their signal status, and gating the result with the RLO according to the appropriate function.	
ON			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	OR operation at signal state "0"	
	==0		Y	Y	Y	Y	Y	-	-	Y	Y	Result=0 (CC1=0) and (CC0=0)	1
	>0		-	-	-	-	-	0	Y	Y	1	Result>0 (CC1=1) and (CC0=0)	1
	<0											Result<0 (CC1=0) and (CC0=1)	1
	<>0											Result≠0 ((CC1=0) and (CC0=1)) or ((CC1=1) and (CC0=0))	1
	<=0											Result<=0 ((CC1=0) and (CC0=1)) or ((CC1=0) and (CC0=0))	1
	>=0											Result>=0 ((CC1=1) and (CC0=0)) or ((CC1=1) and (CC0=0))	1
	UO											unordered (CC1=1) and (CC0=1)	1
	OS											OS=0	1
	BR											BR=0	1
	OV											OV=0	1
X			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	EXCLUSIVE-OR operation at signal state "1"	
	==0		Y	Y	Y	Y	Y	-	-	Y	Y	Result=0 (CC1=0) and (CC0=0)	1
	>0		-	-	-	-	-	0	Y	Y	1	Result>0 (CC1=1) and (CC0=0)	1
	<0											Result<0 (CC1=0) and (CC0=1)	1
	<>0											Result≠0 ((CC1=0) and (CC0=1)) or ((CC1=1) and (CC0=0))	1
	<=0											Result<=0 ((CC1=0) and (CC0=1)) or ((CC1=0) and (CC0=0))	1
	>=0											Result>=0 ((CC1=1) and (CC0=0)) or ((CC1=1) and (CC0=0))	1
	UO											unordered (CC1=1) and (CC0=1)	1
	OS											OS=1	1
	BR											BR=1	1
	OV											OV=1	1
XN			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	EXCLUSIVE-OR operation at signal state "0"	
	==0		Y	Y	Y	Y	Y	-	-	Y	Y	Result=0 (CC1=0) and (CC0=0)	1
	>0		-	-	-	-	-	0	Y	Y	1	Result>0 (CC1=1) and (CC0=0)	1
	<0											Result<0 (CC1=0) and (CC0=1)	1
	<>0											Result≠0 ((CC1=0) and (CC0=1)) or ((CC1=1) and (CC0=0))	1
	<=0											Result<=0 ((CC1=0) and (CC0=1)) or ((CC1=0) and (CC0=0))	1
	>=0											Result>=0 ((CC1=1) and (CC0=0)) or ((CC1=1) and (CC0=0))	1
	UO											unordered (CC1=1) and (CC0=1)	1
	OS											OS=0	1
	BR											BR=0	1
	OV											OV=0	1

Command	Operand	Parameter	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Function	Length in words
												: Instruction depends on	
												: Instruction influences	

Combination instructions (Word)

Combination instructions with the contents of ACCU1			*Status word*									Gating the contents of ACCU1 and/or ACCU1-L with a word or double word according to the appropriate function. The word or double word is either a constant in the instruction or in ACCU2. The result is in ACCU1 and/or ACCU1-L.	
AW			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	AND ACCU2-L	1
AW	k16		-	-	-	-	-	-	-	-	-	AND 16bit constant	2
OW			-	Y	0	0	-	-	-	-	-	OR ACCU2-L	1
OW	k16											OR 16bit constant	2
XOW												EXCLUSIVE OR ACCU2-L	1
XOW	k16											EXCLUSIVE OR 16bit constant	2
AD												AND ACCU2	1
AD	k32											AND 32bit constant	3
OD												OR ACCU2	1
OD	k32											OR 32bit constant	3
XOD												EXCLUSIVE OR ACCU2	1
XOD	k32											EXCLUSIVE OR 32bit constant	3

Timer instructions

Time instructions			*Status word*									Starting or resetting a timer (addressed directly or via parameters). The time value must be in ACCU1-L.	
SP	T f	0 ... 511	BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC	Start time as pulse on edge change from "0" to "1"	1/2
	Timer par.		-	-	-	-	-	-	-	Y	-		2
SE	T f	0 ... 511	-	-	-	-	-	0	-	-	0	Start timer as extended pulse on edge change from	1/2
	Timer par.											"0" to "1"	2
SD	T f	0 ... 511										Start timer as ON delay on edge change	1/2
	Timer par.											from "0" to "1"	2
SS	T f	0 ... 511										Start timer as saving start delay on edge change	1/2
	Timer par.											from "0" to "1"	2
SA	T f	0 ... 511										Start timer as OFF delay on edge change from	1/2
	Timer par.											"1" to "0"	2
FR	T f	0 ... 511										Enable timer for restarting on edge change from "0" to "1"	1/2
	Timer par.											(reset edge bit memory for starting timer)	2
R	T f	0 ... 511										Reset timer	1/2
	Timer par.												2

Command	Operand	Parameter	Status word									Function	Length in words
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
												: Instruction depends on	
												: Instruction influences	

Counter instructions

Counter instructions			*Status word*									The counter value is in ACCU1-L res. in the address transferred as parameter.	
			BR	CC1	CC0	OV	OS	OR	STA	RLO	/FC		
S	C f Counter p.	0 ... 511	-	-	-	-	-	-	-	Y	-	Presetting of counter on edge change from "0" to "1"	1/2 2
R	C f Counter p.	0 ... 511	-	-	-	-	-	0	-	-	0	Reset counter to "0" on edge change from "0" to "1"	1/2 2
CU	C f Counter p.	0 ... 511										Increment counter by 1 on edge change from "0" to "1"	1/2 2
CD	C f Counter p.	0 ... 511										Decrement counter by 1 on edge change from "0" to "1"	1/2 2
FR	C f Counter p.	0 ... 511										Enable counter on edge change from "0" to "1" (reset the edge bit memory for up and down counting)	1/2 2

Chapter 2 Organization Blocks

Overview

Here the description of the integrated organization blocks of the VIPA SPEED7 CPUs may be found.

Content

Overview

General

OBs (**O**rganization **b**locks) are the interface between the operating system of the CPU and the user program. For the main program OB 1 is used. There are reserved numbers corresponding to the call event of the other OBs. Organization blocks are executed corresponding to their priority.

OBs are used to execute specific program sections:

- at the startup of the CPU
- in a cyclic or clocked execution
- whenever errors occur
- whenever hardware interrupts occur

Integrated OBs

The following organization blocks (OBs) are available:

OB	Description
OB 1	Main program (cyclic)
OB 10	Time-of-day interrupt
OB 11	Time-of-day interrupt
OB 20	Time-delay interrupt
OB 21	Time-delay interrupt
OB 28	Watchdog interrupt (250μs)
OB 29	Watchdog interrupt (500μs)
OB 32	Watchdog interrupt (1s)
OB 33	Watchdog interrupt (500ms)
OB 34	Watchdog interrupt (200ms)
OB 35	Watchdog interrupt (100ms)
OB 40	Hardware interrupt
OB 41	Hardware interrupt
OB 57	Manufacturer Specific Interrupt OB
OB 80	Time error (cycle time exceeded or clock alarm run out)
OB 81	Power supply fault
OB 82	Diagnostics interrupt
OB 85	Program execution error (OB not available or Periphery error at update process image)
OB 86	Slave failure / restart
OB 100	Restart
OB 121	Programming error (synchronous error)
OB 122	Periphery access error

OB 1 - Main program

Description

The operating system of the CPU executes OB 1 cyclically. After STARTUP to RUN the cyclical processing of the OB 1 is started. OB 1 has the lowest priority (priority 1) of each cycle time monitored OB. Within the OB 1 functions and function blocks can be called.

Function

When OB 1 has been executed, the operating system sends global data. Before restarting OB 1, the operating system writes the process-image output table to the output modules, updates the process-image input table and receives any global data for the CPU.

Cycle time

Cycle time is the time required for processing the OB 1. It also includes the scan time for higher priority classes which interrupt the main program respectively communication processes of the operating system. This comprises system control of the cyclic program scanning, process image update and refresh of the time functions.

By means of the Siemens SIMATIC manager the recent cycle time of an online connected CPU may be shown.
With **PLC** > *Module Information* > *Scan cycle time* the min., max. and recent cycle time can be displayed.

Scan cycle monitoring time

The CPU offers a scan cycle watchdog for the *max. cycle time*. The default value for the *max. cycle time* is 150ms as *scan cycle monitoring time*. This value can be reconfigured or restarted by means of the SFC 43 (RE_TRIGR) at every position of your program. If the main program takes longer to scan than the specified *scan cycle monitoring time*, the OB 80 (Timeout) is called by the CPU. If OB 80 has not been programmed, the CPU goes to STOP.

Besides the monitoring of the *max. cycle time* the observance of the *min cycle time* can be guaranteed. Here the restart of a new cycle (writing of process image of the outputs) is delayed by the CPU as long as the *min. cycle time* is reached.

Access to local data

The CPU's operating system forwards start information to OB 1, as it does to every OB, in the first 20 bytes of temporary local data.

The start information can be accessed by means of the system function SFC 6 RD_SINFO. Note that direct reading of the start information for an OB is possible only in that OB because that information consists of temporary local data.
More information can be found at chapter "Integrated standard SFCs".

Local data

The following table describes the start information of the OB 1 with default names of the variables and its data types:

Variable	Type	Description
OB1_EV_CLASS	BYTE	Event class and identifiers: 11h: OB 1 active
OB1_SCAN_1	BYTE	01h: completion of a restart 02h: completion of a hot restart 03h: completion of the main cycle 04h: completion of a cold restart 05h: first OB 1 cycle of the new master CPU after master-reserve switchover and STOP of the previous master
OB1_PRIORITY	BYTE	Priority class: 1
OB1_OB_NUMBR	BYTE	OB number (01)
OB1_RESERVED_1	BYTE	reserved
OB1_RESERVED_2	BYTE	reserved
OB1_PREV_CYCLE	INT	Run time of previous cycle (ms)
OB1_MIN_CYCLE	INT	Minimum cycle time (ms) since the last startup
OB1_MAX_CYCLE	INT	Maximum cycle time (ms) since the last startup
OB1_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

OB 10, OB 11 - Time-of-day Interrupt

Description

Time-of-day interrupts are used when you want to run a program at a particular time, either once only or periodically. Time-of-day interrupts can be configured within the hardware configuration or controlled by means of system functions in your main program at run time.

The prerequisite for proper handling of time-of-day interrupts is a correctly set real-time clock on the CPU.

For execution there are the following intervals:

- once
- every minute
- hourly
- daily
- weekly
- monthly
- once at year
- at the end of each month

Note!
For monthly execution of a time-of-day interrupt OBs, only the day 1, 2, ...28 can be used as a starting date.

Function

To start a time-of-day interrupt, you must first set and than activate the interrupt. The three following start possibilities exist:

- The time-of-day interrupts are configured via the hardware configuration. Open the selected CPU with **Edit** > *Object properties* > *Time-of-Day* interrupts. Here the corresponding time-of-day interrupts may be adjusted and activated. After transmission to CPU and startup the monitoring of time-of-day interrupt is automatically started.
- Set the time-of-day interrupt within the hardware configuration as shown above and then activate it by calling SFC 30 ACT_TINT in your program.
- You set the time-of-day interrupt by calling SFC 28 SET_TINT and then activate it by calling SFC 30 ACT_TINT.

The time-of-day interrupt can be delayed and enabled with the system functions SFC 41 DIS_AIRT and SFC 42 EN_AIRT.

Behavior on error

If a time-of-day interrupt OB is called but was not programmed, the operating system calls OB 85. If OB 85 was not programmed, the CPU goes to STOP. Is there an error at time-of-day interrupt processing e.g. start time has already passed, the time error OB 80 is called. The time-of-day interrupt OB is then executed precisely once.

Possibilities of activation

The possibilities of activation of time-of-day interrupts is shown at the following table:

Interval	Description
Not activated	The time-of-day interrupt is not executed, even when loaded in the CPU. It may be activated by calling SFC 30.
Activated once only	The time-of-day OB is cancelled automatically after it runs the one time specified. Your program can use SFC 28 and SFC 30 to reset and reactivate the OB.
Activated periodically	When the time-of-day interrupt occurs, the CPU calculates the next start time for the time-of-day interrupt based on the current time of day and the period.

Local data for time-of-day interrupt OB

The following table describes the start information of the OB 10 and 11 with default names of the variables and its data types:

Variable	Type	Description
OB10_EV_CLASS	BYTE	Event class and identifiers: 11h: interrupt is active
OB10_STRT_INFO	BYTE	11h: Start request for OB 10 12h: Start request for OB 11
OB10_PRIORITY	BYTE	Assigned priority class: default 2
OB10_OB_NUMBR	BYTE	OB number (10, 11)
OB10_RESERVED_1	BYTE	reserved
OB10_RESERVED_2	BYTE	reserved
OB10_PERIOD_EXE	WORD	The OB is executed at the specified intervals: 0000h: once 0201h: once every minute 0401h: once hourly 1001h: once daily 1201h: once weekly 1401h: once monthly 1801h: once yearly 2001h: end of month
OB10_RESERVED_3	INT	reserved
OB10_RESERVED_4	INT	reserved
OB10_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

OB 20, OB 21 - Time-delay Interrupt

Description

A time-delay interrupt allows you to implement a delay timer independently of the standard timers. The time-delay interrupts can be configured within the hardware configuration respectively controlled by means of system functions in your main program at run time.

Activation

For the activation no hardware configuration is necessary. The time-delay interrupt is started by calling SFC 32 SRT_DINT and by transferring the corresponding OB to the CPU. Here the function needs OB no., delay time and a sign. When the delay interval has expired, the respective OB is called by the operating system. The time-delay interrupt that is just not activated can be cancelled with SFC 33 CAN_DINT respectively by means of the SFC 34 QRY_DINT the status can be queried. It can be blocked with SFC 39 DIS_IRT and released with SFC 40 EN_IRT. More information for using the SFCs can be found at chapter "Integrated standard SFCs".
The priority of the corresponding OBs are changed via the hardware configuration. For this open the selected CPU with **Edit** > *Object properties* > *Interrupts*. Here the corresponding priority can be adjusted.

Behavior on error

If a time-delay interrupt OB is called but was not programmed, the operating system calls OB 85. If OB 85 was not programmed, the CPU goes to STOP. Is there an error at time-delay interrupt processing e.g. delay interval has expired and the associated OB is still executing, the time error OB 80 is called. The time-of-day interrupt OB is then executed. If there is no OB 80 in the user program the CPU goes to STOP

Local data

The following table describes the start information of the OB 20 and 21 with default names of the variables and its data types:

Variable	Type	Description
OB20_EV_CLASS	BYTE	Event class and identifiers: 11h: interrupt is active
OB20_STRT_INF	BYTE	21h: start request for OB 20 22h: start request for OB 21
OB20_PRIORITY	BYTE	assigned priority class: Default 3 (OB 20), 4 (OB 21)
OB20_OB_NUMBR	BYTE	OB number (20, 21)
OB20_RESERVED_1	BYTE	reserved
OB20_RESERVED_2	BYTE	reserved
OB20_SIGN	WORD	User ID: input parameter SIGN from the call for SFC 32 (SRT_DINT)
OB20_DTIME	TIME	Configured delay time in ms
OB20_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

OB 28, 29, 32, 33, 34, 35 - Watchdog Interrupt

Description

By means of a watchdog interrupt the cyclical processing can be interrupted in equidistant time intervals The start time of the time interval and the phase offset is the instant of transition from STARTUP to RUN after execution of OB 100.

Watchdog interrupt OB	Default time interval	Default priority class	Option for phase offset
OB 28	250µs	24	no*
OB 29	500µs	24	no*
OB 32	1s	09	yes
OB 33	500ms	10	yes
OB 34	200ms	11	yes
OB 35	100ms	12	yes

*) If both OBs are activated OB 28 is executed first and then OB 29. Due to the very short time intervals and the high priority a simultaneous execution of OB 28 and OB 29 should be avoided.

Activation

A watchdog interrupt is activated by programming the corresponding OB within the CPU.

The watchdog interrupt can be delayed and enabled with the system functions SFC 41 DIS_AIRT and SFC 42 EN_AIRT.

Function

After startup to RUN the activated watchdog OBs are called in the configured equidistant intervals with consideration of the phase shift.

The equidistant start times of the Watchdog OBs result of the respective time frame and the phase shift.

So a sub program can be called time controlled by programming a respective OB.

Phase offset

The phase offset can be used to stagger the execution of watchdog interrupt handling routines despite the fact that these routines are timed to a multiple of the same interval. The use of the phase offset achieves a higher interval accuracy.

The start time of the time interval and the phase offset is the instant of transition from STARTUP to RUN. The call instant for a watchdog interrupt OB is thus the time interval plus the phase offset.

Parameterization

Time interval, phase offset (not OB 28, 29) and priority may be parameterized by the hardware configurator. Depending on the OB there are the following possibilities for parameterization:

OB 28, 29, 33, 34: Parameterizable as VIPA specific parameter by the properties of the SPEED7 CPU.

OB 32, 35: Parameterizable by Siemens CPU 318-2DP.

Note!

You must make sure that the run time of each cyclic interrupt OB is significantly shorter than its interval. Otherwise the time error OB 80 is started. The watchdog interrupt that caused the error is executed later.

Local data

The following table describes the start information of the OB 28, 29, 32 and 35 with default names of the variables and its data types:

Variable	Type	Description
OB35_EV_CLASS	BYTE	Event class and identifiers: 11h: Cyclic interrupt is active
OB35_STRT_INF	BYTE	2Fh: Start request for OB 28 30h: Start request for OB 29 33h: Start request for OB 32 36h: Start request for OB 35
OB35_PRIORITY	BYTE	Assigned priority class; Defaults: 24 (OB 28, 29); 9 (OB 32), 12 (OB 35)
OB35_OB_NUMBR	BYTE	OB number (28, 29, 32, 35)
OB35_RESERVED_1	BYTE	reserved
OB35_RESERVED_2	BYTE	reserved
OB35_PHASE_OFFSET	WORD	Phase offset in ms
OB35_RESERVED_3	INT	reserved
OB35_EXT_FREQ	INT	Interval in ms
OB35_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

Note!

Since the blocks SFC58/59 respectively SFB52/53 for reading and writing data blocks cannot be interrupted, in conjunction with OB 28 and OB 29 the CPU may change to STOP state!

OB 40, OB 41 - Hardware Interrupt

Description

Hardware interrupts are used to enable the immediate detection in the user program of events in the controlled process, making it possible to respond with an appropriate interrupt handling routine. Here OB 40 and OB 41 can be used.

Within the configuration you specify for each module, which channels release a hardware interrupt during which conditions.
With the system functions SFC 55 WR_PARM, SFC 56 WR_DPARM and SFC 57 PARM_MOD you can (re)parameterize the modules with hardware interrupt capability even in RUN.

Activation

The hardware interrupt processing of the CPU is always active. So that a module can release a hardware interrupt, you have to activate the hardware interrupt on the appropriate module by a hardware configuration.

Here you can specify whether the hardware interrupt should be generated for a coming event, a leaving event or both.

Function

After a hardware interrupt has been triggered by the module, the operating system identifies the slot and the corresponding hardware interrupt OB. If this OB has a higher priority than the currently active priority class, it will be started. The channel-specific acknowledgement is sent after this hardware interrupt OB has been executed.

If another event that triggers a hardware interrupt occurs on the same module during the time between identification and acknowledgement of a hardware interrupt, the following applies:

- If the event occurs on the channel that previously triggered the hardware interrupt, then the new interrupt is lost.
- If the event occurs on another channel of the same module, then no hardware interrupt can currently be triggered. This interrupt, however, is not lost, but is triggered if just active after the acknowledgement of the currently active hardware interrupt. Else it is lost.
- If a hardware interrupt is triggered and its OB is currently active due to a hardware interrupt from another module, the new request can be processed only if it is still active after acknowledgement.

During STARTUP there is no hardware interrupt produced. The treatment of interrupts starts with the transition to operating mode RUN. Hardware interrupts during transition to RUN are lost.

Behavior on error

If a hardware interrupt is generated for which there is no hardware interrupt OB in the user program, OB 85 is called by the operating system. The hardware interrupt is acknowledged. If OB 85 has not been programmed, the CPU goes to STOP.

Diagnostic interrupt

While the treatment of a hardware interrupt a diagnostic interrupt can be released. Is there, during the time of releasing the hardware interrupt up to its acknowledgement, on the same channel a further hardware interrupt, the loss of the hardware interrupt is announced by means of a diagnostic interrupt for system diagnostics.

Local data

The following table describes the start information of the OB 40 and 41 with default names of the variables and its data types:

Variable	Type	Description
OB40_EV_CLASS	BYTE	Event class and identifiers: 11h: Interrupt is active
OB40_STRT_INF	BYTE	41h: Interrupt via Interrupt line 1
OB40_PRIORITY	BYTE	Assigned priority class: Default: 16 (OB 40) Default: 17 (OB 41)
OB40_OB_NUMBR	BYTE	OB number (40, 41)
OB40_RESERVED_1	BYTE	reserved
OB40_IO_FLAG	BYTE	Input Module: 54h Output Module: 55h
OB40_MDL_ADDR	WORD	Logical base address of the module that triggers the interrupt
OB40_POINT_ADDR	DWORD	For digital modules: bit field with the statuses of the inputs on the module (Bit 0 corresponds to the first input). For analog modules: bit field, informing which channel has exceeded which limit. For CPs or IMs: Module interrupt status
OB40_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

OB 57 - Manufacturer Specific Interrupt OB

Description

The OB 57 is called by the operating system of the CPU if an manufacturer specific interrupt was triggered via the slot of a CAN slave.

Local data

The following table describes the start information of the OB 57 with default names of the variables and its data types:

Variable	Data type	Description
OB57_EV_CLASS	BYTE	Event class and identifiers: 11h: incoming event
OB57_STRT_INF	BYTE	57h: Start request for OB 57
OB57_PRIORITY	BYTE	Configured priority class: Default value: 2
OB57_OB_NUMBR	BYTE	OB number (57)
OB57_RESERVED_1	BYTE	reserved
OB57_IO_FLAG	BYTE	Input module 54h Output module 55h
OB57_MDL_ADDR	WORD	Logical base address of the module that triggers the interrupt
OB57_LEN	BYTE	reserved
OB57_TYPE	BYTE	reserved
OB57_SLOT	BYTE	reserved
OB57_SPEC	BYTE	reserved
OB57_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

OB 80 - Time Error

Description

The operating system of the CPU calls OB 80 whenever an error occurs like:

- Cycle monitoring time exceeded
- OB request error i.e. the requested OB is still executed or an OB was requested too frequently within a given priority class.
- Time-of-day interrupt error i.e. interrupt time past because clock was set forward or after transition to RUN.

The time error OB can be blocked, respectively delayed and released by means of SFC 39 ... 42.

Note!

If OB 80 has not been programmed, the CPU changes to the STOP mode.

If OB 80 is called twice during the same scan cycle due to the scan time being exceeded, the CPU changes to the STOP mode. You can prevent this by calling SFC 43 RE_TRIGR at a suitable point in the program.

Local data

The following table describes the start information of the OB 80 with default names of the variables and its data types:

Variable	Type	Description
OB80_EV_CLASS	BYTE	Event class and identifiers: 35h
OB80_FLT_ID	BYTE	Error code (possible values: 01h, 02h, 05h, 06h, 07h, 08h, 09h, 0Ah)
OB80_PRIORITY	BYTE	Priority class: 26 (RUN mode) 28 (Overflow of the OB request buffer)
OB80_OB_NUMBR	BYTE	OB number (80)
OB80_RESERVED_1	BYTE	reserved
OB80_RESERVED_2	BYTE	reserved
OB80_ERROR_INFO	WORD	Error information: depending on error code
OB80_ERR_EV_CLASS	BYTE	Event class for the start event that caused the error
OB80_ERR_EV_NUM	BYTE	Event number for the start event that caused the error
OB80_OB_PRIORITY	BYTE	Error information: depending on error code
OB80_OB_NUM	BYTE	Error information: depending on error code
OB80_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

Variables depending on error code

The variables dependent on the error code have the following allocation:

Error code	Variable	Bit	Description
01h			*Cycle time exceeded*
	OB80_ERROR_INFO		Run time of last scan cycle (ms)
	OB80_ERR_EV_CLASS		Class of the event that triggered the interrupt
	OB80_ERR_EV_NUM		Number of the event that triggered the interrupt
	OB80_OB_PRIORITY		Priority class of the OB which was being executed when the error occurred
	OB80_OB_NUM		Number of the OB which was being executed when the error occurred
02h			*The called OB is still being executed*
	OB80_ERROR_INFO		The respective temporary variable of the called block which is determined by
			OB80_ERR_EV_CLASS and
			OB80_ERR_EV_NUM
	OB80_ERR_EV_CLASS		Class of the event that triggered the interrupt
	OB80_ERR_EV_NUM		Number of the event that triggered the interrupt
	OB80_OB_PRIORITY		Priority class of the OB causing the error
	OB80_OB_NUM		Number of the OB causing the error
05h and 06h			*Elapsed time-of-day interrupt due to moving the clock forward*
			Elapsed time-of-day interrupt on return to RUN after HOLD
	OB80_ERROR_INFO	Bit 0 = "1"	The start time for time-of-day interrupt 0 is in the past
		...	...
		Bit 7 = "1"	The start time for time-of-day interrupt 7 is in the past
		Bit 15 ... 8	Not used
	OB80_ERR_EV_CLASS		Not used
	OB80_ERR_EV_NUM		Not used
	OB80_OB_PRIORITY		Not used
	OB80_OB_NUM		Not used

continued ...

... continue error code

Error code	Variable	Bit	Description
07h	meaning of the parameters see error code 02h		*Overflow of OB request buffer for the current priority class* (Each OB start request for a priority class will be entered in the corresponding OB request buffer; after completion of the OB the entry will be deleted. If there are more OB start requests for a priority class than the maximum permitted number of entries in the corresponding Ob request buffer OB 80 will be called with error code 07h)
08h			*Synchronous-cycle interrupt time error*
09h			*Interrupt loss due to high interrupt load*
0Ah	OB80_ERROR_INFO		*Resume RUN after CiR (**C**onfiguration **i**n **R**UN)* CiR synchronizations time in ms

OB 81 - Power supply Error

Description

The operating system of the CPU calls OB 81 whenever an event occurs that is triggered by an error or fault related to the power supply (when entering and when outgoing event).

The CPU does not change to the STOP mode if OB 81 is not programmed.

You can disable or delay and re-enable the power supply error OB using SFCs 39 ... 42.

Local Data

The following table describes the start information of the OB 81 with default names of the variables and its data types:

Variable	Data type	Description
OB81_EV_CLASS	BYTE	Event class and identifiers: 39h: incoming event
OB81_FLT_ID	BYTE	Error code: 22h: Back-up voltage missing
OB81_PRIORITY	BYTE	Priority class: 28 (mode STARTUP)
OB81_OB_NUMBR	BYTE	OB-NR. (81)
OB81_RESERVED_1	BYTE	reserved
OB81_RESERVED_2	BYTE	reserved
OB81_RACK_CPU	WORD	Bit 2 ... 0: 000 (Rack number) Bit 3: 1 (master CPU) Bit 7 ... 4: 1111 (fix)
OB81_RESERVED_3	BYTE	reserved
OB81_RESERVED_4	BYTE	reserved
OB81_RESERVED_5	BYTE	reserved
OB81_RESERVED_6	BYTE	reserved
OB80_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

OB 82 - Diagnostic Interrupt

Description

The system diagnostic is the detection, evaluation and reporting of messages which occur within a PLC system. Examples of errors for these messages could be errors in the user program, module failures or wire breaks on signaling modules.
If a module with diagnostic capability for which you have enabled the diagnostic interrupt detects an error, it outputs a request for a diagnostic interrupt to the CPU (when entering and outgoing event). The operating system then calls OB82.
The local variables of OB82 contain the logical base address as well as four bytes of diagnostic data of the defective module.
If OB82 has not been programmed, the CPU changes to the STOP mode.

You can delay and re-enable the diagnostic interrupt OB using SFC 41 DIS_AIRT and SFC 42 EN_AIRT.

Diagnostic in ring buffer

All diagnostic events reported to the CPU operating system are entered in the diagnostic buffer in the order in which they occurred, and with date and time stamp. This is a buffered memory area on the CPU that retains its contents even in the event of a memory reset.

The diagnostic buffer is a ring buffer with. VIPA CPUs offer space for 100 entries. When the diagnostic buffer is full, the oldest entry is overwritten by the newest. By use of the *PLC functions* of the Siemens SIMATIC manager the diagnostic buffer can be queried.

Besides of the standard entries in the diagnostic buffer, the VIPA CPUs support some additional specific entries in form of event-IDs. More information may be found at the manual of the CPU at the chapter "Deployment of the CPU ..." at "VIPA specific diagnostic entries".

Configurable Diagnostics

Programmable diagnostic events are reported only when you have set the parameters necessary to enable diagnostics. Non-programmable diagnostics events are always reported, regardless of whether or not diagnostics have been enabled.

Write diagnostics user entry with SFC

A diagnostic entry can be written to the diagnostic buffer by means of the system function SFC 52 WR_USMSG.

More information can be found at chapter "Integrated standard SFCs".

Read diagnostic data with SFC 59

You can use system function SFC 59 RD_REC (read record set) in OB 82 to obtain detailed error information. The diagnostic information are consistent until OB 82 is exited, that is, they remain "frozen". Exiting of OB 82 acknowledges the diagnostic interrupt on the module.

The module's diagnostic data is in record sets DS 0 and DS 1. The record set DS 0 contains 4 byte of diagnostic data describing the current status of the module. The contents of these 4 byte are identical to the contents of byte 8 ... 11 of the OB 82 start information

Record set DS 1 contains the 4 byte from record set DS 0 and, in addition, the module specific diagnostic data.

More information about module specific diagnostic data can be found at the description of the appropriate module.

Local data

The following table describes the start information of the OB 82 with default names of the variables and its data types:

Variable	Data type	Description
OB82_EV_CLASS	BYTE	Event class and identifiers: 38h: outgoing event 39h: incoming event
OB82_FLT_ID	BYTE	Error code (42h)
OB82_PRIORITY	BYTE	Priority class: can be assigned via hardware configuration
OB82_OB_NUMBR	BYTE	OB number (82)
OB82_RESERVED_1	BYTE	reserved
OB82_IO_FLAG	BYTE	Input Module 54h Output Module 55h
OB82_MDL_ADDR	INT	Logical base address of the module where the fault occurred
OB82_MDL_DEFECT	BOOL	Module is defective
OB82_INT_FAULT	BOOL	Internal fault
OB82_EXT_FAULT	BOOL	External fault
OB82_PNT_INFO	BOOL	Channel fault
OB82_EXT_VOLTAGE	BOOL	External voltage failed
OB82_FLD_CONNCTR	BOOL	Front panel connector not plugged in
OB82_NO_CONFIG	BOOL	Module is not configured
OB82_CONFIG_ERR	BOOL	Incorrect parameters on module
OB82_MDL_TYPE	BYTE	Bit 3 ... 0: Module class Bit 4: Channel information exists Bit 5: User information exists Bit 6: Diagnostic interrupt from substitute Bit 7: Reserved
OB82_SUB_MDL_ERR	BOOL	Submodule is missing or has an error
OB82_COMM_FAULT	BOOL	Communication failure
OB82_MDL_STOP	BOOL	Operating mode (0: RUN, 1:STOP)
OB82_WTCH_DOG_FLT	BOOL	Watchdog timer responded
OB82_INT_PS_FLT	BOOL	Internal power supply failed
OB82_PRIM_BATT_FLT	BOOL	Battery exhausted
OB82_BCKUP_BATT_FLT	BOOL	Entire backup failed
OB82_RESERVED_2	BOOL	Reserved
OB82_RACK_FLT	BOOL	Expansion rack failure
OB82_PROC_FLT	BOOL	Processor failure
OB82_EPROM_FLT	BOOL	EPROM fault
OB82_RAM_FLT	BOOL	RAM fault
OB82_ADU_FLT	BOOL	ADC/DAC error
OB82_FUSE_FLT	BOOL	Fuse tripped
OB82_HW_INTR_FLT	BOOL	Hardware interrupt lost
OB82_RESERVED_3	BOOL	Reserved
OB82_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

OB 85 - Program execution Error

Description

The operating system of the CPU calls OB 85 whenever one of the following events occurs:

- Start event for an OB that has not been loaded
- Error when the operating system accesses a block
- I/O access error during update of the process image by the system (if the OB 85 call was not suppressed due to the configuration)

The OB 85 may be delayed by means of the SFC 41 and re-enabled by the SFC 42.

Note!

If OB 85 has not been programmed, the CPU changes to STOP mode when one of these events is detected.

Local data

The following table describes the start information of the OB 85 with default names of the variables and its data types:

Variable	Type	Description
OB85_EV_CLASS	BYTE	Event class and identifiers: 35h 38h (only with error code B3h, B4h) 39h (only with error code B1h, B2h, B3h, B4h)
OB85_FLT_ID	BYTE	Error code (possible values: A1h, A2h, A3h, A4h, B1h, B2h, B3h, B4h)
OB85_PRIORITY	BYTE	Priority class: 26 (Default value mode RUN) 28 (mode ANLAUF)
OB85_OB_NUMBR	BYTE	OB number (85)
OB85_RESERVED_1	BYTE	reserved
OB85_RESERVED_2	BYTE	reserved
OB85_RESERVED_3	INT	reserved
OB85_ERR_EV_CLASS	BYTE	Class of the event that caused the error
OB85_ERR_EV_NUM	BYTE	Number of the event that caused the error
OB85_OB_PRIOR	BYTE	Priority class of the OB that was active when the error occurred
OB85_OB_NUM	BYTE	Number of the OB that was active when the error occurred
OB85_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

OB 85 dependent on error codes

If you want to program OB 85 dependent on the possible error codes, we recommend that you organize the local variables as follows:

Variable	Type
OB85_EV_CLASS	BYTE
OB85_FLT_ID	BYTE
OB85_PRIORITY	BYTE
OB85_OB_NUMBR	BYTE
OB85_DKZ23	BYTE
OB85_RESERVED_2	BYTE
OB85_Z1	WORD
OB85_Z23	DWORD
OB85_DATE_TIME	DATE_AND_TIME

The following table shows the event that started OB 85:

OB85_EV_CLASS	OB85_FLT_ID	Variable	Description
35h	A1h, A2h		As a result of your configuration your program or the operating system creates a start event for an OB that is not loaded on the CPU.
	A1h, A2h	OB85_Z1	The respective local variable of the called OB that is determined by OB85_Z23.
	A1h, A2h	OB85_Z23	high word: Class and number of the event causing the OB call low word, high byte: Program level and OB active at the time of error low word, low byte: Active OB
35h	A3h		Error when the operating system accesses a module
		OB85_Z1	Error ID of the operating system high byte: 1: Integrated function 2: IEC-Timer low byte: 0: no error resolution 1: block not loaded 2: area length error 3: write-protect error

continued ...

... continue

OB85_EV_CLASS	OB85_FLT_ID	Variable	Description
		OB85_Z23	high word: block number low word: Relative address of the MC7 command causing the error. The block type must be taken from OB85_DKZ23. (88h: OB, 8Ch: FC, 8Eh: FB, 8Ah: DB)
35h	A4h		PROFINET DB cannot be addressed
34h	A4h		PROFINET DB can be addressed again
39h	B1h		I/O access error when updating the process image of the inputs
	B2h		I/O access error when transferring the output process image to the output modules
	B1h, B2h	OB85_DKZ23	ID of the type of process image transfer where the I/O access error happened. 10: Byte access 20: Word access 30: DWord access 57h: Transmitting a configured consistency range
	B1h, B2h	OB85_Z1	Reserved for internal use by the CPU: logical base address of the module If OB85_RESERVED_2 has the value 76h OB85_Z1 receives the return value of the affected SFC
	B1h, B2h	OB85_Z23	Byte 0: Part process image number Byte 1: Irrelevant, if OB85_DKZ23=10, 20 or 30 OB85_DKZ23=57: Length of the consistency range in bytes Byte 2, 3 The I/O address causing the PII, if OB85_DKZ23=10, 20 or 30 OB85_DKZ23=57: Logical start address of the consistency range
You obtain the error codes B1h and B2h if you have configured the repeated OB 85 call of I/O access errors for the system process image table update.			

continued ...

... continue

OB85_EV_CLASS	OB85_FLT_ID	Variable	Description
38h, 39h	B3h		I/O access error when updating the process image of the inputs, incoming/outgoing event
38h, 39h	B4h		I/O access error when updating the process image of the outputs, incoming/outgoing event
	B3h, B4h	OB85_DKZ23	ID of the type of process image transfer during which the I/O access error has occurred 10: Byte access 20: Word access 30: DWord access 57h: Transmitting a configured consistency range
	B3h, B4h	OB85_Z1	Reserved for internal use by the CPU: logical base address of the module If OB85_RESERVED_2 has the value 76h OB85_Z1 receives the return value of the affected SFC
	B3h, B4h	OB85_Z23	Byte 0: Part process image number Byte 1: Irrelevant, if OB85_DKZ23=10, 20 or 30 OB85_DKZ23=57: Length of the consistency range in bytes Byte 2, 3 The I/O address causing the PII, if OB85_DKZ23=10, 20 or 30 OB85_DKZ23=57: Logical start address of the consistency range
You obtain the error codes B3h or B4h, if you configured the OB 85 call of I/O access errors entering and outgoing event for process image table updating by the system. After a restart, all access to non-existing inputs and outputs will be reported as I/O access errors during the next process table updating.			

OB 86 - Slave Failure / Restart

Description

The operating system of the CPU calls OB 86 whenever the failure of a slave is detected (both when entering and outgoing event).

Note!

If OB 86 has not been programmed, the CPU changes to the STOP mode when this type of error is detected.

The OB 86 may be delayed by means of the SFC 41 and re-enabled by the SFC 42.

Local data

The following table describes the start information of the OB 86 with default names of the variables and its data types:

Variable	Type	Description
OB86_EV_CLASS	BYTE	Event class and identifiers: 38h: outgoing event 39h: incoming event
OB86_FLT_ID	BYTE	Error code: (possible values: C4h, C5h, C7h, C8h)
OB86_PRIORITY	BYTE	Priority class: may be assigned via hardware configuration
OB86_OB_NUMBR	BYTE	OB number (86)
OB86_RESERVED_1	BYTE	reserved
OB86_RESERVED_2	BYTE	reserved
OB86_MDL_ADDR	WORD	Depends on the error code
OB86_RACKS_FLTD	ARRAY (0 ... 31) OF BOOL	Depends on the error code
OB86_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

OB 86 depending on error codes

If you want to program OB 86 dependent on the possible error codes, we recommend that you organize the local variables as follows:

Variable	Type
OB86_EV_CLASS	BYTE
OB86_FLT_ID	BYTE
OB86_PRIORITY	BYTE
OB86_OB_NUMBR	BYTE
OB86_RESERVED_1	BYTE
OB86_RESERVED_2	BYTE
OB86_MDL_ADDR	WORD
OB86_Z23	DWORD
OB86_DATE_TIME	DATE_AND_TIME

The following table shows the event started OB 86:

EV_CLASS	FLT_ID	Variable	Bit ...	Description
39h, 38h	C4h			Failure of a DP station
	C5h			Fault in a DP station
		OB86_MDL_ADDR		Logical base address of the DP master
		OB86_Z23		Address of the affected DP slave:
			Bit 7 ... 0	Number of the DP station
			Bit 15 ... 8	DP master system ID
			Bit 30 ... 16	Logical base address of the DP slave
			Bit 31	I/O identifier
38h	C7h			Return of a DP station, but error in module parameter assignment
		OB86_MDL_ADDR		Logical base address of the DP master
		OB86_Z23		Address of the DP slaves affected:
			Bit 7 ... 0	Number of the DP station
			Bit 15 ... 8	DP master system ID
			Bit 30 ... 16	Logical base address of the DP slave
			Bit 31	I/O identifier
	C8h			Return of a DP station, however discrepancy in configured and actual configuration
		OB86_MDL_ADDR		Logical base address of the DP master
		OB86_Z23		Address of the DP slaves affected:
			Bit 7 ... 0	Number of the DP station
			Bit 15 ... 8	DP master system ID
			Bit 30 ... 16	Logical base address of the DP slave
			Bit 31	I/O identifier

OB 100 - Reboot

Description

On a restart, the CPU sets both itself and the modules to the programmed initial state, deletes all not-latching data in the system memory, calls OB 100 and then executes the main program in OB 1.

Here the current program and the current data blocks generated by SFC remain in memory.

The VIPA CPU executes a startup with OB 100 as follows:

- after POWER ON and operating switch in RUN
- whenever you switch the mode selector from STOP to RUN
- after a request using a communication function (menu command from the programming device)

Even if no OB 100 is loaded into the CPU, the CPU goes to RUN without an error message.

Local data

The following table describes the start information of the OB 100 with default names of the variables and its data types:

Variable	Type	Description
OB100_EV_CLASS	BYTE	Event class and identifiers: 13h: active
OB100_STRTUP	BYTE	Startup request 81h: Manuel restart 82h: Automatic restart
OB100_PRIORITY	BYTE	Priority class: 27
OB100_OB_NUMBR	BYTE	OB number (100)
OB100_RESERVED_1	BYTE	reserved
OB100_RESERVED_2	BYTE	reserved
OB100_STOP	WORD	Number of the event that caused the CPU to STOP
OB100_STRT_INFO	DWORD	Supplementary information about the current startup (see next page)
OB100_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

Allocation OB100_STR_INFO

The following table shows the allocation of OB100_STR_INFO variables:

Bit-No.	Description	Possible values (binary)	Explanation
31 - 24	Startup information	xxxx xxx0	No difference between expected and actual configuration
		xxxx xxx1	Difference between expected and actual configuration
		xxxx 0xxx	Clock for time stamp not battery-backed at last POWER ON
		xxxx 1xxx	Clock for time stamp battery-backed at last POWER ON
23 - 16	Startup just completed	0000 0011	Restart triggered with mode selector
		0000 0100	Restart triggered by command via MPI
		0001 0000	Automatic restart after battery-backed POWER ON
		0001 0011	Restart triggered with mode selector; last POWER ON battery-backed
		0001 0100	Restart triggered by command via MPI; last POWER ON battery-backed
		0010 0000	Automatic restart battery-backed POWER ON (with memory reset by system)
		0010 0011	Restart triggered with mode selector last POWER ON not battery-backed
		0010 0100	Restart triggered by command via MPI last POWER ON not battery-backed
15 - 12	Permissibility of automatic startup	0000	Automatic startup illegal, memory request requested
		0001	Automatic startup illegal, parameter modifications, etc. necessary
		0111	Automatic startup permitted
11 - 8	Permissibility of manual startup	0000	Manual startup illegal, memory request requested
		0001	Manual startup illegal, parameter modifications, etc. necessary
		0111	Manual startup permitted
7 - 0	Last valid intervention or setting of the automatic startup at POWER ON	0000 0000	No startup
		0000 0011	Restart triggered with mode selector
		0000 0100	Restart triggered by command via MPI
		0001 0000	Automatic restart after battery-backed POWER ON
		0001 0011	Restart triggered with mode selector; last POWER ON battery-backed
		0001 0100	Restart triggered by command via MPI; last POWER ON battery-backed
		0010 0000	Automatic restart after battery-backed POWER ON (with memory reset by system)
		0010 0011	Restart triggered with mode selector last POWER ON not battery-backed
		1010 0000	Restart triggered by command via MPI last POWER ON not battery-backed

OB 121 - Programming Error (Synchronous error)

Description

The operating system of the CPU calls OB 121 whenever an event occurs that is caused by an error related to the processing of the program. If OB 121 is not programmed, the CPU changes to STOP. For example, if your program calls a block that has not been loaded on the CPU, OB 121 is called.
OB 121 is executed in the same priority class as the interrupted block. So you have read/write access to the registers of the interrupted block.

Masking of start events

The CPU provides the following SFCs for masking and unmasking start events for OB 121 during the execution of your program:

- SFC 36 MSK_FLT masks specific error codes.
- SFC 37 DMSK_FLT unmasks the error codes that were masked by SFC 36.
- SFC 38 READ_ERR reads the error register.

Local data

The following table describes the start information of the OB 121 with default names of the variables and its data types:

Variable	Data type	Description
OB121_EV_CLASS	BYTE	Event class and identifiers: 25h
OB121_SW_FLT	BYTE	Error code (see next page)
OB121_PRIORITY	BYTE	Priority class: priority class of the OB in which the error occurred.
OB121_OB_NUMBR	BYTE	OB number (121)
OB121_BLK_TYPE	BYTE	Type of block where the error occurred 88h: OB, 8Ah: DB, 8Ch: FC, 8Eh: FB
OB121_RESEVED_1	BYTE	reserved (Data area and access type)
OB121_FLT_REG	WORD	Source of the error (depends on error code). For example: • Register where the conversation error occurred • Incorrect address (read/write error) • Incorrect timer/counter/block number • Incorrect memory area
OB121_BLK_NUM	WORD	Number of the block with command that caused the error.
OB121_PRG_ADDR	WORD	Relative address of the command that caused the error.
OB121_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called.

Information to access the local data can be found at the description of the OB 1.

Error codes The variables dependent on the error code have the following meaning:

Error code	Variable	Description
21h		BCD conversion error
	OB121_FLT_REG:	ID for the register concerned (0000h: accumulator 1)
22h		Area length error when reading
23h		Area length error when writing
28h		Read access to a byte, word or double word with a pointer whose bit address is not 0.
29h		Write access to a byte, word or double word with a pointer whose bit address is not 0.
		Incorrect byte address.
		The data area and access type can be read from OB121_RESERVED_1.
	OB121_RESERVED_1	Bit 3 ... 0 memory area: 0: I/O area 1: process-image input table 2: process-image output table 3: bit memory 4: global DB 5: instance DB 6: own local data 7: local data of caller Bit 7 ... 4 access type: 0: bit access 1: byte access 2: word access 3: double word access
24h		Range error when reading
25h		Range error when writing
	OB121_FLT_REG	Contains the ID of the illegal area in the low byte (86h of own local data area)
26h		Error for timer number
27h		Error for counter number
	OB121_FLT_REG	Illegal number

continued ...

... continue

Error code	Variable	Description
30h		Write access to a write-protected global DB
31h		Write access to a write-protected instance DB
32h		DB number error accessing a global DB
33h		DB number error accessing an instance DB
	OB121_FLT_REG	Illegal DB number
34h		FC number error in FC call
35h		FB number error in FB call
3Ah		Access to a DB that has not been loaded; the DB number is in the permitted range
3Ch		Access to an FC that has not been loaded; the FC number is in the permitted range
3Dh		Access to an SFC that has not been loaded; the SFC number is in the permitted range
3Eh		Access to an FB that has not been loaded; the FB number is in the permitted range
3Fh		Access to an SFB that has not been loaded; the SFB number is in the permitted range
	OB121_FLT_REG	Illegal DB number

OB 122 - Periphery access Error

Description

The operating system of the CPU calls OB 122 whenever an error occurs while accessing data on a module. For example, if the CPU detects a read error when accessing data on an I/O module, the operating system calls OB 122. If OB 122 is not programmed, the CPU changes from the RUN mode to the STOP mode.
OB 122 is executed in the same priority class as the interrupted block. So you have read/write access to the registers of the interrupted block.

Masking of start events

The CPU provides the following SFCs for masking and unmasking start events for OB 122:

- SFC 36 MASK_FLT masks specific error codes
- SFC 37 DMASK_FLT unmasks the error codes that were masked by SFC 36
- SFC 38 READ_ERR reads the error register

Local data

The following table describes the start information of the OB 122 with default names of the variables and its data types:

Variable	Type	Description
OB122_EV_CLASS	BYTE	Event class and identifiers: 29h
OB122_SW_FLT	BYTE	Error code: 42h: I/O access error - reading 43h: I/O access error - writing
OB122_PRIORITY	BYTE	Priority class: Priority class of the OB where the error occurred
OB122_OB_NUMBR	BYTE	OB number (122)
OB122_BLK_TYPE	BYTE	No valid number is entered here
OB122_MEM_AREA	BYTE	Memory area and access type: Bit 3 ... 0: memory area 0: I/O area; 1: Process image of the inputs 2: Process image of the outputs Bit 7 ... 4: access type: 0: Bit access, 1: Byte access, 2: Word access, 3: Dword access
OB122_MEM_ADDR	WORD	Memory address where the error occurred
OB122_BLK_NUM	WORD	No valid number is entered here
OB122_PGR_ADDR	WORD	No valid number is entered here
OB122_DATE_TIME	DATE_AND_TIME	Date and time of day when the OB was called

Information to access the local data can be found at the description of the OB 1.

Chapter 3 Integrated SFBs

Overview

Here the description of the integrated function blocks of the VIPA SPEED7 CPUs may be found.

Content

Overview

General

The system program of the CPU offers you some additional functions that you may use by calling FBs, FCs or OBs. Those additional functions are part of the system program and don't use any work memory. Although the additional functions may be requested, they cannot be read or altered.

The calling of an additional function via FB, FC or OB is registered as block change and influences the nesting depth for blocks.

Integrated SFBs

The following system function blocks (SFBs) are available:

SFB	Label	Description	L-Stack
SFB 0 [1)]	CTU	Count forward	18Byte
SFB 1 [1)]	CTD	Count backwards	18Byte
SFB 2 [1)]	CTUD	Count forward and backwards	18Byte
SFB 3 [1)]	TP	Create pulse	22Byte
SFB 4 [1)]	TON	Create switch-on delay	22Byte
SFB 5 [1)]	TOF	Create switch-off delay	22Byte
SFB 8	USEND	See FB/SFB 8	-
SFB 9	URCV	See FB/SFB 9	-
SFB 12	BSEND	See FB/SFB 12	-
SFB 13	BRCV	See FB/SFB 13	-
SFB 14	GET	See FB/SFB 14	-
SFB 15	PUT	See FB/SFB 15	-
SFB 31	NOTIFY_8P	Messages without acknowledgment display (8 Signals)	-
SFB 32	DRUM	Realization of a step sequential circuit with a max. of 16 steps	-
SFB 33	ALARM	Messages with acknowledgment display	-
SFB 34	ALARM_8	Messages without associated values (8 Signals)	-
SFB 35	ALARM_8P	Messages with associated values (8 Signals)	-
SFB 36	NOTIFY	Messages without acknowledgment display	-
SFB 47 [1)]	COUNT	Counter controlling	48Byte
SFB 52	RDREC	DP-V1-SFB Reading a Data Record from a DP slave	-
SFB 53	WRREC	DP-V1-SFB Writing a Data Record in a DP slave	-
SFB 54	RALRM	DP-V1-SFB Receiving an Interrupt from a DP slave	-

1) This function block is interruptable and does not affect the interrupt reaction time.

Note!

Please note that L-Stack memory is occupied by using the above described SFB 0...5. This can be defined by the CPU parameters. The needed Space is to be found in the table above.

SFB 0 - CTU - Up-counter

Description

The SFB 0 can be used as Up-counter. Here you have the following characteristics:

- If the signal at the up counter input *CU* changes from "0" to "1" (positive edge), the current counter value is incremented by 1 and displayed at output *CV*.
- When called for the first time with *R*="0" the counter value corresponds to the preset value at input *PV*.
- When the upper limit of 32767 is reached the counter will not be incremented any further, i.e. all rising edges at input *CU* are ignored.
- The counter is reset to zero if reset input *R* has signal state "1".
- Output *Q* has signal state "1" if *CV* ≥ *PV*.
- When it is necessary that the instances of this SFB are initialized after a warm start, then the respective instances must be initialized in OB 100 with *R* = 1.

Parameters

Parameter	Declaration	Data type	Memory block	Description
CU	INPUT	BOOL	I, Q, M, D, L, constant	Count input
R	INPUT	BOOL	I, Q, M, D, L, constant	Reset input. *R* takes precedence over *CU*.
PV	INPUT	INT	I, Q, M, D, L, constant	Preset value. The effect of *PV* is described under parameter *Q*.
Q	OUTPUT	BOOL	I, Q, M, D, L	Status of the counter
CV	OUTPUT	INT	I, Q, M, D, L	Current count

CU

Count input:

This counter is incremented by 1 when a rising edge (with respect to the most recent SFB call) is applied to input *CU*.

R

Reset input:

The counter is reset to 0 when input *R* is set to "1", irrespective of the status of input *CU*.

PV

Preset value:

This value is the comparison value for the current counter value. Output *Q* indicates whether the current count is greater than or equal to the preset value *PV*.

Q

Status of the counter:

- *Q* is set to "1", if *CV* ≥ *PV* (current count ≥ preset value)
- else Q = "0"

CV

Current count:

- possible values: 0 ... 32767

SFB 1 - CTD - Down-counter

Description

The SFB 1 can be used as Down-counter. Here you have the following characteristics:

- If the signal state at the down counter input *CD* changes from "0" to "1" (positive edge), the current counter value is decremented by 1 and displayed at output *CV*.
- When called for the first time with *LOAD* = "0" the counter value corresponds to the preset value at input *PV*.
- When the lower limit of -32767 is reached the counter will not be decremented any further, i.e. all rising edges at input *CU* are ignored.
- When a "1" is applied to the *LOAD* input then the counter is set to preset value *PV* irrespective of the value applied to input *CD*.
- Output *Q* has signal state "1" if *CV* ≤ 0.
- When it is necessary that the instances of this SFB are initialized after a warm start, then the respective instances must be initialized in OB 100 with *LOAD* = 1 and *PV* = required preset value for *CV*.

Parameters

Parameter	Declaration	Data type	Memory block	Description
CD	INPUT	BOOL	I, Q, M, D, L, constant	Count input
LOAD	INPUT	BOOL	I, Q, M, D, L, constant	Load input. *LOAD* takes precedence over *CD*.
PV	INPUT	INT	I, Q, M, D, L, constant	Preset value
Q	OUTPUT	BOOL	I, Q, M, D, L	Status of the counter
CV	OUTPUT	INT	I, Q, M, D, L	Current count

CD

Count input:

This counter is decremented by 1 when a rising edge (with respect to the most recent SFB call) is applied to input *CU*.

LOAD

Load input:

When a 1 is applied to the *LOAD* input then the counter is set to preset value *PV* irrespective of the value applied to input *CD*.

PV

Preset value:

The counter is set to preset value *PV* when the input *LOAD* is “1”.

Q

Status of the counter:

Q is set to

- 1, if 0 ≥ *CV* (Current count value smaller/even 0)
- else Q = "0"

CV

Current count:

- possible values: -32 768 ... 32 767

SFB 2 - CTUD - Up-Down counter

Description

The SFB 2 can be used as an Up-Down counter. Here you have the following characteristics:

- If the signal state at the up count input *CU* changes from "0" to "1" (positive edge), the counter value is incremented by 1 and displayed at output *CV*.
- If the signal state at the down count input *CD* changes from "0" to "1" (positive edge), the counter value is decremented by 1 and displayed at output *CV*.
- If both counter inputs have a positive edge, the current counter value does not change.
- When the count reaches the upper limit of 32767 any further edges are ignored.
- When the count reaches the lower limit of -32768 any further edges are ignored.
- When a "1" is applied to the *LOAD* input then the counter is set to preset value *PV*.
- The counter value is reset to zero if reset input *R* has signal state "1". Positive signal edges at the counter inputs and signal state "1" at the load input remain without effect while input *R* has signal state "1".
- Output *QU* has signal state "1", if *CV* ≥ *PV.*
- Output *QD* has signal state "1", if *CV* ≤ 0.
- When it is necessary that the instances of this SFB are initialized after a restart, then the respective instances must be initialized in OB 100 with:
  - when the counter is used as up-counter with *R* = "1"
  - when the counter is used as down-counter with *R* = 0 and *LOAD* = 1 and *PV* = preset value.

Parameters

Parameter	Declaration	Data type	Memory block	Description
CU	INPUT	BOOL	I, Q, M, D, L, constant	Count up input
CD	INPUT	BOOL	I, Q, M, D, L, constant	Count down input
R	INPUT	BOOL	I, Q, M, D, L, constant	Reset input, *R* takes precedence over *LOAD*.
LOAD	INPUT	BOOL	I, Q, M, D, L, constant	Load input, *LOAD* takes precedence over *CU* and *CD*.
PV	INPUT	INT	I, Q, M, D, L, constant	Preset value
QU	OUTPUT	BOOL	I, Q, M, D, L	Status of the up counter
QD	OUTPUT	BOOL	I, Q, M, D, L	Status of the down counter
CV	OUTPUT	INT	I, Q, M, D, L	Current count

CU

Count up input:

A rising edge (with respect to the most recent SFB-call) at input *CU* increments the counter.

CD

Count down input:

A rising edge (with respect to the most recent SFB-call) at input *CD* decrements the counter.

R

Reset input:

When input *R* is set to "1" the counter is reset to 0, irrespective of the status of inputs *CU*, *CD* and *LOAD*.

LOAD

Load input:

When the *LOAD* input is set to "1" the counter is preset to the value applied to *PV*, irrespective of the values of inputs *CU* and *CD*.

PV

Preset value:

The counter is preset to the value applied to *PV*, when the *LOAD* input is set to 1.

QU

Status of the down counter:

- *QU* is set to "1", if *CV* ≥ *PV* (Current count ≥ Preset value)
- else *QU* is 0.

QD

Status of the down counter:

- *QD* is set to 1", if 0 ≥ *CV* (Current count smaller/= 0)
- else *QD* is 0.

CV

Current count

- possible values: -32 768 ... 32 767

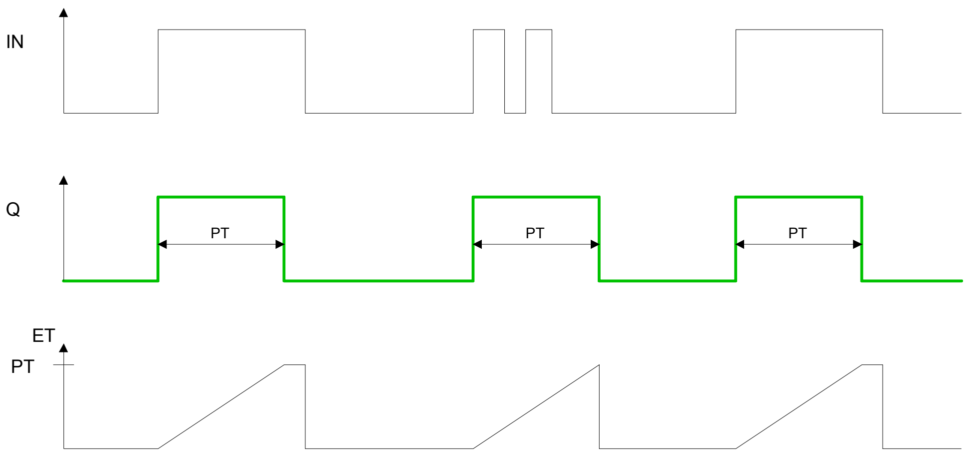
SFB 3 - TP - Create pulse

Description

The SFB 3 can be used to generate a pulse with a pulse duration equal to *PT*. Here you have the following characteristics:

- The pulse duration is only available in the STARTUP and RUN modes.
- The pulse is started with a rising edge at input *IN*.
- During *PT* time the output *Q* is set regardless of the input signal.
- The *ET* output provides the time for which output *Q* has already been set. The maximum value of the *ET* output is the value of the *PT* input. Output *ET* is reset when input *IN* changes to "0", however, not before the time *PT* has expired.
- When it is necessary that the instances of this SFB 3 are initialized after a restart, then the respective instances must be initialized in OB 100 with *PT* = 0 ms.

Time diagram



Parameters

Parameter	Declaration	Data type	Memory block	Description
IN	INPUT	BOOL	I, Q, M, D, L, constant	Start input
PT	INPUT	TIME	I, Q, M, D, L, constant	Pulse duration
Q	OUTPUT	BOOL	I, Q, M, D, L	Status of the time
ET	OUTPUT	TIME	I, Q, M, D, L	Expired time

IN

Start input:

The pulse is started by a rising edge at input *IN*.

PT

Pulse duration:

PT must be positive.
The range of these values is determined by data type TIME.

Q

Output *Q*:

Output *Q* remains active for the pulse duration *PT*, irrespective of the subsequent status of the input signal

ET

Expired time:

The duration for which output *Q* has already been active is available at output *ET* where the maximum value of this output can be equal to the value of *PT*. When input *IN* changes to 0 output *ET* is reset, however, this only occurs after *PT* has expired.

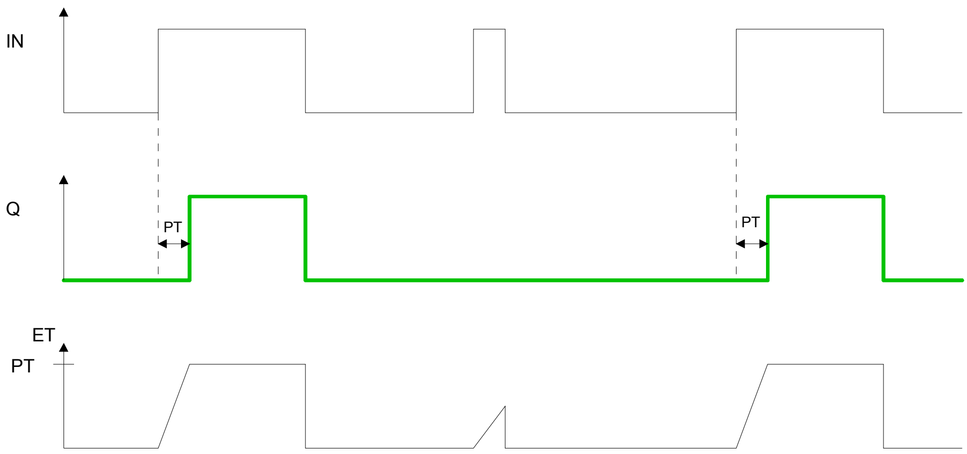
SFB 4 - TON - Create turn-on delay

Description

SFB 4 can be used to delay a rising edge by period *PT*. Here you have the following characteristics:

- The timer runs only in the STARTUP and RUN modes.
- A rising edge at the *IN* input causes a rising edge at output *Q* after the time *PT* has expired. *Q* then remains set until the *IN* input changes to 0 again. If the *IN* input changes to "0" before the time *PT* has expired, output *Q* remains set to "0".
- The *ET* output provides the time that has passed since the last rising edge at the *IN* input. Its maximum value is the value of the *PT* input. *ET* is reset when the *IN* input changes to "0".
- When it is necessary that the instances of this SFB are initialized after a restart, then the respective instances must be initialized in OB 100 with *PT* = 0 ms.

Timing diagram



Parameters

Parameter	Declaration	Type	Memory block	Description
IN	INPUT	BOOL	I, Q, M, D, L, constant	Start input
PT	INPUT	TIME	I, Q, M, D, L, constant	Time delay
Q	OUTPUT	BOOL	I, Q, M, D, L	Status of time
ET	OUTPUT	TIME	I, Q, M, D, L	Expired time

IN

Start input:

The time delay is started by a rising edge at input *IN*. Output *Q* also produces a rising edge when time delay *PT* has expired.

PT

Time delay:

Time delay applied to the rising edge at input *IN PT* must be. The range of values is defined by the data type TIME.

Q

Status of time:

The time delay is started by a rising edge at input *IN*. Output *Q* also produces a rising edge when time delay *PT* has expired and it remains set until the level applied to input *IN* changes back to 0. If input *IN* changes to 0 before time delay *PT* has expired then output *Q* remains at "0".

ET

Expired time:

Output *ET* is set to the time duration that has expired since the most recent rising edge has been applied to input *IN*. The highest value that output *ET* can contain is the value of input *PT*. Output *ET* is reset when input *IN* changes to "0".

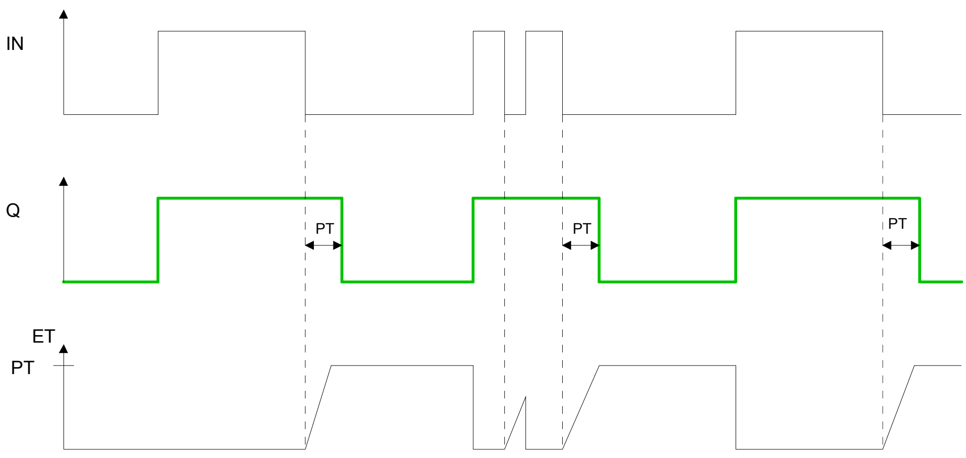
SFB 5 - TOF - Create turn-off delay

Description

SFB 5 can be used to delay a falling edge by period *PT*. Here you have the following characteristics:

- The timer runs only in the STARTUP and RUN modes.
- A rising edge at the *IN* input causes a rising edge at output *Q*. A falling edge at the *IN* input causes a falling edge at output *Q* delayed by the time *PT*. If the *IN* input changes back to "1" before the time *PT* has expired, output *Q* remains set to "1".
- The *ET* output provides the time that has elapsed since the last falling edge at the *IN* input. Its maximum value is, however the value of the *PT* input. *ET* is reset when the *IN* input changes to "1".
- When it is necessary that the instances of this SFB are initialized after a restart, then the respective instances must be initialized in OB 100 with *PT* = 0 ms.

Time diagram



Parameters

Parameter	Declaration	Data type	Memory block	Description
IN	INPUT	BOOL	I, Q, M, D, L, constant	Start input
PT	INPUT	TIME	I, Q, M, D, L, constant	Time delay
Q	OUTPUT	BOOL	I, Q, M, D, L	Status of time
ET	OUTPUT	TIME	I, Q, M, D, L	Expired time

IN

Start input:

The time delay is started by a rising edge at input *IN* results in a rising edge at output *Q*. When a falling edge is applied to input *IN* output *Q* will also produce a falling edge when delay *PT* has expired. If the level at input *IN* changes to "1" before time delay *PT* has expired, then the level at output *Q* will remain at "1".

PT

Time delay:

Time delay applied to the falling edge at input *IN PT* must be. The range of values is defined by the data type TIME.

Q

Status of time:

The time delay is started by a rising edge at input *IN* results in a rising edge at output *Q*. When a falling edge is applied to input *IN* output *Q* will also produce a falling edge when delay *PT* has expired. If the level at input *IN* changes to "1" before time delay *PT* has expired, then the level at output *Q* will remain at "1".

ET

Expired time:

The time period that has expired since the most recent falling edge at input *IN* is available from output *ET*. The highest value that output *ET* can reach is the value of input *PT*. Output *ET* is reset when the level at input *IN* changes to "1".

SFB 32 - DRUM - Realize a step-by-step switch

Description

Implementing a 16-state cycle switch using the SFB 32.

Parameter DSP defines the number of the first step, parameter *LST_STEP* defines the number of the last step.
Every step describes the 16 output bits *OUT0* ... *OUT15* and output parameter *OUT_WORD* that summarizes the output bits.
The cycle switch changes to the next step when a positive edge occurs at input *JOG* with respect to the previous SFB-call. If the cycle switch has already reached the last step and a positive edge is applied to *JOG* variables *Q* and *EOD* will be set, *DCC* is set to 0 and SFB 32 remains at the last step until a "1" is applied to the *RESET* input.

Time controlled switching

The switch can also be controlled by a timer. For this purpose parameter *DRUM_EN* must be set to "1". The next step of the cycle switch is activated when:

- the event bit *EVENTi* of the current step is set and
- when the time defined for the current step has expired.

The time is calculated as the product of time base *DTBP* and the timing factor that applies to the current step (from the *S_PRESET* field).

Note!
The remaining processing time *DCC* in the current step will only be decremented if the respective event bit *EVENTi* is set.

If input *RESET* is set to "1" when the call is issued to SFB 32 then the cycle switch changes to the step that you have specified as a number at input *DSP*.

Note!

Special conditions apply if parameter *DRUM_EN* is set to "1":

- timer-controlled cycle switching, if *EVENTi* = "1" with *DSP* = i = *LST_STEP*.
- event-controlled cycle switching by means of event bits *EVENTi*, when *DTBP* = "0".

In addition it is possible to advance the cycle switch at any time (even if *DRUM_EN* = "1") by means of the *JOG* input.

When this module is called for the first time the *RESET* input must be set to "1".
If the cycle switch has reached the last step and the processing time defined for this step has expired, then outputs *Q* and *EOD* will be set and SFB 32 will remain at the last step until the *RESET* input is set to "1".

The SFB 32 is only active in operating modes RESTART and RUN.

If SFB 32 must be initialized after a warm start it must be called from OB 100 with *RESET* = "1".

Parameters

Parameter	Declaration	Data type	Memory block	Description
RESET	INPUT	BOOL	I, Q, M, D, L, constant	Reset
JOG	INPUT	BOOL	I, Q, M, D, L, constant	Switch to the next stage
DRUM_EN	INPUT	BOOL	I, Q, M, D, L, constant	Control parameter
LST_STEP	INPUT	BYTE	I, Q, M, D, L, constant	Number of the last step
EVENTi, $1 \le i \le 16$	INPUT	BOOL	I, Q, M, D, L, constant	Event bit No. i (belongs to step i)
OUTj, $0 \le j \le 15$	OUTPUT	BOOL	I, Q, M, D, L	Output bit No. j
Q	OUTPUT	BOOL	I, Q, M, D, L	Status parameter
OUT_WORD	OUTPUT	WORD	I, Q, M, D, L, P	Output bits
ERR_CODE	OUTPUT	WORD	I, Q, M, D, L, P	*ERR_CODE* contains the error information if an error occurs when the SFB is being processed
JOG_HIS	VAR	BOOL	I, Q, M, D, L, constant	Not relevant to the user
EOD	VAR	BOOL	I, Q, M, D, L, constant	Identical with output parameter *Q*
DSP	VAR	BYTE	I, Q, M, D, L, P constant	Number of the first step
DSC	VAR	BYTE	I, Q, M, D, L, P constant	Number of the current step
DCC	VAR	DWORD	I, Q, M, D, L, P constant	The remaining processing time for the current step in ms
DTBP	VAR	WORD	I, Q, M, D, L, P constant	The time base in ms that applies to all steps
PREV_TIME	VAR	DWORD	I, Q, M, D, L, constant	Not relevant to the user
S_PRESET	VAR	ARRAY of WORD	I, Q, M, D, L, constant	One dimensional field containing the timing factors for every step
OUT_VAL	VAR	ARRAY of BOOL	I, Q, M, D, L, constant	Two-dimensional field containing the output values for every step
S_MASK	VAR	ARRAY of BOOL	I, Q, M, D, L, constant	Two-dimensional field containing the mask bits for every step.

RESET	Reset: The cycle switch is reset if this is set to "1". *RESET* must be set to "1" when the initial call is issued to the block.
JOG	A rising edge (with respect to the last SFB call) increments the cycle switch to the next stage if the cycle switch has not yet reached the last step. This is independent of the value of *DRUM_EN*.
DRUM_EN	Control parameter that determines whether timer-controlled cycle switching to the next step should be enabled or not ("1": enable timer-controlled increments).
LST_STEP	Number of the last step: • possible values: 1 ... 16
EVENTi, 1≤i≤16	Event bit No. i (belonging to step i)
OUTj 0≤j≤15	Output bit No. j (identical with bit No. j of *OUT_WORD*)
Q	Status parameter specifying whether the processing time that you have defined for the last step has expired.
OUT_WORD	Output bits summarized in a single variable.
ERR_CODE	*ERR_CODE* contains the error information if an error occurs when the SFB is being processed.
JOG_HIS	Not relevant to the user: input parameter *JOG* of the previous SFB-call.
EOD	Identical with output parameter *Q*
DSP	Number of the first step: • possible values 1 ... 16
DSC	Number of the current step
DCC	The remaining processing time for the current step in ms (only relevant if *DRUM_EN* = "1" and if the respective event bit = "1")
DTBP	The time base in ms that applies to all steps.
PREV_TIME	Not relevant to the user: system time of the previous SFB call.
S_PRESET	One-dimensional field containing the timing factors for every step. • Meaningful indices are: [1 ... 16]. In this case *S_PRESET* [x] contains the timing factor of step x.

OUT_VAL

Two-dimensional field containing the output values for every step if you have not masked these by means of *S_MASK*.

- Meaningful indices are: [1 ... 16, 0 ... 15].

In this case *OUT_VAL* [x, y] contains the value that is assigned to output bit *OUTy* in step x.

S_MASK

Two-dimensional field containing the mask bits for every step.

- Meaningful indices are: [1 ... 16, 0 ... 15].

In this case *S_MASK* [x, y] contains the mask bit for the value y of step x.
Significance of the mask bits:

- 0: the respective value of the previous step is assigned to the output bit
- 1: the respective value of *OUT_VAL* is assigned to the output bit.

Error information

ERR_CODE

When an error occurs the status of SFB 32 remains at the current value and output *ERR_CODE* contains one of the following error codes:

ERR_CODE	Description
0000h	No error has occurred
8081h	illegal value for *LST_STEP*
8082h	illegal value for *DSC*
8083h	illegal value for *DSP*
8084h	The product *DCC* = *DTBP* x *S_PRESET*[*DSC*] exceeds the value 2^{31-1} (appr. 24.86 Days)

SFB 31 - NOTIFY_8P - Messages without Acknowl. Display (8x)

Description

Generating block related messages without acknowledgement display for 8 signals.

SFB 31 NOTIFY_8P represents an extension of SFB 36 "NOTIFY" to 8 signals.

A message is generated if at least one signal transition has been detected. A message is always generated at the initial call of SFB 31. All 8 signal are allocated a common message number that is split into 8 sub-messages on the displaying device.

One memory with two memory blocks is available for each instance of SFB 31 NOTIFY_8P. For information on saving signal transitions to intermediate memory refer to the section "Signal transition detection" in the Introduction to Generating Block Related Messages with SFBs.

The displaying device shows the last two signal transitions, irrespective of message loss.

Note!

Before you call SFB 31 NOTIFY_8P in a CPU, you must insure that all connected displaying devices know this block. More information about this may be found in the manuals of the components used.

Parameters

Parameter	Declaration	Data type	Memory block	Description
SIG_i,	INPUT	BOOL	I, Q, M, D, L.	i-th signal to be monitored
ID	INPUT	WORD	Constant (I, Q, M, D, L)	Data channel for messages: EEEEh *ID* is evaluated only at the initial call.
EV_ID	INPUT	DWORD	Constant (I, Q, M, D, L)	Message number (not permitted: 0)
SEVERITY	INPUT	WORD	Constant (I, Q, M, D, L)	Weighting of the event
DONE	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *DONE*: Message generation completed.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *ERROR*
STATUS	OUTPUT	WORD	I, Q, M, D, L	Status parameter *STATUS*: Display of an error information
SD_i	IN_OUT	ANY	I, Q, M, D, T, C	i-th associated value

SIG_i i-th signal to be monitored. It is valid $1 \leq i \leq 8$.

ID Data channel for messages: EEEEh. *ID* is evaluated only at the initial call.

EV_ID Message number (not permitted: 0)
EV_ID is only evaluated at the first call. Subsequently, the message number used for the first call applies to every call of SFB with the corresponding instance DB.
The Siemens STEP®7 programming tool assigns the message number automatically to ensure consistency of the message numbers. The message numbers within a user program must be unique.

SEVERITY Weighting of the event. Here the value 0 is the highest weighting. This parameter is irrelevant for processing the message.
Possible: 0 ... 127 (Default value: 64)

DONE Status parameter *DONE*: Message generation completed.

SD_i i-th associated value. It is valid $1 \leq i \leq$ maxNumber. The max. number may be found in the technical data of your CPU.

Permitted are only data of the type BOOL, (not permitted: bit field), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND _TIME.

Note:
When the ANY pointer accesses a DB, the DB always must be specified.
(e.g.: P# DB10.DBX5.0 Byte 10)

Error information *ERROR / STATUS*

ERROR = TRUE indicates that an error has occurred during processing. For details refer to parameter *STATUS*.

The table below contains all error information specific to SFB 31 and that can be output via the parameters *ERROR* and *STATUS*.

ERROR	*STATUS* (decimal)	Description
0	11	Message lost: The previous signal change or the previous message could not be sent and will be replaced by the current message.
0	22	• Error in the pointer to the associated values *SD_i*: - Relating to data length / type - No access to associated values in user memory, e.g. because of a deleted DB or area length error. The activated message is transferred without or with the maximum possible number of associated values. • Your selected actual parameter of *SEVERITY* is out of high limits. The activated message will be sent with *SEVERITY* = 127.
0	25	Communication was initiated. The message is being processed.
1	1	Communication errors: communication shut-down or no login.
1	4	At the initial call the specified *EV_ID* was out of the permitted range or a formal error in the ANY pointers *SD_i* or the maximum memory area length the CPU can transfer per SFB 31 has been exceeded.
1	10	No access to local user memory (e.g. attempt to access a deleted DB).
1	12	At the call of the SFB an instance DB was specified that does not belong to SFB 31 or a global DB was specified instead of an instance DB.
1	18	*EV_ID* was already in use by one of the SFBs 31 or 33 ... 36.
1	20	Out of working memory.
1	21	The message with the specified *EV_ID* is locked.

SFB 33 - ALARM - Messages with Acknowledgment Display

Description

Generating block-related messages with acknowledgment

SFB 33 ALARM monitors a signal:

- Default mode (that is, acknowledgement triggered reporting is disabled): The block generates a message both on a positive edge (event entering state) and on a negative edge (event leaving state). You can have associated values sent with the message.
- Acknowledgement triggered reporting is enabled: After an incoming message is generated for the signal, the block will no longer generate messages until you have acknowledged this incoming message on a displaying device.

When the SFB is first called, a message with the current signal state is sent. The message is sent to all stations logged on for this purpose.

Once your acknowledgment has been received from a logged on display device, the acknowledgment information is passed on to all other stations logged on for this purpose.

One message memory with 2 memory blocks is available for each instance of SFB 33 ALARM.

SFB 33 ALARM complies with the IEC 1131-5 standard.

Parameters

Parameter	Declaration	Data type	Memory block	Description
EN_R	INPUT	BOOL	I, Q, M, D, L, Constant	Control parameter
SIG	INPUT	BOOL	I, Q, M, D, L	The signal to be monitored
ID	INPUT	WORD	Constant (I, Q, M, D, L)	Data channel for messages: EEEEh *ID* is only evaluated at the first call.
EV_ID	INPUT	DWORD	Constant (I, Q, M, D, L)	Message number (0 not permitted)
SEVERITY	INPUT	WORD	Constant (I, Q, M, D, L)	Weighting of the event
DONE	OUTPUT	BOOL	I, Q, M, D, L	*DONE* status parameter: Generation of message completed
ERROR	OUTPUT	BOOL	I, Q, M, D, L	*ERROR* status parameter
STATUS	OUTPUT	WORD	I, Q, M, D, L	*STATUS* parameter: Displays error information
ACK_DN	OUTPUT	BOOL	I, Q, M, D, L	Event leaving state was acknowledged
ACK_UP	OUTPUT	BOOL	I, Q, M, D, L	Event entering state was acknowledged
SD_i,	IN_OUT	ANY	I, Q, M, D, T, C	i-th associated value

EN_R Control parameter (enabled to receive) that decides whether the outputs *ACK_UP* and *ACK_DN* are updated at the first block call (*EN_R* = 1) or not (*EN_R* = 0). If *EN_R* = 0 the output parameters *ACK_UP* and *ACK_DN* remain unchanged.

SIG Signal to be monitored.

ID Data channel for messages: EEEEh. *ID* is evaluated only at the initial call.

EV_ID Message number (not permitted: 0)
EV_ID is only evaluated at the first call. Subsequently, the message number used for the first call applies to every call of SFB with the corresponding instance DB.
The Siemens STEP®7 programming tool assigns the message number automatically to ensure consistency of the message numbers. The message numbers within a user program must be unique.

SEVERITY Weighting of the event. Here the value 0 is the highest weighting. This parameter is irrelevant for processing the message.
Possible: 0 ... 127 (Default value: 64)

DONE Status parameter *DONE*: Message generation completed.

ACK_DN The *ACK_DN* output is reset at the negative edge. It is set when your acknowledgment of the event leaving the state is received from a logged on display device.

ACK_UP The *ACK_UP* output is reset at the rising edge. It is set when your acknowledgment of the event entering the state has arrived from a logged on display device.

SD_i i-th associated value. It is valid 1 ≤ i ≤ maxNumber. The max. number may be found in the technical data of your CPU.

Permitted are only data of the type BOOL, (not permitted: bit field), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND _TIME.

Note:
When the ANY pointer accesses a DB, the DB always must be specified.
(e.g.: P# DB10.DBX5.0 Byte 10)

Error information
ERROR / STATUS

ERROR = TRUE indicates that an error has occurred during processing. For details refer to parameter *STATUS*.

The following table contains all the error information specific to SFB 33 that can be output with the *ERROR* and *STATUS* parameters.

ERROR	*STATUS* (decimal)	Description
0	11	Message lost: the previous signal change or the previous message could not be sent and will be replaced by the current message.
0	22	• Error in the pointer to the associated values SD_i: - Involving the data length or the data type - Associated values in the user memory not accessible, for example, due to deleted DB or area length error. The activated message is sent without associated values. • The actual parameter you have selected for *SEVERITY* is higher than the permitted range. The activated message will be sent with *SEVERITY*=127.
0	25	Communication was initiated. The message is being processed.
1	1	Communications problems: connection abort or no logon With acknowledgment-triggered reporting active: temporary display, if no display devices support acknowledgment-triggered reporting
1	4	At the first call: the specified *EV_ID* is outside the permitted range or the ANY pointer *SD_i* has a formal error or the maximum memory area that can be sent for the CPU per SFB 33 was exceeded.
1	10	Access to local user memory not possible (for example, access to a deleted DB)
1	12	When the SFB was called: an instance DB that does not belong to SFB 33 was specified a shared DB instead of an instance DB was specified.
1	18	*EV_ID* was already being used by one of the SFBs 31 or 33 ... 36.
1	20	Not enough working memory.
1	21	The message with the specified *EV_ID* is disabled

Note!

After the first block call, the *ACK_UP* and *ACK_DN* outputs have the value 1 and it is assumed that the previous value of the *SIG* input was 0.

SFB 34 - ALARM_8 - Messages without Associated Values (8x)

Description

Generating block-related messages without associated values for 8 signals.

SFB 34 ALARM_8 is identical to SFB 35 ALARM_8P except that it does not have the associated values SD_1 through SD_10.

Parameters

Parameter	Declaration	Data type	Memory block	Description
EN_R	INPUT	BOOL	I, Q, M, D, L, constant	Control parameter
SIG_i	INPUT	BOOL	I, Q, M, D, L	i-th signal to be monitored
ID	INPUT	WORD	Constant (I, Q, M, D, L)	Data channel for messages: EEEEh *ID* is only evaluated at the first call.
EV_ID	INPUT	DWORD	Constant (I, Q, M, D, L)	Message number (0 not permitted)
SEVERITY	INPUT	WORD	Constant (I, Q, M, D, L)	Weighting of the event
DONE	OUTPUT	BOOL	I, Q, M, D, L	*DONE* status parameter: Generation of message completed
ERROR	OUTPUT	BOOL	I, Q, M, D, L	*ERROR* status parameter
STATUS	OUTPUT	WORD	I, Q, M, D, L	*STATUS* parameter: Displays error information
ACK_STATE	OUTPUT	BOOL	I, Q, M, D, L	Bit field acknowledgement status of all 8 messages

EN_R

Control parameter (enabled to receive) that decides whether the output *ACK_STATE* is updated (*EN_R* = 1) when the block is called or not (*EN_R* = 0).

SIG_i

i-th Signal to be monitored. It is valid $1 \leq i \leq 8$.

ID

Data channel for messages: EEEEh. *ID* is evaluated only at the initial call.

EV_ID

Message number (not permitted: 0)
EV_ID is only evaluated at the first call. Subsequently, the message number used for the first call applies to every call of SFB with the corresponding instance DB.
The Siemens STEP®7 programming tool assigns the message number automatically to ensure consistency of the message numbers. The message numbers within a user program must be unique.

SEVERITY

Weighting of the event. Here the value 0 is the highest weighting. This parameter is irrelevant for processing the message.
Possible: 0 ... 127 (Default value: 64)

DONE Status parameter *DONE*, Message generation completed.

ACK_STATE Bit field with the current acknowledgment status of all 8 messages

Bit 7 ... 0: incoming event of SIG_1 ... SIG_8

Bit 15 ... 8: outgoing event of SIG_1 ... SIG_8

(1: Event acknowledged, 0: Event not acknowledged)

Initialization status: FFFFh, this means, all incoming and outgoing events have been acknowledged.

Error information
ERROR / STATUS

ERROR = TRUE indicates that an error has occurred during processing. For details refer to parameter *STATUS*.

The following table contains all the error information specific to SFB 34 that can be output with the *ERROR* and *STATUS* parameters.

ERROR	*STATUS* (decimal)	Description
0	11	Message lost: the previous signal change or the previous message could not be sent and will be replaced by the current message.
0	22	The actual parameter you have selected for *SEVERITY* is higher than the permitted range. The activated message is sent with *SEVERITY*=127.
0	25	Communication was initiated. The message is being processed.
1	1	Communications problems: connection abort or no logon With acknowledgment-triggered reporting active: temporary display, if no display devices support acknowledgment-triggered reporting
1	4	At the first call, the specified *EV_ID* is outside the permitted range.
1	10	Access to local user memory not possible (for example, access to a deleted DB)
1	12	When the SFB was called an instance DB that does not belong to SFB 34 was specified or a shared DB instead of an instance DB was specified.
1	18	*EV_ID* was already being used by one of the SFBs 31 or 33 ... 36.
1	20	Not enough working memory.
1	21	The message with the specified *EV_ID* is disabled

Note!

After the first block call. all the bits of the *ACK_STATE* output are set and it is assumed that the previous values of inputs *SIG_i*, 1≤ i ≤ 8 were 0.

SFB 35 - ALARM_8P - Messages with Associated Values (8x)

Description

Generating block-related messages with associated values for 8 signals.

SFB 35 ALARM_8P represents a linear extension of SFB 33 ALARM to 8 signals.

As long as you have not enabled acknowledgement triggered reporting, a message will always be generated when a signal transition is detected at one or more signals (exception: a message is always sent at the first block call). All 8 signals have a common message *ID* that is split 8 individual messages on the display device. You can acknowledge each individual message separately or a group of messages.

You can use the *ACK_STATE* output parameter to process the acknowledgment state of the individual messages in your program. If you disable or enable a message of an ALARM_8P block, this always affects the entire ALARM_8P block. Disabling and enabling of individual signals is not possible.

One message memory with 2 memory blocks is available for each instance of SFB35 ALARM_8P.

Parameters

Parameter	Declaration	Data type	Memory block	Description
EN_R	INPUT	BOOL	I, Q, M, D, L, Constant	Control parameter
SIG_i	INPUT	BOOL	I, Q, M, D, L	i-th signal to be monitored
ID	INPUT	WORD	Constant (I, Q, M, D, L)	Data channel for messages: EEEEh *ID* is only evaluated at the first call.
EV_ID	INPUT	DWORD	Constant (I, Q, M, D, L)	Message number (0 not permitted)
SEVERITY	INPUT	WORD	Constant (I, Q, M, D, L)	Weighting of the event
DONE	OUTPUT	BOOL	I, Q, M, D, L	*DONE* status parameter: Generation of message completed
ERROR	OUTPUT	BOOL	I, Q, M, D, L	*ERROR* status parameter
STATUS	OUTPUT	WORD	I, Q, M, D, L	*STATUS* parameter: Displays error information
ACK_STATE	OUTPUT	WORD	I, Q, M, D, L	Bit field acknowledgment status of all 8 messages
SD_j	IN_OUT	ANY	I, Q, M, D, T, C	i-th associated value

EN_R
Control parameter (enabled to receive) that decides whether the output *ACK_STATE* is updated (*EN_R* = 1) when the block is called or not (*EN_R* = 0).

SIG_i
i-th Signal to be monitored. It is valid 1 ≤ i ≤ 8.

ID
Data channel for messages: EEEEh. *ID* is evaluated only at the initial call.

EV_ID
Message number (not permitted: 0)
EV_ID is only evaluated at the first call. Subsequently, the message number used for the first call applies to every call of SFB with the corresponding instance DB.
The Siemens STEP®7 programming tool assigns the message number automatically to ensure consistency of the message numbers. The message numbers within a user program must be unique.

SEVERITY
Weighting of the event. Here the value 0 is the highest weighting. This parameter is irrelevant for processing the message.
Possible: 0 ... 127 (Default value: 64)

DONE
Status parameter *DONE*: Message generation completed.

ACK_STATE
Bit field with the current acknowledgment status of all 8 messages

Bit 7 ... 0: incoming event of SIG_1 ... SIG_8

Bit 15 ... 8: outgoing event of SIG_1 ... SIG_8

(1: Event acknowledged, 0: Event not acknowledged)

Initialization status: FFFFh, this means, all incoming and outgoing events have been acknowledged.

SD_i
i-th associated value. It is valid 1 ≤ i ≤ maxNumber. The max. number may be found in the technical data of your CPU.

Permitted are only data of the type BOOL, (not permitted: bit field), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND _TIME.

Note:
When the ANY pointer accesses a DB, the DB always must be specified.
(e.g.: P# DB10.DBX5.0 Byte 10)

Error information
ERROR / STATUS

ERROR = TRUE indicates that an error has occurred during processing. For details refer to parameter *STATUS*.

The following table contains all the error information specific to SFB 35 that can be output with the *ERROR* and *STATUS* parameters.

ERROR	*STATUS* (decimal)	Description
0	11	Message lost: the previous signal change or the previous message could not be sent and will be replaced by the current message.
0	22	• Error in the pointer to the associated values SD_i: - relating to the data length or the data type - no access to associated values in user memory, for example, due to deleted DB or area length error. The activated message is sent without associated values. • The actual parameter you have selected for *SEVERITY* is higher than the permitted range. The activated message will be sent with *SEVERITY*=127.
0	25	Communication was initiated. The message is being processed.
1	1	Communications problems: connection abort or no logon With acknowledgment-triggered reporting active: temporary display, if no display devices support acknowledgment-triggered reporting
1	4	At the first call: the specified *EV_ID* is outside the permitted range or the ANY pointer SD_i has a formal error or the maximum memory area that can be sent for the CPU per SFB 35 was exceeded
1	10	Access to local user memory not possible (for example, access to a deleted DB)
1	12	When the SFB was called an instance DB that does not belong to SFB 35 was specified a shared DB instead of an instance DB was specified.
1	18	*EV_ID* was already being used by one of the SFBs 31 or 33 ... 36.
1	20	Not enough working memory.
1	21	The message with the specified *EV_ID* is disabled.

Note!

After the first block call. all the bits of the *ACK_STATE* output are set and it is assumed that the previous values of inputs *SIG_i*, 1≤ i ≤ 8 were 0.

SFB 36 - NOTIFY - Messages without Acknowledgment Display

Description

Generating block-related messages without acknowledgment display.

SFB 36 NOTIFY monitors a signal. It generates a message both on a rising edge (event entering state) and on a falling edge (event leaving state) with associated values.

When the SFB is first called, a message with the current signal state is sent.

The associated values are queried when the edge is detected and assigned to the message.

Parameters

Parameter	Declaration	Data type	Memory block	Description
SIG	INPUT	BOOL	I, Q, M, D, L	The signal to be monitored.
ID	INPUT	WORD	Constant (I, Q, M, D, L)	Data channel for messages: EEEEh *ID* is only evaluated at the first call.
EV_ID	INPUT	DWORD	Constant (I, Q, M, D, L)	Message number (0 not permitted)
SEVERITY	INPUT	WORD	Constant (I, Q, M, D, L)	Weighting of the event
DONE	OUTPUT	BOOL	I, Q, M, D, L	*DONE* status parameter: Generation of message completed
ERROR	OUTPUT	BOOL	I, Q, M, D, L	*ERROR* status parameter
STATUS	OUTPUT	WORD	I, Q, M, D, L	*STATUS* parameter: Displays error information
SD_i	IN_OUT	ANY	I, Q, M, D, T, C	i-th associated value

SIG

Signal to be monitored.

ID

Data channel for messages: EEEEh. *ID* is evaluated only at the initial call.

EV_ID

EV_ID is only evaluated at the first call. Subsequently, the message number used for the first call applies to every call of SFB with the corresponding instance DB.

The Siemens STEP®7 programming tool assigns the message number automatically to ensure consistency of the message numbers. The message numbers within a user program must be unique.

SEVERITY

Weighting of the event. Here the value 0 is the highest weighting. This parameter is irrelevant for processing the message.

Possible: 0 ... 127 (Default value: 64)

DONE

Status parameter *DONE*, Message generation completed.

SD_i

i-th associated value. It is valid 1 ≤ i ≤ maxNumber. The max. number may be found in the technical data of your CPU.

Permitted are only data of the type BOOL, (not permitted: bit field), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND _TIME.

Note:
When the ANY pointer accesses a DB, the DB always must be specified.
(e.g.: P# DB10.DBX5.0 Byte 10)

Error information
ERROR / STATUS

The following table contains all the error information specific to SFB 36 that can be output with the *ERROR* and *STATUS* parameters.

ERROR	*STATUS* (decimal)	Description
0	11	Message lost: the previous signal change or the previous message could not be sent and will be replaced by the current message.
0	22	• Error in the pointer to the associated values *SD_i*: - Relating to data length / type - No access to associated values in user memory, e.g. because of a deleted DB or area length error. The activated message is transferred without or with the maximum possible number of associated values. • Your selected actual parameter of *SEVERITY* is out of high limits. The activated message will be sent with *SEVERITY* = 127.
0	25	Communication was initiated. The message is being processed.
1	1	Communications problems: connection abort or no logon
1	4	At the first call the specified *EV_ID* is outside the permitted range or the ANY pointer *SD_i* has a formal error or the maximum memory area that can be sent for the CPU per SFB 36 was exceeded.
1	10	Access to local user memory not possible (for example, access to a deleted DB)
1	12	When the SFB was called an instance DB that does not belong to SFB 33 was specified or a shared DB instead of an instance DB was specified.
1	18	*EV_ID* was already being used by one of the SFBs 31 or 33 ... 36.
1	20	Not enough working memory.
1	21	The message with the specified *EV_ID* is disabled.

SFB 47 - COUNT - Counter controlling

Overview

The SFC 47 is a specially developed block for the CPU 31xSC for controlling of the counters.

The SFB is to be called with the corresponding instance DB. Here the parameters of the SFB are stored.

With the SFB COUNT (SFB 47) you have following functional options:

- Start/Stop the counter via software gate *SW_GATE*
- Enable/control digital output DO
- Read the status bit
- Read the actual count and latch value
- Request to read/write internal counter registers

Parameters

Name	Data type	Address (Instance-DB)	Default value	Comment
LADDR	WORD	0.0	300h	This parameter is not evaluated. Always the internal I/O periphery is addressed.
CHANNEL	INT	2.0	0	Channel number
SW_GATE	BOOL	4.0	FALSE	Enables the Software gate
CTRL_DO	BOOL	4.1	FALSE	Enables the output False: Standard Digital Output
SET_DO	BOOL	4.2	FALSE	Parameter is not evaluated
JOB_REQ	BOOL	4.3	FALSE	Initiates the job (edge 0-1)
JOB_ID	WORD	6.0	0	Job ID
JOB_VAL	DINT	8.0	0	Value for write jobs
STS_GATE	BOOL	12.0	FALSE	Status of the internal gate
STS_STRT	BOOL	12.1	FALSE	Status of the hardware gate
STS_LTCH	BOOL	12.2	FALSE	Status of the latch input
STS_DO	BOOL	12.3	FALSE	Status of the output
STS_C_DN	BOOL	12.4	FALSE	Status of the down-count Always indicates the last direction of count. After the first SFB call *STS_C_DN* is set FALSE.
STS_C_UP	BOOL	12.5	FALSE	Status of the up-count Always indicates the last direction of count. After the first SFB call *STS_C_UP* is set TRUE.
COUNTVAL	DINT	14.0	0	Actual count value
LATCHVAL	DINT	18.0	0	Actual latch value
JOB_DONE	BOOL	22.0	TRUE	New job can be started
JOB_ERR	BOOL	22.1	FALSE	Job error
JOB_STAT	WORD	24.0	0	Job error ID

Local data only in instance DB

Name	Data type	Address (Instance DB)	Default value	Comment
RES00	BOOL	26.0	FALSE	reserved
RES01	BOOL	26.1	FALSE	reserved
RES02	BOOL	26.2	FALSE	reserved
STS_CMP	BOOL	26.3	FALSE	Comparator Status *) Status bit STS_CMP indicates that the comparison condition of the comparator is or was reached. STS_CMP also indicates that the output was set. (*STS_DO* = TRUE).
RES04	BOOL	26.4	FALSE	reserved
STS_OFLW	BOOL	26.5	FALSE	Overflow status *)
STS_UFLW	BOOL	26.6	FALSE	Underflow status *)
STS_ZP	BOOL	26.7	FALSE	Status of the zero mark *) The bit is only set when counting without main direction. Indicates the zero mark. This is also set when the counter is set to 0 or if is start counting.
JOB_OVAL	DINT	28.0		Output value for read request.
RES10	BOOL	32.0	FALSE	reserved
RES11	BOOL	32.1	FALSE	reserved
RES_STS	BOOL	32.2	FALSE	Reset status bits: Resets the status bits: STS_CMP, STS_OFLW, STS_ZP. The SFB must be twice called to reset the status bit.

*) Reset with RES_STS

Note!

Per channel you may call the SFB in each case with the same instance DB, since the data necessary for the internal operational are stored here. Writing accesses to outputs of the instance DB is not permissible.

Counter request interface

To read/write counter registers the request interface of the SFB 47 may be used.

So that a new job may be executed, the previous job must have be finished with *JOB_DONE* = TRUE.

Proceeding

The deployment of the request interface takes place at the following sequence:

- Edit the following input parameters:

Name	Data type	Address (DB)	Default	Comment
JOB_REQ	BOOL	4.3	FALSE	Initiates the job (edge 0-1) *
JOB_ID	WORD	6.0	0	Job ID: 00h Job without function 01h Writes the count value 02h Writes the load value 04h Writes the comparison value 08h Writes the hysteresis 10h Writes the pulse duration 20h Writes the end value 82h Reads the load value 84h Reads the comparison value 88h Reads the hysteresis 90h Reads the pulse duration A0h Reads the end value
JOB_VAL	DINT	8.0	0	Value for write jobs (see table at the following page)

*) State remains set also after a CPU STOP-RUN transition.

- Call the SFB. The job is processed immediately. *JOB_DONE* only applies to SFB run with the result FALSE. *JOB_ERR* = TRUE if an error occurred. Details on the error cause are indicated at *JOB_STAT*.

Name	Data type	Address (DB)	Default	Comment
JOB_DONE	BOOL	22.0	TRUE	New job can be started
JOB_ERR	BOOL	22.1	FALSE	Job error
JOB_STAT	WORD	24.0	0000h	Job error ID 0000h No error 0121h Compare value too low 0122h Compare value too high 0131h Hysteresis too low 0132h Hysteresis too high 0141h Pulse duration too low 0142h Pulse duration too high 0151h Load value too low 0152h Load value too high 0161h Count value too low 0162h Count value too high 01FFh Invalid job ID

- A new job may be started with *JOB_DONE* = TRUE.
- A value to be read of a read job may be found in JOB_OVAL in the instance DB at address 28.

Permitted value range for *JOB_VAL*

Continuous count:

Job	Valid range
Writing counter directly	-2147483647 ($-2^{31}+1$) ... +2147483646 ($2^{31}-2$)
Writing the load value	-2147483647 ($-2^{31}+1$) ... +2147483646 ($2^{31}-2$)
Writing comparison value	-2147483648 (-2^{31}) ... +2147483647 ($2^{31}-1$)
Writing hysteresis	0 ... 255
Writing pulse duration*	0 ... 510ms

Single/periodic count, no main count direction:

Job	Valid range
Writing counter directly	-2147483647 ($-2^{31}+1$) ... +2147483646 ($2^{31}-2$)
Writing the load value	-2147483647 ($-2^{31}+1$) ... +2147483646 ($2^{31}-2$)
Writing comparison value	-2147483648 (-2^{31}) ... +2147483647 ($2^{31}-1$)
Writing hysteresis	0 ... 255
Writing pulse duration*	0 ... 510ms

Single/periodic count, main count direction up:

Job	Valid range
End value	2 ... +2147483646 ($2^{31}-1$)
Writing counter directly	-2147483648 (-2^{31}) ... end value -2
Writing the load value	-2147483648 (-2^{31}) ... end value -2
Writing comparison value	-2147483648 (-2^{31}) ... end value -1
Writing hysteresis	0 ... 255
Writing pulse duration*	0 ... 510ms

Single/periodic count, main count direction down:

Job	Valid range
Writing counter directly	2 ... +2147483647 ($2^{31}-1$)
Writing the load value	2 ... +2147483647 ($2^{31}-1$)
Writing comparison value	1 ... +2147483647 ($2^{31}-1$)
Writing hysteresis	0 ... 255
Writing pulse duration*	0 ... 510ms

*) Only even values allowed. Odd values are automatically rounded.

Latch function

As soon as during a count process an edge 0-1 is recognized at the "Latch" input of a counter, the recent counter value is stored in the according latch register.

You may access the latch register via *LATCHVAL* of the SFB 47.

A just in *LATCHVAL* loaded value remains after a STOP-RUN transition.

SFB 52 - RDREC - Reading a Data Record from a DP-V1 slave

Note!

The SFB 52 RDREC interface is identical to the FB RDREC defined in the standard "PROFIBUS Guideline PROFIBUS Communication and Proxy Function Blocks according to IEC 61131-3".

Description

With the SFB 52 RDREC (read record) you read a record set with the number *INDEX* from a DP slave component (module or modules) that has been addressed via *ID*.

Specify the maximum number of bytes you want to read in *MLEN*. The selected length of the target area *RECORD* should have at least the length of *MLEN* bytes.

TRUE on output parameter *VALID* verifies that the record set has been successfully transferred into the target area *RECORD*. In this case, the output parameter *LEN* contains the length of the fetched data in bytes.

The output parameter *ERROR* indicates whether a record set transmission error has occurred. In this case, the output parameter *STATUS* contains the error information.

System dependent this block cannot be interrupted!

Note!

If a DP-V1 slave is configured using a GSD file (GSD stating with Rev. 3) and the DP interface of the DP master is set to Siemens "S7 compatible", than record sets must not be read from I/O modules in the user program with SFB 52. The reason is that in this case the DP master addresses the incorrect slot (configured slot +3).

Remedy: Set the interface for DP master to "DP-V1"!

Operating principle

The SFB 52 RDREC operates asynchronously, that is, processing covers multiple SFB calls. Start the job by calling SFB 52 with *REQ* = 1.

The job status is displayed via the output parameter *BUSY* and bytes 2 and 3 of output parameter *STATUS*. Here, the *STATUS* bytes 2 and 3 correspond with the output parameter *RET_VAL* of the asynchronously operating SFCs (see also meaning of *REQ*, *RET_VAL* and *BUSY* with Asynchronously Operating SFCs).

Record set transmission is completed when the output parameter *BUSY* = FALSE.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D ,L, constant	*REQ* = 1: Transfer record set
ID	INPUT	DWORD	I, Q, M, D, L, constant	Logical address of the DP slave component (module) For an output module, bit 15 must be set (e.g. for address 5: *ID*: DW = 8005h). For a combination module, the smaller of the two addresses should be specified.
INDEX	INPUT	INT	I, Q, M, D, L, constant	Record set number
MLEN	INPUT	INT	I, Q, M, D, L, constant	Maximum length in bytes of the record set information to be fetched
VALID	OUTPUT	BOOL	I, Q, M, D, L	New record set was received and valid
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: The read process is not yet terminated.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	*ERROR* = 1: A read error has occurred.
STATUS	OUTPUT	DWORD	I, Q, M, D, L	Call *ID* (bytes 2 and 3) or error code.
LEN	OUTPUT	INT	I, Q, M, D, L	Length of the fetched record set information.
RECORD	IN_OUT	ANY	I, Q, M, D, L	Target area for the fetched record set.

Error information

See Receiving an interrupt from a DP slave with SFB 54 RALRM.

SFB 53 - WRREC - Writing a Data Record in a DP-V1 slave

Note!
The SFB 53 WRREC interface is identical to the FB WRREC defined in the standard "PROFIBUS Guideline PROFIBUS Communication and Proxy Function Blocks according to IEC 61131-3".

Description

With the SFB 53 WRREC (Write record) you transfer a record set with the number *INDEX* to a DP slave component (module) that has been addressed via *ID*.

Specify the byte length of the record set to be transmitted. The selected length of the source area *RECORD* should, therefore, have at least the length of *LEN* bytes.

TRUE on output parameter *DONE* verifies that the record set has been successfully transferred to the DP slave.

The output parameter *ERROR* indicates whether a record set transmission error has occurred. In this case, the output parameter *STATUS* contains the error information.

System dependent this block cannot be interrupted!

Note!
If a DP-V1 slave is configured using a GSD file (GSD stating with Rev. 3) and the DP interface of the DP master is set to Siemens "S7 compatible", than record sets must not be read from I/O modules in the user program with SFB 53. The reason is that in this case the DP master addresses the incorrect slot (configured slot +3).

Remedy: Set the interface for DP master to "DP-V1"!

Operating principle

The SFB 53 WRREC operates asynchronously, that is, processing covers multiple SFB calls. Start the job by calling SFB 52 with *REQ* = 1.

The job status is displayed via the output parameter *BUSY* and bytes 2 and 3 of output parameter *STATUS*. Here, the *STATUS* bytes 2 and 3 correspond with the output parameter *RET_VAL* of the asynchronously operating SFCs (see also meaning of *REQ, RET_VAL* and *BUSY* with Asynchronously Operating SFCs).

Please note that you must assign the same value to the actual parameter of *RECORD* for all SFB 53 calls that belong to one and the same job. The same applies to the *LEN* parameters.

Record set transmission is completed when the output parameter *BUSY* = FALSE.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: Transfer record set
ID	INPUT	DWORD	I, Q, M, D, L, constant	Logical address of the DP slave component (module or submodule). For an output module, bit 15 must be set (e.g. for address 5: *ID*: DW = 8005h). For a combination module, the smaller of the two addresses should be specified.
INDEX	INPUT	INT	I, Q, M, D, L, constant	Record set number.
LEN	INPUT	INT	I, Q, M, D, L, constant	Maximum byte length of the record set to be transferred
DONE	OUTPUT	BOOL	I, Q, M, D, L	Record set was transferred
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: The write process is not yet terminated.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	*ERROR* = 1: A write error has occurred
STATUS	OUTPUT	DWORD	I, Q, M, D, L	Call *ID* (bytes 2 and 3) or error code
LEN	OUTPUT	INT	I, Q, M, D, L	Length of the fetched record set information
RECORD	IN_OUT	ANY	I, Q, M, D, L	Record set

Error information

See Receiving an interrupt from a DP slave with SFB 54 RALRM.

SFB 54 - RALRM - Receiving an interrupt from a DP-V1 slave

Note!
The SFB 54 RALRM interface is identical to the FB RALRM defined in the standard "PROFIBUS Guideline PROFIBUS Communication and Proxy Function Blocks according to IEC 61131-3".

Description

The SFB 54 RALRM receives an interrupt with all corresponding information from a peripheral module (centralized structure) or from a DP slave component. It supplies this information to its output parameters.

The information in the output parameters contains the start information of the called OB as well as information of the interrupt source.

Call the SFB 54 only within the interrupt OB started by the CPU operating system as a result of the peripheral interrupt that is to be examined.

Note!
If you call SFB 54 RALRM in an OB for which the start event was not triggered by peripherals, the SFB supplies correspondingly reduced information on its outputs.
Make sure to use different instance DBs when you call SFB 54 in different OBs. If you want to evaluate data that are the result of an SFB 54 call outside of the associated interrupt OB you should moreover use a separate instance DP per OB start event.

Parameters

Parameter	Declaration	Data type	Memory block	Description
MODE	INPUT	INT	I, Q, M, D, L, constant	Operating mode
F_ID	INPUT	DWORD	I, Q, M, D, L, constant	Logical start address of the Component (module), from which interrupts are to be received.
MLEN	INPUT	INT	I, Q, M, D, L, constant	Maximum length in bytes of the data interrupt information to be received
NEW	OUTPUT	BOOL	I, Q, M, D, L	A new interrupt was received.
STATUS	OUTPUT	DWORD	I, Q, M, D, L	Error code of the SFB or DP master
ID	OUTPUT	DWORD	I, Q, M, D, L	Logical start address of the component (module), from which an interrupt was received. Bit 15 contains the I/O ID: 0: for an input address 1: for an output address
LEN	OUTPUT	INT	I, Q, M, D, L	Length of the received interrupt information
TINFO	IN_OUT	ANY	I, Q, M, D, L	(task information) Target range OB start and management information
AINFO	IN_OUT	ANY	I, Q, M, D, L	(interrupt information) Target area for header information and additional information. For *AINFO* you should provide a length of at least *MLEN* bytes.

MODE

You can call the SFB 54 in three operating modes (*MODE*):

0: shows the component that triggered the interrupt in the output parameter ID and sets the output parameter *NEW* to TRUE.

1: describes all output parameters, independent on the interrupt-triggering component.

2: checks whether the component specified in input parameter *F_ID* has triggered the interrupt.
- if not, *NEW* = FALSE
- if yes, *NEW* = TRUE, and all other outputs parameters are described.

Note!
If you select a target area *TINFO* or *AINFO* that is too short the SFC 54 cannot enter the full information.

TINFO Data structure of the target area (task information):

<table>
<tr><th>Byte</th><th>Data type</th><th colspan="5">Description</th></tr>
<tr><td>0 ... 19</td><td></td><td colspan="5">Start information of the OB in which SFC 54 was currently called:
Byte 0 ... 11: structured like the parameter TOP_SI in SFC 6 RD_SINFO
Byte 12 ... 19: date and time the OB was requested</td></tr>
<tr><td>20 ... 27</td><td></td><td colspan="5">Management information:</td></tr>
<tr><td>20</td><td>Byte</td><td colspan="5">centralized: 0
decentralized: DP master system ID (possible values: 1 ... 255)</td></tr>
<tr><td>21</td><td>Byte</td><td colspan="5">central: Module rack number (possible values: 0 ... 31)
distributed: Number of DP station (possible values: 0 ... 127)</td></tr>
<tr><td rowspan="8">22</td><td rowspan="8">Byte</td><td colspan="5">centralized: 0</td></tr>
<tr><td rowspan="7">decentralized:</td><td rowspan="5">Bit 3 ... 0</td><td rowspan="5">slave type</td><td>0000:</td><td>DP</td></tr>
<tr><td>0001:</td><td>DPS7</td></tr>
<tr><td>0010:</td><td>DPS7 V1</td></tr>
<tr><td>0011:</td><td>DP-V1</td></tr>
<tr><td>as of 0100:</td><td>reserved</td></tr>
<tr><td rowspan="2">Bit 7 ... 4</td><td rowspan="2">Profile type</td><td>0000:</td><td>DP</td></tr>
<tr><td>as of 0001:</td><td>reserved</td></tr>
<tr><td rowspan="7">23</td><td rowspan="7">Byte</td><td colspan="5">centralized: 0</td></tr>
<tr><td rowspan="6">decentralized:</td><td rowspan="4">Bit 3 ... 0</td><td rowspan="4">Interrupt info type</td><td>0000:</td><td>Transparent (Interrupt originates from a configured decentralized module)</td></tr>
<tr><td>0001:</td><td>Representative (Interrupt originating from a non-DP-V1 slave or a slot that is not configured)</td></tr>
<tr><td>0010:</td><td>Generated interrupt (generated in the CPU)</td></tr>
<tr><td>as of 0011:</td><td>reserved</td></tr>
<tr><td rowspan="2">Bit 7 ... 4</td><td rowspan="2">Structure version</td><td>0000:</td><td>Initial</td></tr>
<tr><td>as of 0001:</td><td>reserved</td></tr>
</table>

continued ...

... continue TINFO

Byte	Data type	Description	
24	Byte	centralized:	0
		decentralized:	Flags of the DP master interface
		Bit 0 = 0:	Interrupt originating from an integrated DP interface
		Bit 0 = 1:	Interrupt originating from an external DP interface
		Bit 7 ... 1:	reserved
25	Byte	centralized:	0
		decentralized:	Flags of the DP slave interface
		Bit 0:	EXT_DIAG_Bit of the diagnostic message frame, or 0 if this bit does not exist in the interrupt
		Bit 7 ... 1:	reserved
26, 27	WORD	centralized:	0
		decentralized:	PROFIBUS ID number

AINFO Data structure of the target area (interrupt information):

Byte	Data type	Description		
0 ... 3		Header information		
0	Byte	Length of the received interrupt information in bytes		
		centralized: 4 ... 224		
		decentralized: 4 ... 63		
1	Byte	centralized: reserved		
		decentralized:	ID for the interrupt type	
			1:	Diagnostic interrupt
			2:	Hardware interrupt
			3:	Removal interrupt
			4:	Insertion interrupt
			5:	Status interrupt
			6:	Update interrupt
			31:	Failure of an expansion device, DP master system or DP station
			32 ... 126	manufacturer specific interrupt
2	**Byte**	**Slot number of the interrupt triggering component**		
3	Byte	centralized: reserved		
		decentralized:	Identifier	
			Bit 1, 0:	
			00	no further information
			01	incoming event, disrupted slot
			10	going event, slot not disrupted anymore
			11	going event, slot still disrupted
			Bit 2:	Add_Ack
			Bit 7 ... 3	Sequence number
4 ... 223		Additional interrupt information: module specific data for the respective interrupt:		
		centralized:	ARRAY[0] ... ARRAY[220]	
		decentralized:	ARRAY[0] ... ARRAY[59]	

TINFO and AINFO

Target Area:

Depending on the respective OB in which SFB 54 is called, the target areas *TINFO* and *AINFO* are only partially written. Refer to the table below for information on which info is entered respectively.

Interrupt type	OB	*TINFO* OB status information	*TINFO* management information	*AINFO* header information	*AINFO* additional interrupt information
Hardware interrupt	4x	Yes	Yes	Yes	centralized: No
					decentralized: as delivered by the DP slave
Status interrupt	55	Yes	Yes	Yes	Yes
Update interrupt	56	Yes	Yes	Yes	Yes
Manufacturer specific interrupt	57	Yes	Yes	Yes	Yes
Peripheral redundancy error	70	Yes	Yes	No	No
Diagnostic interrupt	82	Yes	Yes	Yes	centralized: Record set 1
					decentralized: as delivered by the DP slave
Removal/ Insertion interrupt	83	Yes	Yes	Yes	centralized: no
					decentralized: as delivered by the DP slave
Module rack/ Station failure	86	Yes	Yes	No	No
...	all other OBs	Yes	No	No	No

Error information

The output parameter *STATUS* contains information. It is interpreted as ARRAY[1...4] OF BYTE the error information has the following structure:

Field element	Name	Description
STATUS[1]	Function_Num	00h: if no error Function ID from DP-V1-PDU: in error case 80h is OR linked. If no DP-V1 protocol element is used: C0h
STATUS[2]	Error_Decode	Location of the error ID
STATUS[3]	Error_1	Error ID
STATUS[4]	Error_2	Manufacturer specific error ID expansion: With DP-V1 errors, the DP master passes on *STATUS*[4] to the CPU and to the SFB. Without DP-V1 error, this value is set to 0, with the following exceptions for the SFB 52: • *STATUS*[4] contains the target area length from *RECORD*, if *MLEN* > the target area length from *RECORD* • STATUS[4]=*MLEN*, if the actual record set length < *MLEN* < the target area length from *RECORD*

STATUS[2] (Location of the error ID) can have the following values:

Error_Decode	Source	Description
00 ... 7Fh	CPU	No error no warning
80h	DP-V1	Error according to IEC 61158-6
81h ... 8Fh	CPU	8xh shows an error in the nth call parameter of the SFB.
FEh, FFh	DP Profile	Profile-specific error

STATUS[3] (Error ID) can have the following values:

Error_Decode	Error_Code_1	Explanation according to DP-V1	Description
00h	00h		no error, no warning
70h	00h	reserved, reject	Initial call; no active record set transfer
	01h	reserved, reject	Initial call; record set transfer has started
	02h	reserved, reject	Intermediate call; record set transfer already active
80h	90h	reserved, pass	Invalid logical start address
	92h	reserved, pass	Illegal Type for ANY Pointer
	93h	reserved, pass	The DP component addressed via *ID* or *F_ID* is not configured.
	A0h	read error	Negative acknowledgement while reading the module.
	A1h	write error	Negative acknowledgement while writing the module.
	A2h	module failure	at layer 2
	A3h	reserved, pass	DP protocol error with Direct-Data-Link-Mapper or User-Interface/User
	A4h	reserved, pass	Bus communication disrupted
	A5h	reserved, pass	-
	A7h	reserved, pass	DP slave or module is occupied (temporary error)
	A8h	version conflict	DP slave or module reports non-compatible versions
	A9h	feature not supported	Feature not supported by DP slave or module
	AA ... AFh	user specific	DP slave or module reports a manufacturer specific error in its application. Please check the documentation from the manufacturer of the DP slave or module.
	B0h	invalid index	Record set not known in module illegal record set number ≥256.
	B1h	write length error	Wrong length specified in parameter *RECORD*; with SFB 54: length error in *AINFO*.
	B2h	invalid slot	Configured slot not occupied.
	B3h	type conflict	Actual module type not equal to specified module type
	B4h	invalid area	DP slave or module reports access to an invalid area
	B5h	state conflict	DP slave or module not ready
	B6h	access denied	DP slave or module denies access

continued ...

... continue STATUS[3]

Error_Decode	Error_Code_1	Explanation according to DP-V1	Description
80h	B7h	invalid range	DP slave or module reports an invalid range for a parameter or value
	B8h	invalid parameter	DP slave or module reports an invalid parameter
	B9h	invalid type	DP slave or module reports an invalid type
	BAh ... BFh	user specific	DP slave or module reports a manufacturer specific error when accessing. Please check the documentation from the manufacturer of the DP slave or module.
	C0h	read constrain conflict	The module has the record set, however, there are no read data yet.
	C1h	write constrain conflict	The data of the previous write request to the module for the same record set have not yet been processed by the module.
	C2h	resource busy	The module currently processes the maximum possible jobs for a CPU.
	C3h	resource unavailable	The required operating resources are currently occupied.
	C4h		Internal temporary error. Job could not be carried out. Repeat the job. If this error occurs often, check your plant for sources of electrical interference.
	C5h		DP slave or module not available
	C6h		Record set transfer was canceled due to priority class cancellation
	C7h		Job canceled due to restart of DP masters
	C8h ... CFh		DP slave or module reports a manufacturer specific resource error. Please check the documentation from the manufacturer of the DP slave or module.
	Dxh	user specific	DP slave specific, Refer to the description of the DP slaves.
81h	00h ... FFh		Error in the initial call parameter (with SFB 54: *MODE*)
	00h		Illegal operating mode

continued ...

... continue STATUS[3]

Error_Decode	Error_Code_1	Explanation according to DP-V1	Description
82h	00h ... FFh		Error in the 2. call parameter.
...	...		...
88h	00h ... FFh		Error in the 8. call parameter (with SFB 54: *TINFO*)
	01h		Wrong syntax ID
	23h		Quantity frame exceeded or target area too small
	24h		Wrong range ID
	32h		DB/DI no. out of user range
	3Ah		DB/DI no. is NULL for area ID DB/DI or specified DB/DI does not exist.
89h	00h ... FFh		Error in the 9. call parameter (with SFB 54: *AINFO*)
	01h		Wrong syntax ID
	23h		Quantity frame exceeded or target area too small
	24h		Wrong range ID
	32h		DB/DI no. out of user range
	3Ah		DB/DI no. is NULL for area ID DB/DI or specified DB/DI does not exist
8Ah	00h ... FFh		Error in the 10. call parameter
...	...		...
8Fh	00h ... FFh		Error in the 15. call parameter
FEh, FFh			Profile-specific error

Chapter 4 Integrated Standard FBs

Overview

Here the description of the integrated standard FBs of the SPEED7 CPUs from VIPA may be found.

The description of the FBs of the VIPA library may be found at the chapter "VIPA specific blocks".

Content

Topic **Page**

Overview Integrated Standard-FBs

General

Those in the following listed UTDs and FBs serve for "open communication" with other Ethernet capable communication partners via your user program.

These blocks are part of the Siemens SIMATIC Manager. You will find these in the "Standard Library" at "Communication Blocks".

Please consider when using the blocks for open communication that the partner station does not have to be configured with these blocks.

This can be configured with AG_SEND / AG_RECEIVE or IP_CONFIG.

UDTs

FB	Label	Connection-oriented protocols: TCP native as per RFC 793, ISO on TCP as per RFC 1006	Connectionless protocol: UDP as per RFC 768
UDT 65	TCON_PAR	Data structure for assigning connection parameters	Data structure for assigning parameters for the local communications access point
UDT 66	TCON_ADR		Data structure for assigning addressing parameters for the remote partner

FBs

FB	Label	Connection-oriented protocols: TCP native as per RFC 793, ISO on TCP as per RFC 1006	Connectionless protocol: UDP as per RFC 768
FB 63	TSEND	Sending data	
FB 64	TRCV	Receiving data	
FB 65	TCON	Establishing a connection	Configuring the local communications access point
FB 66	TDISCON	Terminating a connection	Closing the local communications access point
FB 67	TUSEND		Sending data
FB 68	TURCV		Receiving data

Open Communication - FB 63 ... FB 68

Connection-oriented protocols

Connection-oriented protocols establish a (logical) connection to the communication partner before data transmission is started. And if necessary they terminate the connection after the data transfer was finished.

Connection-oriented protocols are used for data transmission when reliable, guaranteed delivery is of particular importance. In general, many logical connections can exist on one physical line.

The following connection-oriented protocols are supported with FBs for open communication via Industrial Ethernet:

- TCP/IP native as per RFC 793 (with connection types 01h and 11h)
- ISO on TCP as per RFC 1006 (with connection type 12h)

TCP native

During data transmission, no information about the length or about the start and end of a message is transmitted. However, the receiver has no means of detecting where one message ends in the data stream and the next one begins. The transfer is stream-oriented.

For this reason, it is recommended that the data length of the FBs is identical for the sending and receiving station. If the number of received data does not fit to the preset length you either will get not the whole data, or you will get data of the following job.

The receive block copies as many bytes into the receive area as you have specified as length. After this, it will set NDR to TRUE and write RCVD_LEN with the value of LEN. With each additional call, you will thus receive another block of sent data.

ISO on TCP

During data transmission, information on the length and the end of the message is also transmitted.

If you have specified the length of the data to be received greater than the length of the data to be sent, the receive block will copy the received data completely into the receive range. After this, it will set NDR to TRUE and write RCVD_LEN with the length of the sent data.

If you have specified the length of the data to be received less than the length of the sent data, the receive block will not copy any data into the receive range but instead will supply the following error information: ERROR = 1, STATUS = 8088h.

Connection-less protocol

There is thus no establishment and termination of a connection with a remote partner. Connection-less protocols transmit data with no acknowledge and with no reliable guaranteed delivery to the remote partner.

The following connection-oriented protocol is supported with FBs for open communication via Industrial Ethernet:

- UDP according to RFC 768 (with connection type 13h)

UDP

In this case, when calling the sending block you have to specify the address parameters of the receiver (IP address and port number). During data transmission, information on the length and the end of the message is also transmitted.

In order to be able to use the sending and receiving blocks first you have to configure the local communications access point at both sides.

With each new call of the sending block, you re-reference the remote partner by specifying its IP address and its port number.

If you have specified the length of the data to be received greater than the length of the data to be sent, the receive block will copy the received data completely into the receive range. After this, it will set NDR to TRUE and write RCVD_LEN with the length of the sent data.

If you have specified the length of the data to be received less than the length of the sent data, the receive block will not copy any data into the receive range but instead will supply the following error information: ERROR = 1, STATUS = 8088h.

UDT 65 - TCON_PAR

Data structure for assigning connection

In the TCP Connection parameterization of native or ISO on TCP, you define which communication partners enabled the connection and which to a request through the communication partner performs a passive connection.

If both communication partners have launched their connection, the operating system can restore the communication link.

To communicate a DB is needed. Facility whereby the DB's data structure from the UDT 65 TCON_PAR. For each connection such a data structure is needed that can be summarized in a global DB.

The CONNECT connection parameter address of FB 65 TCON contains a reference to the associated connection description (e.g. P#DB10.DBX0.0 byte 64).

Data structure

Byte	Parameter	Data type	Start value	Description
0 ... 1	block_length	WORD	40h	Length of UDT 65: 64 Bytes (fixed)
2 ... 3	id	WORD	0000h	Reference to the connection (range of values: 0001h ... 0FFFh) You must specify the value of the parameter in the respective block with the ID.
4	connection _type	BYTE	01h	Connection type: • 11h: TCP/IP native • 12h: ISO on TCP • 01h: TCP/IP native (Compatibility mode)
5	active_est	BOOL	FALSE	ID for the way the connection is established: • FALSE: passive establishment • TRUE: active establishment
6	local_device_id	BYTE	02h	• 02h: communication via CP of the VIPA-CPU 02h (fix)
7	local_tsap_id_len	BYTE	02h	Length of parameter local_tsap_id used; possible values: • 0 or 2, if connection type = 01h or 11h For the active side, only the value 00h is permitted. • 2 to 16, if connection type = 12h
8	rem_subnet_id_len	BYTE	00h	This parameter is currently not used. You must assign 00h to it.
9	rem_staddr_len	BYTE	00h	Length of address for the remote connection transmission point: • 0: unspecified, i.e. parameter rem_staddr is irrelevant. 4: valid IP address in the parameter rem_staddr

continue ...

... continued

Byte	Parameter	Data type	Start value	Description
10	rem_tsap_id_len	BYTE	00h	Length of parameter local_tsap_id used; possible values: • 0 or 2, if connection type = 01h or 11h For the passive side, only the value 00h permitted. • 2 ... 16, if connection type = 12h
11	next_staddr_len	BYTE	00h	Length of parameter next_staddr used
12 ... 27	local_tsap_id	ARRAY [1..16] of BYTE	00h ...	With connection_type = • 11h: local port no. (possible values: 2000 ... 5000), local_tsap_id[1] = high byte of port no. in hexadecimal representation, local_tsap_id[2] = low byte of port no. in hexadecimal representation, local_tsap_id[3-16] = irrelevant • 12h: local TSAP-ID: local_tsap_id[1] = E0h (connection type T-connection), local_tsap_id[2] = Rack and slot in own CPU (Bits 0 to 4 slot, Bits 5 to7: rack number), local_tsap_id[3-16] = TSAP extension • 01h: local port no. (possible values: 2000 ... 5000), local_tsap_id[1] = low byte of Port-Nr. in hexadecimal representation, local_tsap_id[2] = high byte of port no. in hexadecimal representation, local_tsap_id[3-16] = irrelevant **Note:** Make sure that each value of local_tsap_id that you use in your CPU is unique.
28 ... 33	rem_subnet_id	ARRAY [1..6] of BYTE	00h ...	This parameter is currently not used. You must assign 0 to it.
34 ... 39	rem_staddr	ARRAY [1..6] of BYTE	00h ...	IP address for the remote connection transmission point: e.g. 192.168.002.003: With connection_type = • 1xh: rem_staddr[1] = C0h (192), rem_staddr[2] = A8h (168), rem_staddr[3] = 02h (002), rem_staddr[4] = 03h (003), rem_staddr[5-6] = irrelevant • 01h: rem_staddr[1] = 03h (003), rem_staddr[2] = 02h (002), rem_staddr[3] = A8h (168), rem_staddr[4] = C0h (192), rem_staddr[5-6] = irrelevant

continue ...

... continued

Byte	Parameter	Data type	Start value	Description
40 ... 55	rem_tsap_id	ARRAY [1..16] of BYTE	00h ...	With connection_type = • 11h: remote port no. (possible values: 2000 ... 5000), rem_tsap_id[1] = high byte of port no in hexadecimal representation, rem_tsap_id[2] = low byte of port no in hexadecimal representation, rem_tsap_id[3-16] = irrelevant • 12h: remote TSAP-ID: rem_tsap_id[1] = E0h (connection type T-connection), rem_tsap_id[2] = Rack and slot for the remote connection transmission point (CPU) (bits 0 to 4: slot, bits 5 ... 7: rack number), rem_tsap_id[3-16] = TSAP extension • 01h: remote port no. (possible values: 2000 ... 5000), local_tsap_id[1] = low byte of port no. in hexadecimal representation, local_tsap_id[2] = high byte of port no. in hexadecimal representation, local_tsap_id[3-16] = irrelevant
56 ... 61	next_staddr	ARRAY [1..6] of BYTE	00h ...	At local_device_id = • 00h: next_staddr[1]: Rack and slot of associated (local) CP (bits 0 ... 4: slot, bits 5 ... 7: rack number) next_staddr[2-6]: irrelevant • 02h: next_staddr[1-6]: irrelevant
62 ... 63	spare	WORD	0000h	irrelevant

Data structure for communications access point

A communications access point provides the link between application of the communication layer of the operating system dar.
Defined for communication over UDP, each communication partner a communication access point using a DB.
Facility whereby the DB's data structure from the UDT 65 "TCON_PAR".

Data structure

Byte	Parameter	Data type	Start value	Description
0 ... 1	block_length	WORD	40h	Length of UDT 65: 64 Bytes (fixed)
2 ... 3	id	WORD	0000h	Reference to this connection between the user program and the communications level of the operating system (range of values: 0001h ... 0FFFh) You must specify the value of the parameter in the respective block with the ID.
4	connection_type	BYTE	01h	Connection type: • 13h: UDP
5	active_est	BOOL	FALSE	ID for the way the connection is established: You must assign FALSE to this parameter since the communications access point can be used to both send and receive data.
6	local_device_id	BYTE	02h	• 02h: Communication via the CP of the VIPA-CPU 02h (fix).
7	local_tsap_id_len	BYTE	02h	Length of parameter local_tsap_id used; possible value: 2
8	rem_subnet_id_len	BYTE	00h	This parameter is currently not used. Value 00h (fix).
9	rem_staddr_len	BYTE	00h	This parameter is currently not used. Value 00h (fix).
10	rem_tsap_id_len	BYTE	00h	This parameter is currently not used. Value 00h (fix).
11	next_staddr_len	BYTE	00h	This parameter is currently not used. Value 00h (fix).
12 ... 27	local_tsap_id	ARRAY [1..16] of BYTE	00h ...	• Remote port no. (possible values: 2000 ... 5000), local_tsap_id[1] = high byte of port no in hexadecimal representation, local_tsap_id[2] = low byte of port no in hexadecimal representation, local_tsap_id[3-16] = irrelevant **Note:** Make sure that each value of local_tsap_id that you use in your CPU is unique.
28 ... 33	rem_subnet_id	ARRAY [1..6] of BYTE	00h ...	This parameter is currently not used. Value 00h (fix).
34 ... 39	rem_staddr	ARRAY [1..6] of BYTE	00h ...	This parameter is currently not used. Value 00h (fix).
40 ... 55	rem_tsap_id	ARRAY [1..16] of BYTE	00h ...	This parameter is currently not used. Value 00h (fix).
56 ... 61	next_staddr	ARRAY [1..6] of BYTE	00h ...	This parameter is currently not used. Value 00h (fix).
62 ... 63	spare	WORD	0000h	irrelevant

UDT 66 - TCON_ADR

Description

With FB 67 TUSEND, at the parameter *ADDR* you transfer the address of the receiver. This address information must have structure specified below.

With FB 68 TURCV, in the parameter *ADDR* you get the address of the sender of the data that were received. This address information must have structure specified below.

Data block

You have to create an DB that contains one or more data structures as per UDT 66 TADDR_PAR.

In parameter *ADDR* of FB 67 TUSEND you transfer and in parameter *ADDR* of FB 68 TURCV you receive a pointer to the address of the associated remote partner (e.g. P#DB10.DBX0.0 byte 8).

Structure of the address information for the remote partner

Byte	Parameter	Data type	Start value	Description
0 ... 3	rem_ip_addr	ARRAY [1..4] of BYTE	00h ...	IP address of the remote partner, e.g. 192.168.002.003: • rem_ip_addr[1] = C0h (192) • rem_ip_addr[2] = A8h (168) • rem_ip_addr[3] = 02h (002) • rem_ip_addr[4] = 03h (003)
4 ... 5	rem_port_nr	ARRAY [1..2] of BYTE	00h ...	remote port no. (possible values: 2000 ... 5000) • rem_port_nr[1] = high byte of port no. in hexadecimal representation • rem_port_nr[2] = low byte of port no. in hexadecimal representation
6 ... 7	spare	ARRAY [1..2] of BYTE	00h ...	irrelevant

Parameterization - Example

Overview

Below it is shown by an example how the parameter DB for a communication link is to be set up for transmitter and receiver.

The communication partner are 2 CPU 317-4NE12 from VIPA. Here the communication takes place via the integrated CP 343 of each.
The connection type is TCP/IP native.

Data of the communication partners

Properties	Station A CPU 317-4NE12	Station B CPU 317-4NE12
Connection	active	passive
IP address	192.168.3.125	192.168.3.142
Physical address CPU	Rack 0, slot 2	Rack 0, slot 4
Physical address PG/OP	Rack 0, slot 4	Rack 0, slot 4
Physical address of the CP	Rack 0, slot 5	Rack 0, slot 5
Local port no.	not relevant	2005

Parameter DB Station A

The table shows the parameter DB for an active connection establishment.

Parameter	Data type	Value in the example	Description
block_length	WORD	40h	DB block length
id	WORD	0001h	Reference to this connection
connection_type	BYTE	11h	Connection type: TCP/IP native
active_est	BOOL	TRUE	Active connection establishment
local_device_id	BYTE	02h	Communication via the integrated Ethernet interface
local_tsap_id_len	BYTE	00h (only this value is possible)	Parameter local_tsap_id is not used
rem_staddr_len	BYTE	04h	Length of address for the remote connection transmission point: • 4: valid IP address in parameter rem_staddr
rem_tsap_id_len	BYTE	02h (only this value is possible)	Length of parameter rem_tsap_id used
rem_staddr	ARRAY [1..6] of BYTE	"192.168.3.125" • rem_staddr[1] = C0h (192) • rem_staddr[2] = A8h (168) • rem_staddr[3] = 03h (3) • rem_staddr[4] = 7Dh (125) • rem_staddr[5-6] = not relevant	IP address of the remote connection transmission point
rem_tsap_id	ARRAY [1..16] of BYTE	"2005" • rem_tsap_id[1] = 07h • rem_tsap_id[2] = D5h • rem_tsap_id[3-16] = not relevant	Remote port no.: 2005 = 07D5h

Parameter DB Station B

The table shows the parameter DB for an passive connection establishment.

Parameter	Data type	Value in the example	Description
block_length	WORD	40h	DB block length
id	WORD	0002h	Reference to this connection
connection_type	BYTE	11h	Connection type: TCP/IP native
active_est	BOOL	FALSE	Passive connection establishment
local_device_id	BYTE	02h	Communication via the integrated Ethernet interface
local_tsap_id_len	BYTE	02h (only this value is possible)	Length of parameter local_tsap_id used
rem_staddr_len	BYTE	04h	Length of address for the remote connection transmission point: • 4: valid IP address in parameter rem_staddr
rem_tsap_id_len	BYTE	00h (only this value is possible)	Length of parameter rem_tsap_id used
local_tsap_id	ARRAY [1..16] of BYTE	"2005" • local_tsap_id[1] = 07h • local_tsap_id[2] = D5h • local_tsap_id[3-16] = not relevant	Local port no.: 2005 = 07D5h
rem_staddr	ARRAY [1..6] of BYTE	"192.168.3.142" • rem_staddr[1] = C0h (192) • rem_staddr[2] = A8h (168) • rem_staddr[3] = 03h (3) • rem_staddr[4] = 8Eh (142) • rem_staddr[5-6] = not relevant	IP address of the remote connection transmission point

FB 63 - TSEND - Sending data - TCP native and ISO on TCP

Description

FB 63 TSEND sends data over an existing communications connection.
FB 63 TSEND is an asynchronously functioning FB, which means that its processing extends over several FB calls.

To start sending data, call FB 63 with *REQ* = 1.

The job status is indicated at the output parameters *BUSY* and *STATUS*. STATUS corresponds to the *RET_VAL* output parameter of asynchronously functioning SFCs (see also Meaning of the Parameters *REQ*, *RET_VAL* and *BUSY* with Asynchronous SFCs).

The following table shows the relationships between *BUSY*, *DONE* and *ERROR*. Using this table, you can determine the current status of FB 63 or when the establishment of the connection is complete.

BUSY	DONE	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job was completed successfully.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the *STATUS* parameter.
FALSE	FALSE	FALSE	The FB was not assigned a (new) job.

Note!

Due to the asynchronous function of FB 63 TSEND, you must keep the data in the sender area consistent until the *DONE* parameter or the *ERROR* parameter assumes the value TRUE.

Parameters

Parameter	Declaration	Data type	Memory area	Description
REQ	INPUT	BOOL	E, A, M, D, L	Control parameter REQUEST, initiates the transmission at rising edge. At the first call with REQ = 1, data are transmitted from the area specified by the DATA parameter.
ID	INPUT	WORD	M, D, constant	Reference to the connection to be terminated. ID must be identical to the associated parameter ID in the local connection description. Range of values: 0001h ... 0FFFh
LEN	INPUT	INT	E, A, M, D, L	Number of bytes to be sent with the job Range of values: • 1 ... 1460, if connection type = 01h • 1 ... 8192, if connection type = 11h • 1 ... 1452, if connection type = 12h and a CP is being used • 1 ... 8192, if connection type = 12h and no CP is being used
DONE	OUTPUT	BOOL	E, A, M, D, L	DONE status parameter: • 0: Job not yet started or still running. • 1: Job executed without error.
BUSY	OUTPUT	BOOL	E, A, M, D, L	• BUSY = 1: Job is not yet completed. A new job cannot be triggered. • BUSY = 0: Job is completed.
ERROR	OUTPUT	BOOL	E, A, M, D, L	ERROR status parameter: • ERROR = 1: Error occurred during processing. STATUS provides detailed information on the type of error.
STATUS	OUTPUT	WORD	M, D	STATUS status parameter: Error information
DATA	IN_OUT	ANY	E, A, M, D	Send area, contains address and length. The address refers to: • The process image input • The process image output • A bit memory • A data block

Error information

ERROR	STATUS	Description
0	0000h	Send job completed without error.
0	7000h	First call with REQ = 0, sending not initiated.
0	7001h	First call with REQ = 1, sending initiated.
0	7002h	Follow-on call (REQ irrelevant), job being processed **Note:** during this processing the operating system accesses the data in the DATA send buffer.
1	8085h	LEN parameter has the value 0 or is greater than the largest permitted value.
1	8086h	The ID parameter is not in the permitted address range.
0	8088h	LEN parameter is larger than the memory area specified in DATA.
1	80A1h	Communications error: • FB 65 TCON was not yet called for the specified ID • The specified connection is currently being terminated. Transmission over this connection is not possible. • The interface is being reinitialized.
1	80B3h	The parameter for the connection type (connection_type parameter in the connection description) is set to UDP. Please use the FB 67 TUSEND.
1	80C3h	The operating resources (memory) in the CPU are temporarily occupied.
1	80C4h	Temporary communications error: • The connection to the communications partner cannot be established at this time. • The interface is receiving new parameters.
1	8822h	DATA parameter: Source area invalid: area does not exist in DB.
1	8824h	DATA parameter: Range error in ANY pointer.
1	8832h	DATA parameter: DB number too large.
1	883Ah	DATA parameter: Access to send buffer not possible (e.g. due to deleted DB).
1	887Fh	DATA parameter: Internal error, such as an invalid ANY reference.

FB 64 - TRCV - Receiving Data - TCP native and ISO on TCP

Description

FB 64 TRCV receives data over an existing communication connection.
The are two variants available for receiving and processing the data:

- Variant 1: Received data block is processed immediately.
- Variant 2: Received data block is stored in a receive buffer and is only processed when the buffer is full.

The following table shows the relationships between the connection type is shown in the following table:

Connection type	Variant
01h and 11h	The user can specify the variant.
12h	Variant 2 (fix)

The following table describes both variants in detail.

Received Data ...	Range Values for LEN	Range Values for RCVD_LEN	Description
are available immediately	0	1 ... x	The data go into a buffer whose length x is specified in the ANY pointer of the receive buffer (DATA parameter). After being received, a data block is immediately available in the receive buffer. The amount of data received (RCVD_LEN parameter) can be no greater than the size specified in the DATA parameter. Receiving is indicated by NDR = 1.
are stored in the receive buffer. The data are available as soon as the configured length is reached.	• 1 ... 1460, if the connection type= 01h • 1 ... 8192, if the connection type = 11h • 1 ... 1452, if the connection type = 12h and a CP is being used • 1 ... 8192, if the connection type = 12h and no CP is being used	Same value as in the LEN parameter	The data go into a buffer whose length is specified by the LEN parameter. If this specified length is reached, the received data are made available in the DATA parameter (NDR = 1).

Function

FB 64 TRCV is an asynchronously functioning FB, which means that its processing extends over several FB calls. To start receiving data, call FB 64 with *REQ* = 1.

The job status is indicated at the output parameters *BUSY* and *STATUS*. *STATUS* corresponds to the *RET_VAL* output parameter of asynchronously functioning SFCs (see also Meaning of the Parameters *REQ*, *RET_VAL* and *BUSY* with Asynchronous SFCs).

The following table shows the relationships between *BUSY*, *DONE* and *ERROR*. Using this table, you can determine the current status of FB 64 or when the receiving process is complete.

BUSY	DONE	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job was completed successfully.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the STATUS parameter.
FALSE	FALSE	FALSE	The FB was not assigned a (new) job.

Note!

Due to the asynchronous function of FB 64 TRCV, the data in the receiver area are only consistent when the *NDR* parameter assumes the value TRUE.

Parameters

Parameter	Declaration	Data type	Memory area	Description
EN_R	INPUT	BOOL	E, A, M, D, L	With EN_R = 1, FB 64 TRCV is ready to receive (Control parameter).
ID	INPUT	WORD	M, D, constant	Reference to the connection to be terminated. ID must be identical to the associated parameter ID in the local connection description. Range of values: 0001h ... 0FFFh
LEN	INPUT	INT	E, A, M, D, L	• LEN = 0 (ad hoc mode): use implied length specified in the ANY pointer for DATA. The received data are made available immediately when the block is called. The amount of data received is available in RCVD_LEN. • 1 <= LEN <= max: number of bytes to be received. The amount of data actually received is available in RCVD_LEN. The data are available after they have been completely received. "max" depends on the connection type: max = 1460 with connection type 01h, max = 8192 with connection type 11h, max = 1452 with connection type 12h with a CP, max = 8192 with connection type 12h without a CP
NDR	OUTPUT	BOOL	E, A, M, D, L	NDR status parameter: • NDR = 0: Job not yet started or still running. • NDR = 1: Job successfully completed
ERROR	OUTPUT	BOOL	E, A, M, D, L	ERROR status parameter: • ERROR=1: Error occurred during processing. STATUS provides detailed information on the type of error
BUSY	OUTPUT	BOOL	E, A, M, D, L	• BUSY = 1: Job is not yet completed. A new job cannot be triggered. • BUSY = 0: Job is completed.
STATUS	OUTPUT	WORD	M, D	STATUS status parameter: Error information
RCVD_LEN	OUTPUT	INT	E, A, M, D, L	Amount of data actually received, in bytes
DATA	IN_OUT	ANY	E, A, M, D	Receiving area (address and length) The address refers to: • The process image input • The process image output • A bit memory • A data block

Error information

ERROR	STATUS	Description
0	0000h	New data were accepted. The current length of the received data is shown in *RCVD_LEN*.
0	7000h	First call with *REQ* = 0, receiving not initiated
0	7001h	Block is ready to receive.
0	7002h	Follow-on call, job being processed **Note:** during this processing the operating system writes the operating system data to the *DATA* receive buffer. For this reason, an error could result in inconsistent data being in the receive buffer.
1	8085h	*LEN* parameter is greater than the largest permitted value, or you changed the value of *LEN* from the one that existed during the first call
1	8086h	The ID parameter is not in the permitted address range
1	8088h	• Target buffer (DATA) is too small value LEN is greater than the predetermined by *DATA*. Troubleshooting if the connection type = 12h: Increase the destination buffer *DATA*.
1	80A1h	Communications error: • FB 65 TCON was not yet called for the specified ID • The specified connection is currently being terminated. Receiving over this connection is not possible. • The interface is receiving new parameters.
1	80B3h	The parameter for the connection type (connection_type parameter in the connection description) is set to UDP. Please use the FB 68 TRCV.
1	80C3h	The operating resources (memory) in the CPU are temporarily occupied.
1	80C4h	Temporary communications error: The connection is currently being terminated.
1	8922h	*DATA* parameter: Target area invalid: area does not exist in DB.
1	8924h	*DATA* parameter: Range error in ANY pointer
1	8932h	*DATA* parameter: DB number too large.
1	893Ah	*DATA* parameter: Access to receive buffer not possible (e.g. due to deleted DB)
1	897Fh	*DATA* parameter: Internal error, such as an invalid ANY reference

FB 65 - TCON - Establishing a connection

Use with TCP native and ISO on TCP

Both communications partners call FB 65 TCON to establish the communications connection. In the parameters you specify which partner is the active communications transmission point and which is the passive one. For information on the number of possible connections, please refer to the technical data for your CPU.

After the connection is established, it is automatically monitored and maintained by the CPU.

If the connection is interrupted, such as due a line break or due to the remote communications partner, the active partner attempts to reestablish the connection. In this case, you do not have to call FB 65 TCON again.

An existing connection is terminated when FB 66 TDISCON is called or when the CPU has gone into STOP mode. To reestablish the connection, you will have to call FB 65 TCON again.

Use with UDP

Both communications partner call FB 65 TCON in order to configure their local communications access point. A connection is configured between the user program and the communications level of the operating system. No connection is established to the remote partner.

The local access point is used to send and receive UDP message frames.

Description

FB 65 TCON is an asynchronously functioning FB, which means that its processing extends over several FB calls. To start establishing a connection, call FB 65 with *REQ* = 1.

The job status is indicated at the output parameters *RET_VAL* and *BUSY*. *STATUS* corresponds to the *RET_VAL* output parameter of asynchronously functioning SFCs (see also Meaning of the Parameters *REQ*, *RET_VAL* and *BUSY* with asynchronous SFCs).

The following table shows the relationships between *BUSY*, *DONE* and *ERROR*. Using this table, you can determine the current status of FB 65 or when the establishment of the connection is complete.

BUSY	DONE	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job was completed successfully.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the STATUS parameter.
FALSE	FALSE	FALSE	The FB was not assigned a (new) job.

Parameters

Parameter	Declaration	Data type	Memory area	Description
REQ	INPUT	BOOL	E, A, M, D, L	Control parameter REQUEST, initiates establishing the connection at rising edge.
ID	INPUT	WORD	M, D, constant	Reference to the connection to be established to the remote partner or between the user program and the communications level of the operating system. ID must be identical to the associated parameter ID in the local connection description. Range of values: 0001h ... 0FFFh
DONE	OUTPUT	BOOL	E, A, M, D, L	DONE status parameter: • 0: Job not yet started or still running. • 1: Job executed without error.
BUSY	OUTPUT	BOOL	E, A, M, D, L	• BUSY = 1: Job is not yet completed. • BUSY = 0: Job is completed.
ERROR	OUTPUT	BOOL	E, A, M, D, L	ERROR status parameter: • ERROR = 1: Error occurred during processing. STATUS provides detailed information on the type of error.
STATUS	OUTPUT	WORD	M, D	STATUS status parameter: Error information
CONNECT	IN_OUT	ANY	D	Pointer to the associated connection description (UDT 65), see Assigning Parameters for Communications Connections with TCP native and ISO on TCP and Assigning Parameters for the Local Communications Access Point with UDP.

Error information

ERROR	STATUS	Explanation
0	0000h	Connection was able to be established
0	7000h	Call with *REQ* = 0, establishment of connection not initiated
0	7001h	First call with *REQ* = 1, connection being established
0	7002h	Follow-on call (*REQ* irrelevant), connection being established
1	8086h	The ID parameter must not have value of zero.
0	8087h	Maximal number of connections reached; no additional connection possible
1	809Bh	The local_device_id in the connection description does not match the target CPU.
1	80A3h	Attempt being made to re-establish an existing connection.
1	80A7h	Communications error: you have called TDISCON before TCON was complete. TDISCON must first complexly terminate the connection referenced by the ID.
1	80B3h	Inconsistent parameters: • Error in the connection description • Local port (parameter local_tsap_id) is already present in another connection description • ID in the connection description different from the ID specified as parameter
1	80B4h	When using the protocol variant ISO on TCP (connection_type = 12h) for passive establishment of a connection (active_est = FALSE), you violated one or both of the following conditions: "local_tsap_id_len >= 02h" and/or "local_tsap_id[1] = E0h".
1	80C3h	Temporary lack of resources in the CPU.
1	80C4h	Temporary communications error: • The connection cannot be established at this time. • The interface is receiving new parameters.
1	8722h	*CONNECT* parameter: Source area invalid: area does not exist in DB
1	8732h	*CONNECT* parameter: The DB number lies outside the CPU-specific number range.
1	873Ah	*CONNECT* parameter: Access to connection description not possible (e.g. DB not available)
1	877Fh	*CONNECT* parameter: Internal error such as an invalid ANY reference

FB 66 - TDISCON - Terminating a connection

Use with TCP native and ISO on TCP

FB 66 TDISCON terminates a communications connection from the CPU to a communications partner.

Use with UDP

The FB 66 TDISCON closes the local communications access point. The connection between the user program and the communications level of the operating system is terminated.

Description

FB 66 TDISCON is an asynchronously functioning FB, which means that its processing extends over several FB calls. To start terminating a connection, call FB 66 with *REQ* = 1.

After FB 66 TDISCON has been successfully called, the ID specified for

FB 65 TCON is no longer valid and thus cannot be used for sending or receiving.

The job status is indicated at the output parameters RET_VAL and *BUSY*. *STATUS* corresponds to the *RET_VAL* output parameter of asynchronously functioning SFCs (see also Meaning of the Parameters REQ, RET_VAL and *BUSY* with asynchronous SFCs).

The following table shows the relationships between *BUSY*, *DONE* and *ERROR*. Using this table, you can determine the current status of FB 66 or when the establishment of the connection is complete.

BUSY	DONE	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job was completed successfully.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the *STATUS* parameter.
FALSE	FALSE	FALSE	The FB was not assigned a (new) job.

Parameters

Parameter	Declaration	Data type	Memory area	Description
REQ	INPUT	BOOL	E, A, M, D, L	Control parameter REQUEST, initiates terminating the connection specified by the ID. Initiation occurs at rising edge.
ID	INPUT	WORD	M, D, constant	Reference to the connection to be terminated to the remote partner or between the user program and the communications level of the operating system. ID must be identical to the associated parameter ID in the local connection description. Range of values: 0001h ... 0FFFh
DONE	OUTPUT	BOOL	E, A, M, D, L	DONE status parameter: • 0: Job not yet started or still running. • 1: Job executed without error.
BUSY	OUTPUT	BOOL	E, A, M, D, L	• BUSY = 1: Job is not yet completed. • BUSY = 0: Job is completed.
ERROR	OUTPUT	BOOL	E, A, M, D, L	ERROR status parameter: • ERROR = 1: Error occurred during processing. STATUS provides detailed information on the type of error.
STATUS	OUTPUT	WORD	M, D	STATUS status parameter: Error information

Error information

ERROR	STATUS	Explanation
0	0000h	Connection was able to be terminated
0	7000h	First call with *REQ* = 0, termination of connection not initiated
0	7001h	First call with *REQ* = 1, connection being terminated
0	7002h	Follow-on call (*REQ* irrelevant), connection being terminated
1	8086h	The ID parameter is not in the permitted address range
1	80A3h	Attempt being made to terminate a non-existent connection
1	80C4h	Temporary communications error: The interface is receiving new parameters.

FB 67 - TUSEND - Sending data - UDP

Description

FB 67 TUSEND sends data via UDP to the remote partner specified by the parameter *ADDR*.

Note!

When sending separate data in sequence to different partners, you only need to adjust the parameter *ADDR* when calling FB 67 TUSEND. It is not necessary to call FBs 65 TCON and 66 TDISCON again.

Function

FB 67 TUSEND is an asynchronously functioning FB, which means that its processing extends over several FB calls. To start sending data, call FB 67 with *REQ* = 1.

The job status is indicated at the output parameters *BUSY* and *STATUS*. *STATUS* corresponds to the *RET_VAL* output parameter of asynchronously functioning SFCs (see also Meaning of the Parameters *REQ*, *RET_VAL* and *BUSY* with asynchronous SFCs).

The following table shows the relationships between *BUSY*, *DONE* and *ERROR*. Using this table, you can determine the current status of FB 67 or when the sending process (transmission) is complete.

BUSY	DONE	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job was completed successfully.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the *STATUS* parameter.
FALSE	FALSE	FALSE	The FB was not assigned a (new) job.

Note!

Due to the asynchronous function of FB 67 TUSEND, you must keep the data in the sender area consistent until the *DONE* parameter or the *ERROR* parameter assumes the value TRUE.

Parameters

Parameter	Declaration	Data type	Memory area	Description
REQ	INPUT	BOOL	E, A, M, D, L	Control parameter REQUEST, initiates the transmission at rising edge. At the first call with REQ = 1, bytes are transmitted from the area specified by the DATA parameter.
ID	INPUT	WORD	M, D, constant	Reference to the associated connection between the user program and the communication level of the operating system. ID must be identical to the associated parameter ID in the local connection description. Range of values: 0001h ... 0FFFh
LEN	INPUT	INT	E, A, M, D, L	Number of bytes to be sent with the job Range of values: 1 ... 1460
DONE	OUTPUT	BOOL	E, A, M, D, L	DONE status parameter: • 0: Job not yet started or still running. • 1: Job executed without error
BUSY	OUTPUT	BOOL	E, A, M, D, L	• BUSY = 1: Job is not yet completed. Anew job cannot be triggered. • BUSY = 0: Job is completed.
ERROR	OUTPUT	BOOL	E, A, M, D, L	ERROR status parameter: • ERROR = 1: Error occurred during processing. STATUS provides detailed information on the type of error
STATUS	OUTPUT	WORD	M, D	STATUS status parameter: Error information
DATA	IN_OUT	ANY	E, A, M, D	Sender area, contains address and length The address refers to: • The process image input table • The process image output table • A bit memory • A data block
ADDR	IN_OUT	ANY	D	Pointer to the address of the receiver (e.g. P#DB100.DBX0.0 byte 8), see Structure of the Address Information for the Remote Partner with UDP.

Error information

ERROR	STATUS	Description
0	0000h	Send job completed without error.
0	7000h	First call with *REQ* = 1, sending not initiated.
0	7001h	First call with *REQ* = 1, sending initiated.
0	7002h	Follow-on call (*REQ* irrelevant), job being processed **Note:** during this processing the operating system accesses the data in the *DATA* send buffer.
1	8085h	*LEN* parameter has the value 0 or is greater than the largest permitted value.
1	8086h	The *ID* parameter is not in the permitted address range.
0	8088h	*LEN* parameter is larger than the memory area specified in DATA.
1	80A1h	Communications error: • FB 65 TCON was not yet called for the specified *ID* • The specified connection between the user program and the communication level of the operating system is currently being terminated. • Transmission over this connection is not possible. • The interface is being reinitialized (receiving new parameters).
1	80B3h	The parameter for the connection type (connection_type parameter in the connection description) is not set to UDP. Please use the FB 63 TSEND.
1	80C3h	The operating resources (memory) in the CPU are temporarily occupied.
1	80C4h	Temporary communications error: • The connection between the user program and the communication level of the operating system cannot be established at this time. • The interface is receiving new parameters.
1	8822h	*DATA* parameter: Source area invalid: area does not exist in DB.
1	8824h	*DATA* parameter: Range error in ANY pointer.
1	8832h	*DATA* parameter: DB number too large.
1	883Ah	*DATA* parameter: Access to send buffer not possible (e.g. due to deleted DB).
1	887Fh	*DATA* parameter: Internal error, e.g. an invalid ANY reference.

FB 68 - TURCV - Receiving data - UDP

Description

FB 68 TURCV receives data via UDP. After successful completion of FB 68 TURCV the parameter ADDR will show you the address of the remote partner (the sender).

FB 68 TURCV is an asynchronously functioning FB, which means that its processing extends over several FB calls. To start sending data, call FB 68 with *REQ* = 1.

The job status is indicated at the output parameters *RET_VAL* and *BUSY*. *STATUS* corresponds to the *RET_VAL* output parameter of asynchronously functioning SFCs (see also Meaning of the Parameters *REQ*, *RET_VAL* and *BUSY* with asynchronous SFCs).

The following table shows the relationships between *BUSY*, *NDR* and *ERROR*. Using this table, you can determine the current status of FB 68 or when the receiving process is complete.

BUSY	NDR	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job was completed successfully.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the *STATUS* parameter.
FALSE	FALSE	FALSE	The FB was not assigned a (new) job.

Note!

Due to the asynchronous function of FB 68 TURCV, the data in the receiver area are only consistent when the *NDR* parameter assumes the value TRUE.

Parameters

Parameter	Declaration	Data type	Memory area	Description
EN_R	INPUT	BOOL	E, A, M, D, L	Control parameter enabled to receive: when EN_R = 1, FB 68 TURCV is ready to receive.
ID	INPUT	WORD	M, D, constant	Reference to the associated connection between the user program and the communication level of the operating system. ID must be identical to the associated parameter ID in the local connection description. Range of values: 0001h ... 0FFFh
LEN	INPUT	INT	E, A, M, D, L	1 <= LEN <= 1460: number of bytes to be received. The received data are immediately available when the block is called. The amount of data received is available in RCVD_LEN.
NDR	OUTPUT	BOOL	E, A, M, D, L	NDR status parameter: • NDR = 0: Job not yet started or still running. • NDR = 1: Job successfully completed
ERROR	OUTPUT	BOOL	E, A, M, D, L	ERROR status parameter: • ERROR = 1: Error occurred during processing. STATUS provides detailed information on the type of error
BUSY	OUTPUT	BOOL	E, A, M, D, L	• BUSY = 1: Job is not yet completed. Anew job cannot be triggered. • BUSY = 0: Job is completed.
STATUS	OUTPUT	WORD	M, D	STATUS status parameter: Error information
RCVD_LEN	OUTPUT	INT	E, A, M, D, L	Amount of data actually received, in bytes
DATA	IN_OUT	ANY	E, A, M, D	Receiver area, contains address and length The address refers to: • The process image input table • The process image output table • A bit memory • A data block
ADDR	IN_OUT	ANY	D	Pointer to the address of the sender (e.g.P#DB100.DBX0.0 byte 8), see Structure of the Address Information for the Remote Partner with UDP

Error information

ERROR	STATUS	Explanation
0	0000h	New data were accepted. The current length of the received data is shown in *RCVD_LEN*.
0	7000h	First call with *REQ* = 0, receiving not initiated
0	7001h	Block is ready to receive.
0	7002h	Follow-on call, job being processed Note: during this processing the operating system writes the operating system data to the DATA receive buffer. For this reason, an error could result in inconsistent data being in the receive buffer.
1	8085h	*LEN* parameter is greater than the largest permitted value, or you changed the value of *LEN* from the one that existed during the first call
1	8086h	The *ID* parameter is not in the permitted address range
1	8088h	• Target buffer (DATA) is too small. • The value in *LEN* is greater than the receiver area specified by *DATA*.
1	80A1h	Communications error: • FB 65 TCON was not yet called for the specified *ID* • The specified connection between the user program and the communication level of the operating system is currently being terminated. Receiving over this connection is not possible. • The interface is being reinitialized (receiving new parameters).
1	80B3h	The parameter for the connection type (connection_type parameter in the connection description) is not set to UDP. Please use the FB 68 TRCV.
1	80C3h	The operating resources (memory) in the CPU are temporarily occupied.
1	80C4h	Temporary communications error: The connection is currently being established.
1	8922h	*DATA* parameter: Target area invalid: area does not exist in DB.
1	8924h	*DATA* parameter: Range error in ANY pointer
1	8932h	*DATA* parameter: DB number too large.
1	893Ah	*DATA* parameter: Access to receive buffer not possible (e.g. due to deleted DB
1	897Fh	*DATA* parameter: Internal error, such as an invalid ANY reference

Chapter 5 Integrated Standard SFCs

Overview

Here the description of the integrated standard SFCs of the SPEED7 CPUs from VIPA may be found.

The description of the SFCs of the VIPA library may be found at the chapter "VIPA specific blocks".

Note for needed local stack

Please note that local stack memory is occupied by using of some SFCs. This can be defined by the CPU parameters. The needed space is to be found in the following table above:

SFC	Label	L stack
SFC 20	BLKMOV	56Byte
SCF 21	FILL	56Byte
SFC 47	WAIT	22Byte
SFC 64	TIME_TCK	18Byte

Additional error messages of SFC 20, SFC 21

In addition to the standard error messages the SFC 20 and SFC 21 could return the following error messages:

No.	Error message	Remedy
817Dh	Too less local stack	Increase local stack by using CPU parameters
817Eh	Range length error in internal copy loop	Check parameters

Content

Topic **Page**

Overview Integrated standard SFCs

Standard SFCs The following standard system functions (SFCs) are available:

SFC	Label	Description
SFC 0	SET_CLK	Set time
SFC 1	READ_CLK	Read time
SFC 2	SET_RTM	Set operating hour counter
SFC 3	CTRL_RTM	Start/stop operating hour counter
SFC 4	READ_RTM	Read operating hour counter
SFC 5	GADR_LGC	Search logical address of a channel (only modules in rack 0)
SFC 6	RD_SINFO	Read start information of the current OB
SFC 12	D_ACT_DP	Activate or deactivate DP slaves
SFC 13	DPNRM_DG	Read slave diagnostic data
SFC 14	DPRD_DAT	Read consistent user data (also from DP slaves → DP master FW ≥ V3.00)
SFC 15	DPWR_DAT	Write consistent user data (also to DP slaves → DP master FW ≥ V3.00)
SCF 17	ALARM_SQ	Create acknowledgeable block related messages
SFC 18	ALARM_S	Create not acknowledgeable block related messages
SFC 19	ALARM_SC	Acknowledgement state of the last Alarm SQ-arrived-message
SFC 20 [1)]	BLKMOV	Copy variable within work memory
SFC 21 [1)]	FILL	Preset field within work memory
SFC 22	CREAT_DB	Create data block
SFC 23	DEL_DB	Delete data block
SFC 25	COMPRESS	Compressing the user memory
SFC 24	TEST_DB	Test data block
SFC 28	SET_TINT	Set time interrupt
SFC 29	CAN_TINT	Cancel time interrupt
SFC 30	ACT_TINT	Activate time interrupt
SFC 31	QRY_TINT	Request time interrupt
SFC 32	SRT_DINT	Start delay interrupt
SFC 33	CAN_DINT	Cancel delay interrupt
SFC 34	QRY_DINT	Request delay interrupt
SFC 36	MSK_FLT	Mask synchronal error event
SFC 37	DMSK_FLT	De-mask synchronal error event
SFC 38	READ_ERR	Read event status register
SFC 39	DIS_IRT	Disabling interrupts
SFC 40	EN_IRT	Enabling interrupts
SFC 41	DIS_AIRT	Delay of interrupt events
SFC 42	EN_AIRT	Abrogate delay of interrupt events
SFC 43	RE_TRIGR	Re-trigger cycle time control
SFC 44	REPL_VAL	Transfer replacement value to AKKU1
SFC 46	STP	Switch CPU in STOP
SFC 47 [1)]	WAIT	Delay program execution additionally to wait time
SFC 49	LGC_GADR	Search plug-in location of a logical address
SFC 50	RD_LGADR	Search all logical addresses of a module

continued ...

... continue Standard SFCs

SFC	Label	Description
SFC 51	RDSYSST	Read information from the system state list
SFC 52	WR_USMSG	Write user entry in diagnostic buffer (send via MPI in preparation)
SFC 54	RD_DPARM	Read predefined parameters
SFC 55	WR_PARM	Write dynamic parameters (only for analog-, digital modules, FMs, CPs and via PROFIBUS DP-V1 possible)
SFC 56	WR_DPARM	Write predefined parameters (only for analog-, digital modules, FMs, CPs and via PROFIBUS DP-V1 possible)
SFC 57	PARM_MOD	Parameterize module (only for analog-, digital modules, FMs, CPs and via PROFIBUS DP-V1 possible)
SFC 58	WR_REC	Write record set (only for analog-, digital modules, FMs, CPs and via PROFIBUS DP-V1 possible)
SFC 59	RD_REC	Read record set (only for analog-, digital modules, FMs, CPs and via PROFIBUS DP-V1 possible)
SFC 64 [1)]	TIME_TCK	Read millisecond timer
SFC 65	X_SEND	Send data to external partner
SFC 66	X_RCV	Receive data from external partner
SFC 67	X_GET	Read data from external partner
SFC 68	X_PUT	Write data to external partner
SFC 69	X_ABORT	Interrupt connection to external partner
SFC 81	UBLKMOV	Copy variable non-interruptible
SFC 102	RD_DPARA	Redefined parameters
SFC 105	READ_SI	Reading dynamic system resources
SFC 106	DEL_SI	Deleting dynamic system resources
SFC 107	ALARM_DQ	Generating always acknowledgeable and block-related messages
SFC 108	ALARM_D	Generating always acknowledgeable and block-related messages

[1)] This function block is interruptable and does not affect the interrupt reaction time.

General and Specific Error Information RET_VAL

Overview

The return value *RET_VAL* of a system function provides one of the following types of error codes:

- A *general error code*, that relates to errors that can occur in anyone SFC.
- A *specific error code*, that relates only to the particular SFC.

Although the data type of the output parameter *RET_VAL* is integer (INT), the error codes for system functions are grouped according to hexadecimal values.

If you want to examine a return value and compare the value with the error codes, then display the error code in hexadecimal format.

RET_VAL (Return value)

The table below shows the structure of a system function error code:

Bit	Description
7 ... 0	Event number or error class and single error
14 ... 8	Bit 14 ... 8 = "0": **Specific error code** The specific error codes are listed in the descriptions of the individual SFCs. Bit 14 ... 8 > "0": **General error code** The possible general error codes are shown
15	Bit 15 = "1": indicates that an error has occurred.

Specific error code

This error code indicates that an error pertaining to a particular system function occurred during execution of the function.

A specific error code consists of the following two numbers:

- Error class between 0 and 7
- Error number between 0 and 15

Bit	Description
3 ... 0	Error number
6 ... 4	Error class
7	Bit 7 = "1"
14 ... 8	Bit 14 ... 8 = "0"
15	Bit 15 = "1": indicates that an error has occurred.

General error codes RET_VAL

The parameter *RET_VAL* of some SFCs only returns general error information. No specific error information is available.
The general error code contains error information that can result from any system function. The general error code consists of the following two numbers:

- A parameter number between 1 and 111, where 1 indicates the first parameter of the SFC that was called, 2 the second etc.
- An event number between 0 and 127. The event number indicates that a synchronous fault has occurred.

Bit	Description
7 ... 0	Event number
14 ... 8	Parameter number
15	Bit 15 = "1": indicates that an error has occurred.

The following table explains the general error codes associated with a return value. Error codes are shown as hexadecimal numbers. The x in the code number is only used as a placeholder. The number represents the parameter of the system function that has caused the error.

General error codes

Error code	Description
8x7Fh	Internal Error. This error code indicates an internal error at parameter x. This error did not result from the actions if the user and he/she can therefore not resolve the error.
8x22h	Area size error when a parameter is being read.
8x23h	Area size error when a parameter is being written. This error code indicates that parameter x is located either partially or fully outside of the operand area or that the length of the bit-field for an ANY-parameter is not divisible by 8.
8x24h	Area size error when a parameter is being read.
8x25h	Area size error when a parameter is being written. This error code indicates that parameter x is located in an area that is illegal for the system function. The description of the respective function specifies the areas that are not permitted for the function.
8x26h	The parameter contains a number that is too high for a time cell. This error code indicates that the time cell specified in parameter x does not exist.
8x27h	The parameter contains a number that is too high for a counter cell (numeric fields of the counter). This error code indicates that the counter cell specified in parameter x does not exist.

continued ...

... continue

Error code	Description
8x28h	Orientation error when reading a parameter.
8x29h	Orientation error when writing a parameter. This error code indicates that the reference to parameter x consists of an operand with a bit address that is not equal to 0.
8x30h	The parameter is located in the write-protected global-DB.
8x31h	The parameter is located in the write-protected instance-DB. This error code indicates that parameter x is located in a write-protected data block. If the data block was opened by the system function itself, then the system function will always return a value 8x30h.
8x32h	The parameter contains a DB-number that is too high (number error of the DB).
8x34h	The parameter contains a FC-number that is too high (number error of the FC).
8x35h	The parameter contains a FB-number that is too high (number error of the FB). This error code indicates that parameter x contains a block number that exceeds the maximum number permitted for block numbers.
8x3Ah	The parameter contains the number of a DB that was not loaded.
8x3Ch	The parameter contains the number of a FC that was not loaded.
8x3Eh	The parameter contains the number of a FB that was not loaded.
8x42h	An access error occurred while the system was busy reading a parameter from the peripheral area of the inputs.
8x43h	An access error occurred while the system was busy writing a parameter into den peripheral area of the outputs.
8x44h	Error during the n-th (n > 1) read access after an error has occurred.
8x45h	Error during the n-th (n > 1) write access after an error has occurred. This error code indicates that access was denied to the requested parameter.

SFC 0 - SET_CLK - Set system clock

Description

The SFC 0 SET_CLK (set system clock) sets the time of day and the date of the clock in the CPU. The clock continues running from the new time and date.
If the clock is a master clock then the call to SFC 0 will start a clock synchronization cycle as well. The clock synchronization intervals are defined by hardware settings.

Parameters

Parameter	Declaration	Data type	Memory block	Description
PDT	INPUT	DT	D, L	Enter the new date and time at *PDT*.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	When an error occurs while the function is being processed then the returned value contains the respective error code.

PDT

Date and time are entered as data type DT.

Example:

date: 04.27.2006, time: 14:15:55 → DT#2006-04-27-14:15:55.

The time can only be entered with one-second accuracy. The day of the week is calculated automatically by SFC 0.

Remember that you must first create the data type DT by means of FC 3 D_TOD_DT before you can supply it to the input parameter
(see time functions; FC 3, FC 6, FC 7, FC 8, FC 33, FC 40, FC 1, FC 35, FC 34).

RET_VAL
(Return value)

Value	Description
0000h	no error
8080h	error in the date
8081h	error in the time

SFC 1 - READ_CLK - Read system clock

Description

The SFC 1 READ_CLK (read system clock) reads the contents of the CPU clock. This returns the current time and date.

Parameters

Parameter	Declaration	Data type	Memory block	Description
RET_VAL	OUTPUT	INT	I, Q, M, D, L	If an error occurs when this function is being processed the return value contains the error code.
CDT	OUTPUT	DT	D, L	The current date and time are available at output *CDT*.

RET_VAL (Return value)

SFC 1 does not return any specific error information.

CDT

The current date and time are available at output *CDT*.

SFC 2 ... 4 - Run-time meter

Description

VIPA CPUs have 8 run-time meters.

You can use:

SFC 2	SET_RTM	set run-time meter
SFC 3	CTRL_RTM	run-time meter starting / stopping
SFC 4	READ_RTM	read run-time meter

You can use a runtime meter for a variety of applications:

- for measuring the runtime of a CPU
- for measuring the runtime of controlled equipment or connected devices.

Characteristics

When it is started, the runtime meter begins to count starting at the last recorded value. If you want it to start at a different initial value, you must explicitly specify this value with the SFC 2.

If the CPU changes to the STOP mode, or you stop the runtime meter, the CPU records the current value of the runtime meter. When a restart of the CPU is executed, the runtime meter must be restarted with the SFC 3.

Range of values

The runtime meter has a range of value from 0 ... 32767 hours.

SFC 2 - SET_RTM - Set run-time meter

Description

The SFC 2 SET_RTM (set run-time meter) sets the run-time meter of the CPU to the specified value. VIPA CPUs contain 8 run-time meters.

Parameters

Parameter	Declaration	Data type	Memory block	Description
NR	INPUT	BYTE	I, Q, M, D, L, constant	Input *NR* contains the number of the run-time meter that you wish to set. Range: 0 ... 7
PV	INPUT	INT	I, Q, M, D, L, constant	Input *PV* contains the setting for the run-time meter.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL
(Return value)

Value	Description
0000h	no error
8080h	Incorrect number for the run-time meter
8081h	A negative value was supplied to parameter *PV*.

SFC 3 - CTRL_RTM - Control run-time meter

Description

The SFC 3 CTRL_RTM (control run-time meter) starts or stops the run-time meter depending on the status of input *S*.

Parameters

Parameter	Declaration	Data type	Memory block	Description
NR	INPUT	BYTE	I, Q, M, D, L, constant	Input *NR* contains the number of the run-time meter that you wish to set. Range: 0 ... 7
S	INPUT	BOOL	I, Q, M, D, L, constant	Input *S* starts or stops the run-time meter. Set this signal to "0" to stop the run-time meter. Set this signal to "1" to start the run-time meter.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL
(Return value)

Value	Description
0000h	no error
8080h	Incorrect number for the run-time meter

SFC 4 - READ_RTM - Read run-time meter

Description

The SFC 4 READ_RTM (read run-time meter) reads the contents of the run-time meter. The output data indicates the current run-time and the status of the meter ("stopped" or "started").
When the run-time meter has been active for more than 32767 hours it will stop with this value and return value *RET_VAL* indicates the error message "8081h: overflow".

Parameters

Parameter	Declaration	Data type	Memory block	Description
NR	INPUT	BYTE	I, Q, M, D, L, constant	Input *NR* contains the number of the run-time meter that you wish to read. Range: 0 ... 7
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
CQ	OUTPUT	BOOL	I, Q, M, D, L	Output *CQ* indicates whether the run-time meter is started or stopped. • "0": the status of the run-time meter is stopped. • "1": the status of the run-time meter is started.
CV	OUTPUT	INT	I, Q, M, D, L	Output *CV* indicates the up to date value of the run-time meter.

RET_VAL
(Return value)

Value	Description
0000h	no error
8080h	Incorrect number for the run-time meter
8081h	run-time meter overflow

SFC 5 - GADR_LGC - Logical address of a channel

Description

The SFC 5 GADR_LGC (convert geographical address to logical address) determines the logical address of the channel of a I/O module.

Parameters

Parameter	Declaration	Data type	Memory block	Description
SUBNETID	INPUT	BYTE	I, Q, M, D, L, constant	area identifier
RACK	INPUT	WORD	I, Q, M, D, L, constant	Rack No.
SLOT	INPUT	WORD	I, Q, M, D, L, constant	Slot-No.
SUBSLOT	INPUT	BYTE	I, Q, M, D, L, constant	Sub-module slot
SUBADDR	INPUT	WORD	I, Q, M, D, L, constant	Offset in user-data address space of the module
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
IOID	OUTPUT	BYTE	I, Q, M, D, L	area identifier
LADDR	OUTPUT	WORD	I, Q, M, D, L	Logical base address for the module

SUBNETID

area identifier:

- "0": if the module is put locally (including expansion rack).
- DP-master-system-ID of the respective decentralized peripheral system when the slot is located in one of the decentralized peripheral devices.

Rack

Rack No., when the address space identification is 0
Station number of the decentralized Peripheral device when falls the area identification >0

SLOT

Slot-Number

SUBSLOT

Sub-module slot
(when sub-modules cannot be inserted this parameter must be 0)

SUBADDR

Offset in user-data address space of the module

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	no error
8094h	No subnet with the specified *SUBNETID* configured.
8095h	Illegal value for parameter *RACK*
8096h	Illegal value for parameter *SLOT*
8097h	Illegal value for parameter SUBSLOT
8098h	Illegal value for parameter *SUBADDR*
8099h	The slot has not been configured.
809Ah	The sub address for the selected slot has not been configured.

IOID

Area identifier:

- 54h: peripheral input (PI)
- 55h: peripheral output (PQ)

For hybrid modules the SFC returns the area identification of the lower address. When the addresses are equal the SFC returns identifier 54h.

LADDR

Logical base address for the module

SFC 6 - RD_SINFO - Read start information

Description

The SFC 6 RD_SINFO (read start information) retrieves the start information of the last OB accessed and that has not yet been processed completely, as well as the last startup OB. These start information items do not contain a time stamp. Two identical start information items will be returned when the call is issued from OB 100.

Parameters

Parameter	Declaration	Data type	Memory block	Description
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
TOP_SI	OUTPUT	STRUCT	D, L	Start information of the current OB
START_UP_SI	OUTPUT	STRUCT	D, L	Start information of the last OB that was started

TOP_SI and START_UP_SI

This refers to two identical structures as shown below.

Structure element	Data type	Description
EV_CLASS	BYTE	Bits 3 ... 0: event identifier Bits 7 ... 4: event class 1: Start events of standard-OBs 2: Start events of synchronous-error OBs 3: Start events of asynchronous-error OBs
EV_NUM	BYTE	event number
PRIORITY	BYTE	Number defining the priority level
NUM	BYTE	Structure element NUM contains the number of the current OB or of the last OB started
TYP2_3	BYTE	Data identifier 2_3: identifies the information entered into ZI2_3
TYP1	BYTE	Data identifier 1: identifies the information entered into ZI1
ZI1	WORD	Additional information 1
ZI2_3	DWORD	Additional information 2_3

Note!

The content of the structure elements shown in the table above corresponds exactly with the temporary variables of an OB. It must be remembered, however, that the name and the data type of the temporary variables in the different OBs might differ. Furthermore, the call interface of the OBs also contains the date and time at which call to the OB was requested.

RET_VAL (Return value)

The SFC 6 only returns general error information. No specific error information is available.

Example

The OB that was called last and that has not yet been completely processed serves as OB 80; the restart OB that was started last serves as OB 100.

The following table shows the assignment of the structure elements of parameter *TOP_SI* of SFC 6 and the respective local variables of OB 80.

TOP_SI Structure element	Data type	Logical Variable	Data type
EV_CLASS	BYTE	OB100_EV_CLASS	BYTE
EV_NUM	BYTE	OB80_FLT_ID	BYTE
PRIORITY	BYTE	OB80_PRIORITY	BYTE
NUM	BYTE	OB80_OB_NUMBR	BYTE
TYP2_3	BYTE	OB80_RESERVED_1	BYTE
TYP1	BYTE	OB80_ RESERVED_2	BYTE
ZI1	WORD	OB80_ERROR_INFO	WORD
ZI2_3	DWORD	OB80_ERR_EV_CLASS OB80_ERR_EV_NUM OB80_OB_PRIORITY OB80_OB_NUM	BYTE BYTE BYTE BYTE

The following table shows the assignment of the structure elements of parameter *START_UP_SI* of SFC 6 and the respective local variables of OB 100.

START_UP_SI Structure element	Data type	Logical Variable	Data type
EV_CLASS	BYTE	OB100_EV_CLASS	BYTE
EV_NUM	BYTE	OB100_STRTUP	BYTE
PRIORITY	BYTE	OB100_PRIORITY	BYTE
NUM	BYTE	OB100_OB_NUMBR	BYTE
TYP2_3	BYTE	OB100_RESERVED_1	BYTE
TYP1	BYTE	OB100_ RESERVED_2	BYTE
ZI1	WORD	OB100_STOP	WORD
ZI2_3	DWORD	OB100_STRT_INFO	DWORD

SFC 12 - D_ACT_DP - Activating and Deactivating of DP-Slaves

Description

With the SFC 12 D_ACT_DP, you can specifically deactivate and reactivate configured DP slaves. In addition, you can determine whether each assigned DP slave is currently activated or deactivated.

The SFC 12 cannot be used on PROFIBUS PA field devices, which are connected by a DP/PA link to a DP master system.

Note!

As long as any SFC 12 job is busy you cannot download a modified configuration from your PG to the CPU.
The CPU rejects initiation of an SFC 12 request when it receives the download of a modified configuration.

Application

If you configure DP slaves in a CPU, which are not actually present or not currently required, the CPU will nevertheless continue to access these DP slaves at regular intervals. After the slaves are deactivated, further CPU accessing will stop. In this way, the fastest possible DP bus cycle can be achieved and the corresponding error events no longer occur.

Example

Every one of the possible machine options is configured as a DP slave by the manufacturer in order to create and maintain a common user program having all possible options. With the SFC 12, you can deactivate all DP slaves, which are not present at machine startup.

How the SFC operates

The SFC 12 operates asynchronously, in other words, it is executed over several SFC calls. You start the request by calling the SFC 12 with *REQ* = 1.

The status of the job is indicated by the output parameters *RET_VAL* and *BUSY*.

Identifying a job

If you have started a deactivation or activation job and you call the SFC 12 again before the job is completed, the way in which the SFC reacts depends largely on whether the new call involves the same job: if the parameter *LADDR* matches, the SFC call is interpreted as a follow-on call.

Deactivating DP slaves

When you deactivate a DP slave with the SFC 12, its process outputs are set to the configured substitute values or to "0" (secure state).

The assigned DP master does not continue to address this DP slave. Deactivated DP slaves are not identified as fault or missing by the error LEDs on the DP master or CPU.

The process image of the inputs of deactivated DP slaves is updated with 0, that is, it is handled just as for failed DP slaves.

Note!

With VIPA you can not deactivate all DP slaves. At least 1 slave must remain activated at the bus.

If you are using your program to directly access the user data of a previously deactivated DP slave, the I/O access error OB (OB 122) is called, and the corresponding start event is entered in the diagnostic buffer.
If you attempt to access a deactivated DP slave with SFC (i.e. SFC 59 RD_REC), you receive the error information in *RET_VAL* as for an unavailable DP slave.

Deactivating a DP slaves OB 85, even if its inputs or outputs belong to the system-side process image to be updated. No entry is made in the diagnostic buffer.

Deactivating a DP slave does not start the slave failure OB 86, and the operating system also does not make an entry in the diagnostic buffer.

If a DP station fails after you have deactivated it with the SFC 12, the operating system does not detect the failure. As a result, there is no subsequent start of OB 86 or diagnostic buffer entry. The station failure is detected only after the station has been reactivated and indicated in *RET_VAL*.

If you wish to deactivate DP slaves functioning as transmitters in cross communication, we recommend that you first deactivate the receivers (listeners) that detect, which input data the transmitter is transferring to its DP master. Deactivate the transmitter only after you have performed this step.

Activating DP slaves

When you reactivate a DP slave with the SFC 12 it is configured and assigned parameters by the designated DP master (as with the return of a failed station). This activation is completed when the slave is able to transfer user data.

Activating a DP slaves does not start the program error OB 85, even if its inputs or outputs belong to the system-side process image to be updated. An entry in the diagnostic buffer is also not made.

Activating a DP slave does not start the slave failure OB 86, and the operating system also does not make an entry in the diagnostic buffer.

If you attempt to use the SFC 12 to activate a slave, who has been deactivated and is physically separated from the DP bus, a supervision time of 10sec expires. After this monitoring period has expired, the SFC returns the error message 80A2h. The slave remains deactivated. If the slave is reconnected to the DP bus at a later time, it must be reactivated with the SFC 12.

Note!

Activating a DP slave may be time-consuming. Therefore, if you wish to cancel a current activation job, start the SFC 12 again with the same value for *LADDR* and *MODE* = 2. Repeat the call of the SFC 12 until successful cancellation of the activation is indicated by *RET_VAL* = 0.

If you wish to activate DP slaves which take part in the cross communication, we recommend that you first activate the transmitters and then the receivers (listeners).

CPU startup

At a restart the slaves are activated automatically. After the CPU start-up, the CPU cyclically attempts to contact all configured and not deactivated slaves that are either not present or not responding.

Note!

The startup OB 100 does not support the call of the SFC 12.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	Level-triggered control parameter *REQ* = 1: execute activation or deactivation
MODE	INPUT	BYTE	I, Q, M, D, L, constant	Job ID Possible values: 0: request information on whether the addressed DP slave is activated or deactivated. 1: activate the DP slave 2: deactivate the DP slave
LAADR	INPUT	WORD	I, Q, M, D, L, constant	Any logical address of the DP slave
RET_VAL	OUTPUT	INT	I, Q, M, D, L	If an error occurs while the function is processed, the return value contains an error code.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	Active code: *BUSY* = 1: the job is still active. *BUSY* = 0: the job was terminated.

RET_VAL
(Return value)

Value	Description
0000h	The job was completed without errors.
0001h	The DP slave is active (This error code is possible only with *MODE* = 0.)
0002h	The DP slave is deactivated (This error code is possible only with *MODE* = 0.)
7000h	First call with *REQ* = 0. The job specified with *LADDR* is not active; *BUSY* has the value 0.
7001h	First call with *REQ* = 1. The job specified with *LADDR* was triggered; *BUSY* has the value 1.
7002h	Interim call (*REQ* irrelevant). The activated job is still active; *BUSY* has the value 1.
8090h	You have not configured a module with the address specified in *LADDR*. You operate your CPU as I-Slave and you have specified in *LADDR* an address of this slave.

continued ...

... continue

Value	Description
8092h	For the addressed DP slave no activation job is processed at the present. (This error code is possible only with *MODE* = 1.)
8093h	No DP slave is assigned to the address stated in *LADDR* (no projection submitted), or the parameter *MODE* is not known.
80A1h	The addressed DP slave could not be parameterized. (This error code is possible only with *MODE* = 1.) **Note!** The SFC supplies this information only if the activated slave fails again during parameterization. If parameterization of a single module was unsuccessful the SFC returns the error information 0000h.
80A2h	The addressed DP slave does not return an acknowledgement.
80A3h	The DP master concerned does not support this function.
80A4h	The CPU does not support this function for external DP masters.
80A6h	Slot error in the DP slave; user data access not possible. (This error code is possible only with *MODE* = 1.) **Note!** The SFC returns this error information only if the active slave fails after parameterization and before the SFC ends. If only a single module is unavailable the SFC returns the error information 0000h.
80C1h	The SFC 12 was started and continued with another logical address. (This error code is possible only with *MODE* = 1.)
80C3h	• Temporary resource error: the CPU is currently processing the maximum possible activation and deactivation jobs. (this error code is possible only with *MODE* = 1 and *MODE* = 2). • The CPU is busy receiving a modified configuration. Currently you cannot enable/disable DP slaves.
F001h	Not all slaves may be deactivated. At least 1 slave must remain activated.
F002h	Unknown slave address

SFC 13 - DPNRM_DG - Read diagnostic data of a DP-slave

Description

The SFC 13 DPNRM_DG (read diagnostic data of a DP-slave) reads up-to-date diagnostic data of a DP-slave. The diagnostic data of each DP-slave is defined by EN 50 170 Volume 2, PROFIBUS.

Input parameter *RECORD* determines the target area where the data read from the slave is saved after it has been transferred without error. The read operation is started when input parameter *REQ* is set to 1.
The following table contains information about the principal structure of the slave diagnosis.
For additional information please refer to the manuals for the DP-slaves that you are using.

Byte	description
0	station status 1
1	station status 2
2	station status 3
3	master-station number
4	manufacturer code (high byte)
5	manufacturer code (low byte)
6 ...	additional slave-specific diagnostics

Operation

The SFC 13 is executed as asynchronous SFC, i.e. it can be active for multiple SFC-calls. Output parameters *RET_VAL* and *BUSY* indicate the status of the command as shown by the following table.

Relationship between the call, *REQ*, *RET_VAL* and *BUSY*:

Seq. No. of the call	Type of call	REQ	RET_VAL	BUSY
1	first call	1	7001h or Error code	1 0
2 ... (n-1)	intermediate call	irrelevant	7002h	1
n	last call	irrelevant	If the command was completed without errors, then the number of bytes returned is entered as a positive number or the error code if an error did occur.	0

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: read request
LADDR	INPUT	WORD	I, Q, M, D, L, constant	The configured diagnostic address of the DP slave
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed. If no error did occur, then *RET_VAL* contains the length of the data that was transferred.
RECORD	OUTPUT	ANY	I, Q, M, D, L	Target area for the diagnostic data that has been read. Only data type BYTE is valid. The minimum length of the read record or respectively the target area is 6. The maximum length of the read record is 240. When the standard diagnostic data exceeds 240bytes on a norm slave and the maximum is limited to 244bytes, then only the first 240bytes are transferred into the target area and the respective overflow-bit is set in the data.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: read operation has not been completed.

RECORD

The CPU tests the actual length of the diagnostic data that was read:
When the length of *RECORD*

- is less than the amount of data the data is discarded and the respective error code is entered into *RET_VAL*.
- is larger than or equal to the amount of data then the data is transferred into the target areas and *RET_VAL* is set to the actual length as a positive value.

Note!

It is essential that the matching *RECORD* parameters are be used for all calls that belong to a single task. A task is identified clearly by input parameter *LADDR* and *RECORD*.

Norm slaves

The following conditions apply if the amount of standard diagnostic data of the norm slave lies between 241 and 244bytes:
When the length of *RECORD*

- is less than 240bytes the data is discarded and the respective error code is entered into *RET_VAL*.
- is greater than 240bytes, then the first 240bytes of the standard diagnostic data are transferred into the target area and the respective overflow-bit is set in the data.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

If no error did occur, then *RET_VAL* contains the length of the data that was transferred.

Note!
The amount of read data for a DP-slave depends on the diagnostic status.

Error information

More detailed information about general error information is to be found at the beginning of this chapter.

The SFC 13 specific error information consists of a subset of the error information for SFC 59 RD_REC. More detailed information is available from the help for SFC 59.

SFC 14 - DPRD_DAT - Read consistent data

Description

The SFC 14 DPRD_DAT (read consistent data of a DP norm slave) reads consistent data from a DP norm slave. The length of the consistent data must be three or more than four bytes, while the maximum length is 64Byte. Please refer to the manual of your specific CPU for details. Input parameter *RECORD* defines the target area where the read data is saved when the data transfer has been completed without errors. The length of the respective target area must be the same as the length that you have configured for the selected module.
If the module consists of a DP-norm slave of modular construction or with multiple DP-identifiers, then a single SFC 14 call can only access the data of a single module / DP-identifier at the configured start address.
SFC 14 is used because a load command accessing the periphery or the process image of the inputs can read a maximum of four contiguous bytes.

Definition

consistent data

Consistent data is data, where the contents belongs to the same category and that may not be separated. It is, for instance, important that data returned by analog modules is always processed consistently, i.e. the value returned by analog modules must not be modified incorrectly when it is read at two different times.

Parameters

Parameter	Declaration	Data type	Memory block	Description
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Configured start address of the receive data buffer of the module from which the data must be read
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed
RECORD	OUTPUT	ANY	I, Q, M, D, L	Target area for the user data that was read. The length must be exactly the same as the length that was configured for the selected module. Only data type BYTE is permitted.

RET_VAL
(Return value)

Value	Description
0000h	No error has occurred.
8090h	You have not configured a module for the logical base address that you have specified, or you have ignored the restrictions that apply to the length of the consistent data.
8092h	The ANY-reference contains a type that is not equal to BYTE.
8093h	No DP-module from which consistent data can be read exists at the logical address that was specified under *LADDR*.
80A0h	Incorrect start address for the address range in the transfer I/O buffer.
80B0h	Slave failure at the external DP-interface
80B1h	The length of the specified target area is not equal to the configured user data length.
80B2h	External DP-interface system error
80B3h	External DP-interface system error
80C0h	External DP-interface system error
80C2h	External DP-interface system error
80Fxh	External DP-interface system error
87xyh	External DP-interface system error
808xh	External DP-interface system error

SFC 15 - DPWR_DAT - Write consistent data

Description

The SFC 15 DPWR_DAT (write consistent data to a DP-norm slave) writes consistent data that is located in parameter *RECORD* to the DP-norm slave. The length of the consistent data must be three or more than four bytes, while the maximum length is 64Byte. Please refer to the manual of your specific CPU for details. Data is transferred synchronously, i.e. the write process is completed when the SFC has terminated. The length of the respective source area must be the same as the length that you have configured for the selected module.
If the module consists of a DP-norm slave of modular construction, then you can only access a single module of the DP-slave.
The SFC 15 is used because a transfer command accessing the periphery or the process image of the outputs can write a maximum of four contiguous bytes.

Definition

Consistent data

Consistent data is data, where the contents belongs to the same category and that may not be separated. For instance, it is important that data returned by analog modules is always processed consistently, i.e. the value returned by analog modules must not be modified incorrectly when it is read at two different times.

Parameters

Parameter	Declaration	Data type	Memory block	Description
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Configured start address of the output buffer of the module to which the data must be written
RECORD	INPUT	ANY	I, Q, M, D, L	Source area for the user data that will be written. The length must be exactly the same as the length that was configured for the selected module. Only data type BYTE is permitted.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL
(Return value)

Value	Description
0000h	No error has occurred.
8090h	You have not configured a module for the logical base address that you have specified, or you have ignored the restrictions that apply to the length of the consistent data.
8092h	The ANY-reference contains a type that is not equal to BYTE.
8093h	No DP-module to which consistent data can be written exists at the logical address that was specified under *LADDR*.
80A1h	The selected module has failed.
80B0h	Slave failure at the external DP-interface
80B1h	The length of the specified source area is not equal to the configured user data length.
80B2h	External DP-interface system error
80B3h	External DP-interface system error
80C1h	The data of the write command that was previously issued to the module has not yet been processed.
80C2h	External DP-interface system error
80Fxh	External DP-interface system error
85xyh	External DP-interface system error
808xh	External DP-interface system error

SFC 17 - ALARM_SQ and SFC 18 - ALARM_S

Description

Every call to the SFC 17 ALARM_SQ and the SFC 18 ALARM_S generates a message that can have an associated value. This message is sent to all stations that have registered for this purpose. The call to the SFC 17 and the SFC 18 can only be issued if the value of signal *SIG* triggering the message was inverted with respect to the previous call. If this is not true output parameter *RET_VAL* will contain the respective information and the message will not be sent. Input *SIG* must be set to "1" when the call to the SFC 17 and SFC 18 is issued for the first time, else the message will not be sent and *RET_VAL* will return an error code.

Note!

The SFC 17 and the SFC 18 should always be called from a FB after you have assigned the respective system attributes to this FB.

System resources

The SFC 17 and the SFC 18 occupy temporary memory that is also used to save the last two signal statuses with a time stamp and the associated value. When the call to the SFC occurs at a time when the signal statuses of the two most recent "valid" SFC-calls has not been sent (signal overflow), then the current signal status as well as the last signal status are discarded and an overflow-code is entered into temporary memory. The signal that occurred before the last signal will be sent as soon as possible including the overflow-code.

Message acknowledgement

Messages sent by means of the SFC 17 can be acknowledged via a display device. The acknowledgement status for the last "message entering state" and the signal status of the last SFC 17-call may be determined by means of the SFC 19 ALARM_SC.

Messages that are sent by SFC 18 are always acknowledged implicitly. The signal status of the last SFC 18-call may be determined by means of the SFC 19 ALARM_SC.

Temporarily saving

The SFCs 17 and 18 occupy temporary memory that is also used to save the last two signal statuses with a time stamp and the associated value. When the call to the SFC occurs at a time when the signal statuses of the two most recent "valid" SFC-calls has not been sent (signal overflow), then the current signal status as well as the last signal status are discarded and an overflow-code is entered into temporary memory. The signal that occurred before the last signal will be sent as soon as possible including the overflow-code.

Instance overflow

The maximum number of SFC 17- and SFC 18-calls depends on the type of CPU being used.
A resource bottleneck (instance overflow) can occur when the number of SFC-calls exceeds the maximum number of dynamic instances.

This condition is signaled by means of an error condition in *RET_VAL* and via the registered display device.

Parameters

Parameter	Declaration	Data type	Memory block	Description
SIG	INPUT	BOOL	I, Q, M, D, L	The signal that triggered the message.
ID	INPUT	WORD	I, Q, M, D, L	Data channel for messages: EEEEh
EV_ID	INPUT	DWORD	Const. (I, Q, M, D, L)	Message number (0: not permitted)
SD	INPUT	ANY	I, Q, M, D, T, C	Associated value
RET_VAL	OUTPUT	INT	I, Q, M, D, L	Error information

SD

Associated value

Maximum length: 12byte

Valid data types BOOL (bit field not permitted), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND_TIME

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	No error has occurred.
0001h	• The associated value exceeds the maximum length, or • application memory cannot be accessed (e.g. access to deleted DB). The message will be transferred. • The associated value points to the local data area
0002h	Warning: the last unused message acknowledgement memory has been allocated**.**
8081h	The specified *EV_ID* lies outside of the valid range.
8082h	Message loss because your CPU suffers from a lack of resources that are required to generate module related messages by means of SFCs.
8083h	Message loss because a signal of the same type is already available but could not be sent (signal overflow).
8084h	The triggering signal *SIG* for messages has the same value for the current and for the preceding SFC 17 / SFC 18 call.
8085h	The specified *EV_ID* has not been registered.
8086h	An SFC call for the specified *EV_ID* is already being processed with a lower priority class.
8087h	The value of the message triggering signal was 0 during the first call to the SFC 17, SFC 18.
8088h	The specified *EV_ID* has already been used by another type of SFC that is currently (still) occupying memory space.
8xyy	General error information

SFC 19 - ALARM_SC - Acknowledgement state last Alarm

Description

The SFC 19 ALARM_SC can be used to:

- determine the acknowledgement status of the last SFC 17-entering-state message and the status of the message triggering signal during the last SFC 17 ALARM_SQ call
- the status of the message triggering signal during the last SFC 18 ALARM_S call.

The predefined message number identifies the message and/or the signal. The SFC 19 accesses temporary memory that was allocated to the SFC 17 or SFC 18.

Parameters

Parameter	Declaration	Data type	Memory block	Description
EV_ID	INPUT	DWORD	I, Q, M, D, L, constant	Message number for which you want to determine the status of the signal during the last SFC call or the acknowledge-ment status of the last entering-state message (only for SFC 17!)
RET_VAL	OUTPUT	INT	I, Q, M, D, L	Return value
STATE	OUTPUT	BOOL	I, Q, M, D, L	Status of the message triggering signal during the last SFC call.
Q_STATE	OUTPUT	BOOL	I, Q, M, D, L	If the specified parameter *EV_ID* belongs to an SFC 18 call: "1"
				If the specified parameter *EV_ID* belongs to an SFC 17 call: acknowledgement sta-tus of the last entering-state message: "0": not acknowledged "1": acknowledged

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	No error has occurred.
8081h	The specified *EV_ID* lies outside of the valid range.
8082h	No memory is allocated to this *EV_ID* at present (possible cause: the status of the respective signal has never been "1", or it has already changed back to status "0".)
8xyy	General Error information

SFC 20 - BLKMOV - Block move

Description

The SFC 20 BLKMOV (block move) copies the contents of one block of memory (source field) into another block of memory (target field).
Any block of memory may be copied, with the exception of :

- the following blocks: FC, SFC, FB, SFB, OB, SDB
- counters
- timers
- memory blocks of the peripheral area.

It is also possible that the source parameter is located in another data block in load memory that is not relevant to the execution (DB that was compiled with key word UNLINKED).

Interruptability

No limits apply to the nesting depth as long as the source field is not part of a data block that only exists in load memory.
However, when interrupting an SFC 20 that copies blocks from a DB that is not relevant to the current process, then this SFC 20 cannot be nested any longer.

Parameters

Parameter	Declaration	Data type	Memory block	Description
SRCBLK	INPUT	ANY	I, Q, M, D, L	Defines the memory block that must be copied (source field). Arrays of data type STRING are not permitted.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
DSTBLK	OUTPUT	ANY	I, Q, M, D, L	Defines the destination memory block to which the data will be copied (target field). Arrays of data type STRING are not permitted.

Note!

Source and target field must not overlap. If the specified target field is larger than the source filed then only the amount of data located in the source field will be copied. When the specified target field should, however, be smaller than the source filed, then only the amount of data that the target field can accommodate will be copied.
If the type of the ANY-pointer (source or target) is BOOL, then the specified length must be divisible by 8, otherwise the SFC cannot be executed.
If the type of the ANY-pointer is STRING, then the specified length must be equal to 1.

RET_VAL (Return value)

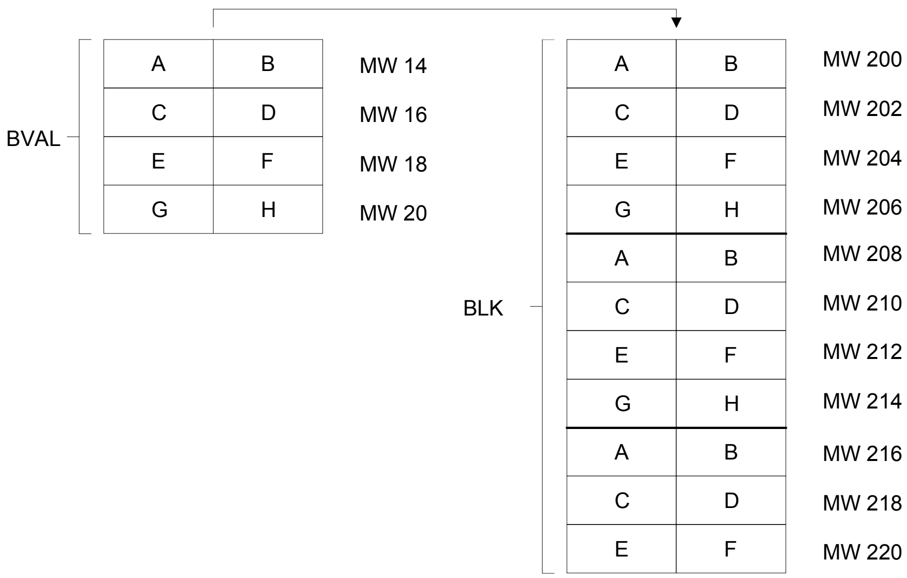
The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	No error
8091h	The maximum nesting depth was exceeded

SFC 21 - FILL - Fill a field

Description

The SFC 21 FILL fills one block of memory (target field) with the contents of another block of memory (source field). The SFC 21 copies the contents from the source field into the specified target field until the block of memory has been filled completely.



Note!

Source and target field must not overlap. Even if the specified target field is not an integer multiple of the length of input parameter BVAL, the target field will be filled up to the last byte. If the target field is smaller than the source field, only the amount of data that can be accommodated by the target will be copied.

Values cannot be written with the SFC 21 into:

- the following blocks: FC, SFC, FB, SFB, SDB
- counters
- timers
- memory blocks of the peripheral area

Parameters

Parameter	Declaration	Data type	Memory block	Description
BVAL	INPUT	ANY	I, Q, M, D, L	Contains the value or the description of the source field that should be copied into the target field. Arrays of the data type STRING are not permitted.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
BLK	OUTPUT	ANY	I, Q, M, D, L	Contains the description of the target field that must be filled. Arrays of the data type STRING are not permitted.

Parameter is a structure

Pay attention to the following when the input parameter consists of a structure:
the length of a structure is always aligned with an even number of bytes. This means, that if you should declare a structure with an uneven number of bytes, the structure will require one additional byte in memory.

Example:

The structure is declared as follows:

STRUKTUR_7_BYTE: STRUCT
BYTE_1_2 : WORD
BYTE_3_4 : WORD
BYTE_5_6 : WORD
BYTE_7: BYTE
END_STRUCT

Structure "STRUKTUR_7_BYTE" requires 8bytes of memory.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

The SFC 21 only returns general error information. No specific error information is available.

SFC 22 - CREAT_DB - Create a data block

Description

The SFC 22 CREAT_DB (create data block) allows the application program to create a data block that does not contain any values. A data block is created that has a number in the specified range and with a specific size. The number assigned to the DB will always be the lowest number in the specified range. To create a DB with specific number you must assigned the same number to the upper and the lower limit of the range. If the application program already contains DBs then the respective numbers cannot be assigned any longer. The length of the DB must be an even number.

Interruptability

The SFC 22 may be interrupted by OBs with a higher priority. If a call is issued to an SFC 22 from an OB with a higher priority, then the call is rejected with error code 8091h.

Parameters

Parameter	Declaration	Data type	Memory block	Description
LOW_LIMIT	INPUT	WORD	I, Q, M, D, L, constant	The lower limit is the lowest number in the range of numbers that you may assign to your data block.
UP_LIMIT	INPUT	WORD	I, Q, M, D, L, constant	The upper limit is the highest number in the range of numbers that you may assign to your data block.
COUNT	INPUT	WORD	I, Q, M, D, L, constant	The counter defines the number of data bytes that you wish to reserve for your data block. Here you must specify an even number of bytes (maximum 65534).
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
DB_NUMBER	OUTPUT	WORD	I, Q, M, D, L	The data block number is the number of the data block that was created. When an error occurs (bit 15 of *RET_VAL* was set) a value of 0 is entered into *DB_NUMBFC*.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	no error
8091h	You issued a nested call to the SFC 22.
8092h	The function "Create a DB" cannot be executed at present because • the function "Compress application memory" is active
80A1h	Error in the number of the DB: • the number is 0 • the number exceeds the CPU-specific number of DBs • lower limit > upper limit
80A2h	Error in the length of the DB: • the length is 0 • the length was specified as an uneven number • the length is larger than permitted by the CPU
80B1h	No DB-number available
80B2h	Insufficient memory available
80B3h	Insufficient contiguous memory available (compress the memory!).

SFC 23 - DEL_DB - Deleting a data block

Description

The SFC 23 DEL_DB (delete data block) deletes a data block in application memory and if necessary from the load memory of the CPU. The specified DB must not be open on the current level or on a level with a lower priority, i.e. it must not have been entered into one of the two DB-registers and also not into B-stack. Otherwise the CPU will change to STOP mode when the call to the SFC 23 is issued.

The following table indicates when a DB may be deleted by means of the SFC 23.

When the DB ...	then SFC 23 ...
was created by means of a call to SFC 22 "CREAT_DB",	can be used to delete it.
was not created with the key word UNLINKED,	can be used to delete it.

Interruptability

The SFC 23 may be interrupted by OBs with a higher priority. When another call is issued to the SFC the second call is rejected and *RET_VAL* is set to error code 8091h.

Parameters

Parameter	Declaration	Data type	Memory block	Description
DB_NUMBER	INPUT	WORD	I, Q, M, D, L, constant	Number of the DB that must be deleted.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	no error
8091h	The maximum nesting depth of the respective CPU for nested calls to SFC 23 has been exceeded.
8092h	The function "Delete a DB" cannot be executed at present because • the function "Compress application memory" is active • you are copying the DB to be deleted from the CPU to an offline project
80A1h	Error in input parameter *DB_NUMBER*: • has a value of 0 • exceeds the maximum DB number that is possible on the CPU that is being used
80B1h	A DB with the specified number does not exist on the CPU
80B2h	A DB with the specified number was created with the key word UNLINKED
80B3h	The DB is located on the flash memory card

SFC 24 - TEST_DB - Test data block

Description

The SFC 24 TEST_DB (test data block) returns information about a data block that is located in the application memory of the CPU. The SFC determines the number of data bytes and tests whether the selected DB is write protected.

Parameters

Parameter	Declaration	Data type	Memory block	Description
DB_NUMBER	INPUT	WORD	I, Q, M, D, L, constant	Number of the DB that must be tested.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
DB_LENGTH	OUTPUT	WORD	I, Q, M, D, L	The number of data bytes that are contained in the selected DB.
WRITE_PROT	OUTPUT	BOOL	I, Q, M, D, L	Information about the write protection code of the selected DB (1 = write protected).

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	no error
80A1h	Error in input parameter *DB_NUMBER*: the selected actual parameter • has a value of 0 • exceeds the maximum DB number that is possible on the CPU that is being used
80B1h	A DB with the specified number does not exist on the CPU.
80B2h	A DB with the specified number was created with the key word UNLINKED.

SFC 25 - COMPRESS - Compressing the User Memory

Gaps in Memory

Gaps can occur in the load memory and in the work memory if data blocks are deleted and reloaded several times. These gaps reduce the effective memory area.

Description

With SFC 25 COMPRESS, you start compression of the RAM section of both the load memory and the work memory. The compression function is the same as when started externally in the RUN mode (mode selector setting).

If compression was started externally and is still active (via Module Status Information), the SFC 25 call will result in an error message.

Parameter	Declaration	Data type	Memory block	Description
RET_VAL	OUTPUT	INT	E, A, M, D, L	Error information
BUSY	OUTPUT	BOOL	E, A, M, D, L	Indicates whether the compression function started by an SFC 25 call is still active. (1 means active.)
DONE	OUTPUT	BOOL	E, A, M, D, L	Indicates whether the compression function started by SFC 25 was completed successfully. (1 means completed successfully.)

Checking the Compression Function

If SFC 25 COMPRESS is called once, the compression function is started.

Call SFC 25 cyclically. First evaluate the parameter RET_VAL after every call. Provided that its value is 0, the parameters BUSY and DONE can be evaluated. If BUSY = 1 and DONE = 0, this indicates that the compression function is still active. When BUSY changes to value 0 and DONE to the value 1, this indicates that the compression function was completed successfully.
If SFC 25 is called again afterwards, the compression function is started again.

SFC 28 ... 31 - Time-of-day interrupt

Conditions

The following conditions must be satisfied before a time-of-day interrupt OB 10 may be called:

- The time-of-day interrupt OB must have been configured by hardware configuration or by means of the SFC 28 (SET_TINT) in the user program.
- The time-of-day interrupt OB must have been activated by hardware configuration or by means of the SFC 30 (ACT_TINT) in the user program.
- The time-of-day interrupt OB must not have been de-selected.
- The time-of-day interrupt OB must exist in the CPU.
- When the SFC 30 is used to set the time-of-day interrupt by a single call to the function the respective start date and time must not have expired when the function is initiated; the periodic execution initiates the time-of-day interrupt OB when the specified period has expired (start time + multiple of the period).

SFCs 28 ... 31

The system function are used as follows

- Set: SFC 28
- Cancel: SFC 29
- Activate: SFC 30
- Query: SFC 31

SFC 28 - SET_TINT

The SFC 28 SET_TINT (set time-of-day interrupt) defines the start date and time for the time-of-day interrupt - organization modules. The start time ignores any seconds and milliseconds that may have been specified, these are set to 0.

Parameters

Parameter	Declaration	Data type	Memory block	Description
OB_NR	INPUT	INT	I, Q, M, D, L, constant	Number of the OB, that is started at a time *SDT* + multiple of *PERIOD* (OB10, OB11).
SDT	INPUT	DT	D, L	Start date and start time
PERIOD	INPUT	WORD	I, Q, M, D, L, constant	Period from the start of *SDT*: 0000h = single 0201h = at minute intervals 0401h = hourly 1001h = daily 1201h = weekly 1401h = monthly 1801h = annually 2001h = at the end of a month
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	No error has occurred.
8090h	*OB_NR* parameter error
8091h	*SDT* parameter error
8092h	*PERIOD* parameter error
80A1h	The stated date/time has already expired.

SFC 29 - CAN_TINT - Cancel time-of-day interrupt

The SFC 29 CAN_TINT (cancel time-of-day interrupt) deletes the start date and time of the specified time-of-day interrupt - organization block

Parameters

Parameter	Declaration	Data type	Memory block	Description
OB_NR	INPUT	INT	I, Q, M, D, L, constant	Number of the OB, in which the start date and time will be canceled (OB 10, OB 11).
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL (Return value)

Value	Description
0000h	No error has occurred.
8090h	*OB_NR* parameter error
80A0h	No start date/time was defined for the respective time-of-day interrupt OB.

SFC 30 - ACT_TINT - Activate time-of-day interrupt

The SFC 30 ACT_TINT (activate time-of-day interrupt) is used to activate the specified time-of-day interrupt - organization block

Parameters

Parameter	Declaration	Data type	Memory block	Description
OB_NR	INPUT	INT	I, Q, M, D, L, constant	Number of the OB to be activated (OB 10, OB 11)
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL (Return value)

Value	Description
0000h	No error has occurred.
8090h	*OB_NR* parameter error
80A0h	No start date/time was defined for the respective time-of.-day interrupt OB
80A1h	The activated time has expired; this error can only occur when the function is executed once only.

SFC 31 - QRY_TINT - Query time-of-day interrupt

The SFC 31 QRY_TINT (query time-of-day interrupt) can be used to make the status of the specified time-of-day interrupt - organization block available via the output parameter *STATUS*.

Parameters

Parameter	Declaration	Data type	Memory block	Description
OB_NR	INPUT	INT	I, Q, M, D, L, constant	Number of the OB, whose status will be queried (OB 10, OB 11).
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
STATUS	OUTPUT	WORD	I, Q, M, D, L	Status of the time-of-day interrupt.

RET_VAL (Return value)

Value	Description
0000h	No error has occurred.
8090h	*OB_NR* parameter error

STATUS

Bit	Value	Description
0	0	The operating system has enabled the time-of-day interrupt.
1	0	New time-of-day interrupts are not discarded.
2	0	Time-of-day interrupt has not been activated and has not expired.
3	-	reserved
4	0	Time-of-day interrupt-OB has not been loaded.
5	0	An active test function disables execution of the time-of-day interrupt-OB.

SFC 32 - SRT_DINT - Start time-delay interrupt

Description

The SFC 32 SRT_DINT (start time-delay interrupt) can be used to start a time-delay interrupt that issues a call to a time-delay interrupt OB after the pre-configured delay time (parameter *DTIME*) has expired. Parameter *SIGN* specifies a user-defined code that identifies the start of the time-delay interrupt. While the function is being executed the values of *DTIME* and *SIGN* appear in the startup event information of the specified OB.

Conditions

The following conditions must be satisfied before a time-delay interrupt OB may be called:

- the time-delay interrupt OB must have been started (using the SFC 32)
- the time-delay interrupt OB must not have been de-selected.
- the time-delay interrupt OB must exist in the CPU.

Parameters

Parameter	Declaration	Data type	Memory block	Description
OB_NR	INPUT	INT	I, Q, M, D, L, constant	Number of the OB, that is started after the time delay (OB 20, OB 21).
DTIME	INPUT	TIME	I, Q, M, D, L, constant	The delay time (1 ... 60 000ms)
SIGN	INPUT	WORD	I, Q, M, D, L, constant	Code that is inserted into the startup event information of the OB when a call is issued to the time-delay interrupt.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

Accuracy

The time from the call to the SFC 32 and the start of the time-delay interrupt OB may be less than the configured time by no more than one millisecond, provided that no interrupt events have occurred that delay the call.

RET_VAL (Return value)

Value	Description
0000h	No error has occurred.
8090h	*OB_NR* parameter error
8091h	*DTIME* parameter error

SFC 33 - CAN_DINT - Cancel time-delay interrupt

Description

The SFC 33 CAN_DINT (cancel time-delay interrupt) cancels a time-delay interrupt that has already been started. The call to the respective time-delay interrupt OB will not be issued.

Conditions

The following conditions must be satisfied before a time-delay interrupt OB may be called:

- The time-delay interrupt OB must have been started (using the SFC 32).
- The time-delay interrupt OB must not have been de-selected.
- The time-delay interrupt OB must exist in the CPU.

Parameters

Parameter	Declaration	Data type	Memory block	Description
OB_NR	INPUT	INT	I, Q, M, D, L, constant	Number of the OB, that must be cancelled (OB 20, OB 21).
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL
(Return value)

Value	Description
0000h	No error has occurred.
8090h	*OB_NR* parameter error
80A0h	Time-delay interrupt has not been started.

SFC 34 - QRY_DINT - Query time-delay interrupt

Description

The SFC 34 QRY_DINT (query time-delay interrupt) can be used to make the status of the specified time-delay interrupt available via the output parameter *STATUS*.

Conditions

The following conditions must be satisfied before a time-delay interrupt OB may be called:

- The time-delay interrupt OB must have been started (using the SFC 32).
- The time-delay interrupt OB must not have been de-selected.
- The time-delay interrupt OB must exist in the CPU.

Parameters

Parameter	Declaration	Data type	Memory block	Description
OB_NR	INPUT	INT	I, Q, M, D, L, Constant	Number of the OB, that must be cancelled (OB 20, OB 21)
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
STATUS	OUTPUT	WORD	I, Q, M, D, L	Status of the time-delay interrupt

RET_VAL
(Return value)

Value	Description
0000h	No error has occurred.
8090h	*OB_NR* parameter error

STATUS

Bit	Value	Description
0	0	The operating system has enabled the time-delay interrupt.
1	0	New time-delay interrupts are not discarded.
2	0	Time-delay interrupt has not been activated and has not expired.
3	-	-
4	0	Time-delay interrupt-OB has not been loaded.
5	0	An active test function disables execution of the time-delay interrupt-OB.

SFC 36 - MSK_FLT - Mask synchronous errors

Description

The SFC 36 MSK_FLT (mask synchronous faults) is used to control the reaction of the CPU to synchronous faults by masking the respective synchronous faults.
The call to the SFC 36 masks the synchronous faults of the current priority class. If you set individual bits of the synchronous fault mask in the input parameters to "1" other bits that have previously been set will remain at "1". This result in new synchronous fault masks that can be retrieved via the output parameters. Masked synchronous faults are entered into an error register and do not issue a call to an OB. The error register is read by means of the SFC 38 READ_ERR.

Parameters

Parameter	Declaration	Data type	Memory block	Description
PRGFLT_SET_MASK	INPUT	DWORD	I, Q, M, D, L, constant	Programming faults that must be masked out
ACCFLT_SET_MASK	INPUT	DWORD	I, Q, M, D, L, constant	Access faults that must be masked out
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
PRGFLT_MASKED	OUTPUT	DWORD	I, Q, M, D, L	Masked programming faults
ACCFLT_MASKED	OUTPUT	DWORD	I, Q, M, D, L	Masked access errors

RET_VAL
(Return value)

Value	Description
0000h	None of the faults has previously been masked.
0001h	One or more of the faults has already been masked, however, the other faults will still be masked out.

SFC 37 - DMSK_FLT - Unmask synchronous errors

Description

The SFC 37 DMSK_FLT (unmask synchronous faults) unmasks any masked synchronous faults. A call to the SFC 37 unmasks the synchronous faults of the current priority class. The respective bits in the fault mask of the input parameters are set to "1". This results in new fault masks that you can read via the output parameters. Queried entries are deleted from in the error register.

Parameters

Parameter	Declaration	Data type	Memory block	Description
PRGFLT_RESET_MASK	INPUT	DWORD	I, Q, M, D, L, constant	Programming faults that must be unmasked
ACCFLT_RESET_MASK	INPUT	DWORD	I, Q, M, D, L, constant	Access faults that must be unmasked
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
PRGFLT_MASKED	OUTPUT	DWORD	I, Q, M, D, L	Masked programming faults
ACCFLT_MASKED	OUTPUT	DWORD	I, Q, M, D, L	Masked access errors

RET_VAL
(Return value)

Value	Description
0000h	All the specified faults have been unmasked.
0001h	One or more of the faults was not masked, however, the other faults will still be unmasked.

SFC 38 - READ_ERR - Read error register

Description

The SFC 38 READ_ERR (read error registers) reads the contents of the error register. The structure of the error register is identical to the structure of the programming fault and access fault masks that were defined as input parameters by means of the SFC 36 and 37. When you issue a call to the SFC 38 the specified entries are read and simultaneously deleted from the error register. The input parameters define which synchronous faults will be queried in the error register. The function indicates the masked synchronous faults of the current priority class that have occurred once or more than once. When a bit is set it signifies that the respective masked synchronous fault has occurred.

Parameters

Parameter	Declaration	Data type	Memory block	Description
PRGFLT_QUERY	INPUT	DWORD	I, Q, M, D, L, constant	Query programming faults
ACCFLT_QUERY	INPUT	DWORD	I, Q, M, D, L, constant	Query access faults
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
PRGFLT_ESR	OUTPUT	DWORD	I, Q, M, D, L	Programming faults that have occurred
ACCFLT_ESR	OUTPUT	DWORD	I, Q, M, D, L	Access faults that have occurred

RET_VAL (Return value)

Value	Description
0000h	All the specified faults have been masked.
0001h	One or more of the faults that have occurred was not masked.

SFC 39 - DIS_IRT - Disabling interrupts

Description

With the SFC 39 DIS_IRT (disable interrupt) you disable the processing of new interrupts and asynchronous errors.
This means that if an interrupt occurs, the operating system of the CPU reacts as follows:

- if neither calls an interrupt OB asynchronous error OB,
- nor triggers the normal reaction if an interrupt OB or asynchronous error OB is not programmed.

If you disable interrupts and asynchronous errors, this remains in effect for all priority classes. The effects of SFC 39 can only be canceled again by calling the SFC 40 or by a restart.

Whether the operating system writes interrupts and asynchronous errors to the diagnostic buffer when they occur depends on the input parameter setting you select for *MODE*.

Note!
Remember that when you program the use of the SFC 39, all interrupts that occur are lost.

Parameters

Parameter	Declaration	Data type	Memory block	Description
MODE	INPUT	BYTE	I, Q, M, D, L, constant	Specifies which interrupts and asynchronous errors are disabled.
OB_NR	INPUT	INT	I, Q, M, D, L, constant	OB number
RET_VAL	OUTPUT	INT	I, Q, M, D, L	If an error occurs while the function is active, the return value contains an error code.

MODE

<table>
<tr><th>MODE</th><th>Description</th></tr>
<tr><td>00</td><td>All newly occurring interrupts and asynchronous errors are disabled (Synchronous errors are not disabled).</td></tr>
<tr><td>01</td><td>All newly occurring events belonging to a specified interrupt class are disabled. Identify the interrupt class by specifying it as follows:
• Time-of-day interrupts: 10
• Time-delay interrupts: 20
• Cyclic interrupts: 30
• Hardware interrupts: 40
• Interrupts for DP-V1: 50
• Asynchronous error interrupts: 80
Entries into the diagnostic buffer are continued.</td></tr>
<tr><td>02</td><td>All new occurrences of a specified interrupt are disabled. You specify the interrupt using the OB number.
Entries into the diagnostic buffer are continued.</td></tr>
<tr><td>80</td><td>All new occurrences of a specified interrupt are disabled. You specify the interrupt using the OB number. Entries continue to be made in the diagnostic buffer.</td></tr>
<tr><td>81</td><td>All new occurrences belonging to a specified interrupt class are disabled and are no longer entered in the diagnostic buffer.
The operating system enters event 5380h in the diagnostic buffer.</td></tr>
<tr><td>82</td><td>All new occurrences belonging to a specified interrupt are disabled and are no longer entered in the diagnostic buffer.
The operating system enters event 5380h in the diagnostic buffer.</td></tr>
</table>

RET_VAL
(Return value)

Value	Description
0000h	No error occurred.
8090h	The input parameter *OB_NR* contains an illegal value.
8091h	The input parameter *MODE* contains an illegal value.
8xyyh	General error information, see Evaluating Errors with the Output parameter *RET_VAL*.

SFC 40 - EN_IRT - Enabling interrupts

Description

With the SFC 40 EN_IRT (enable interrupt) you enable the processing of new interrupts and asynchronous errors that you previously disabled with the SFC 39. This means that if an interrupt event occurs, the operating system of the CPU reacts in one of the follows ways:

- it calls an interrupt OB or asynchronous error OB,
  or
- it triggers the standard reaction if an interrupt OB or asynchronous error OB is not programmed.

Parameters

Parameter	Declaration	Data type	Memory block	Description
MODE	INPUT	BYTE	I, Q, M, D, L, constant	Specifies which interrupts and asynchronous errors will be enabled.
OB_NR	INPUT	INT	I, Q, M, D, L, constant	OB number
RET_VAL	OUTPUT	INT	I, Q, M, D, L	If an error occurs while the function is active, the return value contains an error code.

MODE

MODE	Description
00	All newly occurring interrupts and asynchronous errors are enabled.
01	All newly occurring events belonging to a specified interrupt class are enabled. Identify the interrupt class by specifying it as follows: • Time-of-day interrupts: 10 • Time-delay interrupts: 20 • Cyclic interrupts: 30 • Hardware interrupts: 40 • Interrupts for DP-V1: 50 • Asynchronous error interrupts: 80
02	All newly occurring events of a specified interrupt are enabled. You specify the interrupt using the OB number.

RET_VAL
(Return value)

Value	Description
0000h	No error occurred.
8090h	The input parameter *OB_NR* contains an illegal value.
8091h	The input parameter *MODE* contains an illegal value.
8xyyh	General error information, see Evaluating Errors with the Output parameter *RET_VAL*.

SFC 41 - DIS_AIRT - Delaying interrupts

Description

The SFC 41 DIS_AIRT (disable alarm interrupts) disables processing of interrupt OBs and asynchronous fault OBs with a priority that is higher than the priority of the current OB. You can issue multiple calls to the SFC 41. The operating system will count the number of calls to the SFC 41. Processing of interrupt OBs is disabled until you issue an SFC 42 EN_AIRT to enable all interrupt OBs and asynchronous fault OBs that were disabled by means of SFC 41 or until processing of the current OB has been completed.
Any queued interrupt or asynchronous fault interrupts will be processed as soon as you enable processing by means of the SFC 42 EN_AIRT or when processing of the current OB has been completed.

Parameters

Parameter	Declaration	Data type	Memory area	Description
RET_VAL	OUTPUT	INT	I, Q, M, D, L	Number of disable calls (= number of calls to the SFC 41)

RET_VAL (Return value)

When the SFC has been completed the return value *RET_VAL* indicates the number of disables, i.e. the number of calls to the SFC 41 (processing of all alarm interrupts is only enabled again when *RET_VAL* = 0).

SFC 42 - EN_AIRT - Enabling delayed interrupts

Description

The SFC 42 EN_AIRT (enable alarm interrupts) enables processing of high priority interrupt OBs and asynchronous fault OBs.
Every disabled interrupt must be re-enabled by means of the SFC 42. If you have disabled 5 different interrupts by means of 5 SFC 41 calls you must re-enable every alarm interrupt by issuing 5 individual SFC 42 calls.

Parameters

Parameter	Declaration	Data type	Memory block	Description
RET_VAL	OUTPUT	INT	I, Q, M, D, L	Number of disabled interrupts when the SFC 42 has been completed or the error code when an error has occurred while the function was being processed.

RET_VAL (Return value)

When the SFC has been completed the return value *RET_VAL* indicates the number of disables, i.e. the number of calls to the SFC 41 (processing of all alarm interrupts is only enabled again when *RET_VAL* = 0).

Value	Description
8080h	The function was started in spite of the fact that the alarm interrupt had already been enabled.

SFC 43 - RE_TRIGR - Retrigger the watchdog

Description

The SFC 43 RE_TRIGR (retrigger watchdog) restarts the watchdog timer of the CPU.

Parameter and return values

The SFC 43 has neither parameters nor return values.

SFC 44 - REPL_VAL - Replace value to AKKU1

Description

The SFC 44 REPL_VAL (replace value) transfers a value into AKKU1 of the program level that cause the fault. A call to the SFC 44 can only be issued from synchronous fault OBs (OB 121, OB 122).

Application example for the SFC 44:
When an input module malfunctions so that it is not possible to read any values from the respective module then OB 122 will be started after each attempt to access the module. The SFC 44 REPL_VAL can be used in OB 122 to transfer a suitable replacement value into AKKU1 of the program level that was interrupted. The program will be continued with this replacement value. The information required to select a replacement value (e.g. the module where the failure occurred, the respective address) are available from the local variables of OB 122.

Parameters

Parameter	Declaration	Data type	Memory block	Description
VAL	INPUT	DWORD	I, Q, M, D, L, constant	Replacement value
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

RET_VAL (Return value)

Value	Description
0000h	No error has occurred. A replacement value has been entered.
8080h	The call to the SFC 44 was not issued from a synchronous fault OB (OB 121, OB 122).

SFC 46 - STP - STOP the CPU

Description

The SFC 46 STP changes the operation mode of the CPU to STOP.

Parameter and return values

The SFC 46 has neither parameters nor return values.

SFC 47 - WAIT - Delay the application program

Description

The SFC 47 WAIT can be used to program time delays or wait times from 1 up to 32767µs in your application program.

Interruptability

The SFC 47 may be interrupted by high priority OBs.

Note!
Delay times that were programmed by means of the SFC 47 are minimum times that may be extended by the execution time of the nested priority classes as well as the load on the system!

Parameters

Parameter	Declaration	Data type	Memory block	Description
WT	INPUT	INT	I, Q, M, D, L, constant	Parameter *WT* contains the delay time in µs.

Error information

The SFC 47 does not return specific error codes.

SFC 49 - LGC_GADR - Read the slot address

Description

The SFC 49 LGC_GADR (convert logical address to geographical address) determines the slot location for a module from the logical address as well as the offset in the user-data address space for the module.

Parameters

Parameter	Declaration	Data type	Memory block	Description
IOID	INPUT	BYTE	I, Q, M, D, L, constant	Identifier for the address space: 54h = peripheral input (PI) 55h = peripheral output (PQ) For hybrid modules the SFC returns the area identifier of the lower address. When the addresses are equal the SFC returns identifier 54h.
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Logical address. For hybrid modules the lower of the two addresses must be specified.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
AREA	OUTPUT	BYTE	I, Q, M, D, L	Area identifier: this defines how the remaining output parameters must be interpreted.
RACK	OUTPUT	WORD	I, Q, M, D, L	See next page.
SLOT	OUTPUT	WORD	I, Q, M, D, L	
SUBADDR	OUTPUT	WORD	I, Q, M, D, L	

AREA

AREA specifies how the output parameters *RACK*, *SLOT* and *SUBADDR* must be interpreted. These dependencies are depicted below.

Value of AREA	System	Significance of RACK, SLOT and SUBADDR
0	-	reserved
1	Siemens S7-300	*RACK*: Rack number *SLOT*: Slot number *SUBADDR* : Address offset to base address
2	Decentra-lized periphery	*RACK* (Low Byte): Station number *RACK* (High Byte): DP master system ID *SLOT*: Slot number at station *SUBADDR* : Address offset to base address
3 ... 6	-	reserved

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	No error has occurred.
8090h	The specified logical address is not valid or an illegal value exists for parameter *IOID*

SFC 50 - RD_LGADR - Read all logical addresses of a module

Description

The SFC 50 RD_LGADR (read module logical addresses) determines all the stipulated logical addresses of a module starting with a logical address of the respective module.
You must have previously configured the relationship between the logical addresses and the modules. The logical addresses that were determined are entered in ascending order into the field *PEADDR* or into field PAADDR.

Parameters

Parameter	Declaration	Data type	Memory block	Description
IOID	INPUT	BYTE	I, Q, M, D, L, constant	Area identification: 54h = peripheral input (PI) 55h = peripheral output (PQ)
LADDR	INPUT	WORD	I, Q, M, D, L, constant	A logical address
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
PEADDR	OUTPUT	ANY	I, Q, M, D, L	Field for the PI-addresses, field elements must be of data type WORD.
PECOUNT	OUTPUT	INT	I, Q, M, D, L	Number of returned PI addresses
PAADDR	OUTPUT	ANY	I, Q, M, D, L	Field for PQ addresses, field elements must be of data type WORD.
PACOUNT	OUTPUT	INT	I, Q, M, D, L	Number of returned PQ addresses

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	No error has occurred.
8090h	The specified logical address is not valid or illegal value for parameter *IOID.*
80A0 h	Error in output parameter *PEADDR*: data type of the field elements is not WORD.
80A1h	Error in output parameter PAADDR: data type of the field elements is not WORD.
80A2h	Error in output parameter *PEADDR*: the specified field could not accommodate all the logical addresses.
80A3h	Error in output parameter PAADDR: the specified field could not accommodate all the logical addresses.

SFC 51 - RDSYSST - Read system status list SSL

Description

With the SFC 51 RDSYSST (read system status) a partial list respectively an extract of a partial list of the SSL (**s**ystem **s**tatus **l**ist) may be requested.

Here with the parameters *SSL_ID* and *INDEX* the objects to be read are defined.

The *INDEX* is not always necessary. It is used to define an object within a partial list.

By setting *REQ* the query is started. As soon as *BUSY* = 0 is reported, the data are located in the target area *DR*.

Information about the SSL may be found in Chapter "System status list SSL".

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: start processing
SSL_ID	INPUT	WORD	I, Q, M, D, L, constant	*SSL-ID* of the partial list or the partial list extract
INDEX	INPUT	WORD	I, Q, M, D, L, constant	Type or number of an object in a partial list
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: read operation has not been completed
SSL_HEADER	OUTPUT	STRUCT	D, L	WORD structure with 2 types: LENGTHDR: length record set N_DR: number of existing related records (for access to partial list header information) or number of records transmitted in DR.
DR	OUTPUT	ANY	I, Q, M, D, L	Target area for the SSL partial list or the extraction of the partial list that was read: If you have only read the SSL partial list header info of a SSL partial list, you may not evaluate DR, but only *SSL_HEADER*. Otherwise the product of LENGTHDR and N_DR shows the number of bytes stored in *DR*.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	no error
0081h	The length of the result field is too low. The function still returns as many records as possible. The SSL header indicates the returned number of records.
7000h	First call with *REQ* = 0: data transfer not active; *BUSY* = 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* = 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* = 1.
8081h	The length of the result field is too low. There is not enough space for one record.
8082h	*SSL_ID* is wrong or unknown to the CPU or the SFC.
8083h	Bad or illegal *INDEX.*
8085h	Information is not available for system-related reasons, e.g. because of a lack of resources.
8086h	Record set may not be read due to a system error.
8087h	Record set may not be read because the module does not exist or it does not return an acknowledgement.
8088h	Record set may not be read because the current type identifier differs from the expected type identifier.
8089h	Record set may not be read because the module does not support diagnostic functions.
80A2h	DP protocol error - Layer-2 error (temporary fault).
80A3h	DP protocol error on user-interface/user (temporary fault)
80A4h	Bus communication failure. This error occurs between the CPU and the external DP interface (temporary fault).
80C5h	Decentralized periphery not available (temporary fault).

SFC 52 - WR_USMSG - Write user entry into diagnostic buffer

Description

The SFC 52 WR_USMSG (write user element in diagnosis buffer) writes a used defined diagnostic element into the diagnostic buffer.

Send diagnostic message

To determine whether it is possible to send user defined diagnostic messages you must issue a call to SFC 51 "RDSYSST" with parameters *SZL_ID* = 0132h and *INDEX* = 0005h. Sending of user defined diagnostic messages is possible if the fourth word of the returned record set is set to "1". If it should contain a value of "0", sending is not possible.

Send buffer full

The diagnostic message can only be entered into the send buffer if this is not full. At a maximum of 50 entries can be stored in the send buffer.

If the send buffer is full

- the diagnostic event is still entered into the diagnostic buffer
- the respective error message (8092h) is entered into parameter *RET_VAL*.

Partner not registered

When a user defined diagnostic message must be sent and no partner has registered, then

- the diagnostic event is still entered into the diagnostic buffer.
- the respective error message (0091h or 8091h) is entered into parameter *RET_VAL*.

The contents of an entry

The structure of the entry in the diagnostic buffer is as follows:

Byte	Contents
1, 2	Event ID
3	Priority class
4	OB number
5, 6	reserved
7, 8	Additional information 1
9, 10, 11, 12	Additional information 2
13 ... 20	Time stamp: The data type of the time stamp is Date_and_Time.

Event ID

Every event is assigned to an event ID.

Additional information

The additional information contains more specific information about the event. This information differs for each event. When a diagnostic event is generated the contents of these entries may be defined by the user.
When a user defined diagnostic message is sent to the partners this additional information may be integrated into the (event-ID specific) message text as an associated value.

Parameters

Parameter	Declaration	Data type	Memory block	Description
SEND	INPUT	BOOL	I, Q, M, D, L, constant	Enable sending of user defined diagnostic messages to all registered partners
EVENTN	INPUT	WORD	I, Q, M, D, L, constant	Event-ID. The user assigns the event-ID. This is not preset by the message server.
INFO1	INPUT	ANY	I, Q, M, D, L	Additional information, length 1 word
INFO2	INPUT	ANY	I, Q, M, D, L	Additional information, length 2 words
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.

SEND

When SEND is set to 1 the user defined diagnostic message is sent to all partners that have registered for this purpose. Sending is only initiated when one or more partners have registered and the send buffer is not full. Messages are sent asynchronously with respect to the application program.

EVENTN

The event ID of the user event is entered into *EVENTN*. Event IDs must be of the format 8xyzh , 9xyzh, Axyzh and Bxyzh. Here the IDs of format 8xyzh and 9xyzh refer to predefined events and IDs of format Axyzh and Bxyzh refer to user-defined events.
An event being activated is indicated by x = 1, an event being deactivated by x = 0.
For events of the class A and B, yz refers to the message number that was predefined in hexadecimal representation when the messages were configured.

INFO1

INFO1 contains information with a length of one word. The following data types are valid:

- WORD
- INT
- ARRAY [0...1] OF CHAR

INFO1 can be integrated as associated value into the message text, i.e. to add current information to the message.

INFO2

INFO2 contains information with a length of two words. The following data types are valid:

- DWORD
- DINT
- REAL
- TIME
- ARRAY [0...3] OF CHAR

INFO2 can be integrated as associated value into the message text, i.e. to add current information to the message.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	no error
0091h	No partner registered (the diagnostic event has been entered into the diagnostic buffer)
8083h	Data type *INFO1* not valid
8084h	Data type *INFO2* not valid
8085h	*EVENTN* not valid
8086h	Length of *INFO1* not valid
8087h	Length of *INFO2* not valid
8091h	Error message identical to error code 0091h
8092h	Send operation currently not possible, send buffer full (the diagnostic event has been entered into the diagnostic buffer)

SFC 54 - RD_DPARM - Read predefined parameter

Description

The SFC 54 RD_DPARM (read defined parameter) reads the record with number *RECNUM* of the selected module from the respective SDB1xy.

Parameter *RECORD* defines the target area where the record will be saved

Parameters

Parameter	Declaration	Data type	Memory block	Description
IOID	INPUT	BYTE	I, Q, M, D, L, constant	Identifier for the address space: 54h = peripheral input (PI) 55h = peripheral output (PQ) For hybrid modules the SFC returns the area identifier of the lower address. When the addresses are equal the SFC returns identifier 54h.
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Logical address. For hybrid modules the lower of the two addresses must be specified.
RECNUM	INPUT	BYTE	I, Q, M, D, L, constant	record number (valid range: 0 ... 240)
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed. Additionally: the length of the record that was read in bytes, provided the size of the record fits into the target area and that no communication errors have occurred.
RECORD	OUTPUT	ANY	I, Q, M, D, L	Target area for the record that was read. Only data type BYTE is valid.

RET_VAL (Return value)

Two distinct cases exist for *RET_VAL* = 8xxxh:

- Temporary error (error codes 80A2h ... 80A4h, 80Cxh):
  For this type of error it is possible that the error corrects itself without intervention. For this reason it is recommended that you re-issue the call to the SFC (once or more than once).
  Example for temporary errors: the required resources are occupied at present (80C3h).
- Permanent error (error codes 809xh, 80A1h, 80Bxh, 80Dxh):
  These errors cannot be corrected without intervention. A repeat of the call to the SFC is only meaningful when the error has been removed.
  Example for permanent errors: incorrect length of the record that must be transferred (80B1h).

Value	Description
7000h	First call with *REQ* = 0: data transfer not active; *BUSY* is set to 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified logical base address is invalid: no assignment available in SDB1/SDB2x, or this is not a base address.
8092h	ANY-reference contains a type definition that is not equal to BYTE.
8093h	This SFC is not valid for the module selected by *LADDR* and *IOID*.
80B1h	The length of the target area defined by *RECORD* is too small.
80D0h	The respective SDB does not contain an entry for the module.
80D1h	The record number has not been configured in the respective SDB for the module.
80D2h	According to the type identifier the module cannot be configured.
80D3h	SDB cannot be accessed since it does not exist.
80D4h	Bad SDB structure: the SDB internal pointer points to an element outside of the SDB.

SFC 55 - WR_PARM - Write dynamic parameter

Description

The SFC 55 WR_PARM (write parameter) transfers the record *RECORD* to the target module. Any parameters for this module that exist in the respective SDB will not be replaced by the parameters that are being transferred to the module.

These SFC can be used for digital-, analog modules, FMs, CPs and via PROFIBUS DP-V1.

Conditions

It is important that the record that must be transferred is not static, i.e.:

- do not use record 0 since this record is static for the entire system.
- if the record appears in SDBs 100 ... 129 then the static-bit must not be set.

Parameter

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: write request
IOID	INPUT	BYTE	I, Q, M, D, L, constant	Identifier for the address space: 54h = peripheral input (PI) 55h = peripheral output (PQ) For hybrid modules the SFC returns the area identifier of the lower address. When the addresses are equal the SFC returns identifier 54h.
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Logical base address of the module. For hybrid modules the lower of the two addresses must be specified.
RECNUM	INPUT	BYTE	I, Q, M, D, L, constant	record number (valid values: 0 ... 240)
RECORD	INPUT	ANY	I, Q, M, D, L	Record
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: the write operation has not been completed.

RECORD

With the first call to the SFC the data that must be transferred is read from the parameter *RECORD*. However, if the transfer of the record should require more than one call duration, the contents of the parameter *RECORD* is no longer valid for subsequent calls to the SFC (of the same job).

RET_VAL (Return value)

Two distinct cases exist for *RET_VAL* = 8xxxh:

- Temporary error (error codes 80A2h ... 80A4h, 80Cxh):
  For this type of error it is possible that the error corrects itself without intervention. For this reason it is recommended that you re-issue the call to the SFC (once or more than once).
  Example for temporary errors: the required resources are occupied at present (80C3h).
- Permanent error (error codes 809xh, 80A1h, 80Bxh, 80Dxh):
  These errors cannot be corrected without intervention. A repeat of the call to the SFC is only meaningful when the error has been removed.
  Example for permanent errors: incorrect length of the record that must be transferred (80B1h).

Value	Description
7000h	First call with *REQ* = 0: data transfer not active; *BUSY* is set to 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified logical base address is invalid: no assignment available in SDB1/SDB2x, or this is not a base address.
8092h	ANY-reference contains a type definition that is not equal to BYTE.
8093h	This SFC is not valid for the module selected by *LADDR* and *IOID*.
80A1h	Negative acknowledgement when the record is being transferred to the module (module was removed during the transfer or module failed)
80A2h	DP protocol fault in layer 2, possible hardware-/ interface fault in the DP slave
80A3h	DP protocol fault for user Interface/user
80A4h	Communication failure (this fault occurs between the CPU and the external DP interface)
80B0h	SFC cannot be used with this type of module or the module does not recognize the record.

continued ...

... continue

Value	Description
80B1h	The length of the target area determined by *RECORD* is too small.
80B2h	The slot that was configured has not been populated.
80B3h	The actual type of module is not equal to the required type of module in SDB1
80C1h	The module has not yet completed processing of the data of the preceding write operation for the same record.
80C2h	The module is currently processing the maximum number of jobs for a CPU.
80C3h	Required resources (memory, etc.) are currently occupied.
80C4h	Communication error:
80C5h	Decentralized periphery not available.
80C6h	The transfer of records was aborted due to a priority class abort (warm start or background)
80D0h	The respective SDB does not contain an entry for the module.
80D1h	The record number was not configured in the respective SDB.
80D2h	Based on the type identifier the module cannot be configured.
80D3h	The SDB cannot be accessed since it does not exist.
80D4h	Bad SDB structure: the SDB internal pointer points to an element outside of the SDB.
80D5h	The record is not static.

SFC 56 - WR_DPARM - Write default parameter

Description

The SFC 56 WR_DPARM (write default parameter) transfers the record *RECNUM* from the respective SDB to the target module, irrespective of whether the specific record is static or dynamic.

These SFC can be used for digital-, analog modules, FMs, CPs and via PROFIBUS DP-V1.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: write request
IOID	INPUT	BYTE	I, Q, M, D, L, constant	Identifier for the address space: 54h = peripheral input (PI) 55h = peripheral output (PQ) For hybrid modules the SFC returns the area identifier of the lower address. When the addresses are equal the SFC returns identifier 54h.
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Logical base address of the module. For hybrid modules the lower of the two addresses must be specified.
RECNUM	INPUT	BYTE	I, Q, M, D, L, constant	Record number (valid values: 0 ... 240)
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: the write operation has not been completed.

RET_VAL (Return value)

Two distinct cases exist for *RET_VAL* = 8xxxh:

- Temporary error (error codes 80A2h ... 80A4h, 80Cxh):
  For this type of error it is possible that the error corrects itself without intervention. For this reason it is recommended that you re-issue the call to the SFC (once or more than once).
  Example for temporary errors: the required resources are occupied at present (80C3h).
- Permanent error (error codes 809xh, 80A1h, 80Bxh, 80Dxh):
  These errors cannot be corrected without intervention. A repeat of the call to the SFC is only meaningful when the error has been removed.
  Example for permanent errors: incorrect length of the record that must be transferred (80B1h).

Value	Description
7000h	First call with *REQ* = 0: data transfer not active; *BUSY* is set to 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified logical base address is invalid: no assignment available in SDB1/SDB2x, or this is not a base address.
8093h	This SFC is not valid for the module selected by means of *LADDR* and *IOID*.
80A1h	Negative acknowledgement when the record is being transferred to the module (module was removed during the transfer or module failed)
80A2h	DP protocol fault in layer 2, possible hardware-/ interface fault in the DP slave
80A3h	DP protocol fault for user Interface/user
80A4h	Communication failure (this fault occurs between the CPU and the external DP interface).
80B0h	SFC cannot be used with this type of module or the module does not recognize the record.
80B1h	The length of the target area determined by *RECORD* is too small.
80B2h	The slot that was configured has not been populated.
80B3h	The actual type of module is not equal to the required type of module in SDB1.
80C1h	The module has not yet completed processing of the data of the preceding write operation for the same record.
80C2h	The module is currently processing the maximum number of jobs for a CPU.
80C3h	Required resources (memory, etc.) are currently occupied.
80C4h	Communication error
80C5h	Decentralized periphery not available.
80C6h	The transfer of records was aborted due to a priority class abort (warm start or background).
80D0h	The respective SDB does not contain an entry for the module.
80D1h	The record number was not configured in the respective SDB.
80D2h	Based on the type identifier the module cannot be configured.
80D3h	The SDB cannot be accessed since it does not exist.
80D4h	Bad SDB structure: the SDB internal pointer points to an element outside of the SDB.

SFC 57 - PARM_MOD - Parameterize module

Description

The SFC 57 PARM_MOD (parameterize module) transfers all the records that were configured in the respective SDB into a module, irrespective of whether the specific record is static or dynamic.

These SFC can be used for digital-, analog modules, FMs, CPs and via PROFIBUS DP-V1.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: write request
IOID	INPUT	BYTE	I, Q, M, D, L, constant	Identifier for the address space: 54h = peripheral input (PI) 55h = peripheral output (PQ) For hybrid modules the SFC returns the area identifier of the lower address. When the addresses are equal the SFC returns identifier 54h.
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Logical base address of the module. For hybrid modules the lower of the two addresses must be specified.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: the write operation has not been completed.

RET_VAL (Return value)

Two distinct cases exist for *RET_VAL* = 8xxxh:

- Temporary error (error codes 80A2h ... 80A4h, 80Cxh):
  For this type of error it is possible that the error corrects itself without intervention. For this reason it is recommended that you re-issue the call to the SFC (once or more than once).
  Example for temporary errors: the required resources are occupied at present (80C3h).
- Permanent error (error codes 809xh, 80A1h, 80Bxh, 80Dxh):
  These errors cannot be corrected without intervention. A repeat of the call to the SFC is only meaningful when the error has been removed.
  Example for permanent errors: incorrect length of the record that must be transferred (80B1h).

Value	Description
7000h	First call with *REQ* = 0: data transfer not active; *BUSY* is set to 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified logical base address is invalid: no assignment available in SDB1/SDB2x, or this is not a base address.
8093h	This SFC is not valid for the module selected by means of *LADDR* and *IOID*.
80A1h	Negative acknowledgement when the record is being transferred to the module (module was removed during the transfer or module failed)
80A2h	DP protocol fault in layer 2, possible hardware-/ interface fault in the DP slave
80A3h	DP protocol fault for user Interface/user
80A4h	Communication failure (this fault occurs between the CPU and the external DP interface)
80B0h	SFC cannot be used with this type of module or the module does not recognize the record.
80B1h	The length of the target area determined by *RECORD* is too small.
80B2h	The slot that was configured has not been populated.
80B3h	The actual type of module is not equal to the required type of module in SDB1
80C1h	The module has not yet completed processing of the data of the preceding write operation for the same record.
80C2h	The module is currently processing the maximum number of jobs for a CPU.
80C3h	Required resources (memory, etc.) are currently occupied.
80C4h	Communication error
80C5h	Decentralized periphery not available.
80C6h	The transfer of records was aborted due to a priority class abort (warm start or background)
80D0h	The respective SDB does not contain an entry for the module.
80D1h	The record number was not configured in the respective SDB.
80D2h	Based on the type identifier the module cannot be configured.
80D3h	The SDB cannot be accessed since it does not exist.
80D4h	Bad SDB structure: the SDB internal pointer points to an element outside of the SDB.

SFC 58 - WR_REC - Write record

Description

The SFC 58 WR_REC (write record) transfers the record *RECORD* into the selected module.
The write operation is started when input parameter *REQ* is set to 1 when the call to the SFC 58 is issued. Output parameter *BUSY* returns a value of 0 if the write operation was executed immediately. *BUSY* is set to 1 if the write operation could not be completed.

These SFC can be used for digital-, analog modules, FMs, CPs and via PROFIBUS DP-V1.

System dependent this block cannot be interrupted!

Parameter

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: write request
IOID	INPUT	BYTE	I, Q, M, D, L, constant	Identifier for the address space: 54h = peripheral input (PI) 55h = peripheral output (PQ) For hybrid modules the SFC returns the area identifier of the lower address. When the addresses are equal the SFC returns identifier 54h.
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Logical base address of the module. For hybrid modules the lower of the two addresses must be specified.
RECNUM	INPUT	BYTE	I, Q, M, D, L, constant	Record number (valid range: 2 ... 240)
RECORD	INPUT	ANY	I, Q, M, D, L	Record. Only data type BYTE is valid.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: the write operation has not been completed.

RECORD

With the first call to the SFC the data that must be transferred is read from the parameter *RECORD*. However, if the transfer of the record should require more than one call duration, the contents of the parameter *RECORD* is no longer valid for subsequent calls to the SFC (of the same job).

RET_VAL (Return value)

Two distinct cases exist for *RET_VAL* = 8xxxh:

- Temporary error (error codes 80A2h ... 80A4h, 80Cxh):
  For this type of error it is possible that the error corrects itself without intervention. For this reason it is recommended that you re-issue the call to the SFC (once or more than once).
  Example for temporary errors: the required resources are occupied at present (80C3h).
- Permanent error (error codes 809xh, 80A0, 80A1h, 80Bxh):
  These errors cannot be corrected without intervention. A repeat of the call to the SFC is only meaningful when the error has been removed.
  Example for permanent errors: incorrect length of the record that must be transferred (80B1h).

Value	Description
7000h	First call with *REQ* = 0: data transfer not active; *BUSY* is set to 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified logical base address is invalid: no assignment available in SDB1/SDB2x, or this is not a base address.
8092h	ANY-reference contains a type definition that is not equal to BYTE.
8093h	This SFC is not valid for the module selected by *LADDR* and *IOID*.
80A1h	Negative acknowledgement when the record is being transferred to the module (module was removed during the transfer or module failed)
80A2h	DP protocol fault in layer 2, possible hardware-/ interface fault in the DP slave
80A3h	DP protocol fault for user Interface/user
80A4h	Communication failure (this fault occurs between the CPU and the external DP interface)

continued ...

... continue

Value	Description
80B0h	• SFC not valid for the type of module. • Module does not recognize the record. • Record number ≥ 241 not permitted. • Records 0 and 1 not permitted.
80B1h	The length specified in parameter *RECORD* is wrong.
80B2h	The slot that was configured has not been populated.
80B3h	The actual type of module is not equal to the required type of module in SDB1
80C1h	The module has not yet completed processing of the data of the preceding write operation for the same record.
80C2h	The module is currently processing the maximum number of jobs for a CPU.
80C3h	Required resources (memory, etc.) are currently occupied.
80C4h	Communication error
80C5h	Decentralized periphery not available.
80C6h	The transfer of records was aborted due to a priority class abort (warm start or background)

Note!
A general error 8544h only indicates that access to at least one byte of I/O memory containing the record was disabled. However, the data transfer was continued.

SFC 59 - RD_REC - Read record

Description

The SFC 59 RD_REC (read record) reads the record with the number *RECNUM* from the selected module.

These SFC can be used for digital-, analog modules, FMs, CPs and via PROFIBUS DP-V1.

The read operation is started when input parameter *REQ* is set to 1 when the call to SFC 59 is issued. Output parameter *BUSY* returns a value of 0 if the read operation was executed immediately. *BUSY* is set to 1 if the read operation could not be completed. Parameter *RECORD* determines the target area where the record is saved when it has been transferred successfully.

System dependent this block cannot be interrupted!

Parameter

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: read request
IOID	INPUT	BYTE	I, Q, M, D, L, constant	Identifier for the address space: 54h = peripheral input (PI) 55h = peripheral output (PQ) For hybrid modules the SFC returns the area identifier of the lower address. When the addresses are equal the SFC returns identifier 54h.
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Logical base address of the module. For hybrid modules the lower of the two addresses must be specified.
RECNUM	INPUT	BYTE	I, Q, M, D, L, constant	Record number (valid range: 0 ... 240)
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed. Additionally: the length of the actual record that was read, in bytes (range: +1 ... +240), provided that the target area is greater than the transferred record and that no communication errors have occurred.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: the write operation has not been completed.

continued ...

... continue

Parameter	Declaration	Data type	Memory block	Description
RECORD	OUTPUT	ANY	I, Q, M, D, L	Target area for the record that was read. When SFC 59 is processed in asynchronous mode you must ensure that the actual parameters of *RECORD* have the same length information for all calls. Only data type BYTE is permitted.

Suitable choice of RECORD

To ensure that an entire record is read you must select a target area with a length of 241bytes. In this case the value in *RET_VAL* indicates the actual length of the data that was transferred successfully.

RET_VAL (Return value)

RET_VAL contains an error code when an error occurs while the function was being processed.
When the transfer was successful *RET_VAL* contains:

- a value of 0 if the entire target area was filled with data from the selected record (the record may, however, be incomplete).
- the length of the record that was transferred, in bytes (valid range: 1 ... 240), provided that the target area is greater than the transferred record.

Error information

Two distinct cases exist for *RET_VAL* = 8xxxh:

- Temporary error (error codes 80A2h ... 80A4h, 80Cxh):
  For this type of error it is possible that the error corrects itself without intervention. For this reason it is recommended that you re-issue the call to the SFC (once or more than once).
  Example for temporary errors: the required resources are occupied at present (80C3h).
- Permanent error (error codes 809xh, 80A0h, 80A1h, 80Bxh):
  These errors cannot be corrected without intervention. A repeat of the call to the SFC is only meaningful when the error has been removed.
  Example for permanent errors: incorrect length of the record that must be transferred (80B1h).

Error information

Value	Description
7000h	First call with *REQ* = 0: data transfer not active; *BUSY* is set to 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified logical base address is invalid: no assignment available in SDB1/SDB2x, or this is not a base address.
8092h	ANY-reference contains a type definition that is not equal to BYTE.
8093h	This SFC is not valid for the module selected by *LADDR* and *IOID*.
80A0h	Negative acknowledgement when reading from the module (module was removed during the transfer or module failed)
80A2h	DP protocol fault in layer 2, possible hardware-/ interface fault in the DP slave
80A3h	DP protocol fault for user Interface/user
80A4h	Communication failure (this fault occurs between the CPU and the external DP interface)
80B0h	• SFC not valid for the type of module. • Module does not recognize the record. • Record number ≥ 241 not permitted.
80B1h	The length specified in parameter *RECORD* is wrong.
80B2h	The slot that was configured has not been populated.
80B3h	The actual type of module is not equal to the required type of module in SDB1
80C0h	The module has registered the record but this does not contain any read data as yet.
80C1h	The module has not yet completed processing of the data of the preceding write operation for the same record.
80C2h	The module is currently processing the maximum number of jobs for a CPU.
80C3h	Required resources (memory, etc.) are currently occupied.
80C4h	Communication error
80C5h	Decentralized periphery not available.
80C6h	The transfer of records was aborted due to a priority class abort (warm start or background)

Note!

A general error 8745h only indicates that access to at least one byte of I/O memory containing the record was disabled. However, the data was read successfully from the module and saved to the I/O memory block.

SFC 64 - TIME_TCK - Read system time tick

Description

The SFC 64 TIME_TCK (time tick) retrieves the system time tick from the CPU. This ma be used to assess the time that certain processes require calculating the difference between the values returned by two SFC 64 calls. The system time is a "time counter" that counts from 0 to a max. of 2147483647ms and that restarts from 0 when an overflow occurs. The timing intervals and the accuracy of the system time depend on the CPU. Only the operating modes of the CPU influence the system time.

System time and operating modes

Operating mode	System time ...
Restart RUN	... permanently updated.
STOP	... stopped to retain the last value.
warm start	... continues from the value that was saved when STOP occurred.
reboot	... is deleted and starts from "0".

Parameters

Parameter	Declaration	Data type	Memory block	Description
RET_VAL	OUTPUT	TIME	I, Q, M, D, L	Parameter *RET_VAL* contains the system time that was retrieved, range from 0 ... 2^{31} -1ms.

RET_VAL (Return value)

The SFC 64 does not return any error information.

SFC 65 - X_SEND - Send data

Description

The SFC 65 X_SEND can be used to send data to an external communication partner outside the local station. The communication partner receives the data by means of the SFC 66 X_RCV. Input parameter *REQ_ID* is used to identify the transmit data. This code is transferred along with the transmit data and it can be analyzed by the communication partner to determine the origin of the data. The transfer is started when input parameter *REQ* is set to 1. The size of the transmit buffer that is defined by parameter *SD* (on the sending CPU) must be less than or equal to the size of the receive buffer (on the communication partner) that was defined by means of parameter *RD*. In addition, the data type of the transmit buffer and the receive buffer must be identical.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	control parameter "request to activate", initiates the operation
CONT	INPUT	BOOL	I, Q, M, D, L, constant	control parameter "continue", defines whether the connection to the communication partner is terminated or not when the operation has been completed
DEST_ID	INPUT	WORD	I, Q, M, D, L, constant	Address parameter "destination ID". Contains the MPI-address of the communication partners.
REQ_ID	INPUT	DWORD	I, Q, M, D, L, constant	Operation code identifying the data on the communication partner.
SD	INPUT	ANY	I, Q, M, D	Reference to the send buffer. The following data types are possible: BOOL, BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5_TIME, DATE_AND_TIME as well as arrays of the respective data types, with the exception of BOOL.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: the send operation has not yet been completed. *BUSY* = 0: the send operation has been completed, or no send operation is active.

REQ_ID

Input parameter *REQ_ID* identifies the send data.
Parameter *REQ_ID* is required by the receiver when

- the sending CPU issues multiple calls to SFC 65 with different *REQ_ID* parameters and the data is transferred to a single communication partner.
- more than one sending CPU are transferring data to a communication partner by means of the SFC 65.

Receive data can be saved into different memory blocks by analyzing the *REQ_ID* parameter.

Data consistency

Since send data is copied into an internal buffer of the operating system when the first call is issued to the SFC it is important to ensure that the send buffer is not modified before the first call has been completed successfully. Otherwise an inconsistency could occur in the transferred data.
Any write-access to send data that occurs after the first call is issued does not affect the data consistency.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

The "real error information" that is contained in the table "specific error information" a. o. may be classified as follows:

Value	Description
809xh	Error on the CPU where the SFC is being executed
80Axh	Permanent communication error.
80Bxh	Error on the communication partner.
80Cxh	Temporary error.

Specific error information:

Value	Description
0000h	Processing completed without errors.
7000h	First call with *REQ* = 0: no data transfer is active; *BUSY* is set to 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified target address of the communication partners is not valid, e.g. • bad *IOID* • bad base address exists • bad MPI-address (> 126)
8092h	Error in *SD* or *RD*, e.g.: • illegal length for *SD* • *SD* = NIL is not permitted
8095h	The block is already being processed on a priority class that has a lower priority.
80A0h	Error in received acknowledgement.
80A1h	Communication failures: SFC-call after an existing connection has been terminated.
80B1h	ANY-pointer error. The length of the data buffer that must be transferred is wrong.
80B4h	ANY-pointer data type error, or ARRAY of the specified data type is not permitted.
80B5h	Processing rejected because of an illegal operating mode.
80B6h	The received acknowledgement contains an unknown error code.
80B8h	The SFC 66 "X_RCV" of the communication partner rejected the data transfer (*RD* = NIL).
80B9h	The data block was identified by the communication partner (SFC 66 "X_RCV" was called with *EN_DT* = 0) but it has not yet been accepted into the application program because the operating mode is STOP.
80BAh	The answer of the communication partner does not fit into the communication telegram.
80C0h	The specified connection is already occupied by another operation.
80C1h	Lack of resources on the CPU where the SFC is being executed, e.g.: • The module is already executing the maximum number of different send operations. • Connection resources may be occupied, e.g. by a receive operation.
80C2h	Temporary lack of resources for the communication partner, e.g.: • The communication partner is currently processing the maximum number of operations. • The required resources (memory, etc.) are already occupied. • Not enough memory (initiate compression.)
80C3h	Error when establishing a connection, e.g.: • The local station is connected to the MPI sub-net. • You have addressed the local station on the MPI sub-net. • The communication partner cannot be contacted any longer • Temporary lack of resources for the communication partner.

SFC 66 - X_RCV - Receive data

Description

The SFC 66 X_RCVS can be used to receive data, that was sent by means of SFC 65 X_SEND by one or more external communication partners.
SFC 66 can determine whether the data that was sent is available at the current point in time. The operating system could have stored the respective data in an internal queue. If the data exists in the queue the oldest data block can be copied into the specified receive buffer.

Parameters

Parameter	Declaration	Data type	Memory block	Description
EN_DT	INPUT	BOOL	I, Q, M, D, L, constant	Control parameter "enable data transfer". You can check whether one or more data blocks are available by setting this to 0. A value of 1 results in the oldest data block of the queue being copied into the memory block that was specified by means of *RD*.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
REQ_ID	OUTPUT	DWORD	I, Q, M, D, L	Operation code of the SFC 65 "X_SEND" whose send data is located uppermost in the queue, i.e. the oldest data in the queue. If the queue does not contain a data block *REQ_ID* is set to 0.
NDA	OUTPUT	BOOL	I, Q, M, D, L	Status parameter "new data arrived". *NDA* = 0: • The queue does not contain a data block. *NDA* = 1: • The queue does contain one or more data blocks. (call to the SFC 66 with *EN_DT* = 0). • The oldest data block in the queue was copied into the application program. (call to the SFC 66 with *EN_DT* = 1).

continued ...

... continue

Parameter	Declaration	Data type	Memory block	Description
RD	OUTPUT	ANY	I, Q, M, D	Reference to the receive data buffer (receive data area). The following data types are available: BOOL, BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5_TIME, DATE_AND_TIME as well as arrays of these data types with the exception of BOOL. If you wish to discard the oldest data block in the queue you must assign a value of NIL to *RD*.

Data reception indication

with *EN_DT* = 0

The operating system inserts data received from a communication partner in the sequence in which they are received.
You can test whether at least one data block is ready by issuing a call to the SFC 66 with *EN_DT* = 0 and testing the resulting output parameter *NDA*.

- *NDA* = 0 means that the queue does not contain a data block. *REQ_ID* is irrelevant, *RET_VAL* contains a value of 7000h.
- *NDA* = 1 means that the queue does contain one or more data blocks.

If the queue contains a data block you should also test output parameters *RET_VAL* and *REQ_ID*. *RET_VAL* contains the length of the data block in bytes, *REQ_ID* contains the operation code of the send block. If the queue should contain multiple data blocks parameters *REQ_ID* and *RET_VAL* refer to the oldest data block contained in the queue.

Transferring data into the receive buffer

with *EN_DT* = 1

When input parameter *EN_DT* = 1 then the oldest data block in the queue is copied into the target block defined by *RD*. You must ensure that the size of *RD* is greater than or equal to the size of the transmit buffer of the respective SFC 65 X_SEND defined by parameter *SD* and that that the data types match. If received data should be saved into different areas you can determine the *REQ_ID* in the first call (SFC-call with *EN_DT* = 0) and select a suitable value for *RD* in the subsequent call (with *EN_DT* = 1). If the operation was processed successfully *RET_VAL* contains the length (in bytes) of data block that was copied and a positive acknowledgement is returned to the sending station.

Discarding data

If you do not want to accept the received data assign a value of NIL to *RD*. The respective communication partner receives a negative acknowledgement (the value of *RET_VAL* of the respective SFC 65 X_SEND is 80B8h) and parameter *RET_VAL* is set to 0.

Data consistency

You must make sure that the receive buffer is not read before the operation has been completed since you could otherwise be reading could cause inconsistent data.

Operating mode transition to STOP mode

When the CPU changes to STOP mode,

- all newly received commands receive a negative acknowledgement.
- for commands that have already been received: all commands that have been entered into the in receive queue receive a negative acknowledgement.
- all data blocks are discarded when a warm start follows.
- when a warm start follows, the data block that belongs to the oldest operation is transferred into the application program, provided that it was falls queried before the operating mode changed to STOP (SFC-call with *EN_DT* = 0). Otherwise it will be discarded.
  All other data blocks are discarded.

Termination of a connection

When the connection is terminated any operation that was entered into the receive queue of this connection is discarded.
Exception: if this is the oldest operation in the queue that has already been recognized by a SFC-call with *EN_DT* = 0 it can be transferred into the receive buffer by means of *EN_DT* = 1.

RET_VAL (Return value)

If no error has occurred, *RET_VAL* contains:

- when *EN_DT* = 0/1 and *NDA* = 0: 7000h. In this case the queue does not contain a data block.
- when *EN_DT* = 0 and *NDA* = 1, *RET_VAL* contains the length (in bytes) of the oldest data block that was entered into the queue as a positive number.
- when *EN_DT* = 1 and *NDA* = 1, *RET_VAL* contains the length (in bytes) of the data block that was copied into the receive buffer *RD* as a positive number.

Error information

The "real error information" that is contained in the table "specific error information" a. o. may be classified as follows:

Value	Description
809xh	Error on the CPU where the SFC is being executed
80Axh	Permanent communication error
80Bxh	Error on the communication partner
80Cxh	Temporary error

Specific Error information:

Value	Description
0000h	Processing completed without errors.
00xyh	When *NDA* = 1 and *RD* <> NIL: *RET_VAL* contains the length of the received data block (when *EN_DT* = 0) or the data block copied into *RD* (when *EN_DT* = 1).
7000h	*EN_DT* = 0/1 and *NDA* = 0
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified target address of the communication partners is not valid, e.g. • bad *IOID* • bad base address exists • bad MPI-address (> 126)
8092h	Error in *SD* or *RD*, e.g.: • The amount of data received is too much for the buffer defined by *RD*. • *RD* has data type BOOL but the length of the received data is greater than one byte.
8095h	The block is already being processed on a priority class that has a lower priority.
80A0h	Error in received acknowledgement.
80A1h	Communication failures: SFC-call after an existing connection has been terminated.
80B1h	ANY-pointer error. The length of the data block that must be transferred is wrong.
80B4h	ANY-pointer data type error, or ARRAY of the specified data type is not permitted.
80B6h	The received acknowledgement contains an unknown error code.
80BAh	The answer of the communication partner does not fit into the communication telegram.
80C0h	The specified connection is already occupied by another operation.
80C1h	Lack of resources on the CPU where the SFC is being executed, e.g.: • the module is already executing the maximum number of different send operations. • connection resources may be occupied, e.g. by a receive operation.
80C2h	Temporary lack of resources for the communication partner, e.g.: • The communication partner is currently processing the maximum number of operations. • The required resources (memory, etc.) are already occupied. • Not enough memory (initiate compression).
80C3h	Error when establishing a connection, e.g.: • The local station is connected to the MPI sub-net. • You have addressed the local station on the MPI sub-net. • The communication partner cannot be contacted any longer. • Temporary lack of resources for the communication partner.

SFC 67 - X_GET - Read data

Description

The SFC 67 X_GET can be used to read data from an external communication partner that is located outside the local station. No relevant SFC exists on the communication partner. The operation is started when input parameter *REQ* is set to 1. Thereafter the call to the SFC 67 is repeated until the value of output parameter *BUSY* becomes 0. Output parameter *RET_VAL* contains the length of the received data block in bytes.
The length of the receive buffer defined by parameter *RD* (in the receiving CPU) must be identical or greater than the read buffer defined by parameter *VAR_ADDR* (for the communication partner) and the data types of *RD* and *VAR_ADDR* must be identical.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	Control parameter "request to activate", used to initiate the operation
CONT	INPUT	BOOL	I, Q, M, D, L, constant	Control parameter "continue", determines whether the connection to the communication partner is terminated or not when the operation has been completed
DEST_ID	INPUT	WORD	I, Q, M, D, L, constant	Address parameter "destination ID". Contains the MPI address of the communication partner.
VAR_ADDR	INPUT	ANY	I, Q, M, D	Reference to the buffer in the partner-CPU from where data must be read. You must select a data type that is supported by the communication partner.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed. If no error has occurred, *RET_VAL* contains the length of the data block that was copied into receive buffer *RD* as positive number of bytes.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: the receive operation has not been completed. *BUSY* = 0: The receive operation has been completed or no receive operation active.
RD	OUTPUT	ANY	I, Q, M, D	Reference to the receive buffer (receive data area). The following data types are permitted: BOOL, BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5_TIME, DATE_AND_TIME as well as arrays of the above data types, with the exception of BOOL

Data consistency

The following rules must be satisfied to prevent the data consistency from being compromised:

- Active CPU (receiver of data):
  The receive buffer should be read in the OB that issues the call to the respective SFC. If this is not possible the receive buffer should only be read when processing of the respective SFC has been completed.
- Passive CPU (sender of data):
  The maximum amount of data that may be written into the send buffer is determined by the block size of the passive CPU (sender of data).
- Passive CPU (sender of data):
  Send data should be written to the send buffer while interrupts are inhibited.

Operating mode transition to STOP mode

When the CPU changes to STOP mode the connection established by means of the SFC 67 is terminated. The type of start-up that follows determines whether any previously received data located in a buffer of the operating system are discarded or not.

- A warm start means that the data located in the buffer is copied into the area defined by *RD*.
- A reboot start means that the data is discarded.

Operating mode transition of the communication partners to STOP mode

A transition to operating mode STOP of the CPU of the communication partner does not affect the data transfer, since it is also possible to read data in operating mode STOP.

RET_VAL (Return value)

The "real error information" that is contained in the table "specific error information" a. o. may be classified as follows:

Value	Description
809xh	Error on the CPU where the SFC is being executed
80Axh	Permanent communication error
80Bxh	Error on the communication partner
80Cxh	Temporary error

Specific error information:

Value	Description
0000h	Processing completed without errors.
00xyh	*RET_VAL* contains the length of the received data block.
7000h	Call issued with *REQ* = 0 (call without processing), *BUSY* is set to 0, no data transfer is active.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified target address of the communication partners is not valid, e.g. • bad *IOID* • bad base address exists • bad MPI-address (> 126)
8092h	Error in *SD* or *RD*, e.g.: • illegal length for *RD* • the length or the data type of *RD* does not correspond with the received data. • *RD* = NIL is not permitted.
8095h	The block is already being processed on a priority class that has a lower priority.
80A0h	Error in received acknowledgement.
80A1h	Communication failures: SFC-call after an existing connection has been terminated.
80B0h	Object cannot be found, e.g. DB was not loaded.
80B1h	ANY-pointer error. The length of the data block that must be transferred is wrong.

continued ...

... continue

Value	Description
80B2h	HW-error: module does not exist • The slot that was configured is empty. • Actual module type does not match the required module type. • Decentralized periphery not available. • The respective SDB does not contain an entry for the module.
80B3h	Data may only be read or written, e.g. write protected DB
80B4h	The communication partner does not support the data type specified in *VAR_ADDR*.
80B6h	The received acknowledgement contains an unknown error code.
80BAh	The answer of the communication partner does not fit into the communication telegram.
80C0h	The specified connection is already occupied by another operation.
80C1h	Lack of resources on the CPU where the SFC is being executed, e.g.: • The module is already executing the maximum number of different send operations. • Connection resources may be occupied, e.g. by a receive operation.
80C2h	Temporary lack of resources for the communication partner, e.g.: • The communication partner is currently processing the maximum number of operations. • The required resources (memory, etc.) are already occupied • Not enough memory (initiate compression.)
80C3h	Error when establishing a connection, e.g.: • The local station is connected to the MPI sub-net. • You have addressed the local station on the MPI sub-net. • The communication partner cannot be contacted any longer. • Temporary lack of resources for the communication partner.

SFC 68 - X_PUT - Write data

Description

The SFC 68 X_PUT can be used to write data to an external communication partner that is located outside the local station. No relevant SFC exists on the communication partner. The operation is started when input parameter *REQ* is set to 1. Thereafter the call to SFC 68 is repeated until the value of output parameter *BUSY* becomes 0. The length of the send buffer defined by parameter *SD* (in the sending CPU) must be identical or greater than the receive buffer defined by parameter *VAR_ADDR* (for the communication partner) and the data types of *SD* and *VAR_ADDR* must be identical.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	control parameter "request to activate", used to initiate the operation
CONT	INPUT	BOOL	I, Q, M, D, L, constant	control parameter "continue", determines whether the connection to the communication partner is terminated or not when the operation has been completed
DEST_ID	INPUT	WORD	I, Q, M, D, L, constant	Address parameter "destination ID". Contains the MPI address of the communication partner.
VAR_ADDR	INPUT	ANY	I, Q, M, D	Reference to the buffer in the partner-CPU into which data must be written. You must select a data type that is supported by the communication partner.
SD	INPUT	ANY	I, Q, M, D	Reference to the buffer in the local CPU that contains the send data. The following data types are permitted: BOOL, BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5_TIME, DATE_AND_TIME as well as arrays of the above data types, with the exception of BOOL.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: the send operation has not been completed. *BUSY* = 0: The send operation has been completed or no send operation is active.

Data consistency

The following rules must be satisfied to prevent the data consistency from being compromised:

- Active CPU (sender of data):
  The send buffer should be written in the OB that issues the call to the respective SFC. If this is not possible the send buffer should only be written when processing of the first call to the respective SFC has been completed.
- Active CPU (sender of data):
  The maximum amount of data that may be written into the send buffer is determined by the block size of the passive CPU (sender of data).
- Passive CPU (receiver of data):
  Receive data should be read from the receive buffer while interrupts are inhibited.

Operating mode transition to STOP mode

When the CPU changes to STOP mode the connection established by means of the SFC 68 is terminated and data can no longer be sent. If the send data had already been copied into the internal buffer when the transition to STOP mode occurs the contents of the buffer is discarded.

Operating mode transition of the partners to STOP mode

A transition to operating mode STOP of the CPU of the communication partner does not affect the data transfer, since it is also possible to write data in operating mode STOP.

RET_VAL (Return value)

The "real error information" that is contained in the table "specific error information" a. o. may be classified as follows:

Value	Description
809xh	Error on the CPU where the SFC is being executed.
80Axh	Permanent communication error.
80Bxh	Error on the communication partner.
80Cxh	Temporary error.

Specific error information:

Value	Description
0000h	Processing completed without errors.
7000h	Call issued with *REQ* = 0 (call without processing), *BUSY* is set to 0, no data transfer is active.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* is set to 1.
8090h	The specified target address of the communication partners is not valid, e.g. • bad *IOID* • bad base address exists • bad MPI-address (> 126)
8092h	Error in *SD* or *RD*, e.g.: • illegal length of *SD* • *SD* = NIL is not permitted
8095h	The block is already being processed on a priority class that has a lower priority.
80A0h	The data type specified by *SD* of the sending CPU is not supported by the communication partner.
80A1h	Communication failures: SFC-call after an existing connection has been terminated.
80B0h	Object cannot be found, e.g. DB was not loaded.
80B1h	ANY-pointer error. The length of the data block that must be transferred is wrong.
80B2h	HW-error: module does not exist • the slot that was configured is empty. • Actual module type does not match the required module type. • Decentralized periphery not available. • The respective SDB does not contain an entry for the module.
80B3h	Data can either be read or written, e.g. write protected DB
80B4h	The communication partner does not support the data type specified in *VAR_ADDR*.
80B6h	The received acknowledgement contains an unknown error code.
80B7h	Data type and / or the length of the transferred data does not fit the buffer in the partner CPU where the data must be written.
80BAh	The answer of the communication partner does not fit into the communication telegram.
80C0h	The specified connection is already occupied by another operation.
80C1h	Lack of resources on the CPU where the SFC is being executed, e.g.: • the module is already executing the maximum number of different send operations. • connection resources may be occupied, e.g. by a receive operation.
80C2h	Temporary lack of resources for the communication partner, e.g.: • The communication partner is currently processing the maximum number of operations. • The required resources (memory, etc.) are already occupied • Not enough memory (initiate compression)
80C3h	Error when establishing a connection, e.g.: • The local station is connected to the MPI sub-net. • You have addressed the local station on the MPI sub-net. • The communication partner cannot be contacted any longer. • Temporary lack of resources for the communication partner.

SFC 69 - X_ABORT - Disconnect

Description

The SFC 69 X_ABORT can be used to terminate a connection to a communication partner that is located outside the local station, provided that the connection was established by means one of SFCs 65, 67 or 68. The operation is started when input parameter *REQ* is set to 1.

If the operation belonging to SFCs 65, 67 or 68 has already been completed (*BUSY* = 0) then the connection related resources occupied by both partners are enabled again when the call to the SFC 69 has been issued. However, if the respective operation has not yet been completed (*BUSY* = 1), the call to the respective SFC 65, 67 or 68 must be repeated after the connection has been terminated with *REQ* = 0 and *CONT* = 0. The connection resources are only available again when *BUSY* = 0.
The SFC 69 can only be called on the side where SFC 65, 67 or 68 is being executed.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	Control parameter "request to activate", used to initiate the operation
DEST_ID	INPUT	WORD	I, Q, M, D, L, constant	Address parameter "destination ID". Contains the MPI address of the communication partner.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: connection termination not yet completed. *BUSY* = 0: connection termination has been completed.

Operating mode transition to STOP mode

The connection termination initiated by means of the SFC 69 is still completed, even if the CPU changes to STOP mode.

Operating mode transition of the partners to STOP mode

A transition to operating mode STOP of the CPU of the communication partner does not affect the connection termination, the connection is terminated in spite of the change of operating mode.

RET_VAL (Return value)

The "real error information" that is contained in the table "specific error information" and others may be classified as follows:

Value	Description
809xh	Error on the CPU where the SFC is being executed
80Axh	Permanent communication error
80Bxh	Error on the communication partner
80Cxh	Temporary error

Specific error information:

Value	Description
0000h	*REQ* = 1 when the specified connection has not been established.
7000h	Call issued with *REQ* = 0 (call without processing), *BUSY* is set to 0, no data transfer is active.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* is set to 1.
7002h	Intermediate call with *REQ* = 1.
8090h	The specified target address of the communication partners is not valid, e.g. • bad *IOID* • bad base address exists • bad MPI-address (> 126)
8095h	The block is already being processed on a priority class that has a lower priority.
80A0h	Error in the acknowledgement that was received.
80A1h	Communication failures: SFC-call after an existing connection has been terminated.
80B1h	ANY-pointer error. The length of the data block that must be transferred is wrong.
80B4h	ANY-pointer data type error, or ARRAY of the specified data type is not permitted.
80B6h	The received acknowledgement contains an unknown error code.
80BAh	The answer of the communication partner does not fit into the communication telegram.
80C0h	The specified connection is already occupied by another operation.
80C1h	Lack of resources on the CPU where the SFC is being executed, e.g.: • the module is already executing the maximum number of different send operations. • connection resources may be occupied, e.g. by a receive operation.
80C2h	Temporary lack of resources for the communication partner, e.g.: • The communication partner is currently processing the maximum number of operations. • The required resources (memory, etc.) are already occupied. • Not enough memory (initiate compression).
80C3h	Error when establishing a connection, e.g.: • The local station is connected to the MPI sub-net. • You have addressed the local station on the MPI sub-net. • The communication partner cannot be contacted any longer. • Temporary lack of resources for the communication partner.

SFC 81 - UBLKMOV - Copy data area without gaps

Description

The SFC 81 UBLKMOV (uninterruptible block move) creates a consistent copy of the contents of a memory block (= source field) in another memory block (= target field). The copy procedure cannot be interrupted by other activities of the operating system.
It is possible to copy any memory block, with the exception of:

- the following blocks: FC, SFC, FB, SFB, OB, SDB
- counters
- timers
- memory blocks of the peripheral area
- data blocks those are irrelevant to the execution.

The maximum amount of data that can be copied is 512bytes.

Interruptability

It is not possible to interrupt the copy process. For this reason it is important to note that any use of the SFC 81 will increase the reaction time of your CPU to interrupts.

Parameters

Parameter	Declaration	Data type	Memory block	Description
SRCBLK	INPUT	ANY	I, Q, M, D, L	Specifies the memory block that must be copied (source field). Arrays of data type STRING are not permitted.
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed.
DSTBLK	OUTPUT	ANY	I, Q, M, D, L	Specifies the target memory block where the data must be copied (target field). Arrays of data type STRING are not permitted.

Note!

The source and target field must not overlap.

If the specified target field is larger than the source field, only the amount of data located in the source field will be copied into the target field. However, if the size of the specified target field is less than the size of the source field, then only the amount of data that will fit into the target field will be copied.
If the data type of the ANY-pointer (source or target) is BOOL, then the specified length must be divisible by 8, otherwise the SFC will not be executed.
If the data type of the ANY-pointer is STRING the specified length must be 1.

RET_VAL
(Return value)

Value	Description
0000h	no error
8091h	The source area is located in a data block that is not relevant to execution.

SFC 102 - RD_DPARA - Reading Predefined Parameters

Description

With SFC 102 RD_DPARA you can read the record set with the number RECNUM of a selected module from system data configured with STEP7. The read record set is entered into the target area opened with the parameter *RECORD*.

Operating principle

The SFC 102 RD_DPARA operates asynchronously, that is, processing covers multiple SFC calls. Start the job by calling SFC 102 with *REQ* = 1. The job status is displayed via the output parameters RET_VAL and BUSY. Refer also to Meaning of *REQ*, *RET_VAL* and *BUSY* with Asynchronously Operating SFCs.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L	REQ = 1: Read request
LADDR	INPUT	WORD	I, Q, M, D, L, constant	Address of the module. For an output address, the highest value bit must be set.
RECNUM	INPUT	BYTE	I, Q, M, D, L, constant	Record set number (permitted values: 0 ... 240
RET_VAL	OUTPUT	INT	I, Q, M, D, L	If an error occurs while the function is active, the return value contains an error code. If no error occurred during the transmission, the following two cases are distinguished: • RET_VAL contains the length of the actually read record set in bytes if the destination area is larger than the read record set. • RET_VAL contains 0 if the length of the read record set is equal to the length of the destination area.
BUSY	OUTPUT	BOOL	I, Q, M, D, L	BUSY = 1: The job is not yet closed.
				Destination area for the read record set. Only data type BYTE is permitted. Note: Note that the RECORD parameter of CPUs always required the full specification of the DB parameters (for example: P#DB13.DBX0.0 byte 100). Omitting an explicit DB no. is not permitted for CPUs and causes an error message in the user program.

Error Information

See Configuring Modules with SFC 57 PARM_MOD.

SFC 105 - READ_SI - Reading Dynamic System Resources

Overview

When messages are generated with SFCs 107 ALARM_DQ and 108 ALARM_D, the operating system occupies temporarily system memory space.

For example, if you do not delete a FB that exists in the CPU with SFC 107 or SFC 108 calls it may happen that corresponding system resources stay permanently occupied. If you reload the FB with SFC 108 or SFC 108 calls, it may happen that the SFCs 107 and 108 are not processed properly anymore.

Description

With SFC 105 READ_SI you can read currently used system resources occupied with the SFCs 107 and 108 when messages were generated. This is done via the values of EV_ID and CMP_ID used in this place. The values are passed on to SFC 105 READ_SI in parameter *SI_ID*.

SFC 105 READ_SI has four possible operating modes that we explain in the table below. Set the desired operating mode via the MODE parameter.

MODE	Which of the system resources occupied by SFC 107/SFC 108 are read?
1	All (call of SFC 105 with SI_ID:=0)
2	The system resource occupied by the call of SFC 107-/SFC 108 with EV_ID:=ev_id (call of the SFC 105 with *SI_ID*:=ev_id)
3	The system resource occupied by the call of SFC 107-/SFC 108 with CMP_ID:=cmp_id (call of the SFC 105 with *SI_ID*:=ev_id)
0	Additional system resources that could not be read with the previous call in MODE=1 or MODE=3 because you have specified a target field SYS_INST that is too small

Operating principle

If you have not selected a sufficiently large SYS_INST target area when you called the SFC 105 in MODE=1 or MODE=3, it contains the content of all currently occupied system resources selected via MODE parameter.

High system load on resources will cause a correspondingly high SFC runtime. That is, a high load on CPU performance may result in overshoot of the maximum configurable cycle monitoring time.

You can work around this runtime problem as follows: Select a relatively small SYS_INST target area. RET_VAL = 0001h informs you if the SFC cannot enter all system resources to be read in SYS_INST. In this case, call SFC 105 with MODE=0 and the same SI_ID as for the previous call until the value of RET_VAL is 0000h.

Note!

Since the operating system does not coordinate the SFC 105 calls that belong to the read job, you should execute all SFC 105 calls with the same priority class.

Target Area SYS_INST

The target area for the fetched occupied system resource must lie within a DB. You should appropriately define the target area as a field of structures, whereby a structure is constructed as follows:

Structure element	Data type	Description
SFC_NO	WORD	No. of the SFC that occupies the system resource
LEN	BYTE	Length of the structures in bytes, incl. SFC_NO and LEN: 0Ch
SIG_STAT	BOOL	Signal state
ACK_STAT	BOOL	Acknowledgement status of the incoming event (positive edge)
EV_ID	DWORD	Message number
CMP_ID	DWORD	Partial system ID

Parameters

Parameter	Declaration	Data type	Memory Area	Description
MODE	INPUT	INT	I, Q, M, D, L, constant	Job identifier Permissible values: • 1: Read all system resources • 2: Read the system resource that was occupied with EV_ID = ev_id when SFC 107-/SFC 108 was called • 3: Read the system resources that were occupied with CMP_ID = cmp_id when SFC 107-/SFC 108 was called • 0: subsequent call
SI_ID	INPUT	DWORD	I, Q, M, D, L, constant	ID for the system resource(s) to be read Permissible values • 0, if MODE = 1 • Message number ev_id, if MODE = 2 • ID cmp_id for identification of the system section, if MODE = 3
RET_VAL	OUTPUT	INT	I, Q, M, D, L	Return value (error information or job status)
N_SI	OUTPUT	INT	I, Q, M, D, L	Number of output system resources with SYS_INT
SYS_INST	OUTPUT	ANY	D	Target area for the fetched system resources.

RET_VAL
(Return value)

Error code	Description
0000h	No error occurred.
0001h	Not all system resources could be read because the *SYS_INT* target range you have selected is too short.
8081h	(only with MODE=2 or 3) You have assigned the value 0 to *SI_ID*.
8082h	(only with MODE=1) You have assigned one of 0 different values to *SI_ID*.
8083h	(only with MODE=0) You have assigned *SI_ID* a value other than at the preceding call of the SFC with MODE=1 or 3.
8084h	You have assigned an illegal value to MODE.
8085h	SFC 105 is already being processed in another OB.
8086h	Target area *SYS_INST* too small for a system resource.
8087h or 8092h	Target area *SYS_INST* does not exist in a DB or error in the ANY pointer.
8xyyh	General error information, see Evaluating Errors with the Output Parameter *RET_VAL*.

SFC 106 - DEL_SI - Reading Dynamic System Resources

Overview

When messages are generated with SFCs 107 ALARM_DQ and 108 ALARM_D, the operating system occupies temporarily system memory space.

For example, if you do not delete a FB that exists in the CPU with SFC 107 or SFC 108 calls it may happen that corresponding system resources stay permanently occupied. If you reload the FB with SFC 108 or SFC 108 calls, it may happen that the SFCs 107 and 108 are not processed properly anymore.

Description

With SFC 106 DEL_SI you can delete currently used system resources.

SFC 106 DEL_SI has three possible operating modes explained in the table below. Set the desired operating mode via the *MODE* parameter.

MODE	Which of the system resources occupied by SFC 107/SFC 108 are deleted?
1	All (call of SFC 106 with SI_ID:=0)
2	The system resource occupied by the call of SFC 107-/SFC 108 with EV_ID:=ev_id (call of the SFC 106 with SI_ID:=ev_id)
3	The system resource occupied by the call of SFC 107-/SFC 108 with CMP_ID:=cmp_id (call of the SFC 106 with SI_ID:=ev_id)

Parameters

Parameter	Declaration	Data type	Memory Area	Description
MODE	INPUT	INT	I, Q, M, D, L, constant	Job identifier Permissible values • 1: delete all system resources • 2: delete the system resource that was occupied with EV_ID = ev_id when SFC 107-/SFC 108 was called • 3: delete the system resources that were occupied with CMP_ID = cmp_id when SFC 107-/SFC 108 was called
SI_ID	INPUT	DWORD	I, Q, M, D, L, constant	ID of the system resource(s) to be deleted Permissible values • 0, if MODE=1 • Message number ev_id, if MODE=2 • ID cmp_id for identification of the • system section, if MODE=3
RET_VAL	OUTPUT	INT	I, Q, M, D, L	Error Information

RET_VAL
(Return value)

Error code	Description
0000h	No error occurred.
8081h	(only with MODE=2 or 3) You have assigned the value 0 to *SI_ID*.
8082h	(only with MODE=1) You have assigned one of 0 different values to *SI_ID*.
8084h	You have assigned an illegal value to MODE.
8085h	SFC 106 is currently being processed.
8086h	Not all selected system resources could be deleted because at least one of them was being processed when SFC 106 was called.
8xyyh	General error information, see Evaluating Errors with the Output Parameter RET_VAL

SFC 107 - ALARM_DQ and SFC 108 - ALARM_D

Description

With every call the SFCs 107 ALARM_DQ (Generating Acknowledgeable Block Related Messages) and 108 ALARM_D (Permanently Acknowledged Block Related Messages) generate a message to which you can append an associated value. Thus, you correspond with SFCs 17 ALARM_SQ and 18 ALARM_S.

When generating messages with SFCs 107 ALARM_DQ and 108 ALARM_D, the operating system temporarily occupies a system resource for the duration of the signal cycle.

The signal cycle time for SFC 108 ALARM_D starts at the SFC call with *SIG*=1 and ends at a new call with *SIG*=0. This interval for SFC 107 ALARM_DQ may be extended by the time expiring until the incoming signal is acknowledged at a logged in displaying device.

For SFC 108 ALARM_D, the signal cycle lasts from the SFC call SIG=1 until another call with SIG=0. For SFC 107 ALARM_DQ, this time period also includes the time until the incoming signal is acknowledged by one of the reported display devices, if necessary.

If, during the signal cycle, the message-generating block is overloaded or deleted, the associated system resource remains occupied until the next restart.

The additional functionality of SFCs 107 ALARM_DQ and 108 ALARM_D compared to SFCs 17 and 18 is now that you can manage these occupied system resources:

- With the help of SFC 105 READ_SI you can fetch information related to occupied system resources.
- With SFC 106 DEL_SI you can release occupied system resources again. This is of special significance for permanently occupied system resources. A currently occupied system resource, for example, stays occupied until the next restart if you, in the course of a program change, delete an FB call that contains SFC107 or SFC108 calls. When you change the program, and reload an FB with SFC 107 or SFC 108 calls, it may happen that the SFCs 107 and 108 do not generate anymore messages.

Description Parameter

The SFCs 107 and 108 contain one parameter more than the SFCs 17 and 18, namely the input *CMP_ID*. Use this input to assign the messages generated with SFCs 107 and 108 to logical areas, for example to parts of the system. If you call SFC 107/SFC 108 in an FB the obvious thing to do is to assign the number of the corresponding instance DB to *CMP_ID*.

Parameters

Parameter	Declaration	Data type	Memory Area	Description
SIG	INPUT	BOOL	I, Q, M, D, L	The message triggering signal
ID	INPUT	WORD	I, Q, M, D, L, constant	Data channel for messages: EEEEh
EV_ID	INPUT	DWORD	I, Q, M, D, L, constant	Message number (not allowed: 0)
CMP_ID	INPUT	DWORD	I, Q, M, D, L, constant	Component identifier (not allowed: 0) ID for the partial system to which the corresponding message is assigned Recommended values: • low word: 1 ... 65535 • high word: 0 You will not be confronted with any conflicts if you are compliant with these recommendations.
SD	INPUT	ANY	I, Q, M, D, T, C	Associated value Maximum length: 12 bytes Permitted are only data of the type BOOL (not allowed: Bit field), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND_TIME
RET_VAL	OUTPUT	INT	I, Q, M, D, L	Error Information

RET_VAL
(Return value)

Error code	Description
0000h	No error occurred.
0001h	• The length of the associated value exceeds the maximum permissible length, or • Access to user memory not possible (for example, access to deleted DB). The activated message is sent. • The associated value points to a value in the local data area. The message is sent. (S7-400 only)
0002h	Warning: The last free message acknowledge memory was occupied. (S7-400 only)
8081h	The specified *EV_ID* lies outside the valid range.
8082h	Message loss because your CPU has no more resource for generating block related messages with SFCs.
8083h	Message loss, the same signal transition is already present but could not be sent yet (signal overflow).
8084h	With the current and the previous SFC 107-/SFC-108 call the message triggering signal SIG has the same value.
8085h	There is no logon for the specified *EV_ID*.
8086h	An SFC call for the specified *EV_ID* is already being processed in a lower priority class.
8087h	At the initial call of SFC 107/SFC 108 the message triggering signal had the value 0.
8088h	The specified EV_ID is already in use by another system resource (to SFC 17, 18, 107, 108).
8089h	You have assigned the value 0 to *CMP_ID*.
808Ah	*CMP_ID* not fit to *EV_ID*
8xyyh	General error information, see Evaluating Errors with the Output Parameter *RET_VAL*.

Chapter 6 VIPA specific blocks

Overview

Here you find the description of the VIPA specific blocks that are exclusively used with PLCs from VIPA.

Content

Overview

General

The integrated blocks are developed in machine-code and are therefore running with high speed. They do not occupy space in the internal application memory.

The integrated blocks are called via the user application.

The following pages list the VIPA specific blocks that may be called in the control application for special functions.

Overview

The following VIPA specific blocks are available:

FB/SFB	Label	Description
FB/SFB 8	USEND	Uncoordinated data transmission
FB/SFB 9	URCV	Uncoordinated data reception
FB/SFB 12	BSEND	Sending data an blocks
FB/SFB 13	BRCV	Receiving data in blocks
FB/SFB 14	GET	Remote CPU read
FB/SFB 15	PUT	Remote CPU write
FB 55	IP_CONFIG	Programmed Communication Connections
FB 60	SEND	Send to CP 040
FB 61	RECEIVE	Receive from CP 040

FC	Label	Description
FC 5	AG_SEND	Transfer data to Ethernet CP 343
FC 6	AG_RECV	Receive data from CP
FC 10	AG_CNTRL	Check and control Ethernet CP 343 connections
FC 200	IBS_INIT	Registration and initialization of an INTERBUS master at the CPU
FC 202	IBS_SERVICE	Service communication between CPU and INTERBUS master
FC 204	IBS_LOOP	Slow asynchronous data communication between CPU and INTERBUS master (waits for master release)
FC 205	IBS_CYCLE	Fast asynchronous data communication between CPU and INTERBUS master (waits not for master release)
FC 206	IBS_IRQ	Synchronous data communication between CPU and INTERBUS master with synchronization via interrupt
FC 207	IBS_PCP	Peripherals Communication Protocol (PCP) communication for instructions and parameters for INTERBUS slaves
FC 208	IBS_DIAG	Read diagnostic data from INTERBUS master res. INTERBUS slaves

SFB	Label	Description
SFB 7	TIMEMESS	VIPA Micro second timer with difference evaluation
SFB 239	FUNC	Execute system internal functions

SFC	Label	Description
SFC 53 [1)]	uS_TICK	VIPA micro second timer
SFC 192	CP_S_R	internally used for FB 7 and FB 8 *
SFC 193	AI_OSZI	Oscilloscope-/FIFO function
SCF 194	DPEXCH	SPEED-Bus data transfer between DP master and CPU
SFC 195	FILE_ATT	Change VIPA file attributes
SFC 196	AG_CNTRL	internally used for FC 10 *
SFC 198	AG_USEND	internally used for FB/SFB 8 *
SFC 199	AG_URCV	internally used for FB/SFB 9 *
SFC 200	AG_GET	internally used for FB/SFB 14 *
SFC 201	AG_PUT	internally used for FB/SFB 15 *
SFC 202	AG_BSEND	internally used for FB/SFB 12 *
SFC 203	AG_BRCV	internally used for FB/SFB 13 *
SFC 204	IP_CONF	internally used for FB 55 IP_CONF *
SFC 205	AG_SEND	internally used for FC 5 AG_SEND *
SFC 206	AG_RECV	internally used for FC 6 AG_RECV *
SFC 208	FILE_OPN	Open VIPA file
SFC 209	FILE_CRE	Create VIPA file
SFC 210	FILE_CLO	Close VIPA file
SFC 211	FILE_RD	Read VIPA file
SFC 212	FILE_WR	Write VIPA file
SFC 213	FILE_SEK	Position VIPA file pointer
SFC 214	FILE_REN	Rename VIPA file
SFC 215	FILE_DEL	Delete VIPA file
SFC 216	SER_CFG	RS232 Parameterization
SFC 217	SER_SND	RS232 Send
SFC 218	SER_RCV	RS232 Receive
SFC 219	CAN_TLGR	Send CAN telegram
SFC 253	IBS_ACCESS	internally used for SPEED-Bus INTERBUS master *
SFC 254	RW_SBUS	Communication between SPEED-Bus INTERBUS master and CPU

1) This function block is interruptable and does not affect the interrupt reaction time.

***) Note!**

To call the function please use exclusively the block listed here. The direct call of the associated internal SFC leads to errors in the corresponding instance DB!

Include VIPA library

Overview

The VIPA specific blocks may be found at www.vipa.de as downloadable library at the service area with *Downloads > VIPA LIB*.

The library is available as packed zip-file.

If you want to use VIPA specific blocks, you have to import the library into your project.

Execute the following steps:

- Extract FX000011_Vxxx.zip
- "Retrieve" the library
- Open library and transfer blocks into the project

Unzip FX000011_Vxxx.zip

Start your un-zip application with a double click on the file FX000011_Vxxx.zip and copy the file VIPA.ZIP to your work directory. It is not necessary to extract this file, too.

Retrieve library

To retrieve your library for the SPEED7-CPUs, start the SIMATIC manager from Siemens. Open the dialog window for archive selection via **File** > *Retrieve*. Navigate to your work directory.

Choose VIPA.ZIP and click at [Open].

Select a destination folder where the blocks are to be stored. [OK] starts the extraction.

Open library and transfer blocks to project

After the extraction open the library.

Open your project and copy the necessary blocks from the library into the directory "blocks" of your project.

Now you have access to the VIPA specific blocks via your user application.

Siemens S7 Communication - FB/SFB 8 ... FB 55

Overview

With Siemens S7 communication you can transfer large volumes of data between via Ethernet connected PLC stations based on Siemens STEP®7. The communication connections are static i.e. they are to be configured in a connection table.

Possibilities of communication functions

- *Siemens S7-300 communication functions*

  By including the VIPA specific function blocks FB 8 ... FB 55 you get access to the Siemens S7-300 communication functions. More information for including the function blocks can be found above at "Include VIPA library".
- *Siemens S7-400 communication functions*

  To deploy the Siemens S7-400 communication functions the in the operating system of the CPU integrated system function blocks SFB 8 ... SFB 23 should be used. Here copy the interface description of the SFBs from the standard library at system function block to the directory container, generate an instance data block for each call and call the SFB with the associated instance data block.

Configuring

Precondition for Siemens S7 communication is a configured connection table in which the communication links are defined.

For this e.g. WinPLC7 from VIPA or NetPro from Siemens can be used. A communication link is specified by a connection ID for each communication partner. Use the *local ID* to initialize the FB/SFB in the PLC from which the connection is regarded and the *partner ID* to configure the FB/SFB in the partner PLC.

Function blocks

The following function blocks can be used for Siemens S7 communications:

FB/SFB	Label	Description
FB/SFB 8	USEND	Uncoordinated data transmission
FB/SFB 9	URCV	Uncoordinated data reception
FB/SFB 12	BSEND	Sending data in blocks
FB/SFB 13	BRCV	Receiving data in blocks
FB/SFB 14	GET	Remote CPU read
FB/SFB 15	PUT	Remote CPU write
FB 55	IP_CONFIG	Programmed Communication Connections

Note!

Please use for the Siemens S7 communication exclusively the FB/SFBs listed here. The direct call of the associated internal SFCs leads to errors in the corresponding instance DB!

FB/SFB 8 - USEND - Uncoordinated data transmission

Description

FB/SFB 8 USEND may be used to transmit data to a remote partner FB/SFB of the type URCV (FB/SFB 9). You must ensure that parameter *R_ID* of both FB/SFBs is identical. The transmission is started by a positive edge at control input *REQ* and proceeds without coordination with the partner FB/SFB.
Depending upon communication function the following behavior is present:

Siemens S7-300 Communication (FB 8)

The data is sent on a rising edge at *REQ*. The parameters *R_ID*, *ID* and *SD_1* are transferred on each rising edge at *REQ*. After a job has been completed, you can assign new values to the *R_ID*, *ID* and *SD_1* parameters.

Siemens S7-400 Communication (SFB 8)

The data is sent on a rising edge at *REQ*. The data to be sent is referenced by the parameters *SD_1* ... *SD_4* but not all four send parameters need to be used.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L	Control parameter request, activates the exchange of data when a rising edge is applied (with respect to the most recent FB/SFB-call)
ID	INPUT	WORD	I, Q, M, D, constant	Connection reference. The *ID* must be specified in the form wxyzh.
R_ID	INPUT	DWORD	I, Q, M, D, L, constant	Addressing parameter *R_ID*. Format DW#16#wxyzWXYZ.
DONE	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *DONE*: 0: task has not been started or it is still being executed. 1: task was executed without error.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *ERROR*: *ERROR* = 0 + *STATUS* = 0000h: without warnings or errors ERROR = 0 + *STATUS* unequal to 0000h: Warning. *STATUS* contains detailed information. *ERROR* = 1: an error has occurred.
STATUS	OUTPUT	WORD	I, Q, M, D, L	Status parameter *STATUS*, returns detailed information about the type of error.
SD_i, 1≤ i ≤4	IN_OUT	ANY	I, Q, M, D, T, C	Pointer to transmit buffer i. Only data type BOOL is valid (Bit field not permitted), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND_TIME, COUNTER, TIMER.

Note!

You must, however, make sure that the areas defined by the parameters *SD_1*/*SD_1*...*SD_4* and *RD_1*/*RD_1*... *RD_4* (at the corresponding partner FB/SFB URCV) agree in Number, Length and Data type.

The parameter *R_ID* must be identical at both FB/SFBs. Successful completion of the transmission is indicated by the status parameter *DONE* having the logical value 1.

Error information

ERROR	STATUS (decimal)	Description
0	11	Warning: the new task is not active, since the previous task has not completed.
0	25	Communications initiated. The task is being processed.
1	1	• Communication failures, e.g. Connection parameters not loaded (local or remote) • Connection interrupted (e.g. cable, CPU turned off, CP in STOP)
1	4	Error in transmission range pointers *SD_i* with respect to the length or the data type.
1	10	Access to local application memory not possible (e.g. access to deleted DB).
1	12	The call to the FB/SFB • contains an instance DB that does not belong to the FB/SFB 8 • contains a global DB instead of an instance DB • could not locate an instance DB (load a new instance DB from the PG)
1	18	*R_ID* already exists in the connection *ID*.
1	20	Not enough memory.

Data consistency

To ensure the data consistency is not compromised, can the currently used transmission ranges SD_i be described again only if the current job is completed. This requires that the DONE parameter is evaluated.

This is the case when the value of the status parameter *DONE* changes to 1.

FB/SFB 9 - URCV - Uncoordinated data reception

Description

FB/SFB 9 URCV can be used to receive data asynchronously from a remote partner FB/SFB of the type USEND (FB/SFB 8). You must ensure that parameter *R_ID* of both FB/SFBs is identical. The block is ready to receive then there is a logical 1 at the *EN_R* input. An active job can be cancelled with *EN_R*=0. Depending upon communication function the following behavior is present:

Siemens S7-300 Communication (FB 9)

The parameters *R_ID*, *ID* and *RD_1* are applied with every positive edge on *EN_R*. After a job has been completed, you can assign new values to the *R_ID*, *ID* and *RD_1* parameters.

Siemens S7-400 Communication (SFB 9)

The receive data areas are referenced by the parameters *RD_1...RD_4*.

Parameters

Parameter	Declaration	Data type	Memory block	Description
EN_R	INPUT	BOOL	I, Q, M, D, L	Control parameter enabled to receive, indicates that the partner is ready for reception
ID	INPUT	WORD	I, Q, M, D, constant	A reference for the connection. Format wxyzh
R_ID	INPUT	DWORD	I, Q, M, D, L, constant	Address parameter *R_ID*. Format DW#16#wxyzWXYZ.
NDR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *NDR*: new data transferred.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *ERROR*: *ERROR* = 0 + *STATUS*=0000h: without warnings or errors *ERROR* = 0 + *STATUS* unequal to 0000h: Warning. *STATUS* contains detailed information. *ERROR* = 1: an error has occurred.
STATUS	OUTPUT	WORD	I, Q, M, D, L	Status parameter *STATUS*, returns detailed information about the type of error.
RD_i, 1≤ i ≤4	IN_OUT	ANY	I, Q, M, D, T, C	Pointer to receive buffer i. Only data type BOOL is valid (Bit field not permitted), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND_TIME, COUNTER, TIMER.

Note!

The quantity, length and data type of the buffer areas defined by parameters *SD_i* and *RD_i*, $1 \le i \le 4$ must be identical (*RD_i* is the receive buffer of the respective partner FB/SFB, see FB/SFB 8). The initial call to FB/SFB 9 creates the "receive box". The receive data available during any subsequent calls must fit into this receive box. When a data transfer completes successfully parameter *NDR* is set to 1.

Error information

ERROR	STATUS (decimal)	Description
0	9	Overrun warning: old receive data was overwritten by new receive data.
0	11	Warning: the new task is not active since the previous task has not completed.
0	25	Communications initiated. The task is being processed.
1	1	Communication failures, e.g. • Connection parameters not loaded (local or remote) • Connection interrupted (e.g. cable, CPU turned off, CP in STOP)
1	4	Error in receive buffer pointer *RD_i* with respect to the length or the data type.
1	10	Access to local application memory not possible (e.g. access to deleted DB).
1	12	The call to the FB/SFB • contains an instance DB that does not belong to the FB/SFB 9 • contains a global DB instead of an instance DB • could not locate an instance DB (load a new instance DB from the PG)
1	18	*R_ID* already exists in the connection *ID*.
1	19	The respective FB/SFB USEND transmits data quicker than FB/SFB URCV can copy the data into the receive buffers.
1	20	Not enough memory.

Data consistency

The data are received consistently if you remember the following points:

Siemens S7-300 Communication:

After the status parameter *NDR* has changed to the value 1, you must immediately call FB 9 URCV again with the value 0 at *EN_R*. This ensures that the receive area is not overwritten before you have evaluated it.

Evaluate the receive area (*RD_1*) completely before you call the block with the value 1 at control input *EN_R*).

Siemens S7-400 Communication:

After the status parameter *NDR* has changed to the value 1, there are new receive data in your receive areas (*RD_i*). A new block call may cause these data to be overwritten with new receive data. If you want to prevent this, you must call SFB 9 URCV (such as with cyclic block processing) with the value 0 at *EN_R* until you have finished processing the receive data.

FB/SFB 12 - BSEND - Sending data in blocks

Description

FB/SFB 12 BSEND sends data to a remote partner FB/SFB of the type BRCV (FB/SFB 13). The data area to be transmitted is segmented. Each segment is sent individually to the partner. The last segment is acknowledged by the partner as it is received, independently of the calling up of the corresponding FB/SFB/FB BRCV. With this type of data transfer, more data can be transported between the communications partners than is possible with all other communication FBs/SFBs for configured S7 connections, namely 65534 bytes.

Depending upon communication function the following behavior is present:

Siemens S7-300 Communication (FB 12)

The send job is activated on a rising edge at *REQ*. The parameters *R_ID*, *ID*, *SD_1* and *LEN* are transferred on each positive edge at *REQ*. After a job has been completed, you can assign new values to the *R_ID*, *ID*, *SD_1* and *LEN* parameters. For the transmission of segmented data the block must be called periodically in the user program.
The start address and the maximum length of the data to be sent are specified by *SD_1*. You can determine the job-specific length of the data field with *LEN*.

Siemens S7-400 Communication (SFB 12)

The send job is activated after calling the block and when there is a rising edge at *REQ*. Sending the data from the user memory is carried out asynchronously to the processing of the user program.

The start address and the maximum length of the data to be sent are specified by *SD_1*. You can determine the job-specific length of the data field with *LEN*. In this case, *LEN* replaces the length section of *SD_1*.

Function

If there is a rising edge at control input *R*, the current data transfer is canceled.

Successful completion of the transfer is indicated by the status parameter *DONE* having the value 1.

A new send job cannot be processed until the previous send process has been completed if the status parameter *DONE* or *ERROR* have the value 1.

Due to the asynchronous data transmission, a new transmission can only be initiated if the previous data have been retrieved by the call of the partner FB/SFB. Until the data are retrieved, the status value 7 will be given when the FB/SFB BSEND is called.

Note!

The parameter *R_ID* must be identical at the two corresponding FBs/SFBs.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L	Control parameter request, a rising edge activates the data exchange (with respect to the most recent FB/SFB call)
R	INPUT	BOOL	I, Q, M, D, L, constant	control parameter reset: terminates the active task
ID	INPUT	WORD	I, Q, M, D, constant	A reference for the connection. Format wxyzh.
R_ID	INPUT	DWORD	I, Q, M, D, L, constant	Address parameter *R_ID*. Format DW#16#wxyzWXYZ.
DONE	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *DONE*: 0: task has not been started or is still being executed. 1: task was executed without error.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *ERROR*: *ERROR* = 0 + *STATUS* = 0000h: without warnings or errors *ERROR* = 0 + *STATUS* unequal to 0000h: Warning. *STATUS* contains detailed information. *ERROR* = 1: an error has occurred.
STATUS	OUTPUT	WORD	I, Q, M, D, L	Status parameter *STATUS*, returns detailed information about the type of error.
SD_1	IN_OUT	ANY	I, Q, M, D, T, C	Pointer to the send data buffer. The length parameter is only utilized when the block is called for the first time after a warm start or a cold start. It specifies the maximum length of the send buffer. Only data type BOOL is valid (Bit field not permitted), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND_TIME, COUNTER, TIMER.
LEN	IN_OUT	WORD	I, Q, M, D, L	The length of the send data block in bytes.

Error information

ERROR	STATUS (decimal)	Description
0	11	Warning: the new task is not active since the previous task has not completed.
0	25	The communication process was initiated. The task is being processed.
1	1	Communication failures, e.g. : • Connection parameters not loaded (local or remote) • Connection interrupted (e.g. cable, CPU turned off, CP in STOP)
1	2	Negative acknowledgement received from the partner FB/SFB. The function cannot be executed.
1	3	*R_ID* is not available to the communication link specified by *ID* or the receive block has never been called.
1	4	Error in send buffer pointer *SD_1* with respect to the length or the data type, or parameter *LEN* was set to 0 or an error has occurred in the receive data buffer pointer *RD_1* of the respective FB/SFB 13 BRCV
1	5	Reset request was executed.
1	6	The status of the partner FB/SFB is DISABLED (*EN_R* has a value of 0)
1	7	The status of the partner FB/SFB is not correct (the receive block has not been called after the most recent data transfer.)
1	8	Access to the remote object in application memory was rejected.
1	10	Access to local application memory not possible (e.g. access to deleted DB).
1	12	The call to the FB/SFB • contains an instance DB that does not belong to the FB/SFB 12 • contains a global DB instead of an instance DB • could not locate an instance DB (load a new instance DB from the PG)
1	18	*R_ID* already exists in the connection *ID*.
1	20	Not enough memory.

Data consistency

To guarantee consistent data the segment of send buffer *SD_1* that is currently being used can only be overwritten when current send process has been completed. For this purpose the program can test parameter *DONE*.

FB/SFB 13 - BRCV - Receiving data in blocks

Description

The FB/SFB 13 BRCV can receive data from a remote partner FB/SFB of the type BSEND (FB/SFB 12). The parameter *R_ID* of both FB/SFBs must be identical.

After each received data segment an acknowledgement is sent to the partner FB/SFB and the *LEN* parameter is updated.

Depending upon communication function the following behavior is present:

Siemens S7-300 Communication (FB 13)

The parameters *R_ID*, *ID* and *RD_1* are applied with every positive edge on *EN_R*. After a job has been completed, you can assign new values to the *R_ID*, *ID* and *RD_1* parameters. For the transmission of segmented data the block must be called periodically in the user program.

Siemens S7-400 Communication (SFB 13)

Receipt of the data from the user memory is carried out asynchronously to the processing of the user program.

Parameters

Parameter	Declaration	Data type	Memory block	Description
EN_R	INPUT	BOOL	I, Q, M, D, L, constant	control parameter enabled to receive, indicates that the partner is ready for reception
ID	INPUT	WORD	I, Q, M, D, constant	A reference for the connection. Format wxyzh.
R_ID	INPUT	DWORD	I, Q ,M, D, L, constant	Address parameter *R_ID*. Format DW#16#wxyzWXYZ.
NDR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *NDR*: new data accepted.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *ERROR*: *ERROR* = 0 + *STATUS*=0000h: without warnings or errors *ERROR* = 0 + *STATUS* unequal to 0000h: Warning. *STATUS* contains detailed information. *ERROR* = 1: an error has occurred.
STATUS	OUTPUT	WORD	I, Q, M ,D, L	Status parameter *STATUS*, returns detailed information about the type of error.
RD_1	IN_OUT	ANY	I, Q, M, D ,T, C	Pointer to the receive data buffer. The length specifies the maximum length for the block that must be received. Only data type BOOL is valid (Bit field not permitted), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND_TIME, COUNTER, TIMER.
LEN	IN_OUT	WORD	I, Q, M, D, L	Length of the data that has already been received.

Function

The FB/SFB 13 is ready for reception when control input *EN_R* is set to 1. Parameter *RD_1* specifies the start address of the receive data buffer. An acknowledgement is returned to the partner FB/SFB after reception of each data segment and parameter *LEN* of the FB/SFB 13 is updated accordingly. If the block is called during the asynchronous reception process a warning is issued via the status parameter *STATUS*.

Should this call be received with control input *EN_R* set to 0 then the receive process is terminated and the FB/SFB is reset to its initial state. When all data segments have been received without error parameter *NDR* is set to 1. The received data remains unaltered until FB/SFB 13 is called again with parameter *EN_R* = 1.

Error information

ERROR	STATUS (decimal)	Description
0	11	Warning: the new task is not active since the previous task has not completed.
0	17	Warning: block is receiving asynchronous data.
0	25	Communications has been initiated. The task is being processed.
1	1	Communication failures, e.g. • Connection parameters not loaded (local or remote) • Connection interrupted (e.g. cable, CPU turned off, CP in STOP)
1	2	Function cannot be executed.
1	4	Error in the receive data block pointer *RD_1* with respect to the length or the data type (the send data block is larger than the receive data block).
1	5	Reset request received, incomplete data transfer.
1	8	Access to the remote object in application memory was rejected.
1	10	Access to local application memory not possible (e.g. access to deleted DB).
1	12	The call to the FB/SFB • contains an instance DB that does not belong to the FB/SFB 13 • contains a global DB instead of an instance DB • could not locate an instance DB (load a new instance DB from the PG)
1	18	*R_ID* already exists in the connection *ID*.
1	20	Not enough memory.

Data consistency

To guarantee data consistency during reception the following points must be met:

- When copying has been completed (parameter *NDR* is set to 1) FB/SFB 13 must again be called with parameter *EN_R* set to 0 in order to ensure that the receive data block is not overwritten before it has bee evaluated.
- The most recently used receive data block *RD_1* must have been evaluated completely before the block is denoted as being ready to receive (calls with parameter *EN_R* set to 1).

Receiving Data S7-400

If a receiving CPU with a BRCV block ready to accept data (that is, a call with *EN_R* = 1 has already been made) goes into STOP mode before the corresponding send block has sent the first data segment for the job, the following will occur:

- The data in the first job after the receiving CPU has gone into STOP mode are fully entered in the receive area.
- The partner SFB BSEND receives a positive acknowledgement.
- Any additional BSEND jobs can no longer be accepted by a receiving CPU in STOP mode.
- As long as the CPU remains in STOP mode, both *NDR* and *LEN* have the value 0.

To prevent information about the received data from being lost, you must perform a hot restart of the receiving CPU and call SFB 13 BRCV with *EN_R* = 1.

FB/SFB 14 - GET - Remote CPU read

Description

The FB/SFB 14 GET can be used to read data from a remote CPU. The respective CPU must be in RUN mode or in STOP mode.

Depending upon communication function the following behavior is present:

Siemens S7-300 Communication (FB 14)

The data is read on a rising edge at *REQ*. The parameters *ID*, *ADDR_1* and *RD_1* are transferred on each rising edge at *REQ*. After a job has been completed, you can assign new values to the *ID*, *ADDR_1* and *RD_1* parameters.

Siemens S7-400 Communication (SFB 14)

The SFB is started with a rising edge at *REQ*. In the process the relevant pointers to the areas to be read out (*ADDR_i*) are sent to the partner CPU.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L	control parameter request, a rising edge activates the data exchange (with respect to the most recent FB/SFB-call)
ID	INPUT	WORD	I, Q, M, D, constant	A reference for the connection. Format wxyzh.
NDR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *NDR*: data from partner CPU has been accepted.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *ERROR*: *ERROR* = 0 + *STATUS*=0000h: without warnings or errors *ERROR* = 0 + *STATUS* unequal to 0000h: Warning. *STATUS* contains detailed information. *ERROR* = 1: an error has occurred.
STATUS	OUTPUT	WORD	I, Q, M, D, L	Status parameter *STATUS*, returns detailed information about the type of error.
ADDR_1	IN_OUT	ANY	e.g. I, Q, M, D	Pointer indicating the buffers in the partner CPU that must be read
ADDR_2	IN_OUT	ANY	e.g. I, Q, M, D	Pointer indicating the buffers in the partner CPU that must be read
ADDR_3	IN_OUT	ANY	e.g. I, Q, M, D	Pointer indicating the buffers in the partner CPU that must be read
ADDR_4	IN_OUT	ANY	e.g. I, Q, M, D	Pointer indicating the buffers in the partner CPU that must be read
RD_i, 1≤ i ≤4	IN_OUT	ANY	I, Q, M, D, T, C	Pointers to the area of the local CPU in which the read data are entered. Only data type BOOL is valid (Bit field not permitted), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND_TIME, COUNTER, TIMER.

Function

The remote CPU returns the data and the answer is checked for access problems during the read process for the data. The data type is checked in addition.

When a data transfer error is detected the received data are copied into the configured receive data buffer (*RD_i*) with the next call to FB/SFB 14 and parameter *NDR* is set to 1. It is only possible to activate a new read process when the previous read process has been completed. You must ensure that the defined parameters on the *ADDR_i* and *RD_i* areas and the number that fit in quantity, length and data type of data to each other.

Error information

ERROR	STATUS (decimal)	Description
0	11	Warning: the new task is not active since the previous task has not completed.
0	25	The communication process was initiated. The task is being processed.
1	1	Communication failures, e.g. • Connection parameters not loaded (local or remote) • Connection interrupted (e.g. cable, CPU turned off, CP in STOP)
1	2	Negative acknowledgement from partner device. The function cannot be executed.
1	4	Error in receive data buffer pointer *RD_i* with respect to the length or the data type.
1	8	Partner CPU access error
1	10	Access to local application memory not possible (e.g. access to deleted DB).
1	12	The call to the FB/SFB • contains an instance DB that does not belong to the FB/SFB 14 • contains a global DB instead of an instance DB • could not locate an instance DB (load a new instance DB from the PG)
1	20	Not enough memory.

Data consistency

The data are received consistently if you evaluate the current use of range *RD_i* completely before initiating another job.

FB/SFB 15 - PUT - Remote CPU write

Description

The FB/SFB 15 PUT can be used to write data to a remote CPU. The respective CPU may be in RUN mode or in STOP mode.

Depending upon communication function the following behavior is present:

Siemens S7-300 Communication (SB 15)

The data is sent on a rising edge at *REQ*. The parameters *ID*, *ADDR_1* and *SD_1* are transferred on each rising edge at *REQ*. After a job has been completed, you can assign new values to the *ID*, *ADDR_1* and *SD_1* parameters.

Siemens S7-400 Communication (SFB 15)

The SFB is started on a rising edge at *REQ*. In the process the pointers to the areas to be written (*ADDR_i*) and the data (*SD_i*) are sent to the partner CPU.

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L	control parameter request, a rising edge activates the data exchange (with respect to the most recent FB/SFB-call)
ID	INPUT	WORD	I, Q, M, D, constant	A reference for the connection. Format wxyzh.
DONE	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *DONE*: function completed.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	Status parameter *ERROR*: *ERROR* = 0 + *STATUS*=0000h: without warnings or errors *ERROR* = 0 + *STATUS* unequal to 0000h: Warning. *STATUS* contains detailed information. *ERROR* = 1: an error has occurred.
STATUS	OUTPUT	WORD	I, Q, M, D, L	Status parameter *STATUS*, returns detailed information about the type of error.
ADDR_1	IN_OUT	ANY	e.g. I, Q, M, D	Pointer indicating the buffers in the partner CPU into which data is written
ADDR_2	IN_OUT	ANY	e.g. I, Q, M, D	Pointer indicating the buffers in the partner CPU into which data is written
ADDR_3	IN_OUT	ANY	e.g. I, Q, M, D	Pointer indicating the buffers in the partner CPU into which data is written
ADDR_4	IN_OUT	ANY	e.g. I, Q, M, D	Pointer indicating the buffers in the partner CPU into which data is written
SD_i, 1≤i ≤4	IN_OUT	ANY	I, Q, M, D, T, C	Pointer to the data buffers in the local CPU that contains the data that must be sent. Only data type BOOL is valid (Bit field not permitted), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE_AND_TIME, COUNTER, TIMER.

Function

The partner CPU stores the data at the respective address and returns an acknowledgement. This acknowledgement is tested and when an error is detected in the data transfer parameter *DONE* is set to 1 with the next call of FB/SFB 15. The write process can only be activated again when the most recent write process has been completed. The amount, length and data type of the buffer areas that were defined by means of parameters *ADDR_i* and *SD_i*, 1 ≤ i ≤ 4 must be identical.

Error information

ERROR	STATUS (decimal)	Description
0	11	Warning: the new task is not active since the previous task has not completed.
0	25	The communication process was initiated. The task is being processed.
1	1	Communication failures, e.g. • Connection parameters not loaded (local or remote) • Connection interrupted (e.g. cable, CPU turned off, CP in STOP)
1	2	Negative acknowledgement from partner device. The function cannot be executed.
1	4	Error in transmission range pointers *SD_i* with respect to the length or the data type.
1	8	Partner CPU access error
1	10	Access to local application memory not possible (e.g. access to deleted DB).
1	12	The call to the FB/SFB • contains an instance DB that does not belong to the FB/SFB 15. • contains a global DB instead of an instance DB. • could not locate an instance DB (load a new instance DB from the PG).
1	20	Not enough memory.

Data consistency

Siemens S7-300 Communication

In order to ensure data consistency, send area *SD_1* may not be used again for writing until the current send process has been completed. This is the case when the state parameter *DONE* has the value 1.

Siemens S7-400 Communication

When a send operation is activated (rising edge at *REQ*) the data to be sent from the send area *SD_i* are copied from the user program. After the block call, you can write to these areas without corrupting the current send data.

FB 55 - IP_CONFIG - Progr. Communication Connections

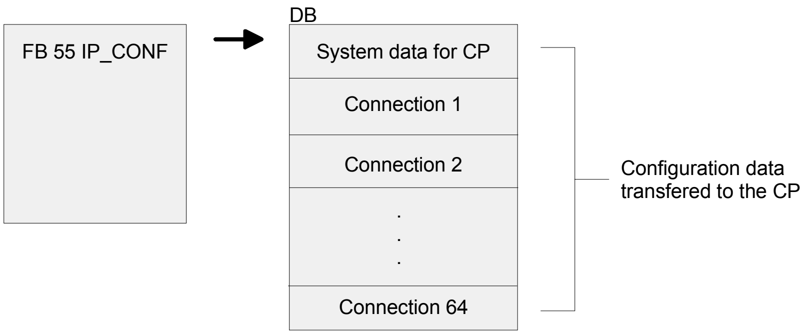
Overview

In some situations, it is an advantage to set up communication connections not with Siemens NetPro but program-controlled by a specific application.

A VIPA function block (FB 55) is available for these applications that allows flexible transfer of data blocks with configuration data to a CP.

Principle

Configuration data for communication connections may be transferred to the CPU by the FB 55 called in the user program.



The configuration DB may be loaded into the CP at any time.

Attention!

As soon as the user program transfers the connection data via FB 55 IP_CONFIG, the CPU switches the CP briefly to STOP. The CP accepts the system data (including IP address) and the new connection data and processes it during startup (RUN).

FB 55 - IP_CONFIG

Depending on the size of the configuration DB, the data may be transferred to the CP in several segments. This means that the FB must as long be called as the FB signals complete transfer by setting the *DONE* bit to 1.

The Job is started with *ACT* = 1.

Parameters

Parameter	Declaration	Data type	Memory block	Description
ACT	INPUT	BOOL	I, Q, M, D, L	When the FB is called with *ACT* = 1, the DBxx is transmitted to the CP. If the FB is called with *ACT* = 0, only the status codes *DONE*, *ERROR* and *STATUS* are updated.
LADDR	INPUT	WORD	I, Q, M, D, constant	Module base address When the CP is configured by the Siemens hardware configuration, the module base address is displayed in the configuration table. Specify this address here.
CONF_DB	INPUT	ANY	I, Q, M, D	The parameter points to the start address of the configuration data area in a DB.
LEN	INPUT	INT	I, Q, M, D, constant	Length information in bytes for the configuration data area.
DONE	OUTPUT	BOOL	I, Q, M, D, L	The parameter indicates whether the configuration data areas was completely transferred. Remember that it may be necessary to call the FB several times depending on the size of the configuration data area (in several cycles) until the *DONE* parameter is set to 1 to signal completion of the transfer.
ERROR	OUTPUT	BOOL	I, Q, M, D, L	Error code
STATUS	OUTPUT	WORD	I, Q, M, D	Status code
EXT_ STATUS	OUTPUT	WORD	I, Q, M, D	If an error occurs during the execution of a job, the parameter indicates, which parameter was detected as the cause of the error in the configuration DB. High byte: Index of the parameter block Low byte: Index of the subfield within the parameter block.

Error information

ERROR	STATUS	Description
0	0000h	Job completed without errors
0	8181h	Job active
1	80B1h	The amount of data to be sent exceeds the upper limit permitted for this service.
1	80C4h	Communication error The error can occur temporarily; it is usually best to repeat the job in the user program.

continued...

...continue

ERROR	STATUS	Description
1	80D2h	Configuration error, the module you are using does not support this service.
1	8183h	The CP rejects the requested record set number.
1	8184h	System error or illegal parameter type.
1	8185h	The value of the *LEN* parameter is larger than the *CONF_DB* less the reserved header (4bytes) or the length information is incorrect.
1	8186h	Illegal parameter detected. The ANY pointer *CONF_DB* does not point to data block.
1	8187h	Illegal status of the FB. Data in the header of *CONF_DB* was possibly overwritten.
1	8A01h	The status code in the record set is invalid (value is >=3).
1	8A02h	There is no job running on the CP; however the FB has expected an acknowledgment for a competed job.
1	8A03h	There is no job running on the CP and the CP is not ready; the FB triggered the first job to read a record set.
1	8A04h	There is no job running on the CP and the CP is not ready; the FB nevertheless expected an acknowledgment for a completed job.
1	8A05h	There is a job running, but there was no acknowledgment; the FB nevertheless triggered the first job for a read record set job.
1	8A06h	A job is complete but the FB nevertheless triggered the first job for a read record sets job.
1	8B01h	Communication error, the DB could not be transferred.
1	8B02h	Parameter error, double parameter field
1	8B03h	Parameter error, the subfield in the parameter field is not permitted.
1	8B04h	Parameter error, the length specified in the FB does not match the length of the parameter fields/subfields.
1	8B05h	Parameter error, the length of the parameter field is invalid.
1	8B06h	Parameter error, the length of the subfield is invalid.
1	8B07h	Parameter error, the ID of the parameter field is invalid.
1	8B08h	Parameter error, the ID of the subfield is invalid.
1	8B09h	System error, the connection does not exist.
1	8B0Ah	Data error, the content of the subfield is not correct.
1	8B0Bh	Structure error, a subfield exists twice.
1	8B0Ch	Data error, the parameter does not contain all the necessary parameters.
1	8B0Dh	Data error, the *CONF_DB* does not contain a parameter field for system data.

continued...

...continue

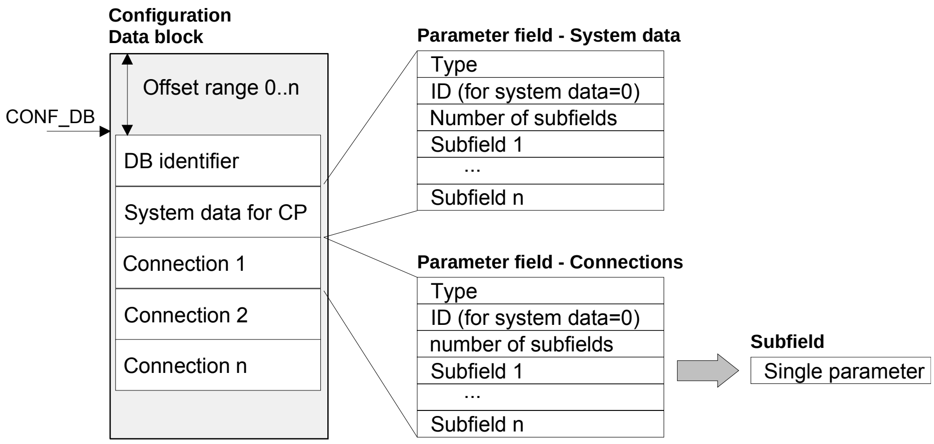
ERROR	STATUS	Description
1	8B0Eh	Data error/structure error, the *CONF_DB* type is invalid.
1	8B0Fh	System error, the CP does not have enough resources to process *CONF_DB* completely.
1	8B10	Data error, configuration by the user program is not set.
1	8B11	Data error, the specified type of parameter field is invalid.
1	8B12	Data error, too many connections were specified
1	8B13	CP internal error
1	8F22h	Area length error reading a parameter.
1	8F23h	Area length error writing a parameter.
1	8F24h	Area error reading a parameter.
1	8F25h	Area error writing a parameter.
1	8F28h	Alignment error reading a parameter.
1	8F29h	Alignment error writing a parameter.
1	8F30h	The parameter is in the write-protected first current data block.
1	8F31h	The parameter is in the write-protected second current data block.
1	8F32h	The parameter contains a DB number that is too high.
1	8F33h	DB number error
1	8F3Ah	The target area was not loaded (DB).
1	8F42h	Timeout reading a parameter from the I/O area.
1	8F43h	Timeout writing a parameter from the I/O area.
1	8F44h	Address of the parameter to be read is disabled in the accessed rack.
1	8F45h	Address of the parameter to be written is disabled in the accessed rack.
1	8F7Fh	Internal error

Configuration Data Block

The configuration data block (CONF_DB) contains all the connection data and configuration data (IP address, subnet mask, default router, NTP time server and other parameters) for an Ethernet CP. The configuration data block is transferred to the CP with function block FB 55.

Structure

The *CONF_DB* can start at any point within a data block as specified by an offset range. The connections and specific system data are described by an identically structured parameter field.



Parameter field for *system data for CP*

Below, there are the subfields that are relevant for networking the CP. These must be specified in the parameter field for system data. Some applications do not require all the subfield types.

Structure

Type = 0
ID = 0
Number of subfields = n
Subfield 1
Subfield 2
Subfield n

Subfield				Parameter	
ID	Type	Length (byte)	Description	Special features	Use
1	SUB_IP_V4	4 + 4	IP address of the local station according to IPv4		mandatory
2	SUB_NETMASK	4 + 4	Subnet mask of the local station		mandatory
4	SUB_DNS_SERV_ADDR	4 + 4	DNS Server Address	This subfield can occur to 4 times. The first entry is the primary DNS server.	optional
8	SUB_DEF_ROUTER	4 + 4	IP address of the default router		optional
14	SUB_DHCP_ENABLE	4 + 1	Obtain an IP address from a DHCP.	0: no DHCP 1: DHCP	optional
15	SUB_CLIENT_ID	Length Client-ID + 4	-	-	optional

Parameter fields for *Connections*

There is shown below which values are needed to be entered in the parameter fields and which subfields are to be used for the various connection types.

Some applications do not require all the subfield types. The ID parameter that precedes each connection parameter field beside the type ID is particularly important. On programmed connections this ID may freely be assigned within the permitted range of values. For identification of the connection this ID is to be used on the call interface of the FCs for the SEND/RECV.

Range of values for the connection ID: 1, 2 ... 64

TCP Connection

Type = 1
ID = Connection ID
Number of subfields = n
Subfield 1
Subfield 2
Subfield n

Subfield				Parameter	
ID	Type	Length (byte)	Description	Special features	Use
1	SUB_IP_V4	4 + 4	IP address of the remote station according to IPv4		mandatory*)
9	SUB_LOC_PORT	4 + 2	Port of the local station		mandatory
10	SUB_REM_PORT	4 + 2	Port of the remote station		mandatory*)
18	SUB_CONNECT_NAME	Length Name + 4	Name of the connection		optional
19	SUB_LOC_MODE	4 + 1	Local mode of the connection, Possible values: 0x00 = SEND/REC 0x10 = S5-addressing mode for FETCH/WRITE **) 0x80 = FETCH **) 0x40 = WRITE **) If you do not set the parameter, the default setting is SEND/RECV. For FETCH/WRITE a passive connection setup is necessary.		optional
21	SUB_KBUS_ADR	-	-	Value: fix 2	optional
22	SUB_CON_ESTABL	4 + 1	Type of connection establishment. With this option, you specify whether the connection is established by this station. Possible values: 0 = passive; 1 = active		mandatory

*) Option using passive connection

**) the coding may be combined with OR operations

UDP Connection

Type = 2
ID = Connection ID
Number of subfields = n
Subfield 1
Subfield 2
Subfield n

Subfield				Parameter	
ID	Type	Length (byte)	Description	Special features	Use
1	SUB_IP_V4	4 + 4	IP address of the remote station according to IPv4		mandatory
9	SUB_LOC_PORT	4 + 2	Port of the local station		mandatory
10	SUB_REM_PORT	4 + 2	Port of the remote station		mandatory
18	SUB_CONNECT_NAME	Length Name + 4	Name of the connection		optional
19	SUB_LOC_MODE	4 + 1	Local mode of the connection Possible values: 0x00 = SEND/REC 0x10 = S5-addressing mode for FETCH/WRITE *) 0x80 = FETCH *) 0x40 = WRITE *) If you do not set the parameter, the default setting is SEND/RECV. For FETCH/WRITE a passive connection setup is necessary		optional
21	SUB_KBUS_ADR	-	-	Value: fix 2	optional
23	SUB_ADDR_IN_DATA_BLOCK	4 + 1	Select free UDP connection. The remote node is entered in the job header of the job buffer by the user program when it calls AG_SEND. This allows any node on Ethernet/LAN/WAN to be reached. Possible values: 1 = free UDP connection 0 = otherwise	If the "Free UDP connection" is selected for this parameter, the parameters SUB_IP_V4, SUB_LOC_PORT SUB_REM_PORT are omitted.	optional

*) the coding may be combined with OR operations

ISO-on-TCP

Type = 3
ID = Connection ID
Number of subfields = n
Subfield 1
Subfield 2
Subfield n

Subfield				Parameter	
ID	Type	Length (byte)	Description	Special features	Use
1	SUB_IP_V4	4 + 4	IP address of the remote station according to IPv4		mandatory*)
11	SUB_LOC_PORT	Length TSAP + 4	TSAP of the local station		mandatory
12	SUB_REM_PORT	Length TSAP + 4	TSAP of the remote station		mandatory*)
18	SUB_CONNECT_NAME	Length Name + 4	Name of the connection		optional
19	SUB_LOC_MODE	4 + 1	Local mode of the connection Possible values: 0x00 = SEND/RECV 0x10 = S5-addressing mode for FETCH/WRITE **) 0x80 = FETCH **) 0x40 = WRITE **) If you do not set the parameter, the default setting is SEND/RECV. For FETCH/WRITE a passive connection setup is necessary		optional
21	SUB_KBUS_ADR	-	-	Value: fix 2	optional
22	SUB_CON_ESTABL	4 + 1	Type of connection establishment With this option, you specify whether the connection is established by this station. Possible values: 0 = passive; 1 = active		mandatory

*) option using passive connection

**) the coding may be combined with OR operation

H1 (ISO)

Type = 10
ID = Connection ID
Number of subfields = n
Subfield 1
Subfield 2
Subfield n

Subfield				Parameter	
ID	Type	Length (byte)	Description	Special features	Use
51	SUB_MAC	4+6	MAC address of the remote station		mandatory
12	SUB_REM_TSAP	Length TASP + 4	TSAP of the remote station		mandatory*)
11	SUB_LOC_TSAP	Length TASP + 4	TSAP of the local station		mandatory
19	SUB_LOC_MODE	4 + 1	Local mode of the connection Possible values: 0x00 = SEND/RECV 0x10 = S5-addressing mode for FETCH/WRITE **) 0x80 = FETCH **) 0x40 = WRITE **) If you do not set the parameter, the default setting is SEND/RECV. For FETCH/WRITE a passive connection setup is necessary		optional
22	SUB_CON_ESTABL	4 + 1	Type of connection establishment With this option, you specify whether the connection is established by this station. Possible values: 0 = passive; 1 = active		mandatory
52	SUB_TIME_CON_RETRAN	4 + 2	Time interval after which a failed connection is established again. (1...60s, default: 5s)	irrelevant with passive connection establishment	optional
53	SUB_TIME_DAT_RETRAN	4 + 2	Time interval after which a failed send is triggered again. (100...30000ms, default: 1000ms)		optional
54	SUB__COUNT_MAXDATA	4 + 2	Number of send attemps, incl 1. attemp (1...100, Default: 5)		optional
55	SUB_TIME_DATAINACT	4 + 2	Time interval after which a connection is released, if there is no responds of the partner station. (6...160s, default: 30s)		optional
18	SUB_CONNECT_NAME	Length Name + 4	Name of the connection		optional

*) option using passive connection

**) the coding may be combined with OR operation

Siemens S7

Type = 11
ID = Connection ID
Number of subfields = n
Subfield 1
Subfield 2
Subfield n

Subfield				Parameter	
ID	Type	Length (byte)	Description	Special features	Use
56	SUB_S7_C_DETAIL	4 + 14	Connection specific parameter (see below)		mandatory
1	SUB_IP_V4	4 + 4	IP address according to IPv4	IP address of the remote partner	mandatory*)
51	SUB_MAC	4 + 6	MAC address of the remote station		mandatory
22	SUB_CON_ESTABL	4 + 1	Type of connection establishment With this option, you specify whether the connection is established by this station. Possible values: 0 = passive; 1 = active		mandatory
18	SUB_CONNECT_NAME	Length Name + 4	Name of the connection		optional

*) option using passive connection

SUB_S7_C_DETAIL

Parameter	Declaration	Data type	Description
SubBlockID	IN	WORD	ID
SubBlockLen	IN	WORD	Length
TcpIpActive	IN	INT	Connection via MAC or IP address (MAC=0, IP=1)
LocalResource	IN	WORD	Local resource 0001h ... 00DFh (1=PG, 2=OP, 0010h ... 00DFh=not specified)
LocalRack	IN	WORD	Number local rack 0000h ... 0002h
LocalSlot	IN	WORD	Number local slot 0002h ... 000Fh (2=CPU, 4=VIPA-PG/OP, 5=CP int., 6=CP ext.)
RemoteResource	IN	WORD	Remote resource 0001h ... 00DFh (1=PG, 2=OP, 0010h ... 00DFh=not specified)
RemoteRack	IN	WORD	Number remote rack 0000h ... 0002h
RemoteSlot	IN	WORD	Number remote slot 0002h ... 000Fh (2=CPU, 4=VIPA-PG/OP, 5=CP int., 6=CP ext.)

The "local TSAP" is created with *LocalResource*, *LocalRack* and *LocalSlot.*

The "remote TSAP" is created with *RemoteResource*, *RemoteRack* and *RemoteSlot*.

Example for configuring a Siemens S7 connection

The configuration of a dynamic Siemens S7 connection via IP_CONF takes place analog to the configuration of a fix Siemens S7 connection with Siemens NetPro

Based on Siemens NetPro there are the following parameters corresponding to the following subfields:

"Properties - Siemens S7- Connection"

Siemens NetPro	FB55 - IP_CONFIG
establish an active connection	SUB_CON_ESATBL.CON_ESTABL
TCP/IP	SUB_S7_C_DETAILS.TcpIpActive
IP respectively MAC address remote station	SUB_IP_V4.rem_IP.IP_0...IP_3 resp. SUB_MAC.rem_MAC.MAC_0...MAC5
Local ID	Connection ID

"Address details"

Siemens NetPro	FB55 - IP_CONFIG
Local rack	SUB_S7_C_DETAILS.LocalRack
Local slot	SUB_S7_C_DETAILS.LocalSlot
Local resource	SUB_S7_C_DETAILS.LocalResource
Remote rack	SUB_S7_C_DETAILS.RemoteRack
Remote slot	SUB_S7_C_DETAILS.RemoteSlot
Remote resource	SUB_S7_C_DETAILS.RemoteResource

Additional Parameter fields

Block_VIPA_HWK

As soon as the Block_VIPA_HWK (special identification 99) is contained in the DB, all connections, which were parameterized in the NETPRO, are still remain. Now it is possible to change with IP_CONFIG only the system data (IP, Netmask etc.).

If the special identification Block_VIPA_HWK were found, no other connecting data may be parameterized in the DB, otherwise error is announced in the RETVAL.

If the Block_VIPA_HWK is not in the DB, then all connections are removed from NETPRO (as with Siemens) and the connections from this DB are only configured.

Type = 99
ID = 0
Number of subfields = 0

Block_VIPA_ BACNET

As soon as the Block_VIPA_BACNET (special identification 100) is contained in the DB, a BACNET configuration is derived from the DB and no further blocks are evaluated thereafter.

Type = 100
Number of subfields = 0

Block_VIPA_IPK

Type = 101
ID = Connection ID
Number of subfields = n
Subfield 1
Subfield 2
Subfield n

Subfield				Parameter	
ID	Type	Length (byte)	Description	Special features	Use
1	VIPA_IPK_CYCLE	4 + 4	IPK cycle time for connection ID	VIPA specific	optional

Example DB

Address	Name	Type	Initial value	Actual	Comment
0.0	DB_Ident	WOR	W#16#1	W#16#1	
2.0	Systemdaten.Typ	INT	0	0	System data
4.0	Systemdaten.VerbId	INT	0	0	fix 0
6.0	Systemdaten.SubBlock_Anzahl	INT	3	3	
8.0	Systemdaten.ip.SUB_IP_V4	WOR	W#16#1	W#16#1	
10.0	Systemdaten.ip. SUB_IP_V4_LEN	WOR	W#16#8	W#16#8	
12.0	Systemdaten.ip.IP_0	BYTE	B#16#0	B#16#AC	
13.0	Systemdaten.ip.IP_1	BYTE	B#16#0	B#16#14	
14.0	Systemdaten.ip.IP_2	BYTE	B#16#0	B#16#8B	
15.0	Systemdaten.ip.IP_3	BYTE	B#16#0	B#16#61	
16.0	Systemdaten.netmask.SUB_NETMASK	WOR	W#16#2	W#16#2	
18.0	Systemdaten.netmask. SUB_NETMASK _LEN	WOR	W#16#8	W#16#8	
20.0	Systemdaten.netmask.NETMASK_0	BYTE	B#16#0	B#16#FF	
21.0	Systemdaten.netmask.NETMASK_1	BYTE	B#16#0	B#16#FF	
22.0	Systemdaten.netmask.NETMASK_2	BYTE	B#16#0	B#16#FF	
23.0	Systemdaten.netmask.NETMASK_3	BYTE	B#16#0	B#16#0	
24.0	Systemdaten.router.SUB_DEF_ROUTER	WOR	W#16#8	W#16#8	
26.0	Systemdaten.router. SUB_DEF_ROUTER	WOR	W#16#8	W#16#8	
28.0	Systemdaten.router.ROUTER_0	BYTE	B#16#0	B#16#AC	
29.0	Systemdaten.router.ROUTER_1	BYTE	B#16#0	B#16#14	
30.0	Systemdaten.router.ROUTER_2	BYTE	B#16#0	B#16#8B	
31.0	Systemdaten.router.ROUTER_3	BYTE	B#16#0	B#16#61	
32.0	Con_TCP_ID1.Typ	INT	1	1	TCP connection
34.0	Con_TCP_ID1.VerbId	INT	0	1	Connection ID
36.0	Con_TCP_ID1.SubBlock_Anzahl	INT	4	4	
38.0	Con_TCP_ID1.ip1.SUB_IP_V4	WOR	W#16#1	W#16#1	
40.0	Con_TCP_ID1.ip1. SUB_IP_V4_LEN	WOR	W#16#8	W#16#8	
42.0	Con_TCP_ID1.ip1.IP_0	BYTE	B#16#0	B#16#AC	
43.0	Con_TCP_ID1.ip1.IP_1	BYTE	B#16#0	B#16#14	
44.0	Con_TCP_ID1.ip1.IP_2	BYTE	B#16#0	B#16#8B	
45.0	Con_TCP_ID1.ip1.IP_3	BYTE	B#16#0	B#16#62	
46.0	Con_TCP_ID1.locport.SUB_LOC_PORT	WOR	W#16#9	W#16#9	
48.0	Con_TCP_ID1.locport. SUB_LOC_PORT _LEN	WOR	W#16#6	W#16#6	
50.0	Con_TCP_ID1.locport.LOC_PORT	WOR	W#16#0	W#16#3E9	
52.0	Con_TCP_ID1.remport. SUB_REM_PORT	WOR	W#16#A	W#16#A	
54.0	Con_TCP_ID1.remport. SUB_REM_PORT	WOR	W#16#6	W#16#6	
56.0	Con_TCP_ID1.remport.REM_PORT	WOR	W#16#0	W#16#3E9	
58.0	Con_TCP_ID1.con_est.SUB_CON_ESTABL	WOR	W#16#16	W#16#16	
60.0	Con_TCP_ID1.con_est. SUB_CON_ESTABL	WOR	W#16#6	W#16#6	
62.0	Con_TCP_ID1.con_est.CON_ESTABL	BYTE	B#16#0	B#16#1	
64.0	Con_ISO_ID3.Typ	INT	3	3	ISO-on-TCP connection
66.0	Con_ISO_ID3.VerbId	INT	0	3	Connectuion ID
68.0	Con_ISO_ID3.SubBlock_Anzahl	INT	4	4	
70.0	Con_ISO_ID3.ip1. SUB_IP_V4	WOR	W#16#1	W#16#1	
72.0	Con_ISO_ID3.ip1. SUB_IP_V4_LEN	WOR	W#16#8	W#16#8	
74.0	Con_ISO_ID3.ip1.IP_0	BYTE	B#16#0	B#16#AC	
75.0	Con_ISO_ID3.ip1.IP_1	BYTE	B#16#0	B#16#10	
76.0	Con_ISO_ID3.ip1.IP_2	BYTE	B#16#0	B#16#8B	
77.0	Con_ISO_ID3.ip1.IP_3	BYTE	B#16#0	B#16#62	
78.0	Con_ISO_ID3.loc_TSAP.SUB_LOC_PORT	WOR	W#16#B	W#16#B	
80.0	Con_ISO_ID3.loc_TSAP. SUB_LOC_PORT	WOR	W#16#A	W#16#A	
82.0	Con_ISO_ID3.loc_TSAP.LOC_TSAP[0]	BYTE	B#16#0	B#16#54	
83.0	Con_ISO_ID3.loc_TSAP.LOC_TSAP[1]	BYTE	B#16#0	B#16#53	
84.0	Con_ISO_ID3.loc_TSAP.LOC_TSAP[2]	BYTE	B#16#0	B#16#41	
85.0	Con_ISO_ID3.loc_TSAP.LOC_TSAP[3]	BYTE	B#16#0	B#16#50	
86.0	Con_ISO_ID3.loc_TSAP.LOC_TSAP[4]	BYTE	B#16#0	B#16#30	
87.0	Con_ISO_ID3.loc_TSAP.LOC_TSAP[5]	BYTE	B#16#0	B#16#31	
88.0	Con_ISO_ID3.rem_TSAP. SUB_REM_PORT	WOR	W#16#C	W#16#C	
90.0	Con_ISO_ID3.rem_TSAP. SUB_REM_PORT	WOR	W#16#A	W#16#A	
92.0	Con_ISO_ID3.rem_TSAP.REM_TSAP[0]	BYTE	B#16#0	B#16#54	
93.0	Con_ISO_ID3.rem_TSAP.REM_TSAP[1]	BYTE	B#16#0	B#16#53	
94.0	Con_ISO_ID3.rem_TSAP.REM_TSAP[2]	BYTE	B#16#0	B#16#41	

continued ...

... continue

Address	Name	Type	Initial value	Actual	Comment
95.0	Con_ISO_ID3.rem_TSAP.REM_TSAP[3]	BYTE	B#16#0	B#16#50	
96.0	Con_ISO_ID3.rem_TSAP.REM_TSAP[4]	BYTE	B#16#0	B#16#30	
97.0	Con_ISO_ID3.rem_TSAP.REM_TSAP[5]	BYTE	B#16#0	B#16#31	
98.0	Con_ISO_ID3.con_est.SUB_CON_ESTABL	WORD	W#16#16	W#16#16	
100.0	Con_ISO_ID3.con_est.SUB_CON_ESTABL_LEN	WORD	W#16#6	W#16#6	
102.0	Con_ISO_ID3.con_est.CON_ESTABL	BYTE	B#16#0	B#16#1	
104.0	S7_Verb .Typ	INT	11	11	S7 connection
106.0	S7_Verb.Verb_ID	INT	0	0	Connection ID
108.0	S7_Verb.SubBlock_Anzahl	INT	5	5	
110.0	S7_Verb.Verb_Parameter.SUB_S7_C_DETAIL	INT	56	56	
112.0	S7_Verb.Verb_Parameter. SUB_S7_C_DETAIL_LEN	INT	18	18	
114.0	S7_Verb.Verb_Parameter.TcpIpActive	INT	0	1	
116.0	S7_Verb.Verb_Parameter.LocalResource	INT	0	2	
118.0	S7_Verb.Verb_Parameter.LocalRack	INT	0	0	
120.0	S7_Verb.Verb_Parameter.LocalsSlot	INT	0	2	
122.0	S7_Verb.Verb_Parameter.RemoteResource	INT	0	2	
124.0	S7_Verb.Verb_Parameter.RemoteRack	INT	0	0	
126.0	S7_Verb.Verb_Parameter.RemoteSlot	INT	0	2	
128.0	S7_Verb.ipl.SUB_IP_V4	WORD	W#16#1	W#16#1	
130.0	S7_Verb.ipl. SUB_IP_V4_LEN	WORD	W#16#8	W#16#8	
132.0	S7_Verb.ipl.IP_0	BYTE	B#16#0	B#16#AC	
133.0	S7_Verb.ipl.IP_1	BYTE	B#16#0	B#16#10	
134.0	S7_Verb.ipl.IP_2	BYTE	B#16#0	B#16#8B	
135.0	S7_Verb.ipl.IP_3	BYTE	B#16#0	B#16#62	
136.0	S7_Verb.Mac.SUB_MAC	INT	51	51	
138.0	S7_Verb.Mac. SUB_MAC _LEN	INT	10	10	
140.0	S7_Verb.Mac.MAC_0	BYTE	B#16#0	B#16#0	
141.0	S7_Verb.Mac.MAC_1	BYTE	B#16#0	B#16#20	
142.0	S7_Verb.Mac.MAC_2	BYTE	B#16#0	B#16#D5	
143.0	S7_Verb.Mac.MAC_3	BYTE	B#16#0	B#16#77	
144.0	S7_Verb.Mac.MAC_4	BYTE	B#16#0	B#16#53	
145.0	S7_Verb.Mac.MAC_5	BYTE	B#16#0	B#16#9B	
146.0	S7_Verb.con_est .SUB_CON_ESTABL	WORD	W#16#16	W#16#16	
148.0	S7_Verb.con_est. SUB_CON_ESTABL _LEN	WORD	W#16#6	W#16#6	
150.0	S7_Verb.con_est.CON_ESTABL	BYTE	B#16#0	B#16#1	
152.0	S7_Verb.name_verb.SUB_CONNECT_NAME	WORD	W#16#12	W#16#12	
154.0	S7_Verb.name_verb. SUB_CONNECT_NAME _LEN	WORD	W#16#23	W#16#23	
156.0	S7_Verb.name_verb.CONNECT_NAME[0]	CHAR	' '	'V'	Connection S7 with IP-Config 1
157.0	S7_Verb.name_verb.CONNECT_NAME[1]	CHAR	' '	'e'	
158.0	S7_Verb.name_verb.CONNECT_NAME[2]	CHAR	' '	'r'	
159.0	S7_Verb.name_verb.CONNECT_NAME[3]	CHAR	' '	'b'	
160.0	S7_Verb.name_verb.CONNECT_NAME[4]	CHAR	' '	'i'	
161.0	S7_Verb.name_verb.CONNECT_NAME[5]	CHAR	' '	'n'	
162.0	S7_Verb.name_verb.CONNECT_NAME[6]	CHAR	' '	'd'	
163.0	S7_Verb.name_verb.CONNECT_NAME[7]	CHAR	' '	'u'	
164.0	S7_Verb.name_verb.CONNECT_NAME[8]	CHAR	' '	'n'	
165.0	S7_Verb.name_verb.CONNECT_NAME[9]	CHAR	' '	'g'	
166.0	S7_Verb.name_verb.CONNECT_NAME[10]	CHAR	' '	' '	
167.0	S7_Verb.name_verb.CONNECT_NAME[11]	CHAR	' '	'S'	
168.0	S7_Verb.name_verb.CONNECT_NAME[12]	CHAR	' '	'7'	
169.0	S7_Verb.name_verb.CONNECT_NAME[13]	CHAR	' '	' '	
170.0	S7_Verb.name_verb.CONNECT_NAME[14]	CHAR	' '	'm'	
171.0	S7_Verb.name_verb.CONNECT_NAME[15]	CHAR	' '	'i'	
172.0	S7_Verb.name_verb.CONNECT_NAME[16]	CHAR	' '	't'	
173.0	S7_Verb.name_verb.CONNECT_NAME[17]	CHAR	' '	' '	
174.0	S7_Verb.name_verb.CONNECT_NAME[18]	CHAR	' '	'I'	
175.0	S7_Verb.name_verb.CONNECT_NAME[19]	CHAR	' '	'P'	
176.0	S7_Verb.name_verb.CONNECT_NAME[20]	CHAR	' '	'-'	
177.0	S7_Verb.name_verb.CONNECT_NAME[21]	CHAR	' '	'C'	
178.0	S7_Verb.name_verb.CONNECT_NAME[22]	CHAR	' '	'o'	
179.0	S7_Verb.name_verb.CONNECT_NAME[23]	CHAR	' '	'n'	
180.0	S7_Verb.name_verb.CONNECT_NAME[24]	CHAR	' '	'f'	
181.0	S7_Verb.name_verb.CONNECT_NAME[25]	CHAR	' '	'i'	
182.0	S7_Verb.name_verb.CONNECT_NAME[26]	CHAR	' '	'g'	
183.0	S7_Verb.name_verb.CONNECT_NAME[27]	CHAR	' '	' '	
184.0	S7_Verb.name_verb.CONNECT_NAME[28]	CHAR	' '	'1'	
185.0	S7_Verb.name_verb.CONNECT_NAME[29]	CHAR	' '	' '	
186.0	S7_Verb.name_verb.CONNECT_NAME[30]	CHAR	' '	' '	

FB 60 - SEND - Send to System SLIO CP 040

Description

This FB serves for the data output from the CPU to the System SLIO CP 040. Here you define the send range via the identifiers *DB_NO*, *DBB_NO* and *LEN*.

Via the rising edge of the bit *REQ* the send initialization is set and the data are sent.

Parameters

Name	Declaration	Type	Description
REQ	IN	BOOL	Release SEND with positive edge.
R	IN	BOOL	Release synchronous reset.
LADDR	IN	INT	Logical base address of the CP.
DB_NO	IN	INT	Number of DB containing data to send.
DBB_NO	IN	INT	Data byte number - send data starting from data byte.
LEN	IN	INT	Length of telegram in byte, to be sent.
IO_SIZE	IN	WORD	Configured IO size of the module.
DONE *	OUT	BOOL	Send order finished without errors.
ERROR *	OUT	BOOL	Send order finished with errors. Parameter *STATUS* contains the error information.
STATUS *	OUT	WORD	Specification of the error with *ERROR* = 1.
CONTROL	IN_OUT	BYTE	Divided byte with RECEIVE handling block: SEND (bit 0 … 3), RECEIVE (bit 4 … 7).

*) Parameter is available until the FB is called..

REQ

Request - Send release: With a positive edge on input *REQ* the transfer of the data is triggered. Depending on the number of data, a data transfer can run over several program cycles.

R

Synchronous reset: For the initialization SEND is once to be called in the start-up OB with every parameter and set *R*.

At any time a current order may be canceled and the FB may be set to initial state with signal state "1" of *R*. Please regard that the data, which the CP has already received, are still sent to the communication partner.

The Send function is deactivated as long as *R* is statically set to "1".

LADDR

Peripheral address: With *LADDR* the address of the corresponding CP may be determined. This is the address, which you have assigned via the hardware configuration for the CP.

DB_NO

Number of the data block, which contains the data to send. Zero is not permitted.

DBB_NO

Data byte number: Number of data byte in the data block, starting from which the transmit data are stored.

LEN	Length: Length of the user data to be sent. It is: 1 ≤ *LEN* ≤ 1024.
IO_SIZE	Size I/O area: Enter the size of the I/O area. Depending on the host system the CP occupies for input and output the following bytes in the I/O areas: • PROFIBUS: 8byte, 20byte or 60byte selectable • PROFINET: 20byte or 60byte selectable • CANopen: 8byte • EtherCAT: 60byte • DeviceNET: 60byte • ModbusTCP: 60byte
DONE	*DONE* is set at order ready without errors and *STATUS* = 0000h.
ERROR	*ERROR* is set at order ready with error. Here *STATUS* contains the corresponding error message.
STATUS	If there is no error, *STATUS* = 0000h. With an error here the corresponding error code may be found. As long as *ERROR* is set, the value of *STATUS* is available. The following error messages are possible: 0000h = No error pending 0202h = Handling block and CP are not synchronous (Remedy: Start synchronous reset) 0301h = DB not valid 070Ah = Transfer failed, there is no response of the partner or the telegram was negative acknowledged. 0816h = Parameter *LEN* is not valid (*LEN* = 0 or *LEN* > 1024) 8181h = Order running (Status and no error message)
CONTROL	The handling blocks SEND and RECEIVE use the common parameter *CONTROL* for the handshake. Assign to this parameter a common flag byte.

Error indication

The *DONE* output shows "order ready without error". If there was an *ERROR*, the corresponding event number is displayed in the *STATUS*. If no error occurs the value of *STATUS* is "0".

DONE, *ERROR* and *STATUS* are also output in response to a reset of the FB. In the event of an error, the binary result *BR* is reset. If the block is terminated without errors, the binary result has the status "1".

Please regard the parameter *DONE*, *ERROR* and *STATUS* are only available at one block call. For further evaluation these should be copied to a free data area.

FB 61 - RECEIVE - Receive from System SLIO CP 040

Description

This FB serves for the data reception from the System SLIO CP 040. Here you set the reception range via the identifiers *DB_NO* and *DBB_NO*. The length of the telegram is stored in *LEN*.

Parameters

Parameter	Declaration	Data type	Description
EN_R	IN	BOOL	Release RECEIVE data.
R	IN	BOOL	Release synchronous reset.
LADDR	IN	INT	Logical base address of the CP.
DB_NO	IN	INT	Number of DB containing received data.
DBB_NO	IN	INT	Data byte number - receive data starting from data byte.
IO_SIZE	IN	WORD	Configured IO size of the module.
LEN	OUT	INT	Length of received telegram in byte
NDR *	OUT	BOOL	Receive order finished without errors.
ERROR *	OUT	BOOL	Receive order finished with errors. Parameter *STATUS* contains the error information.
STATUS *	OUT	WORD	Specification of the error with *ERROR* = 1.
CONTROL	IN_OUT	BYTE	Divided byte with RECEIVE handling block: SEND (bit 0 … 3), RECEIVE (bit 4 … 7).

*) Parameter is available until the FB is called..

EN_R

Enable Receive - Release to read: With signal status "1" at *EN_R* the examination, whether data from the CP are read, is released. Depending upon the number of data, a data transfer can run over several program cycles.

At any time a current order may be canceled with signal state "0" of *EN_R*. Here the canceled receipt order is finished with an error message (*STATUS*).

The Receive function is deactivated as long as *EN_R* is statically set to "0".

R

Synchronous reset: For the initialization RECEIVE is once to be called in the start-up OB with every parameter and set *R*.

At any time a current order may be canceled and the FB may be set to initial state with signal state "1" of *R*.

The Receive function is deactivated as long as *R* is statically set to "1".

LADDR

Peripheral address: With *LADDR* the address of the corresponding CP may be determined. This is the address, which you have assigned via the hardware configuration for the CP.

DB_NO

Number of the data block, which contains the data are read. Zero is not permitted.

DBB_NO

Data byte number: Number of data byte in the data block, starting from which the received data are stored.

IO_SIZE	Size I/O area: Enter the size of the I/O area. Depending on the host system the CP occupies for input and output the following bytes in the I/O areas: • PROFIBUS: 8byte, 20byte or 60byte selectable • PROFINET: 20byte or 60byte selectable • CANopen: 8byte • EtherCAT: 60byte • DeviceNET: 60byte • ModbusTCP: 60byte
LEN	Length: Length of the user data to be sent. It is: 1 ≤ *LEN* ≤ 1024.
NDR	New received data are ready for the CPU in the CP.
ERROR	*ERROR* is set at order ready with error. Here *STATUS* contains the corresponding error message.
STATUS	If there is no error, *STATUS* = 0000h. With an error here the corresponding error code may be found. As long as *ERROR* is set, the value of *STATUS* is available. The following error messages are possible: 0000h = No error pending 0202h = Handling block and CP are not synchronous (Remedy: Start synchronous reset) 0301h = DB not valid 070Ah = Transfer failed, there is no response of the partner or the telegram was negative acknowledged. 0816h = Parameter *LEN* is not valid (*LEN* = 0 or *LEN* > 1024) 080Ah = A free receive buffer is not available 080Ch = Wrong character received (Character frame or parity error) 8181h = Order running (Status and no error message)
CONTROL	The handling blocks SEND and RECEIVE use the common parameter *CONTROL* for the handshake. Assign to this parameter a common flag byte.

Error indication

The *NDR* output shows "order ready without error / data kept". If there was an *ERROR*, the corresponding event number is displayed in the *STATUS*. If no error occurs the value of *STATUS* is "0".

NDR, *ERROR* and *STATUS* are also output in response to a reset of the FB. In the event of an error, the binary result *BR* is reset. If the block is terminated without errors, the binary result has the status "1".

Please regard the parameter *NDR*, *ERROR* and *STATUS* are only available at one block call. For further evaluation these should be copied to a free data area.

FC 5 - AG_SEND / FC 6 - AG_RECV - CP 343 communication

Overview

The two blocks serve the processing of the Ethernet-CP 343 connection commands on the side of the PLC. Including these blocks in the cycle block OB1 you may send and receive data cyclically.

Within these blocks, the SFCs 205 and 206 are called that are stored as special function blocks in the CPU.

Note!

Please regard that you may only use the SEND/RECV-FCs from VIPA in your user application for the communication with VIPA-CPs. At a change to VIPA-CPs in an already existing project, the present AG_SEND / AG_LSEND res. AG_RECV / AG_LRECV may be replaced by AG_SEND res. AG_RECV from VIPA without adjustment. Due to the fact that the CP automatically adjusts itself to the length of the data to transfer, the L variant of SEND res. RECV is not required for VIPA CPs.

Communication blocks

For the communication between CPU and CP, the following FCs are available:

AG_SEND (FC 5)

This block transfers the user data from the data area given in *SEND* to the CP specified via *ID* and *LADDR*. As data area you may set a PA, bit memory or data block area. When the data area has been transferred without errors, "order ready without error" is returned.

AG_RECV (FC 6)

The block transfers the user data from the CP into a data area defined via *RECV*. As data area you may set a PA, bit memory or data block area. When the data area has been transferred without errors, "order ready without error” is returned.

Status displays

The CP processes send and receive commands independently from the CPU cycle and needs for this transfer time. The interface with the FC blocks to the user application is here synchronized by means of acknowledgements/receipts.

For status evaluation the communication blocks return parameters that may be evaluated directly in the user application.

These status displays are updated at every block call.

Deployment at high communication load

Do not use cyclic calls of the communication blocks in OB 1. This causes a permanent communication between CPU and CP. Program instead the communication blocks within a time OB where the cycle time is higher res. event controlled.

FC call is faster than CP transfer time

If a block is called a second time in the user application before the data of the last time is already completely send res. received, the FC block interface reacts like this:

AG_SEND

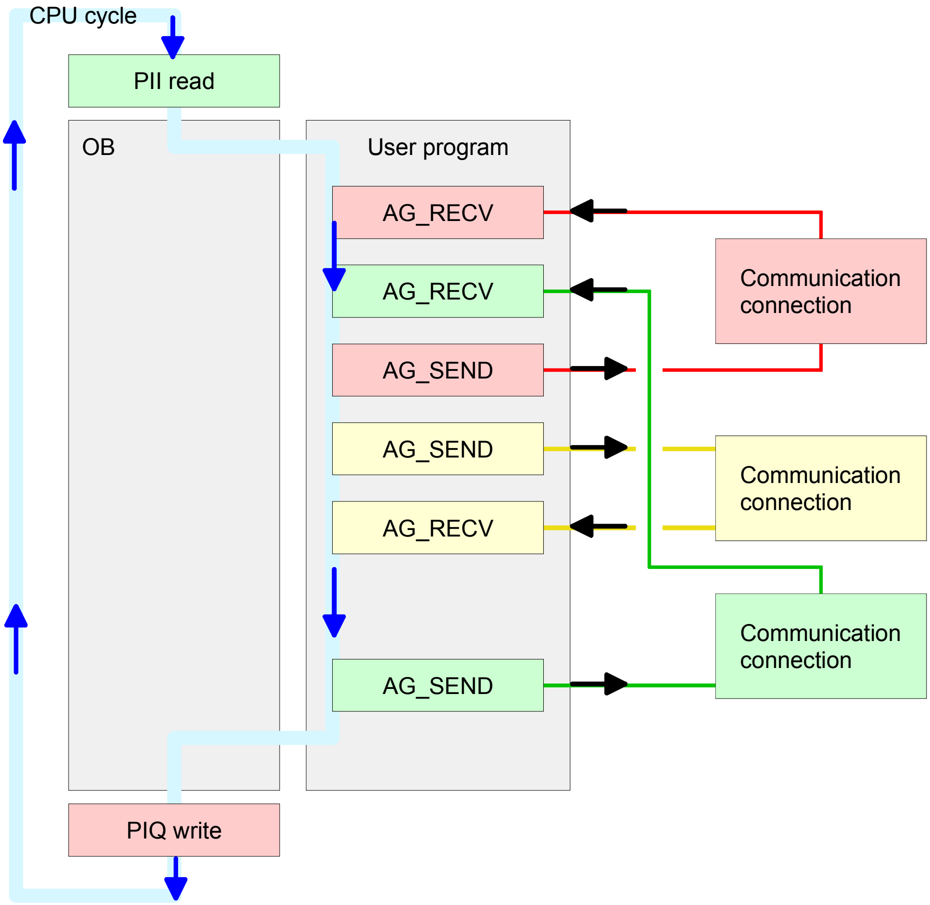
No command is accepted until the data transfer has been acknowledged from the partner via the connection. Until this you receive the message "Order running" before the CP is able to receive a new command for this connection.

AG_RECV

The order is acknowledged with the message "No data available yet" as long as the CP has not received the receive data completely.

AG_SEND, AG_RECV in the user application

The following illustration shows a possible sequence for the FC blocks together with the organizations and program blocks in the CPU cycle:



The FC blocks with concerning communication connection are summed up by color. Here you may also see that your user application may consist of any number of blocks. This allows you to send or receive data (with AG_SEND res. AG_RECV) event or program driven at any wanted point within the CPU cycle.

You may also call the blocks for **one** communication connection several times within one cycle.

AG_SEND (FC5)

By means of AG_SEND the data to send are transferred from the CPU to an Ethernet CP 343.

Parameters

Parameter	Declaration	Data type	Description
ACT	INPUT	BOOL	Activation of the sender 0: Updates *DONE*, *ERROR* and *STATUS* 1: The data area defined in *SEND* with the length *LEN* is send
ID	INPUT	INT	Connection number 1 ... 16 (identical with *ID* of NetPro)
LADDR	INPUT	WORD	Logical basic address of the CP (identical with *LADDR* of NetPro)
SEND	INPUT	ANY	Data area
LEN	INPUT	INT	Number of bytes from data area to transfer
DONE	OUTPUT	BOOL	Status parameter for the order 0: Order running 1: Order ready without error
ERROR	OUTPUT	BOOL	Error message 0: Order running (at *DONE* = 0) 0: Order ready without error (at *DONE* = 1) 1: Order ready with error
STATUS	OUTPUT	WORD	Status message returned with *DONE* and *ERROR*. More details are to be found in the following table.

AG_RECV (FC6)

With the 1. call of AG_RECV a receive buffer for the communication between CPU and an Ethernet CP 343 is established. From now on received data are automatically stored in this buffer. As soon as after calling AG_RECV the return value of *NDR* = 1 is returned, valid data are present.

Since with a further call of AG_RECV the receive buffer is established again for the receipt of new data, you have to save the previous received data.

Parameters

Parameter	Declaration	Data type	Description
ID	INPUT	INT	Connection number 1 ... 16 (identical with ID of NetPro)
LADDR	INPUT	WORD	Logical basic address of the CP (identical with *LADDR* of NetPro)
RECV	INPUT	ANY	Data area for the received data
NDR	OUTPUT	BOOL	Status parameter for the order 0: Order running 1: Order ready data received without error
ERROR	OUTPUT	BOOL	Error message 0: Order running (at *NDR* = 0) 0: Order ready without error (at *NDR* = 1) 1: Order ready with error
STATUS	OUTPUT	WORD	Status message returned with *NDR* and *ERROR*. More details are to be found in the following table.
LEN	OUTPUT	INT	Number of bytes that have been received

DONE, ERROR, STATUS

The following table shows all messages that can be returned by the Ethernet CP 343 after a SEND res. RECV command.

A "-" means that this message is not available for the concerning SEND res. RECV command.

DONE (SEND)	NDR (RECV)	ERROR	STATUS	Description
1	-	0	0000h	Order ready without error.
-	1	0	0000h	New data received without error.
0	-	0	0000h	No order present.
-	0	0	8180h	No data available yet.
0	0	0	8181h	Order running
0	0	1	8183h	No CP project engineering for this order.
0	-	1	8184h	System error
-	0	1	8184h	System error (destination data area failure).
0	-	1	8185h	Parameter *LEN* exceeds source area *SEN.D*
	0	1	8185h	Destination buffer (RECV) too small.
0	0	1	8186h	Parameter *ID* invalid (not within 1 ...16).
0	-	1	8302h	No receive resources at destination station, receive station is not able to process received data fast enough res. has no receive resources reserved.
0	-	1	8304h	The connection is not established. The send command shouldn't be sent again before a delay time of >100ms.
-	0	1	8304h	The connection is not established. The receive command shouldn't be sent again after a delay time of >100ms.
0	-	1	8311h	Destination station not available under the defined Ethernet address.
0	-	1	8312h	Ethernet error in the CP.
0		1	8F22h	Source area invalid, e.g. when area in DB not present Parameter *LEN* < 0
-	0	1	8F23h	Source area invalid, e.g. when area in DB not present Parameter *LEN* < 0
0	-	1	8F24h	Range error at reading a parameter.
-	0	1	8F25h	Range error at writing a parameter.
0	-	1	8F28h	Orientation error at reading a parameter.
-	0	1	8F29h	Orientation error at writing a parameter.
-	0	1	8F30h	Parameter is within write protected 1. recent data block
-	0	1	8F31h	Parameter is within write protected 2. recent data block
0	0	1	8F32h	Parameter contains oversized DB number.
0	0	1	8F33h	DB number error
0	0	1	8F3Ah	Area not loaded (DB)

continued...

... continue DONE, ERROR, STATUS

DONE (SEND)	NDR (RECV)	ERROR	STATUS	Description
0	-	1	8F42h	Acknowledgement delay at reading a parameter from peripheral area.
-	0	1	8F43h	Acknowledgement delay at writing a parameter from peripheral area.
0	-	1	8F44h	Address of the parameter to read locked in access track
-	0	1	8F45h	Address of the parameter to write locked in access track
0	0	1	8F7Fh	Internal error e.g. invalid ANY reference e.g. parameter *LEN* = 0.
0	0	1	8090h	Module with this module start address not present or CPU in STOP.
0	0	1	8091h	Module start address not within double word grid.
0	0	1	8092h	reference contains type setting unequal BYTE.
-	0	1	80A0h	Negative acknowledgement at reading the module.
0	0	1	80A4h	reserved
0	0	1	80B0h	Module doesn’t recognize record set.
0	0	1	80B1h	The length setting (in parameter *LEN*) is invalid.
0	0	1	80B2h	reserved
0	0	1	80C0h	Record set not readable.
0	0	1	80C1h	The set record set is still in process.
0	0	1	80C2h	Order accumulation.
0	0	1	80C3h	The operating sources (memory) of the CPU are temporarily occupied.
0	0	1	80C4h	Communication error (occurs temporarily; a repetition in the user application is reasonable).
0	0	1	80D2h	Module start address is wrong.

Status parameter at reboot

At a reboot of the CP, the output parameters are set as follows:

- *DONE* = 0
- *NDR* = 0
- *ERROR* = 0
- *STATUS* = 8180h (at AG_RECV)
  STATUS = 8181h (at AG_SEND)

FC 10 - AG_CNTRL - CP 343 communication

Description

The connections of the Ethernet CP 343 may be diagnosed and initialized by means of the VIPA FC 10.

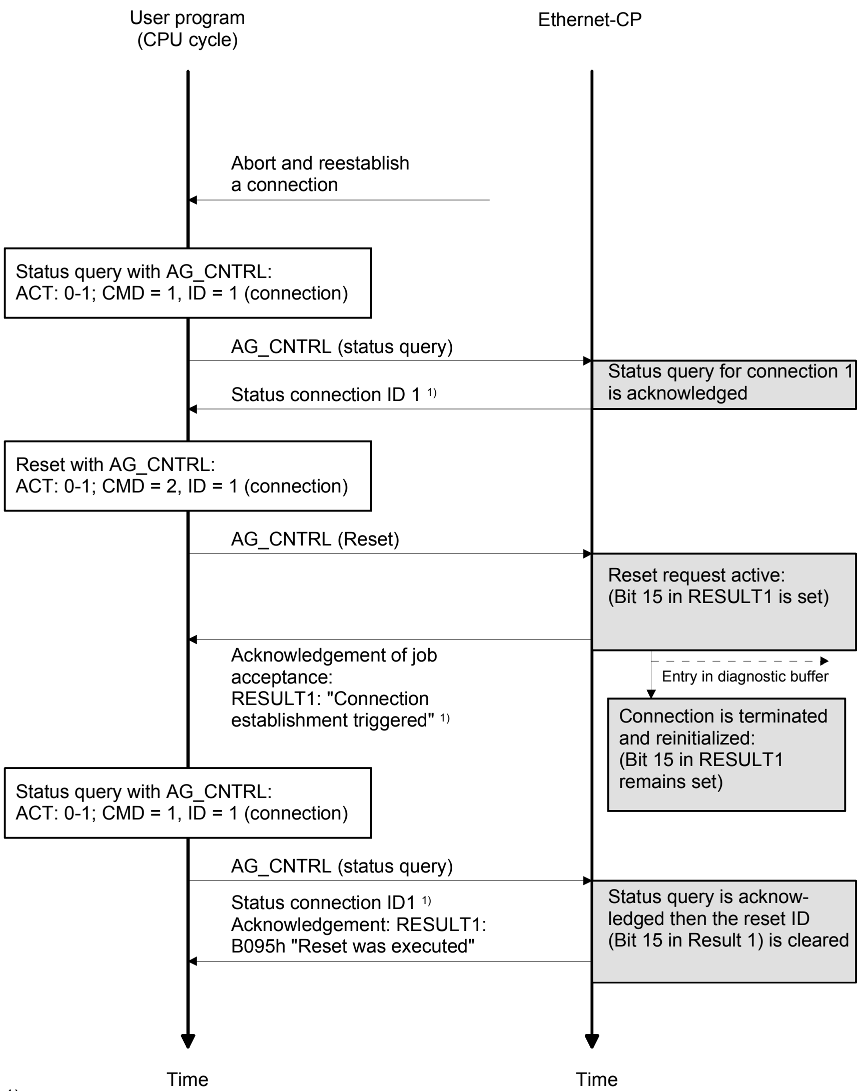
The following jobs may be executed by parameterizable commands:

- Reading connection information
- Resetting configured connections

The commands of this block are permitted only for SEND/RECV connections based on the ISO/RFC/TCP and UDP protocols.

FC 10 in the user program

The following diagram shows a typical sequence of AG_CNTRL. Here it is shown how the connection status is initially queried and then, in a second job, how the connection termination is triggered with the rest command.



1) Parameter transfer *DONE*, *ERROR*, *STATUS* and *RESULT1/2*

Parameters

Parameter	Declaration	Data type	Description
ACT	INPUT	BOOL	Job triggered by edge change 0-1 of the memory bit *ACT*
ID	INPUT	INT	Connection ID according to configuration
LADDR	INPUT	WORD	Base address of CP in hardware configuration
CMD	INPUT	INT	Job ID
DONE	OUTPUT	BOOL	Execution code
ERROR	OUTPUT	BOOL	Error code
STATUS	OUTPUT	WORD	Status code
RESULT1	OUTPUT	DWORD	Job result 1 under command
RESULT2	OUTPUT	DWORD	Job result 2 under command

ACT

Possible values: 0, 1

The FC is to be called with edge change 0-1 of *ACT*.

If it is called with *ACT* = 0, there is no function call and the block is exited immediately.

ID

Possible values: 1, 2 ... n, or 0

The number of the connection is specified in the parameter *ID*. The connection number may be found in the configuration. n is the maximum number of connections.

If the call addresses every connection as *ID* 0 is to be specified (_ALL-function with *CMD* 3 respectively *CMD* 4).

LADDR

Module base address

At CP configuration with the hardware configurator the module base address is displayed in the configuration table.

Specify this address here.

CMD

Command to the FC AG_CNTRL

(See Commands and evaluating the job results)

DONE

0: Job is still being processed or not yet triggered

1: Job executed

This parameter indicates whether or not the job was completed without errors. For the meaning of this parameter in conjunction with the *ERROR* and *STATUS* parameters, refer to the following table.

If *DONE* = 1 *RESULT* may be evaluated.

ERROR

0: No error

1: Error

Error indication (refer to the table DONE, ERROR, STATUS)

STATUS

Status indication (refer to the table DONE, ERROR, STATUS)

RESULT1/2

Information returned according to the command sent to the FC AG_CNTRL (See commands and evaluating the job results).

DONE, ERROR, STATUS

The following table shows the messages that may be returned by the Ethernet-CP 343 after an AG_CNTRL call.

Additional the command results in the parameters *RESULT1* and *RESULT2* are to be evaluated.

DONE	ERROR	STATUS	Description
1	0	0000h	Job executed without error
0	0	0000h	No job executing
0	0	8181h	Job active, the block call is to be repeated with the same parameters until *DONE* or *ERROR* is returned.
0	1	8183h	There is no CP configuration for this job or the service has not yet started in the Ethernet-CP 343.
0	1	8186h	Parameter *ID* is invalid. The permitted *ID* depends on the selected command.
0	1	8187h	Parameter *CMD* is invalid
0	1	8188h	Sequence error in the *ACT* control
0	1	8090h	Module with this address does not exist or CPU in STOP.
0	1	8091h	The module base address is not on a double-word boundary.
0	1	80B0h	The module does not recognize the record set.
0	1	80C0h	The record set cannot be read.
0	1	80C1h	The specified record set is currently being processed.
0	1	80C2h	There are too many jobs pending.
0	1	80C3h	CPU resources (memory) occupied.
0	1	80C4h	Communication error (error occurs temporarily; it is usually best to repeat the job in the user program).
0	1	80D2h	The module base address is incorrect.

Status parameter at cold restart

The output parameters are set to the following values during a restart of the CP:

- *DONE* = 0
- *NDR* = 0
- *ERROR* = 8180h (at AG_RECV)
  ERROR = 8181h (at AG_SEND)

Note!

Please consider the block may only be called with new parameters if a job started before was just ended with *DONE* = 1.

Commands and evaluating the job results

The following table shows the possible commands and the results that may be evaluated in the parameters *RESULT1* and *RESULT2*.

CMD 0

NOP - no operation
The block is executed without a job being sent to the CP.

RESULT	Hex value/range	Description
RESULT 1	0000 0001h	Executed without error
RESULT 2	0000 0000h	Default

CMD 1

CN_STATUS - connection status

This command returns the status of the connection selected with the *ID* of the CP addressed by *LADDR*. If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CMD 5 - CN_CLEAR_RESET).

RESULT	Hex value/range	Description
RESULT 1	0000 000xh	Bit 3 ... 0: Codes for the send direction (excluded: 0010_b) Bit 0: Connection reserved for send and receive jobs Bit 1: Send job being executed Bit 3, 2: Previous job 00: No information 01: Send job completed successfully 10: Send job not completed successfully
	0000 00x0h	Bit 7 ... 4: Codes for receive direction (excluded: 0010_b) Bit 4: Connection reserved for send and receive jobs Bit 5: Receive job being executed Bit 7, 6: Previous job 00: No information 01: Receive job completed successfully 10: Receive job not completed successfully
	0000 0x00h	Bit 11 ... 8: Codes for FETCH/WRITE (excluded: 0011_b, 0111_b, 1000_b, 1011_b, 0010_b) Bit 8: Connection type 0: No FETCH connection 1: Connection reserved for FETCH jobs Bit 9: Connection type 0: No WRITE connection 1: Connection reserved for WRITE jobs Bit 10: Job status (FETCH/ WRITE) 0: Job status OK 1: Job status not OK This ID is set in the following situations: - The job was acknowledged negatively by the CPU - The job could not be forwarded to the CPU because the connection was in the "LOCKED" status. - The job was rejected because the FETCH/WRITE header did not have the correct structure. Bit 11: Status of FETCH/WRITE job 0: No job active 1: Job from LAN active

continued ...

... continue

RESULT	Hex value/range	Description
	0000 x000h	Bit 15 ... 12: General CP information (excluded: 0011_b, 1011_b) Bit 13, 12: Connection status (only available for SEND/RECV connections based on the ISO/RFC/TCP protocols; with UDP, the corresponding internal information is output) 00: Connection is terminated 01: Connection establishment active 10: Connection termination active 11: Connection is established Bit 14: CP information 0: CP in STOP 1: CP in RUN Bit 15: Reset ID 0: FC 10 has not yet reset a connection or the reset ID was cleared. 1: The FC 10 has executed a connection reset
	xxxx 0000h	Bit 31 ... 16: Reserved for later expansions
RESULT 2	0000 0000h	Reserved for later expansions

CMD 2

CN_RESET - connection reset

This command resets the connection selected with the *ID* of the CP addressed by *LADDR*.

Resetting the connection means that a connection is aborted and established again (active ore passive depending on the configuration).

An entry is also generated in the diagnostic buffer in which the job result may be found.

RESULT	Hex value/range	Description
RESULT 1	0000 0001h	The reset job was transferred to the CP successfully. The connection abort and subsequent connection establishment were triggered.
	0000 0002h	The reset job could not be transferred to the CP because the service was not started on the CP (for example CP in STOP).
RESULT 2	0000 0000h	Default

CMD 3

CN_STATUS_ALL - all connections status

This command returns the connection status of all connections (established/terminated) in the *RESULT1/2* parameters (at total of 8byte of group information) of the CP addressed by *LADDR*.

The *ID* parameter must be set to "0" (checked for "0").

When necessary, you may obtain detailed information about a terminated or not configured connection using a further connection status call with *CMD* = 1.

RESULT	Hex value/range	Description
RESULT 1	xxxx xxxxh	32 Bit: Connection 1 ... 32 0: Connection terminated / not configured 1: Connection established
RESULT 2	xxxx xxxxh	32 Bit: Connection 33 ... 64 0: Connection terminated / not configured 1: Connection established

CMD 4

CN_RESET_ALL - all connections reset

This command resets all connection of the CP addressed by *LADDR*.

The *ID* parameter must be set to "0" (checked for "0").

Resetting the connection means that a connection is aborted and established again (active ore passive depending on the configuration).

An entry is also generated in the diagnostic buffer in which the job result may be found.

RESULT	Hex value/range	Description
RESULT 1	0000 0001h	The reset job was transferred to the CP successfully. The connection abort and subsequent connection establishment of every connection were triggered.
	0000 0002h	The reset job could not be transferred to the CP because the service was not started on the CP (for example CP in STOP).
RESULT 2	0000 0000h	Default

CMD 5

CN_CLEAR_RESET - Clear the reset ID

This command resets the reset ID (bit 15 in RESULT1) for the connection selected with the *ID* of the CP addressed by *LADDR*.

This job executes automatically when the connection status is read (*CMD* = 1); the separate job described here is therefore only required in special situations.

RESULT	Hex value/range	Description
RESULT 1	0000 0001h	The clear job was transferred to the CP successfully.
	0000 0002h	The clear job could not be transferred to the CP because the service was not started on the CP (for example CP in STOP).
RESULT 2	0000 0000h	Default

CMD 6

CN_DISCON - connection disconnect

This command resets the connection, which was selected by *ID* and *LADDR*. The reset is executed by means of aborting the connection.

Possibly in the stack stored data are lost without any instructions. After that no further connection is automatically established. The connection may again be established by the control job CN_STARTCON. An entry is also generated in the diagnostic buffer in which the job result may be found.

RESULT	Hex value/range	Description
RESULT 1	0000 0001h	The job was transferred to the CP successfully. The connection abort was triggered.
	0000 0002h	This job could not be transferred to the CP because the service was not started on the CP (for example CP in STOP).
RESULT 2	0000 0000h	Default

CMD 7

CN_STARTCON - start connection

This command establishes a connection, which was selected by *ID* and *LADDR* and aborted by the control job CN_DISCON before. An entry is also generated in the diagnostic buffer in which the job result may be found.

RESULT	Hex value/range	Description
RESULT 1	0000 0001h	The job was transferred to the CP successfully. The connection abort was triggered.
	0000 0002h	This job could not be transferred to the CP because the service was not started on the CP (for example CP in STOP).
RESULT 2	0000 0000h	Default

FC 200 - IBS_INIT

Description

This FC synchronizes the INTERBUS master with the CPU and checks the number of connected in- and output bytes as well as the bus structure.

Parameters

Parameter	Declaration	Data type	Description
WORK_DB	IN	BLOCK_DB	INTERBUS work DB
LADDR	IN	INT	Logical base address of INTERBUS master
MODE	IN	INT	Mode for start-up
WAIT_TIME	IN	S5TIME	Wait time for INTERBUS Master acknowledgement
TIMER_NO	IN	INT	Timer number for wait time
SERVICE_DB_SEND	IN	INT	DB number with services
SERVICE_DB_REC	IN	INT	DB number for INTERBUS master acknowledgement
NO_OF_SERVICES	IN	Word	Number of services to be processed starting at FIRST_SERVICE
READ_DIAG	IN	BOOL	Structure diagnostic data
RET_VAL	OUT	WORD	Return value on error
FIRST_SERVICE	IN_OUT	BYTE	Number of 1. service of the service DB to be processed

WORK_DB

Set the work DB for the wanted master.

LADDR

Set the address (**L**ogical **Addr**ess) from where on the register of the masters is to be mapped into the CPU. At start-up of the CPU, the INTERBUS master are mapped into the I/O address range of the CPU with the following formula if no hardware configuration is present:

$$\textit{Start address} = 256 \cdot (\textit{Slot}-101)+2048$$

The slot numbering at the SPEED-Bus starts with 101 at the left side of the CPU and ascends from the right to the left.
For example, the 1. slot has the address 2048, the 2. the address 2304 etc..

MODE

This parameter allows you to preset 3 modes for start-up:

0 = Calculate address only

1 = Calculate address and wait for Ready of the INTERBUS master

2 = Calculate address, parameterize and start INTERBUS master

3 = Calculate address and automatically start of INTERBUS after auto-configuration via switch

WAIT_TIME
TIMER_NO

Here you may define a waiting period with the according timer by setting *WAIT_TIME* and *TIMER-NO* that the CPU has to wait for a master acknowledgement after a service command.

Note!

Please regard at setting a timer number. That always 2 sequential timers are used: Timer 1: *TIMER_NO*, Timer 2: *TIMER_NO* + 1

SERVICE_DB_SEND
SERVICE_DB_REC

Enter the DB that contains the according service instructions via *SERVICE_DB_SEND*. In *SERVICE_DB_REC* the INTERBUS master returns the receipt.

More details about the structure of the service DB may be found on the following page at "FC 202 Process service".

NO_OF_SERVICES
FIRST_SERVICE

In *NO_OF_SERVICES* you enter the number of services that have to be processed in the service DB after the 1. service that you set in *FIRST_SERVICE*.

READ_DIAG

This parameter allows you to influence the structure of a diagnosis:

0 = Normal diagnosis

1 = Extended diagnosis

RET_VAL

In case of an error, *RET_VAL* may contain the following error messages:

1 = Waiting period for master receipt (READY) exceeded - master not ready

2 = Execution of a service to process has failed

FC 202 - IBS_SERVICE

Description

This function block allows you to transfer services to the INTERBUS master and to react to the according acknowledgements.

For the INTERBUS master card USC4-1 from Phoenix Contact is deployed as INTERBUS hardware platform, please also refer to the extensive documentation (IBS SYS FW G4 UM) from Phoenix Contact for the description of the INTERBUS services and INTERBUS error messages.

Parameters

Parameter	Declaration	Data type	Description
WORK_DB	IN	BLOCK_DB	INTERBUS work DB
SERVICE_DB_SEND	IN	INT	DB number with services
SERVICE_DB_REC	IN	INT	DB number for INTERBUS master acknowledgement
FIRST_SERVICE	IN	Byte	Number of 1. service of the service DB to be processed
START	IN_OUT	BOOL	Start bit of the function
ERROR	IN_OUT	BOOL	Error bit of the function

WORK_DB

Set the work DB for the wanted master.

SERVICE_DB_SEND
SERVICE_DB_REC

Enter the DB that contains the according service instructions via *SERVICE_DB_SEND*. In *SERVICE_DB_REC* the INTERBUS master returns the receipt.

FIRST_SERVICE

Enter the position of the first service within the send DB.

Note!

Please regard that you have to enter the number of services that are to be transferred after *FIRST_SERVICE* in the work DB before calling the FC 202.

Structure service DB

You may enter a max. of 30 services in one DB. Up to 2 DBs, 60 services in total, may be transferred to the INTERBUS master at every FC call.

DBB	Contents
0 ... 69	Record set 1
70 ... 139	Record set 2
.	.
.	.
.	.
2030 ... 2099	Record set 30
2100	Instruction number 2. DB

Structure record set

DBW	Contents
0	Send length (Number of bytes to be send)
1	Code number of service
2	Parameter count
3 ... 68	Parameter

START

By setting the start bit, the services are transferred to the INTERBUS master and started.

ERROR

In case of an error, the Start bit is set back and the error bit is set. Additionally, the number of the service that has been processed when the error occurred is entered in the DBB113 of the work DB. The error code is displayed in DBB112.

The following error codes may occur:

2 = Error of the master at reading data from SSGI Box

3 = Return code of the acknowledgement not valid

4 = Service could not be processed

5 = No acknowledgement within waiting period

Note!

If DBB112 contains the error code 4, further error codes are entered into DBW114 and 116 of the work DB.

Information about these error codes is to be found in the documentation of the services (IBS SYS FW G4 UM) from Phoenix Contact.

FC 204 - IBS_LOOP, FC 205 - IBS_CYCLE

Description

The FC 204 serves the exchange of in- and output data between INTERBUS master and CPU. This block always awaits an acknowledgement of the master after a data request and continues the cycle processing only after reception.

If this block influences the cycle processing of the CPU too much, you should use the FC 205 Asynchr_Cycle instead. In opposite to the FC 204 this does not wait for an acknowledgement but continues cycle processing after data request.

Occurring error messages are to be found after block processing in the work DB in DBW150.

Parameters

Parameter	Declaration	Data type	Description
WORK_DB	IN	BLOCK_DB	INTERBUS work DB
RW_MODE	IN	INT	Mode of Read/Write (0=R/W, 1=R, 2=W)
OPERATION_ MODE	IN	INT	Operation mode (0=asynchr., 1=asynchr. with consistency)
TYP_OUT	IN	INT	Data type of INTERBUS slave out data (0=DB, 1=MB, 2=OB)
TYP_IN	IN	INT	Data type of INTERBUS slave in data (0=DB, 1=MB, 2=IB)
START	IN_OUT	BOOL	Start bit of the function

WORK_DB

Set the work DB for the wanted master.

RW_MODE

The following modes are available:

0 = Read input data and write output data

1 = Read input data only

2 = Write output data only

OPERATION_MODE

The transfer may happen with the following operating modes:

0 = Asynchronous data exchange without consistency lock

In this operating mode it may happen that read res. written data is not out of the same INTERBUS cycle and is therefore inconsistent.

1 = Asynchronous data exchange with consistency lock

Here the CPU sets a bit for read/write request. As soon as the next INTERBUS cycle is finished and data is ready, the INTERBUS master sets a release bit. The CPU transfers its data and signalizes the end of data transfer by setting back the request. Now the INTERBUS master deletes the release and continues the INTERBUS cycle.

TYP_OUT
TYP_IN

This parameter defines the type of the data area where the I/O data of connected INTERBUS slaves is stored.

The following types are available:

0 = DB (data block)

1 = MB (bit memory byte)

2 = I/O range of the CPU

START

By setting the Start bit, the FC is executed. The start is set back again in the block.

Error message

During the execution of the block, the following errors that are stored in DBW 150 of the work DB may occur:

1 = Data release of the master missing - read inputs

2 = Data release of the master missing - write outputs

3 = Data release of the masters is not deleted

FC 206 - IBS_IRQ

Description

At deployment of the FC 206, the data transfer of the in- and output data between CPU and INTERBUS master is controlled via interrupts.

As soon as the INTERBUS master has provided its data, it initializes an interrupt. The CPU transfers its data and also signalizes the end of the data transfer via an interrupt. Now the INTERBUS master continues the INTERBUS cycle.

Parameters

Parameter	Declaration	Data type	Description
WORK_DB	IN	BLOCK_DB	INTERBUS work DB
RW_MODE	IN	INT	Mode of R/W (0=R/W, 1=R, 2=W)
TYP_OUT	IN	INT	Data type of INTERBUS slave out data (0=DB, 1=MB, 2=OB)
TYP_IN	IN	INT	Data type of INTERBUS slave in data (0=DB, 1=MB, 2=IB)

WORK_DB

Set the work DB for the wanted master.

RW_MODE

The following modes are available:

0 = Read input data and write output data

1 = Read input data only

2 = Write output data only

TYP_OUT
TYP_IN

This parameter defines the type of the data area where the I/O data of connected INTERBUS slaves is stored.

The following types are available:

0 = DB (data block)

1 = MB (bit memory byte)

2 = I/O range of the CPU

FC 207 - IBS_PCP

Description

This function block allows you to transfer PCP services to the INTERBUS master and to react to the according acknowledgements. The **P**eripherals **C**ommunication **P**rotocol (PCP) serves the transmission of instructions and parameters to connected slaves and the reception of acknowledgements and data of the slaves.

Information about the services is to be found in the documentation of the services, available via our application department.

Parameters

Parameter	Declaration	Data type	Description
WORK_DB	IN	BLOCK_DB	INTERBUS work DB
SERVICE_DB_SEND	IN	INT	DB number with services
SERVICE_DB_REC	IN	INT	DB number for INTERBUS master acknowledgement
FIRST_SERVICE	IN	Byte	Number of 1. service of the service DB to be processed
START	IN_OUT	BOOL	Start bit of the function
ERROR	IN_OUT	BOOL	Error bit of the function

WORK_DB

Set the work DB for the wanted master.

SERVICE_DB_SEND
SERVICE_DB_REC

Enter the DB that contains the according PCP service instructions via *SERVICE_DB_SEND*. In *SERVICE_DB_REC* the slaves return the receipt.

FIRST_SERVICE

Enter the position of the first PCP service within the send.

Note!

Please regard that you have to enter the number of services that are to be transferred after *FIRST_SERVICE* in the work DB before calling the FC 207.

Structure service DB

You may enter a max. of 30 PCP services in one DB. Up to 2 DBs, 60 PCP services in total, may be transferred to the INTERBUS master at every FC call.

DBB	Content
0 ... 69	Record set 1
70 ... 139	Record set 2
.	.
.	.
.	.
2030 ... 2099	Record set 30
2100	Sequence number of 2. DB

Structure record set

DBW	Content
0	Send length (Number of bytes to be send)
1	Code number of PCP service
2	Parameter count
3 ... 68	Parameter

START

By setting the start bit, the PCP services are transferred to the INTERBUS master and started.

ERROR

In case of an error, the start bit is set back and the error bit is set. Additionally, the number of the PCP service that has been processed when the error occurred is entered in the DBB193. The following error codes may be entered into DBB192:

2 = Error of the master at reading data from SSGI Box

3 = Return code of the acknowledgement not valid

4 = Service could not be processed

5 = No acknowledgement within waiting period

Note!

If *ERROR* contains the error code 4, further error codes are entered into DBW194 and 196 of the work DB.

Information about these error codes is to be found in the documentation of the error codes, available via our application department.

FC 208 - IBS_DIAG

Description

Via this function block you may read diagnostic data from the master res. slave in case of an INTERBUS breakdown. Here you may also define the reboot operating mode of the INTERBUS master after breakdown.

Parameters

Parameter	Declaration	Data type	Description
WORK_DB	IN	BLOCK_DB	INTERBUS work DB
ACTIVATE	IN	INT	Manual error acknowledgement
AUTO_START	IN	INT	Automatic error acknowledgement
RUN	OUT	Byte	INTERBUS at status RUN
PERIPHERAL_ERROR	OUT	BOOL	Error at periphery
BUS_QUALITY	OUT	BOOL	Sporadic bus errors occurred
DETECTION	OUT	BOOL	Internal error is searched
BUSY_STATE	OUT	BOOL	Internal diagnostic function is busy

WORK_DB

Set the work DB for the wanted master.

ACTIVATE
AUTO_START

The *ACTIVATE* transmission parameter of the type Boolean that you may control for example via an external caliper, allows you to reboot the INTERBUS master by setting (push button).

By setting of auto-start, the INTERBUS master reboots automatically after error recovering. *AUTO-START* has always preference before *ACTIVATE*.

RUN

This parameter shows the status of the INTERBUS master:

0 = INTERBUS master is in STOP

1 = INTERBUS master is in RUN

PERIPHERAL_ERROR

If a periphery error occurs, the INTERBUS master announces PF = 1.
At PF = 0 no periphery error occurred.

In case of an error you will see the number of the causing slave in the work DB starting with 1.

BUS_QUALITY

This parameter displays information about the transfer quality within the INTERBUS. As soon as the bit is set by the INTERBUS master, some single transmission interferences have occurred. Please check the transfer routes with according diagnosis software.

DETECTION

The parameter *DETECTION* is set by the INTERBUS master when the internal error detection is running. When the error detection is finished, *DETECTION* is set back again.

BUSY_STATE

When a diagnosis is executed within the diagnosis block, *BUSY_STATE* is set. As soon as diagnosis data are available, the block sets *BUSY_STATE* back again.

SFB 7 - uS_TIME and SFC 53 - uS_TICK - Time measurement

SFC 53 uS_TICK

This block allows you to read the µs ticker integrated in the SPEED7-CPU. The µs ticker is a 32bit µs time counter that starts at every reboot with 0 and counts to 2^{32-1}µs. At overflow the counter starts again with 0. With the help of the difference creation of the *RETVAL* results of 2 SFC 53 calls before and after an application you may thus evaluate the runtime of the application in µs.

Runtime in dependence of the operating mode

Status	µs system time
Start-up	Starts with 0 and is permanently updated
RUN	is permanently updated
STOP	is stopped (time cannot be read)
Reboot (Reset)	Starts again with 0

Parameters

Name	Declaration	Type	Comment
RETVAL	OUT	DINT	System time in µs

RETVAL

The parameter *RETVAL* contains the read system time in the range of 0 ... 2^{32-1}µs.

SFB 7 TIMEMESS

In opposite to the SFC 53, the SFB 7 returns the difference between two calls in µs.

With *RESET* = 1 the current timer value is transferred to *store*.
Another call with *RESET* = 0 displays the difference in µs via *VALUE*.

Parameters

Name	Declaration	Type	Comment
RESET	IN	BOOL	*RESET*=1 start timer
VALUE	OUT	DWORD	Difference in µs
STORE	STAT	DWORD	DW for 1. time

RESET

RESET = 1 transfers the current timer value to *STORE*.
Here *VALUE* is not influenced.

VALUE

After a call with *RESET* = 0, *VALUE* returns the time difference between the two SFB 7 calls.

STORE

STORE serves the storage of the 1. time value. *STORE* is a static variable that is located in the instance block.

SFB 239 - FUNC

Description

With the SFB 239 FUNC system internal functions may be executed. The function is always to be called together with an instance DB.

Attention!
After processing the function the CPU always automatically gets to STOP!

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: Start processing
FUNC	INPUT	BYTE	I, Q, M, D, L, constant	Function number
CODE	INPUT	WORD	I, Q, M, D, L, constant	Safety code to ensure the functionality
PARAM	INPUT	ANY	I, Q, M, D, L	reserved
BUSY	OUTPUT	BOOL	I, Q, M, D, L	reserved
RET_VAL	OUTPUT	INT	I, Q, M, D, L	reserved

Functions

FUNC	CODE	Description
0	CA749FE0	The function copies the current loaded project in the RAM to a put memory card as s7prog.wld. With a SPEED7 CPU from VIPA the s7prog.wld is automatically read from a put memory card always after an overall reset.
1	6F33DA8B	The function copies the current loaded project in the RAM to a put memory card as autoload.wld. With a SPEED7 CPU from VIPA the autoload.wld is automatically read from a put memory card always after PowerON.

SFC 193 - AI_OSZI - Oscilloscope-/FIFO function

Description

The SFC 193 serves for controlling the oscilloscope-/FIFO function of analog input channels with this functionality.

It allows to start the recording and to read the buffered data. Depending upon the parameterization there are the following possibilities:

Oscilloscope operation

- Depending on the trigger condition at edge evaluation the monitoring of the configured channel may be started respectively at manual operation the recording may be started.
- The recorded measuring values may be accessed by the SFC 193 as soon as the buffer is full.

FIFO operation

- Start the recording.
- Read the puffer at any time.

Note!

The SFC may only be called from on level of priority e.g. only from OB 1 or OB 35.
The module is to be parameterized before.
For starting and reading in each case the SCF 193 is to be called. The differentiation of both variants takes place in the parameter *MODE.*

Parameters

Parameter	Declaration	Data type	Function depending on MODE
REQ	IN	BOOL	Execute function (start/read)
LADR	IN	WORD	Base address of the module
MODE	IN	WORD	Mode (start/read)
CHANNEL	IN	BYTE	Channel to be read
OFFSET	IN	DWORD	Address offset for reading (not FIFO operation)
RECORD	IN	ANY	Memory for the read data
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy
TIMESTAMP	OUT	DWORD	Time stamp (only at edge evaluation)
LEN	INOUT	DWORD	Number of values to be handled per channel

REQ

Depending on the set *MODE* when the bit is set the recording respectively the reading may be started.

Depending on the trigger condition at edge evaluation the monitoring of the configured channel may be started respectively at manual operation the recording may be started.

The data are read from the module, if "read" is set at *MODE.*

LADR

Logical basic address of the module.

MODE

The SFC 193 may be called with 3 different modes. The corresponding mode may be set by the parameter *MODE*. The configured mode is executed by setting *REQ*.

The following values are supported:

01h: Starts recording respectively edge monitoring depending upon the parameterization.

00h: Read data within several cycles until *BUSY* = 0.

80h: Read data with one access.

CHANNEL

Here the channel is specified to be read. With each call one channel may be read. This parameter is irrelevant at start calls with *MODE* = 01h.

OFFSET

Offset specifies an address offset for the reading process. By this you get access to sub-ranges of the recorded data. The value for the maximum offset depends on the number of values, which were recorded per channel.

OFFSET is not supported in FIFO operation. It will be ignored.

RECORD

Here an area for the read values to be stored at may be defined.

In FIFO operation every value of the selected channel may be read, which were stored up to the time of start reading. Please regard that the buffer has a sufficient size for the data to be buffered, otherwise an error is reported.

BUSY

BUSY = 1 indicates that the function just processed. *BUSY* = 0 indicates that the function is finished.

TIMESTAMP

There is an internal clock with a resolution of 1µs running in every SPEED-Bus module. The returned value corresponds to the time at the SPEED-Bus module, on which the trigger event occurred.

TIMESTAMP is only available at the edge triggered oscilloscope operation. It is valid as long as the job is running (*RETVAL* = 7xxxh) and bit 4 of byte 0 is set respectively the job has been finished without an error (*RETVAL* = 0000h).

LEN

The length parameter realized as IN/OUT is variably interpreted depending on the selected mode at the function call.

Mode: start (MODE: = 01h)

At *MODE* = 01h this parameter may only be used at the manual oscilloscope start. Here the requested number of values per channel to be buffered may be assigned. In this mode there is no value reported by *LEN*.

Mode: read (MODE: = 00h or 80h)

At *MODE* = 00h respectively 80h the number of values to be read may be set. This parameter is ignored in FIFO operation. The number of the read values is returned by *LEN*.

RETVAL (Return value)

In addition to the module specific error codes listed here, there general SFC error information may be returned as well.

RETVAL	Description depending on the BUSY-Bit	BUSY
Byte		
0	Bit 1, 0:	
	00: Call with *REQ*: = 0 (idle, waiting for *REQ* = 1)	0
	01: First call with *REQ*: = 1	1
	10: Subsequent call with REQ: = 1	1
	11: Oscilloscope is just recording	1
	Bit 2: REQ: = 1, but recording was not yet started. (*MODE*: = 00h or *MODE*: = 80h)	0
	Bit 3: reserved	-
	Bit 4: Trigger event occurred and recording is just running.	1
	Bit 5: Waiting for trigger event	1
	Bit 7…6: reserved	-
1	Bit 0: reserved	-
	Bit 1: The number of recorded values exceeds the target area defined by *RECORD* (in words).	0
	Bit 2: The number of the recorded values exceeds the area defined by *LEN* and *OFFSET*.	0
	Bit 3: Buffer overflow in FIFO operation.	0
	Bit 7...4:	
	0000: Job finished without an error	0
	0111: Job still running	1
	1000: Job finished with error (see following table)	0

Job finished without an error

RETVAL	Description depending on the BUSY-Bit	BUSY
0000h	Job was finished without an error.	0

Job finished with error

RETVAL	Description depending on the BUSY-Bit	BUSY
8002h:	Oscilloscope-/FIFO function is not configured.	0
8003h:	An internal error occurred - please contact VIPA.	0
8005h:	The selected channel may not be read - wrong channel number.	0
8007h:	The value at *OFFSET* exceeds the number of recorded values.	0
8090h:	There is no SPEED-Bus module with this address available.	0
80D2h:	*LADR* exceeds the peripheral address area.	0

SFC 194 - DP_EXCH

Description

With the SFC 194 you can exchange data between your CPU and a PROFIBUS DP master, which is connected via SPEED-Bus.

Normally each PROFIBUS DP master embeds its I/O area into the peripheral area of the CPU. Here you can address a periphery range of 0 ... 2047 via the hardware configuration.

Since this limits the maximum number of PROFIBUS DP master modules at the SPEED-Bus, there is the possibility to deactivate the mapping at the appropriate DP master and to activate instead the access via handling blocks. Here you can write data from the CPU in a defined area of the DP master and read data from a defined area of the DP master.

Parameters

Parameter	Declaration	Data type	Functionality depending on MODE
LADR	IN	WORD	Base address of the DP master module on the SPEED-Bus
MODE	IN	WORD	Modus (0 = read / 1 = write)
LEN	IN	WORD	Length of the data area in the DP master
OFFSET	IN	DWORD	Begin of the data area in the DP master
RETVAL	OUT	WORD	Return value (0 = OK)
DATA	IN OUT	ANY	Pointer to the data area of the CPU

LADR

Logical base address of the module.

MODE

Den SFC 194 may be called with the following modes:

0000 = Transfer data from the DP master to the CPU.

0001 = Transfer data from the CPU to the DP master.

LEN

Here the length of the data area in the DP master is defined.

OFFSET

Here the beginning of the data area in the DP master is defined. Please consider that the area defined via *OFFSET* and *LEN* does not exceed the area defined of the DP master by the hardware configuration

RETVAL (Return value)

In addition to the module-specific error codes listed here, as return value there are also general error codes possible for SFCs .

A description of the general error codes may be found in the chapter "Integrated standard SFCs".

RetVal	Description
0000h	No error
8001h	LADR could not be assigned to a DP master at the SPEED-Bus.
8002h	The value of the parameter *MODE* is out of range.
8003h	The value of the parameter *LEN* is 0.
8004h	The value of the parameter *LEN* is greater than the data area defined at *DATA*.
8005h	The area defined by *OFFSET* and *LEN* is out of the range 0 …2047.
8006h	The DP master specified by *LADR* is not configured for access via handling block. Activate in the properties of the DP master "IO-Mode HTB".
8008h	There are gap(s) in the input area.
8009h	There are gap(s) in the output area.
8010h	Error while accessing the input area (e.g. DP master is not reachable)
8011h	Error while accessing the output area (e.g. DP master is not reachable)
8Fxxh	Error at *DATA* (xx see "General error codes RET_VAL").

MMC access - SFC 208...215 and SFC 195

Overview

The SFC 208 ... SFC 215 and SFC 195 allow you to include the MMC access into your user application.
The following parameters are necessary for the usage of the SFCs:

HANDLE, FILENAME

The access takes place via a *HANDLE* number. That is assigned to a *FILENAME* via a call of the SFC 208 FILE_OPN res. SFC 209 FILE_CRE. At the same time a max. of 4 *HANDLE* may be opened (0 ... 3). To close an opened file call the SFC 210 FILE_CLO and thus release the *HANDLE* again.

MEDIA

As media format set 0 for the MMC. Other formats are not supported at this time.

ORIGIN, OFFSET

Read and write start with the position of a write/read flag. After opening res. creation of a file, the write/read flag is at position 0. With SFC 213 FILE_SEK you may shift the write/read flag from an *ORIGIN* position for an *OFFSET* (number Bytes).

REG, BUSY

With *REQ* = 1 you activate the according function. *REG* = 0 returns the current state of a function via *RETVAL*.

Busy = 1 monitors that the according function is in process.

RETVAL

After the execution of a function *RETVAL* returns a number code:

RETVAL = 0:	Function has been executed without errors
0 < *RETVAL* < 7000h:	*RETVAL* = Length of the transferred data (only SFC 211 and SFC 212)
7000h ≤ *RETVAL* < 8000h:	Monitors the execution state of the function
RETVAL ≥ 8000h:	Indicates an error that is described more detailed in the according SFC.

Attention!

For the access of the MMC you must regard the following hints. Nonobservance may cause data loss at the MMC:

- A max. of 4 Handle (0 ... 3) may be used at the same time!
- File names must follow the 8.3 format or special character!
- These SFCs only gives you access to the top directory level (Root directory) of the MMC!
- You may only rename or delete files that you've closed before with SFCs 210 FILE_CLO!

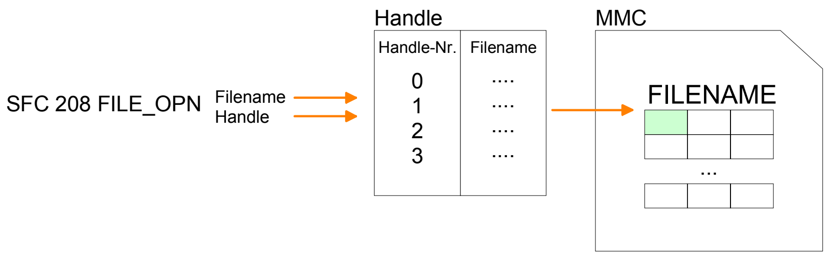
The following pages describe the according SFCs:

SFC 208 - FILE_OPN

Description

You may open a file on the MMC with SFC 208. Here a *HANDLE* is connected to a *FILENAME*. By using the *HANDLE* you now have read and write access to the file until you close the file again with the SFC 210 FILE_CLO. *REQ* = 1 initializes the function.

After the opening the read/write flag is at 0.



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
MEDIA	IN	INT	0 = MMC
FILENAME	IN	STRING[254]	Name of file (must be in 8.3 format)
HANDLE	IN	INT	Index of file 0 ... 3
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy

RETVAL (Return value)

Codes that are returned by *RETVAL*:

Code	Description
0000h	OK
7000h 7001h 7002h	*REQ* = 0, *BUSY* = 0 (nothing present) *REQ* = 1, 1. call Block is executed
8010h 8011h 8100h	Parameter *FILENAME* is not present (e.g. DB not loaded). Error *Filename* (not conform with 8.3 or special character). The defined *HANDLE* is not valid.
9001h 9002h 9003h	*Handle* is assigned to another file. Another function has been called via this *HANDLE* and is ready. Another function has been called via this *HANDLE* and is not ready.
A000h A001h A003h A004h A100h	System internal error occurred. The defined *MEDIA* type is not valid. A general error in the file system occurred. The in *FILENAME* defined file doesn't exist or is a directory. General file system error (e.g. no MMC plugged).

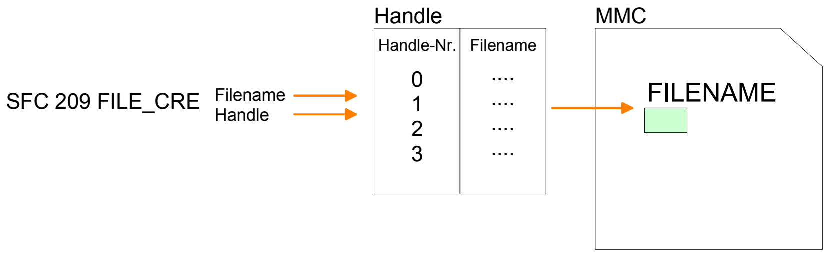
SFC 209 - FILE_CRE

Description

By using this block you may create a new file with the entered file name on the MMC (if plugged) and open it for read/write access.

Please regard that you may only create files at the top directory level.
REQ = 1 initializes the function.

After opening, the write /read flag is at 0.



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
MEDIA	IN	INT	0 = MMC
FILENAME	IN	STRING[254]	Name of file (must be in 8.3 format)
HANDLE	IN	INT	Index of file 0 ... 3
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy

RETVAL (Return value)

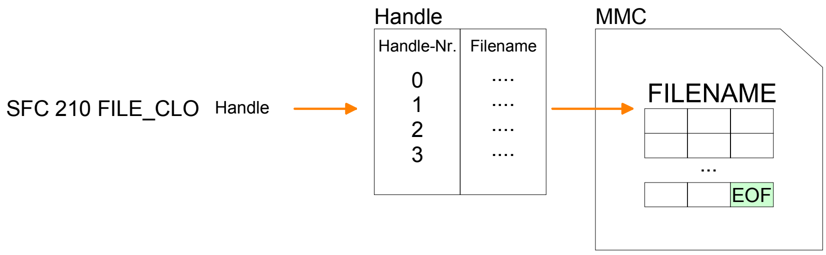
Codes that are returned by *RETVAL*:

Code	Description
0000h	OK
7000h 7001h 7002h	*REQ* = 0, *BUSY* = 0 (nothing present) *REQ* = 1, 1. call Block is executed.
8010h 8011h 8100h	Parameter *FILENAME* is not present (e.g. DB not loaded). Error *Filename* (not conform with 8.3 or special character). The defined *HANDLE* is not valid.
9001h 9002h 9003h	*HANDLE* is assigned to another file. Another function has been called via this *HANDLE* and is ready. Another function has been called via this *HANDLE* and is not ready.
A000h A001h A003h A004h A100h	System internal error occurred. The defined *MEDIA* type is not valid. A general error in the file system occurred. No root-entry is available in the directory. General file system error (e.g. no MMC plugged).

SFC 210 - FILE_CLO

Description

This block allows you to close an opened file. Here an EOF (**E**nd **o**f **F**ile) is added, the file is closed and the *HANDLE* released. *REQ* = 1 initializes the function.



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
HANDLE	IN	INT	Index of file 0 ... 3
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy

RETVAL (Return value)

Codes that are returned by *RETVAL*:

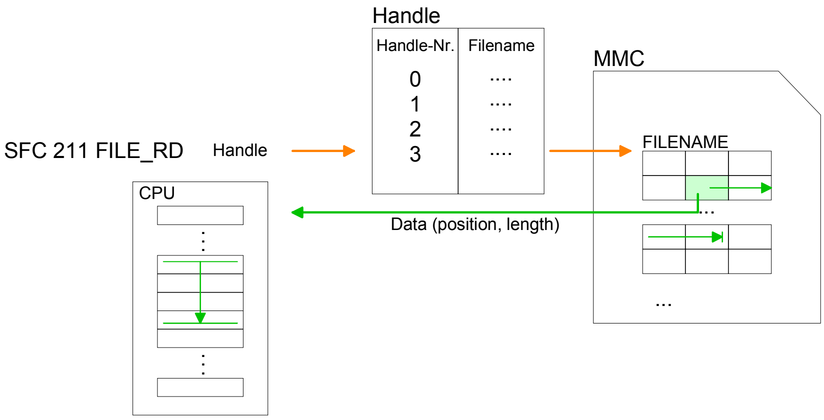
Code	Description
0000h	OK
7000h 7001h 7002h	*REQ* = 0, *BUSY* = 0 (nothing present) *REQ* = 1, 1. call Block is executed.
8100h	The defined *HANDLE* is invalid.
9001h 9002h 9003h	The *HANDLE* is not assigned to a file name. Another function has been called via this *Handle* and is ready. Another function has been called via this *Handle* and is not ready.
A000h A100h	System internal error occurred. General file system error (e.g. no MMC plugged).

SFC 211 - FILE_RD

Description

This allows you to transfer data from the MMC to the CPU via the opened *HANDLE* starting from an *ORIGIN* position (position of the read-/write flag). During every call you may transfer a max. of 512byte.

By setting of *DATA* you define storage place and length of the write area in the CPU. *REQ* = 1 initializes the function.



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
HANDLE	IN	INT	Index of file 0 ... 3
DATA	IN	ANY	Pointer to PLC memory and data length
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy

RETVAL (Return value)

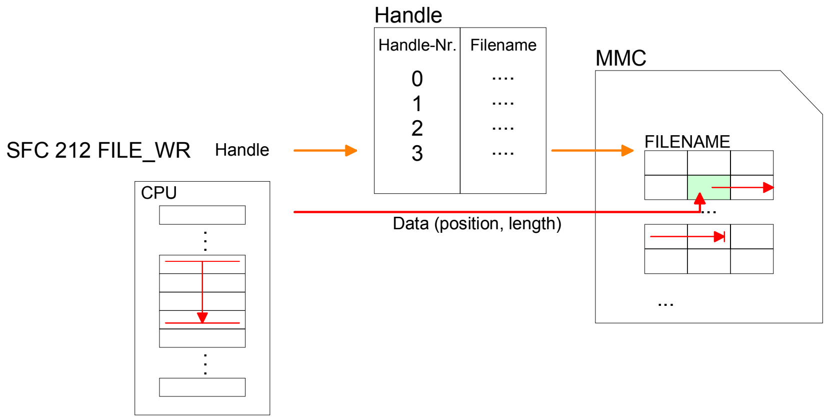
Codes that are returned by *RETVAL*:

Code	Description
0xxxh	0 = OK, 0xxx = Length of read data
7000h 7001h 7002h	*REQ* = 0, *BUSY* = 0 (nothing present) *REQ* = 1, 1. call Block is executed
8010h 8011h 8012h 8100h	Pointer in *DATA* has type BOOL Pointer in *DATA* cannot be decoded (e.g. DB not loaded) Data length exceeds 512Byte The defined *HANDLE* is not valid.
9001h 9002h 9003h	For this *HANDLE* no file is opened. Another function has been called via this *HANDLE* and is ready. Another function has been called via this *HANDLE* and is not ready.
A000h A003h A100h	System internal error occurred Internal error General file system error (e.g. no MMC plugged).

SFC 212 - FILE_WR

Description

Use this block for write access to the MMC. This writes data from the position and length of the CPU defined under *Data* to the MMC via the according *HANDLE* starting at the write/read position. During every call you may transfer a max. of 512byte. *REQ* = 1 initializes the function.



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
HANDLE	IN	INT	Index of file 0 ... 3
DATA	IN	ANY	Pointer to PLC memory and data length
RETVAL	OUT	WORD	Return value
BUSY	OUT	BOOL	Function is busy

The parameter *RETVAL* returns the length of the written data. The block doesn't announce an error message that the MMC is full. The user has to check himself if the number of the bytes to write corresponds to the number of written bytes returned by *RETVAL*.

RETVAL (Return value)

Codes that are returned by *RETVAL*:

Code	Description
0xxxh	0 = OK, 0xxx = Length of written data
7000h 7001h 7002h	*REQ* = 0, *BUSY* = 0 (nothing present) *REQ* = 1, 1. call Block is executed
8010h 8011h 8012h 8100h	Pointer in *DATA* has type BOOL. Pointer in *DATA* cannot be decoded (e.g. DB not loaded). Data length exceeds 512byte. The defined *HANDLE* is not valid.
9001h 9002h 9003h	For this *Handle* no file is opened. Another function has been called via this *HANDLE* and is ready. Another function has been called via this *HANDLE* and is not ready.
A000h A002h A003h A100h	System internal error occurred. File is write-protected. Internal error. General file system error (e.g. no MMC plugged).

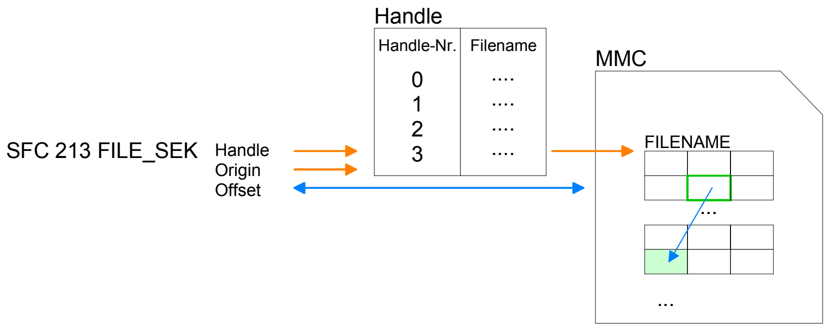
SFC 213 - FILE_SEK

Description

FILE_SEK allows you to detect res. alter the position of the write/read flag of the according *HANDLE*.

By setting *ORIGIN* as start position and an *OFFSET* you may define the write/read flag for the according *HANDLE*.

REQ = 1 starts the function.



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
HANDLE	IN	INT	Index of file 0 ... 3
ORIGIN	IN	INT	0 = file start, 1 = current position, 2 = file end
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy
OFFSET	INOUT	DINT	Offset write/read flag

RETVAL (Return value)

Codes that are returned by *RETVAL*:

Code	Description
0000h	OK, *OFFSET* contains the current write/read position
7000h 7001h 7002h	*REQ* = 0, *BUSY* = 0 (nothing present) *REQ* = 1, 1. call Block is executed.
8100h	The defined *HANDLE* is not valid.
9001h 9002h 9003h	For this *HANDLE* no file is opened. Another function has been called via this *HANDLE* and is ready. Another function has been called via this *HANDLE* and is not ready.
A000h A004h A100h	System internal error occurred. *ORIGIN* parameter is defective. General file system error (e.g. no MMC plugged).

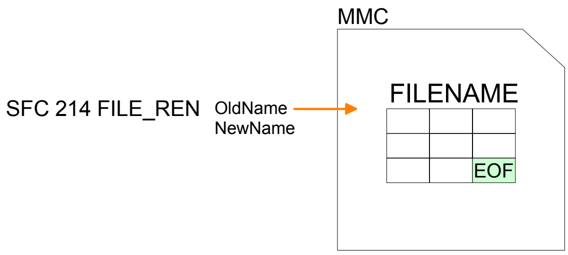
SFC 214 - FILE_REN

Description

Using FILE_REN you may alter the file name defined in *OLDNAME* to the file name that you type in *NEWNAME*.

Attention!

Please regard that you may only rename files that you've closed before with FILE_CLO. Nonobservance may cause data loss at the MMC!



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
MEDIA	IN	INT	0 = MMC
OLDNAME	IN	STRING[254]	Old name of file (must be in 8.3 format)
NEWNAME	IN	STRING[254]	New name of file (must be in 8.3 format)
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy.

RETVAL (Return value)

Codes that are returned by *RETVAL*:

Code	Description
0000h	OK, file has been renamed
7000h	*REQ* = 0, *BUSY* = 0 (nothing present)
7001h	*REQ* = 1, 1. call
7002h	Block is executed
8010h	Parameter *OLDNAME* is not present (e.g. DB not loaded)
8011h	Error *OLDNAME* (not conform with 8.3 format or special character)
8020h	Parameter *NEWNAME* is not present (e.g. DB not loaded)
8021h	Error *NEWNAME* (not conform with 8.3 format or special character)
A000h	System internal error occurred
A001h	The defined *MEDIA* type is not valid
A003h	The new filename *NEWNAME* already exists
A004h	File *OLDNAME* is not found
A006h	File *OLDNAME* is just open
A100h	File system returns error at creation of the file (e.g. no MMC plugged)

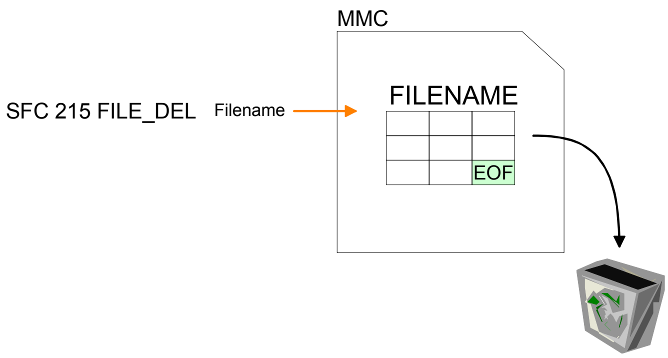
SFC 215 - FILE_DEL

Description

This block allows you to delete a file at the MMC. For this, type the file name of the file to delete under *FILENAME*.

Attention!

Please regard that you may only delete files that you've closed before with FILE_CLO. Nonobservance may cause data loss at the MMC!



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
MEDIA	IN	INT	0 = MMC
FILENAME	IN	STRING[254]	Name of file (must be in 8.3 format)
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy.

RETVAL (Return value)

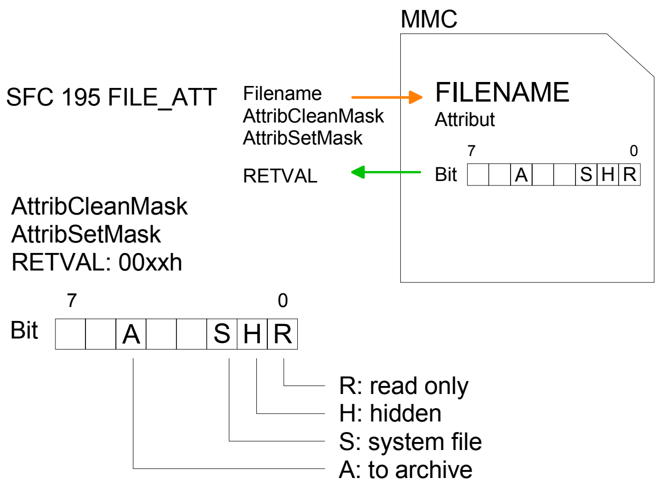
Codes that are returned by *RETVAL*:

Code	Description
0000h	OK, file has been deleted
7000h	*REQ* = 0, *BUSY* = 0 (nothing present)
7001h	*REQ* = 1, 1. call
7002h	Block is executed
8010h	Parameter *FILENAME* is not available (e.g. DB not loaded)
8011h	*FILENAME* is defective (e.g. is not conform with 8.3 format or special character)
A000h	System internal error occurred
A001h	The defined *MEDIA* type is not valid
A002h	The file is write-protected
A004h	File *FILENAME* is not found
A005h	*FILENAME* is a directory - you can't delete
A006h	File is just open
A100h	General file system error (e.g. no MMC plugged)

SFC 195 - FILE_ATT

Description

In the root directory of the MMC the file attributes may be changed by FILE_ATT.
Here enter a file name. The corresponding attributes may be reset with *AttribCleanMask* respectively set with *AttribSetMask* by given bit pattern. Setting takes priority over resetting.
After job execution the current state of the attributes is returned with RETVAL 00xxh. For determination of the current file attributes by RETVAL, the parameters *AttribCleanMask* and *AttribSetMask* may be set to value 00h.



Parameters

Parameter	Declaration	Data type	Description
REQ	IN	BOOL	Activate function
MEDIA	IN	INT	0 = MMC
FILENAME	IN	STRING[254]	Name of file (must be in 8.3 format)
ATTRIBCLEANMASK	IN	BYTE	Bit pattern of attributes to clean
ATTRIBSETMASK	IN	BYTE	Bit pattern of attributes to set
RETVAL	OUT	WORD	Return value (00xxh=OK with xx: attributes)
BUSY	OUT	BOOL	Function is busy

RETVAL
(Return value)

Return codes of *RETVAL*:

Code	Description
00xxh	OK, attributes have been changed with xx: attributes
7000h	*REQ* = 0, *BUSY* = 0 (nothing present)
7001h	*REQ* = 1, 1. call
7002h	Block is executed
A001h	The defined *MEDIA* type is not valid
A002h	Error in parameter *ATTRIBSETMASK*
A004h	File *FILENAME* is not found
A005h	*FILENAME* is a directory
A006h	File is just open
A010h	File error *FILENAME*
A100h	General file system error (e.g. no MMC plugged)

PtP communication - SFC 216...218

Overview

You may de-activate the DP master integrated in the SPEED7-CPU via a hardware configuration using *Object properties* and the parameter "Function RS485". and thus release the RS485 interface for PtP (**p**oint-**t**o-**p**oint) communication.

The RS485 interface supports in PtP operation the serial process connection to different source res. destination systems.

Parameterization

The parameterization happens during runtime using the SFC 216 (SER_CFG). For this you have to store the parameters in a DB for all protocols except ASCII.

Communication

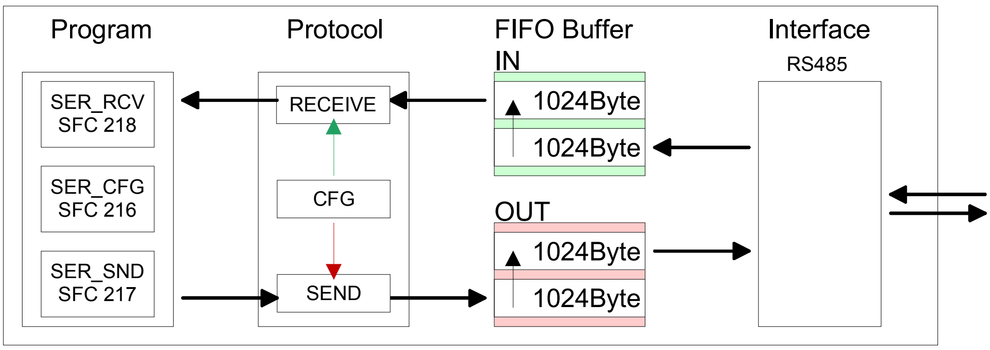
Data, which are written into the according data channel by the PLC, is stored in a FIFO send buffer (**f**irst **i**n **f**irst **o**ut) with a size of 2x1024byte and then put out via the interface.

When the interface receives data, this is stored in a FIFO receive buffer with a size of 2x1024byte and can there be read by the PLC.

If the data is transferred via a protocol, the adoption of the data to the according protocol happens automatically. In opposite to ASCII and STX/ETX, the protocols 3964R, USS and Modbus require the acknowledgement of the partner.

An additional call of the SFC 217 SER_SND causes a return value in *RETVAL* that includes among others recent information about the acknowledgement of the partner.
Further on for USS and Modbus after a SER_SND the acknowledgement telegram must be evaluated by call of the SFC 218 SER_RCV.

RS485 PtP communication



Overview SFCs for serial communication

The following SFCs are used for the serial communication:

SFC		Description
SFC 216	SER_CFG	RS485 parameterize
SFC 217	SER_SND	RS485 send
SFC 218	SER_RCV	RS485 receive

SFC 216 - SER_CFG

Description

The parameterization happens during runtime deploying the SFC 216 (SER_CFG). You have to store the parameters for STX/ETX, 3964R, USS and Modbus in a DB.

Parameters

Parameter	Declaration	Data type	Description
PROTOCOL	IN	BYTE	1=ASCII, 2=STX/ETX, 3=3964R
PARAMETER	IN	ANY	Pointer to protocol-parameters
BAUDRATE	IN	BYTE	Number of baudrate
CHARLEN	IN	BYTE	0=5Bit, 1=6Bit, 2=7Bit, 3=8Bit
PARITY	IN	BYTE	0=Non, 1=Odd, 2=Even
STOPBITS	IN	BYTE	1=1Bit, 2=1.5Bit, 3=2Bit
FLOWCONTROL	IN	BYTE	1 (fix)
RETVAL	OUT	WORD	Return value (0 = OK)

All time settings for timeouts must be set as hexadecimal value. Find the Hex value by multiply the wanted time in seconds with the baudrate.

Example: Wanted time 8ms at a baudrate of 19200Baud

Calculation: 19200bit/s x 0.008s ≈ 154bit → (9Ah)

Hex value is 9Ah.

PROTOCOL

Here you fix the protocol to be used. You may choose between:

1: ASCII
2: STX/ETX
3: 3964R
4: USS Master
5: Modbus RTU Master
6: Modbus ASCII Master

PARAMETER (as DB)

At ASCII protocol, this parameter is ignored.

At STX/ETX, 3964R, USS and Modbus you fix here a DB that contains the communication parameters and has the following structure for the according protocols:

Data block at STX/ETX

DBB0:	STX1	BYTE	(1. Start-ID in hexadecimal)
DBB1:	STX2	BYTE	(2. Start-ID in hexadecimal)
DBB2:	ETX1	BYTE	(1. End-ID in hexadecimal)
DBB3:	ETX2	BYTE	(2. End-ID in hexadecimal)
DBW4:	TIMEOUT	WORD	(max. delay time between 2 telegrams in a time window of 10ms)

Note!

The start res. end sign should always be a value <20, otherwise the sign is ignored!

With not used IDs please always enter FFh!

Data block at 3964R

DBB0:	Prio	BYTE	(The priority of both partners must be different)
DBB1:	ConnAttmptNr	BYTE	(Number of connection trials)
DBB2:	SendAttmptNr	BYTE	(Number of telegram retries)
DBW4:	CharTimeout	WORD	(Char. delay time in 10ms time window)
DBW6:	ConfTimeout	WORD	(Acknowledgement delay time in 10ms time window)

Data block at USS

DBW0:	Timeout	WORD	(Delay time in 10ms time grid)

Data block at Modbus-Master

DBW0:	Timeout	WORD	(Respond delay time in 10ms time grid)

BAUD RATE

Velocity of data transfer in Bit/s (Baud).

04h: 1200Baud	05h: 1800Baud	06h: 2400Baud	07h: 4800Baud
08h: 7200Baud	09h: 9600Baud	0Ah: 14400Baud	0Bh: 19200Baud
0Ch: 38400Baud	0Dh: 57600Baud	0Eh: 115200Baud	

CHARLEN

Number of data bits where a character is mapped to.

0: 5bit 1: 6bit 2: 7bit 3: 8bit

PARITY

The parity is -depending on the value- even or odd. For parity control, the information bits are extended with the parity bit, that amends via its value ("0" or "1") the value of all bits to a defined status. If no parity is set, the parity bit is set to "1", but not evaluated.

0: NONE 1: ODD 2: EVEN

STOPBITS

The stop bits are set at the end of each transferred character and mark the end of a character.

1: 1bit 2: 1.5bit 3: 2bit

FLOWCONTROL

The parameter *FLOWCONTROL* is ignored. When sending RTS=1, when receiving RTS=0.

RETVAL SFC 216 (Return values)

Return values send by the block:

Error code	Description
0000h	no error
809Ah	interface not found e. g. interface is used by PROFIBUS
8x24h	Error at SFC-Parameter x, with x: 1: Error at *PROTOCOL* 2: Error at *PARAMETER* 3: Error at *BAUDRATE* 4: Error at *CHARLENGTH* 5: Error at *PARITY* 6: Error at *STOPBITS* 7: Error at *FLOWCONTROL*
809xh	Error in SFC parameter value x, where x: 1: Error at *PROTOCOL* 3: Error at *BAUDRATE* 4: Error at *CHARLENGTH* 5: Error at *PARITY* 6: Error at *STOPBITS* 7: Error at *FLOWCONTROL*
8092h	Access error in parameter DB (DB too short)
828xh	Error in parameter x of DB parameter, where x: 1: Error 1. parameter 2: Error 2. parameter ...

SFC 217 - SER_SND

Description

This block sends data via the serial interface.

The repeated call of the SFC 217 SER_SND delivers a return value for 3964R, USS and Modbus via *RETVAL* that contains, among other things, recent information about the acknowledgement of the partner station.

The protocols USS and Modbus require to evaluate the receipt telegram by calling the SFC 218 SER_RCV after SER_SND.

Parameters

Parameter	Declaration	Data type	Description
DATAPTR	IN	ANY	Pointer to Data Buffer for sending data
DATALEN	OUT	WORD	Length of data sent
RETVAL	OUT	WORD	Return value (0 = OK)

DATAPTR

Here you define a range of the type Pointer for the send buffer where the data to be sent are stored. You have to set type, start and length.

Example: Data is stored in DB5 starting at 0.0 with a length of 124byte.

DataPtr:=P#DB5.DBX0.0 BYTE 124

DATALEN

Word where the number of the sent Bytes is stored.

At **ASCII** if data were sent by means of SFC 217 faster to the serial interface than the interface sends, the length of data to send could differ from the *DATALEN* due to a buffer overflow. This should be considered by the user program.

With **STX/ETX**, **3964R**, **Modbus** and **USS** always the length set in *DATAPTR* is stored or 0.

RETVAL SFC 217 (Return values)

Return values of the block:

Error code	Description
0000h	Send data - ready
1000h	Nothing sent (data length 0)
20xxh	Protocol executed error free with xx bit pattern for diagnosis
7001h	Data is stored in internal buffer - active (busy)
7002h	Transfer - active
80xxh	Protocol executed with errors with xx bit pattern for diagnosis (no acknowledgement by partner)
90xxh	Protocol not executed with xx bit pattern for diagnosis (no acknowledgement by partner)
8x24h	Error in SFC parameter x, where x:
	1: Error in *DATAPTR*
	2: Error in *DATALEN*
8122h	Error in parameter *DATAPTR* (e.g. DB too short)
807Fh	Internal error
809Ah	interface not found e.g. interface is used by PROFIBUS
809Bh	interface not configured

Protocol specific RETVAL values

ASCII

Value	Description
9000h	Buffer overflow (no data send)
9002h	Data too short (0byte)

STX/ETX

Value	Description
9000h	Buffer overflow (no data send)
9001h	Data too long (>1024byte)
9002h	Data too short (0byte)
9004h	Character not allowed

3964R

Value	Description
2000h	Send ready without error
80FFh	NAK received - error in communication
80FEh	Data transfer without acknowledgement of partner or error at acknowledgement
9000h	Buffer overflow (no data send)
9001h	Data too long (>1024byte)
9002h	Data too short (0byte)

... Continue RETVAL SFC 217

USS

Error code	Description
2000h	Send ready without error
8080h	Receive buffer overflow (no space for receipt)
8090h	Acknowledgement delay time exceeded
80F0h	Wrong checksum in respond
80FEh	Wrong start sign in respond
80FFh	Wrong slave address in respond
9000h	Buffer overflow (no data send)
9001h	Data too long (>1024byte)
9002h	Data too short (<2byte)

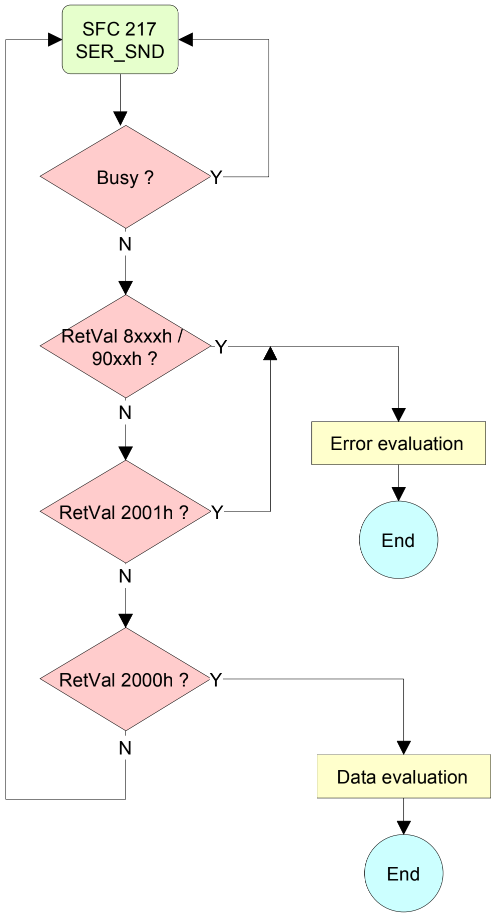
Modbus RTU/ASCII Master

Error code	Description
2000h	Send ready (positive slave respond)
2001h	Send ready (negative slave respond)
8080h	Receive buffer overflow (no space for receipt)
8090h	Acknowledgement delay time exceeded
80F0h	Wrong checksum in respond
80FDh	Length of respond too long
80FEh	Wrong function code in respond
80FFh	Wrong slave address in respond
9000h	Buffer overflow (no data send)
9001h	Data too long (>1024byte)
9002h	Data too short (<2byte)

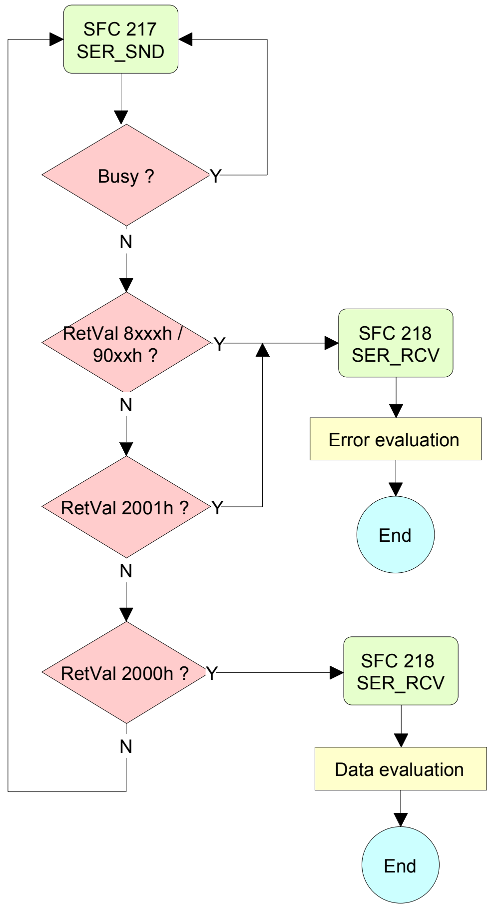
Principles of programming

The following text shortly illustrates the structure of programming a send command for the different protocols.

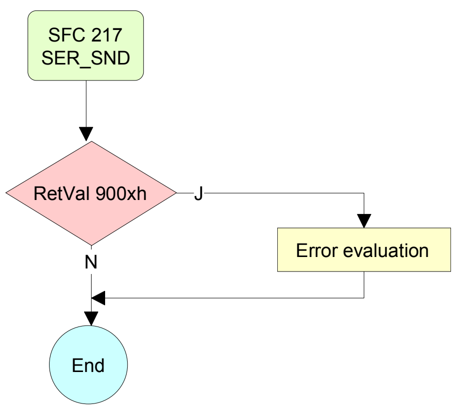
3964R



USS / Modbus



ASCII / STX/ETX



SFC 218 - SER_RCV

Description

This block receives data via the serial interface.

Using the SFC 218 SER_RCV after SER_SND with the protocols USS and Modbus the acknowledgement telegram can be read.

Parameters

Parameter	Declaration	Data type	Description
DATAPTR	IN	ANY	Pointer to Data Buffer for received data
DATALEN	OUT	WORD	Length of received data
ERROR	OUT	WORD	Error Number
RETVAL	OUT	WORD	Return value (0 = OK)

DATAPTR

Here you set a range of the type Pointer for the receive buffer where the reception data is stored. You have to set type, start and length.

Example: Data is stored in DB5 starting at 0.0 with a length of 124byte.
DataPtr:=P#DB5.DBX0.0 BYTE 124

DATALEN

Word where the number of received Bytes is stored.

At **STX/ETX** and **3964R**, the length of the received user data or 0 is entered.

At **ASCII**, the number of read characters is entered. This value may be different from the read telegram length.

ERROR

This word gets an entry in case of an error. The following error messages may be created depending on the protocol:

ASCII

Bit	Error	Description
0	overrun	Overflow, a sign couldn't be read fast enough from the interface
1	framing error	Error that shows that a defined bit frame is not coincident, exceeds the allowed length or contains an additional Bit sequence (Stop bit error)
2	parity	Parity error
3	overflow	Buffer is full

STX/ETX

Bit	Error	Description
0	overflow	The received telegram exceeds the size of the receive buffer.
1	char	A sign outside the range 20h ... 7Fh has been received.
3	overflow	Buffer is full.

3964R / Modbus RTU/ASCII Master

Bit	Error	Description
0	overflow	The received telegram exceeds the size of the receive buffer.

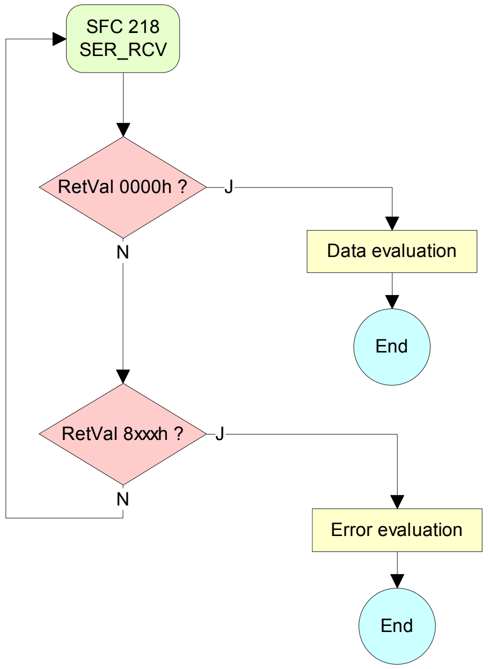
RETVAL SFC 218 (Return value)

Return values of the block:

Error code	Description
0000h	no error
1000h	Receive buffer too small (data loss)
8x24h	Error at SFC-Parameter x, with x: 1: Error at *DATAPTR* 2: Error at *DATALEN* 3: Error at *ERROR*
8122h	Error in parameter *DATAPTR* (e.g. DB too short)
809Ah	Serial interface not found res. interface is used by PROFIBUS
809Bh	Serial interface not configured

Principles of programming

The following picture shows the basic structure for programming a receive command. This structure can be used for all protocols.



SFC 219 - CAN_TLGR - CANopen communication

SFC 219 CAN_TLGR SDO request to CAN master

Every SPEED7-CPU provides the integrated SFC 219. This allows you to initialize a SDO read or write access from the PLC program to the CAN master.

For this you address the master via the slot number and the destination slave via its CAN address. The process data is defined by the setting of *INDEX* and *SUBINDEX*. Via SDO per each access a max. of one data word process data can be transferred.

Parameters

Parameter	Declaration	Data type	Description
REQUEST	IN	BOOL	1 = Activate function
SLOT_MASTER	IN	BYTE	SPEED-Bus slot (101 ... 116)
NODEID	IN	BYTE	CAN address (1 ... 127)
TRANSFERTYPE	IN	BYTE	Type of transfer
INDEX	IN	DWORD	CANopen index
SUBINDEX	IN	DWORD	CANopen sub index
CANOPENERROR	OUT	DWORD	CANopen error
RETVAL	OUT	WORD	Return value (0 = OK)
BUSY	OUT	BOOL	Function is busy
DATABUFFER	INOUT	ANY	Data Buffer for SFC communication

REQUEST

Control parameter: 1: Initialization of the order

SLOT_MASTER

101...116: slot 1 ... 16 from master at SPEED-Bus

NODELD

Address of the CANopen node (1...127)

TRANSFERTYPE

40h: Read SDO

23h: Write SDO (1 DWORD)
2Bh: Write SDO (1 WORD)
2Fh: Write SDO (1 BYTE)

INDEX

CANopen Index

SUBINDEX

CANopen Sub index

SLOT_MASTER

0:	System 200 CPU 21xCAN
1 ... 32:	System 200 IM 208CAN
101 ... 115:	System 300S 342-1CA70

CANOPENERROR When no error occurs, *CANOPENERROR* returns 0.

In case of an error *CANOPENERROR* contains one of the following error messages that are created by the CAN master:

Code	Description
05030000h	Toggle Bit not alternated
05040000h	SDO Time out value reached
05040001h	Client/server command specify not valid, unknown
05040002h	Invalid block size (only block mode)
05040003h	Invalid sequence number (only block mode)
05040004h	CRC error (only block mode)
05040005h	Insufficient memory
06010000h	Attempt to read a write only object
06010001h	Attempt to write a write only object
06020000h	Object does not exist in the object dictionary
06040041h	Object cannot be mapped to the PDO
06040042h	The number and length of the objects to be mapped would exceed PDO length.
06040043h	General parameter incompatibility reason
06040047h	General internal incompatibility reason in the device
06060000h	Access failed because of an hardware error
06070010h	Data type does not match, length of service parameter does not match.
06070012h	Data type does not match, length of service parameter exceeded.
06070013h	Data type does not match, length of service parameter shortfall.
06090011h	Sub index does not exist
06090030h	value range of parameter exceeded (only for write access)
06090031h	Value of parameter written too high
06090032h	Value of parameter written too low
06090036h	Maximum value is less than minimum value
08000000h	General error
08000020h	Data cannot be transferred or stored to the application.
08000021h	Data cannot be transferred or stored to the application because of local control.
08000022h	Data cannot be transferred or stored to the application because of the present device state.
08000023h	Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated from file and generation fails because of an file error.)

RETVAL

When the function has been executed without error, the return value contains the valid length of the response data: 1: BYTE, 2: WORD, 4: DWORD.

If an error occurs during execution, the return value contains one of the following error codes.

Code	Description
F021h	Invalid slave address (call parameter equal 0 or higher 127)
F022h	Invalid transfer type (value not equal to 40h, 23h, 2Bh, 2Fh)
F023h	Invalid data length (data buffer too small, at SDO read access this should be at least 4 Byte, at SDO write access at least 1Byte, 2Byte or 4 Byte).
F024h	SFC is not supported.
F025h	Write buffer in CANopen master overflow, service cannot be processed at this time.
F026h	Read buffer in CANopen master overflow, service cannot be processed at this time.
F027h	SDO read or write access with defective response, see CANopen Error Codes.
F028h	SDO timeout (no CANopen station with this node-ID found).

BUSY

As long as *BUSY* = 1, the current order is not finished.

DATABUFFER

Data area via that the SFC communicates. Set here an ANY pointer of the type Byte.

SDO read access: Destination area for the read user data.

SDO write access: Source area for the user data to write.

Note!

When the SDO request has been executed without errors, *RETVAL* contains the length of the valid response data (1, 2 or 4 byte) and *CANOPENERROR* the value 0.

SFC 254 - RW_SBUS - IBS communication

Description

This block serves the INTERBUS-FCs 20x as communication block between INTERBUS master and CPU. For the usage of the INTERBUS-FCs 20x the
SFC 254 must be included in your project as block.

Parameters

Name	Declaration	Type	Description
READ/WRITE	IN	Byte	0 = Read, 1 = Write
LADDR	IN	WORD	Logical Address of INTERBUS master
IBS_ADDR	IN	WORD	Address at INTERBUS Master
DATAPOINTER	IN	ANY	Pointer to PLC data
RETVAL	OUT	WORD	Return value (0 = OK)

READ/WRITE

This defines the transfer direction seen from the CPU. Read reads the data from the Dual port memory of the INTERBUS master.

LADDR

Enter the address (**L**ogical **Addr**ess) from where on the register of the master is mapped in the CPU. At the start-up of the CPU, the INTERBUS master are stored in the I/O address range of the CPU following the shown formula if no hardware configuration is present:

Start address = 256· (slot-101)+2048

The slot numbers at the SPEED-Bus start with 101 at the left side of the CPU and raises from the right to the left. For example the 1. slot has the address 2048, the 2. the address 2304 etc.

IBS_ADDR

Address in the address range of the INTERBUS master.

DATAPOINTER

Pointer to the data area of the CPU.

RETVAL

Value that the function returns. 0 means OK.

Chapter 7 System Status List SSL

Overview

This chapter describes all the partial lists of the system status list, readable via SFC 51 RDSYSST or via Hardware configurator.

Content

Overview SSL

SSL

The SSL (**s**ystem **s**tatus **l**ist) describes the current status of a automation system. It contains the following information:

- *System data*
  These are fixed or assigned characteristics data of a CPU as configuration of the CPU, status of the priority classes and communication.
- *Module status data in the CPU*
  This describes the current status of the components monitored by system diagnostic functions.
- *Diagnostics data*
  The diagnostics data of modules with diagnostic capabilities assigned to the CPU.
- *Diagnostics buffer*
  Diagnostic entries of the diagnostic buffer in the order in which they occur.

SSL partial list

Only partial lists of the SSL may be accessed. The partial lists are virtual list, this means, they are only created by the operating system of the CPUs when specifically requested and my only be read.

A partial list or a list extract may be read e.g. by means of the SFC 51 RDSYSST. Here with the parameters SSL_ID and INDEX you define the kind of information to read.

A partial list always has the following structure:

- Header
  - SSL-ID
  - Index
  - Length of the record set in byte
  - Number of record sets of the partial list
- Record sets
  A record set of a partial list has a certain length, depending on the information of the partial list. It depends on the partial list as the data words are used in a record set.

SSL-ID

The SSL-ID has the following structure:

<table>
<tr><td></td><td colspan="16">SSL-ID</td></tr>
<tr><td></td><td colspan="8">High byte</td><td colspan="8">Low byte</td></tr>
<tr><td>Bit number</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td colspan="4">Module class:
CPU: 0000
IM: 0100
FM: 1000
CP: 1100</td><td colspan="4">Number of the partial list extract:
Definition of the subset of the partial list</td><td colspan="8">Number of the partial list:
Definition of the partial list of the SSL</td></tr>
</table>

Overview - SSL partial lists

SSL partial lists

In the following all the possible SSL partial lists with additional SSL-ID are listed, which are supported by the SPEED7 system.

SSL partial lists, which are only for internal usage, are no more described.

SSL partial list	SSL-ID
Module identification	xy11h
CPU characteristics	xy12h
User memory areas	xy13h
System areas	xy14h
Identification components	xy1Ch
Interrupt status	xy22h
Communication: status data	xy32h
Status of the LEDs	xy74h
Status information CPU	xy91h
Stations status information	xy92h
Diagnostic buffer of the CPU	xyA0h
Module diagnostic information (record set 0)	xyB1h
Module diagnostic information (record set 1) via physical address	xyB2h
Module diagnostic information (record set 1) via logical address	xyB3h
Diagnostic data of a DP slave	xyB4h

Module Identification - SSL-ID: xy11h

Description

With the SSL-ID xy11h you obtain the module identification data of you module.

Parameters

SSL_ID	INDEX	Description
0011h	-	All identification data
0111h	 0001h 0006h 0007h	Selection of the identification data: Identification data of the module Identification data of the basic hardware Identification data of the basic firmware
0E11h	-	Identification data record set 8

LENTHDR	One record set is 14words long (28bytes).
N_DR	Number of record sets

Record set *SSL_ID*: xy11h

Name	Length	Description
index	1word	Number of a identification record set
mlfb	20byte	• With INDEX 0007h: reserved • With INDEX 0001h and 0006h: Order number (MlfB) of the module; string consists of 19 characters and a blank (20h)
bgtyp	1word	reserved
ausbg1	1word	• With INDEX 0001h: Version of the module • With INDEX 0006h and 0007h: "V" and the 1. number of the version ID
ausbg2	1word	• With INDEX 0001h: reserved • With INDEX 0006h and 0007h: remaining numbers of the version ID

CPU Characteristics - SSL-ID: xy12h

Description

Here you can determine the hardware-specific characteristics of your CPU by specifying the appropriate feature code.

Parameters

SSL_ID	INDEX	Description
0012h	-	All CPU characteristics
0112h		CPU characteristics of one group:
	0000h	MC7 processing unit
	0100h	Time system
	0200h	System response
	0300h	MC7 language description of the CPU
0E11h	0F12h	SSL partial list header information

LENTHDR	One record set is 1word long (2bytes).
N_DR	Number of record sets

Record set

SSL_ID: 0012h

All record sets of the CPU characteristics relevant for your CPU are listed. They follow completely one behind the other. One record set is 1word long. For each feature there is an ID. This ID is 1word long.

You will find the list of the characteristics IDs on the following page.

SSL_ID: 0112h

All data records relevant for the group are listed. They follow completely one behind the other.

Characteristics identifier

Identifier	Description
0000h - 00FFh	**MC7 processing unit**
0001h	MC7 processing generating code
0002h	MC7 interpreter
0100h - 01FFh	**Time system**
0101h	1ms resolution
0102h	10ms resolution
0103h	no real time clock
0104h	BCD time-of-day format
0105h	all time-of-day functions (set time-of-day, set and read time-of-day, time-of-day synchronization: time-of-day slave and time-of-day master)
0200h - 02FFh	**System response**
0201h	Capable of multiprocessor mode
0202h	Cold restart, warm restart and hot restart possible
0203h	Cold restart and hot restart possible
0204h	Warm restart and hot restart possible
0205h	Only warm restart possible
0206h	New distributed I/O configuration is possible during RUN by using predefined resources.
0208h	For taking motion control functionality into account
0300h - 03FFh	**MC7 language description of the CPU**
0301h	reserved
0302h	all 32 bit fixed-point instructions
0303h	all floating-point instructions
0304h	sin, asin, cos, acos, tan, atan, sqr, sqrt, in, exp
0305h	ACCU3/ACCU4 with corresponding instructions (ENT, PUSH, POP, LEAVE)
0306h	Master Control Relay instructions
0307h	Addr. reg. 1 exists with corresponding instructions
0308h	Addr. reg. 2 exists with corresponding instructions
0309h	Operations for area-crossing addressing
030Ah	Operations for area-internal addressing
030Bh	all memory-indirect addressing instructions via M
030Ch	all memory-indirect addressing instructions via DB
030Dh	all memory-indirect addressing instructions via DI
030Eh	all memory-indirect addressing instructions for L
030Fh	all instructions for parameter transfer in FCs
0310h	Memory bit edge instructions via I
0311h	Memory bit edge instructions via Q
0312h	Memory bit edge instructions via M
0313h	Memory bit edge instructions via DB
0314h	Memory bit edge instructions via DI
0315h	Memory bit edge instructions via L
0316h	Dynamic evaluation of the FC bits
0317h	Dynamic local data area with the corresponding instructions
0318h	reserved
0319h	reserved

Memory Areas - SSL-ID: xy13h

Description

With the partial list with the SSL-ID xy13h you obtain information about the memory areas of the CPU.

Parameters

SSL_ID	INDEX	Description
0013h	-	Record sets for any memory areas

LENTHDR	One record set is 18words long (36byte).
N_DR	Number of record sets

Record set *SSL_ID*: xy13h

Name	Length	Description
index	1word	Not relevant
code	1word	Type of memory: 0001h: volatile memory (RAM) 0006h: non volatile memory (RAM) 0007h: mixed memory (RAM and EPROM)
size	2words	Total size of the selected memory (total of area Ber1 and Ber2)
mode	1word	Logical mode of the memory: Bit 0: RAM Bit 1: EPROM Bit 2: RAM and EPROM For work memory: Bit 3: Code and data separated Bit 4: Code and data together
granu	1word	0 (fix)
ber1	2words	Size of the RAM in byte.
belegt1	2words	Size of the RAM being used.
block1	2words	Largest free block in the RAM "0": no information available or cannot be determined.
ber2	2words	Size of the EPROM in byte.
belegt2	2words	Size of the EPROM being used.
block2	2words	Largest free block in the EPROM "0":no information available or cannot be determined.

System areas - SSL-ID: xy14h

Description

If you read the partial list with SSL-ID xy14h, you obtain information about the system areas of the CPU.

Parameters

SSL_ID	INDEX	Description
0014h	-	All system areas of a CPU
0F14h	-	SSL partial list header information

LENTHDR	One record set is 4words long (8byte)
N_DR	Number of record sets You must at least assign a number of 9 record sets. If you select a target area, which is too small, the SFC 51 RDSYSST does not provide a record set.

Record set *SSL_ID*: xy14h

Name	Length	Description
index	1word	Index of the system area 0001h: PII (quantity in byte) 0002h: PIQ (quantity in byte) 0004h: Timers (quantity) 0005h: Counters (quantity) 0006h: Quantity of bytes in the logical address area. 0007h: Local data (entire local data area of the CPU in byte) 0008h: Memory (number in bytes)
code	1word	Memory type: 0001h: RAM 0002h: EPROM
quantity	1word	Number of elements of the system area defined by *Index*.
remain	1word	Number of retentive elements defined by *Index*.

Component Identification - SSL-ID: xy1Ch

Description

If you read the partial list you can identify the CPU or the automation system.

Parameters

SSL_ID	INDEX	Description
001Ch	-	Identification of all components
011Ch	 0001h 0002h 0003h 0005h 0006h 0007h 0008h	Identification of one components: Name of the automation system Name of the module Plant identification of the module Serial number of the module OD of the CPU (always "0") Module type name Serial number of the MCC
011Ch	00FFh	CID of the MCC (only at *SZL_ID* x11Ch)
021Ch		reserved
031Ch		reserved
0F1Ch	-	SSL partial list header information

LENTHDR	A record set is 17words long (34byte).
N_DR	Number of record sets

Record set

A record set of the partial list with *SSL_ID*: 011Ch has the following structure:

INDEX	Name	Length	Description
0001h	index	1word	Index of the component: 0001h
	name	12words	Name of the automation system (max. 24 characters) *
	res	4words	reserved
0002h	index	1word	Index of the component: 0002h
	name	12words	Name of the module (max. 24 characters) *
	res	4words	reserved
0003h	index	1word	Index of the component: 0003h
	tag	16words	Plant identification of the module(max. 32 characters) *
	res	4words	reserved
0005h	index	1word	Index of the component: 0005h
	serialn	12words	Serial number of the module (max. 24 characters) *
	res	3words	reserved
0007h	index	1word	Index of the component: 0007h
	cputypname	16words	Module type name as character string (max. 32 characters) *
0008h	index	1word	Index of the component: 0008h
	sn_mcc	16words	Serial number of the MCC (max. 32 characters) *. The string ends immediately after "MMC" if no MCC is installed.
00FFh	index	1word	Index of the component: 00FFh
	cid	16words	CID of the MCC

*) If names and designations are shorter than the corresponding max. characters, the gaps are filled with 00h.

Interrupt Status - SSL-ID: xy22h

Description

This partial list contains information about the current status of interrupt processing and interrupt generation in the module.

Parameters

SSL_ID	INDEX	Description
0222h		Record set on the specified interrupt. The interrupt class is to be specified via INDEX.
	0000h	Free cycle
	000Ah	Time-of-day interrupt
	0014h	Time-delay interrupt
	001Eh	Cyclic interrupt
	0028h	Hardware interrupt
	0032h	DP interrupt
	0050h	Asynchronous error interrupt
	0064h	Startup
	0078h	Synchronous error interrupt
	00FFh	Manufacturer Specific Interrupt (OB 57)

LENTHDR	A record set is 14words long (28bytes).
N_DR	Number of record sets

Record set *SSL_ID*: xy22h

Name	Length	Description
info	10words	Start info for the given OB, with following exceptions: • OB 1 provides the current minimum (in bytes 8 and 9) and maximum cycle time (in bytes 10 and 11) (time base: ms, byte count begins at 0). • When a job is active for a time-delay interrupt, bytes 8 ... 11 (byte count begins at) get the remaining time in ms left of the delay time set as a parameter. • OB 80 contains the configured minimum (in bytes 8 and 9) and maximum cycle time (in bytes 10 and 11) (time base: ms, byte count begins at 0). • Error interrupts without the current information. • Interrupts contain the status info from the current parameter settings of the interrupt source. • In the case of synchronous errors, the priority class entered is 7Fh if the OBs were not yet processed; otherwise, the priority class of the last call. • If an OB has several start events and these have not yet occurred at the information time, then event no. xyzzh is returned with x: event class, y: undefined. zz: smallest defined number in the group, Otherwise, the number of the last start event that occurred is used.

continued ...

... continue

Name	Length	Description
al 1	1word	Processing identifiers: Bit 0: Interrupt event is caused by parameters: 0: enabled 1: disabled Bit 1: Interrupt event as per SFC 39 DIS_IRT 0: not locked 1: locked Bit 2: 1: Interrupt source is active (generation job ready for time interrupts, time-of-day/time-delay interrupt OB started, cyclic interrupt OB was configured). Bit 4: Interrupt OB 0: is not loaded 1: is loaded Bit 5: Interrupt OB is by TIS: 0: enabled 1: disabled Bit 6: Entry in diagnostic buffer 0: enabled 1: disabled
al 2	1word	Reaction with not loaded/locked OB Bit 0: 1: Lock interrupt source Bit 1: 1: Generate interrupt event error Bit 2: 1: CPU goes into STOP mode Bit 3: 1: Interrupt only discarded
al 3	2words	reserved

Communication Status Data - SSL-ID: xy32h

Description

If you read this partial list you obtain the status data of module communication.

Parameters

SSL_ID	INDEX	Description
0132h		Status data of one CPU communication section
	0008h	Time system

LENTHDR	A record set is 20words long (40bytes).
N_DR	Number of record sets

Record set

SSL_ID: 0132h *INDEX 0008h*

The partial list extract contains information about the status of the 16bit run-time meter 0 ... 7.

Name	Length	Description
index	1word	0008h: Time system status
zykl	1word	reserved
korr	1word	Correction factor for the time
clock 0	1word	Run-time meter 0: time in hours
clock 1	1word	Run-time meter 1: time in hours
clock 2	1word	Run-time meter 2: time in hours
clock 3	1word	Run-time meter 3: time in hours
clock 4	1word	Run-time meter 4: time in hours
clock 5	1word	Run-time meter 5: time in hours
clock 6	1word	Run-time meter 6: time in hours
clock 7	1word	Run-time meter 7: time in hours
time	4words	Current date and time (format: date_and_time)
bszl_0	1byte	Bit x: Run-time meter x with $0 \leq x \leq 7$ 1: Run-time meter active
bszl_1	1byte	reserved
bszü_0	1byte	Bit x: Run-time meter overflow x with $0 \leq x \leq 7$ 1: overflow
bszü_1	1byte	reserved
status	1word	Time status (for bit assignment, see below)
res	3byte	reserved
status_valid	1byte	Validity of variable *status*: 01h: *status* valid

status	Time status															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	SG	correction value					-	-	hr	su/wi	-	res		-	-	sync

Bit	Description	Default value
0	Synchronization failure This parameter indicates whether the time transmitted in the frame from an external time master is synchronized. 0: synchronization failed, 1: synchronization occurred **Note:** Evaluation of this bit in a CPU is only useful if there is continuous external time synchronization.	0
1	Parameter is not used.	0
2	Parameter is not used.	0
4, 3	Time resolution 00: 0.001s 01: 0.01s 10: 0.1s 11: 1s	00
5	Parameter is not used.	0
6	Summer/winter time indicator The parameter indicates whether the local time calculated using the correction value is summer or winter time. 0: winter time 1: summer time	0
7	Notification hour This parameter indicates whether the next time adjustment also includes a switchover from summer to winter time or vice versa. 0: no adjustment made 1: adjustment made	0
8	reserved	0
9	reserved	0
14 ... 10	Correction value (Local time = basic time ± correction value * 0.5h) This correction takes into account the time zone and the time difference.	00000
15	Sign for the correction value 0: positive 1: negative	0

Status of the Module LEDs - SSL-ID: xy74h

Description

This partial list contains information about the LEDs of the CPU.

Parameters

SSL_ID	INDEX	Description
0074h	-	Record sets of all CPU LEDs
0174h		Record set of one CPU LED:
	0001h	SF (group error)
	0004h	RUN
	0005h	STOP
	0006h	FRCE (Force)
	0008h	BATF: 0 (fix)
	000Bh	DP master BUSF1: 0 (fix)
	000Ch	DP master group error (ERROR)
0E74h		Record sets of all CPU LEDs even with DP master/ slave if exist
	0000h	INDEX = 0000h (mandatory)

LENTHDR	A record set is 2words long (4bytes).
N_DR	Number of record sets

Record set

SSL_ID: xy74h

Name	Length	Description
index	1word	*INDEX* of the LED (if exist) 0001h: SF (group error) 0004h: RUN 0005h: STOP 0006h: FRCE (Force) 0008h: BATF: 0 (fix) 000Bh: DP master BUSF1: 0 (fix) 000Ch: DP master group error (ERROR) 1000h: MCC 1001h: PROFIBUS slave DE 2000h: PROFIBUS master RUN 2001h: PROFIBUS master ERR 2002h: PROFIBUS master DE 2003h: PROFIBUS master IF
led_on	1byte	Status of the LED: 0: off 1: on
led_blink	1byte	Flashing status of the LED: 0: not flashing 1: flashing normally (2Hz) 2: flashing slowly (0.5Hz)

Status Information CPU - SSL-ID: xy91h

Description

If you read the partial list, you obtain the status information of modules assigned to the CPU.

Parameters

SSL_ID	INDEX	Description
0091h	-	Module status information of all plugged-in modules
0191h	-	Status information of all not-deactivated modules
0291h	-	Module status information of all faulty and not-deactivated modules
0391h	-	Module status information of all unavailable modules
0591h	-	Module status information of all modules (host module -central modules)
0991h	xx00h	Module status information of all DP master systems xx: contains the DP master system ID.
0A91h	-	Status information of all DP master systems.
4C91h	adr	Module status information of a module connected to an external DP interface module via the logical base address. Bit 14 ... 0: logical base address of the module Bit 15: 0: input, 1: output
0D91h	xx00h xxyyh	All modules in the rack With xx you have to specify the number of the rack. All modules of a DP station or all I/O devices With xx you have to specify the DP master system ID and with yy the stations number.
0E91h	-	Module status information of all configured modules (central, distributed PROFIBUS DP).
0F91h	-	Only SSL partial list header information

LENTHDR	A record set is 8words long (16bytes).
N_DR	Number of record sets. Depending on the product the number of records transferred can be lower.

Additional Record sets

In the case of 0091h, 0191h and 0F91h two additional record sets are supplied per rack:

- A record for the power supply if it exists
- A record set for the rack

The sequence of the records in case of a centralized structure is:
Power supply, slots 1 ... n, rack

Record set *SSL_ID*: xy91h:

Name	Length	Description
adr1	1word	See following table.
adr2	1word	See following table.
logadr	1word	First assigned logical I/O address (base address).
solltyp	1word	reserved
isttyp	1word	reserved
reserved	1word	00xx: CPU No. 1-4
eastat	1word	I/O status: Bit 0: 1: Module error (detected by diagnostic interrupt) Bit 1: 1: Module exists Bit 2: 1: Module does not exist Bit 3: 1: Module disabled Bit 4: 1: Station error Bit 5: 1: A CiR event at this module /station is busy or not yet completed. Bit 6: 1: reserved Bit 7: 1: Module in local bus segment Bit 15 ... 8: Data ID for logical address (input: B4h, output: B5h, external DP interface: FFh)
ber_bgbr	1word	Area ID/module width Bit 2 ... 0: Module width Bit 3: reserved Bit 4 ... 6: Area ID 0: Siemens S7-400 1: Siemens S7-300 2: ET area 3: P area 4: Q area 5: IM3 area 6: IM4 area Bit 7: reserved

adr1 *At a centralized configuration*

	adr1															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0								Rack number (0 ... 31)							

At a decentralized configuration with PROFIBUS DP

Bit 15: 0 is the ID for PROFIBUS

	adr1															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	DP master system ID (1 ... 32)							Station number (0 ... 127)							

At a decentralized configuration with PROFINET IO

For the full PROFINET IO-System-ID 100 is to be added to Bit 12 ... 14.

Bit 15: 1 is the ID for PROFINET

	adr1															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	PROFINET IO system ID (0 ... 15)			Station number (0 ... 2047)											

adr2 *At a centralized respectively decentralized structure with PROFIBUS DP*

	adr2															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Slot number								Submodule slot number							

Station Status Information - SSL-ID: xy92h

Description

If you read this partial list, you obtain information about the expected and the current hardware configuration of centrally installed stations of a DP master system, connected via a DP interface.

Parameters

SSL_ID	INDEX	Description
0092h 4092h	DPM-ID	Expected status of the central stations of a DP master system
0192h 4192h	DPM-ID	Activation status of the stations of a DP master system
0292h 4292h	DPM-ID	Actual status of the stations of a DP master system
0692h 4692h	DPM-ID	Diagnostic status of the expansion racks in the central configuration of the stations of a DP master system

LENTHDR	One record set is 8words long (16bytes).
N_DR	Number of record sets

Record set *SSL_ID*: xy92h:

Name	Length	Description
status_0...status_15	16byte	Rack status / station status or backup status (The backup status is only relevant for DP modules.) 0092h: 0: Rack/station not configured 1: Rack/station configured 4092h: 0: Station not configured 1: Station configured 0192h: 0: Station is not configured or configured and activated 1: Station is configured and activated 0292h: 0: Rack/station failure, deactivated or not configured 1: Rack/station exists and is activated 4292h: 0: station failure, deactivated or not configured 1: station exists, activated and has not failed 0692h: 0: All modules of the expansion rack / of a station exist, are available with no problems and activated. 1: At least 1 module of the expansion rack / of a station is not OK or the station is deactivated. 4692h: 0: All modules of a station exist, are available with no problems, and activated. 1: At least 1 module of a station is not OK or the station is deactivated.

continued ...

... continue

Name	Length	Description
status_0	1byte	Bit 0: Central rack (INDEX = 0) or station 1 (INDEX > 0) Bit 1: 1. Expansion rack or station 2 ... ... Bit 7: 7. Expansion rack or station 8
status_1	1byte	Bit 0: 8. Expansion rack or station 9 ... ... Bit 7: 15. Expansion rack or station 16
status_2	1byte	Bit 0: 16. Expansion rack or station 17 ... ... Bit 5: 21. Expansion rack or station 22 Bit 6: 0: or station 23 Bit 7: 0: or station 24
status_3	1byte	Bit 0: 0: or station 25 ... ... Bit 5: 0: or station 30 Bit 6: Expansion rack in Siemens S5 area or station 31 Bit 7: 0: or station 32
status_4	1byte	Bit 0: 0: or station 33 ... ... Bit 7: 0: or station 40
...	...	...
status_15	1byte	Bit 0: 0: or station 121 ... ... Bit 7: 0: or station 128

Diagnostic Buffer - SSL-ID: xyA0h

Description

If you read the partial list, you obtain the entries of the diagnostic buffer of your CPU.

Parameters

SSL_ID	INDEX	Description
00A0	-	Shows all entries of the diagnostics buffer, which are possible in the current mode.
01A0	xxxxh	Shows the most recent entries of the diagnostics buffer. Here you specify the number of INDEX.
0FA0	-	SSL partial list header information

LENTHDR	A record set is 10words long (20bytes).
N_DR	Number of record sets

Record set

SSL_ID: xyA0h

Name	Length	Description
ID	1word	Event ID
info	5words	Information about the event
time	4words	Time stamp of the event

Diagnostic buffer

More information about the events in the diagnostics buffer of your CPU may be found in the manual of your CPU or in the manual of you programming software.

Diagnostic Information - SSL-ID: 00B1h

Description

If you read this partial list, you obtain the first 4 diagnostic bytes of a module with diagnostic capability.

Parameters

SSL_ID	INDEX	Description
00B1h	adr	Shows the first 4 diagnostic bytes of a module. Here the following is to be specified via INDEX: Bit 14 ... 0: Logical base address of the module Bit 15: 0: input, 1: output

LENTHDR	A record set is 2words long (4bytes).
N_DR	1 (Number of record sets)

Record set

SSL_ID: 00B1h

Name	Length	Description
byte0	1byte	Bit 0: Module fault (group fault ID) Bit 1: Internal fault Bit 2: External fault Bit 3: Channel error exists Bit 4: No external auxiliary voltage Bit 5: No front connector Bit 6: Module not assigned parameters Bit 7: Wrong parameters on module
byte1	1byte	Bit 3 ... 0: Module class 0000: CPU 0101: Analog modules 1000: FM 1100: CP 1111: Digital modules 0011: DP Norm slave 0100: IM Bit 4: Channel information exists Bit 5: User information exists Bit 6: Diagnostic interrupt from substitute Bit 7: Maintenance requirement (PROFINET IO only)
byte2	1byte	Bit 0: User module incorrect/does not exist Bit 1: Communication fault Bit 2: Mode 0: RUN, 1: STOP Bit 3: Watchdog responded Bit 4: Internal module power supply failed Bit 5: Battery exhausted (BFS) Bit 6: Entire buffer failed Bit 7: Maintenance requirement (PROFINET IO only)
byte3	1byte	Bit 0: Expansion rack failure (detected by IM) Bit 1: Processor failure Bit 2: EPROM error Bit 3: RAM error Bit 4: ADC/DAC error Bit 5: Fuse blown Bit 6: Hardware error lost Bit 7: reserved (fix 0)

Diagnostic Record set 1 - SSL-ID: 00B2h

Description

If you read this partial list, you obtain the diagnostic record set 1 of a module in a central rack (not for PROFIBUS DP or submodules).

The module is to be specified via rack and slot number.

Parameters

SSL_ID	INDEX	Description
00B2h	xxyyh	Shows diagnostic record set 1 of a module. Here the following is to be specified via INDEX: xx: Number of the rack yy: Slot number of the module

LENTHDR	The length of the record set depends on the module.
N_DR	1 (Number of record set)

Record set

Information to length and structure of the diagnostic record set may be found in the corresponding manual of your diagnosticable module.

Diagnostic Data - SSL-ID: 00B3h

Description

If you read this partial list, you obtain all the diagnostic data of a module. You can also obtain this information for PROFIBUS DP and submodules. The module is to be specified via the logical base address.

Parameters

SSL_ID	INDEX	Description
00B3h	adr	Shows all the diagnostic data of a module. Here the following is to be specified via INDEX: Bit 14 ... 0: Logical base address of the module Bit 15: 0: input, 1: output

LENTHDR	The length of the record set depends on the module.
N_DR	1 (Number of record set)

Record set

Information to length and structure of the diagnostic data may be found in the corresponding manual of your diagnosticable module.

Diagnostic Data of a DP slave - SSL-ID: 00B4h

Description

If you read this partial list, you obtain the diagnostic data of a PROFIBUS DP slave. This diagnostic data is structured in compliance with EN 50 170 Volume 2, PROFIBUS.
The module is to be specified via the configured diagnostic address.

Parameters

SSL_ID	INDEX	Description
00B4h	diagadr	Shows all the diagnostic data of a PROFIBUS DP slave. Here the configured diagnostic address of the DP slave is to be specified with INDEX.

LENTHDR	Length of a record set The maximum length is 240bytes. For standard slaves, which have a diagnostic data length of more than 240bytes up to a maximum of 244bytes, the first 240bytes are read and the overflow bit is set in the data.
N_DR	1 (Number of record set)

Record set

SSL_ID: 00B4h

Name	Length	Description
status1	1byte	Station status 1
status2	1byte	Station status 2
status3	1byte	Station status 3
stat_nr	1byte	Number of master station
ken_hi	1byte	Vendor ID (high byte)
ken_lo	1byte	Vendor ID (low byte)
...	...	Further diagnostic data specific to the particular slave