SIEMENS

T 400
SIMADYN D

Function Blocks

Manual

Edition 12.2004

Safety guidelines

This Manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the Manual by a warning triangle and are marked as follows according to the level of danger:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesireable result or state.

Correct usage

Note the following:

This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

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Disclaimer of liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

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Technical data subject to change.

Editions

T 400, SIMADYN D

Manual

Function Blocks

Edition 12.2004

NOTE

Please note that the current edition of this documentation contains different editions of the individual chapters. The following overview tells you when a chapter was revised the last time.

Overview (chapter editions)

Chapter		Edition
	Foreword	Edition 12.2004
1	Closed-loop control blocks	Edition 03.2003
2	Input/output blocks	Edition 12.2004
3	Communication blocks	Edition 12.2004
4	Logic blocks	Edition 03.2003
5	Service-/diagnostic blocks	Edition 03.2003
6	Drive converter-specific blocks	Edition 03.2003
7	SIMOLINK blocks	Edition 12.2004

Foreword

Purpose of this Manual

This Manual explains the principle use and functions of the STEP 7 automation software with the main focus on the appropriate technological and drive control components T400, FM 458-1 DP, SIMADYN D, SIMATIC TDC or D7-SYS.

TDC: Technology and Drives Control

Basic knowledge required

This Manual addresses programmers and commissioning engineers. General knowhow regarding automation technology is required in order to understand the contents of the Manual

Validity of the Manual

This Manual is valid for SIMATIC D7-SYS Version 6.2.

Additional support

If you have questions relating to the use of the products described in the Manual, which cannot be answered here, then please contact your local Siemens office. You can also call the Hotline:

- **Tel.:** +49 (180) 5050-222
- **Fax:** +49 (180) 5050-223
- **e-mail:** adsupport@siemens.com

Training Center

Appropriate training courses are available in order to make it easier to get to know the SIMADYN D automation system. Please contact the central Training Center in D-Erlangen (I&S IS INA TC):

- **Tel.:** +49 (9131) 7-27689, -27972
- **Fax:** +49 (9131) 7-28172
- **Internet:** www.siemens.de/sibrain
- **Intranet:** http://info-tc.erlm.siemens.de/

NOTE

This user part of the Manual does not include any detailed information/instructions with individual descriptions, but is only intended to provide a basic procedure. More detailed information on the dialog boxes in the software and how they are handled is provided in the appropriate online help.

Information overview

This manual is part of the overall documentation for the technological and drive control components T400, FM 458, SIMADYN D, SIMATIC TDC and SIMATIC D7-SYS:

Title	Content
System and communications configuring D7-SYS	**The first project in a few steps** This Section provides an extremely simple entry into the methodology when assembling and programming the SIMATIC TDC/SIMADYN D control system. It is especially conceived for first-time users of a control system. **System software** This Section provides basic know-how about the structure of the operating system and an application program of a CPU. It should be used to obtain an overview of the programming methodology, and basis for configuring user programs. **Communications configuring** This section provides you with basic know-how about the communication possibilities and how you configure links to the communication partners. **Changeover from STRUC V4.x to D7-SYS** Essential features are included in this section, which have changed over STRUC V4.x with the introduction of SIMATIC D7-SYS.
STEP 7 option packages for D7-SYS	**Basis software** This section explains the essential use and the functions of the STEP 7 automation software. For first users, it provides an overview on configuring, programming and commissioning a station. When working with the basis software, you can access the online help which provides you with support when it comes to detailed questions on using the software. **CFC** The CFC language (Continuous Function Chart) allows you to graphically interconnect blocks. When working with the particular software, you can also use the online help which can answer detailed questions regarding the use of the editors/compiler. **SFC** Configuring sequence controls using SFC (Sequential Function Chart) of SIMATIC S7. In the SFC editor, you generate a sequence chart using graphic resources. The SFC elements of the chart are then positioned according to specific rules.
Hardware	The complete hardware spectrum is described as reference in this Manuals.
Function blocks	These Reference Manuals provide you with an overview of selected function blocks for the associated technological and drive control components T400, FM 458-1 DP, SIMADYN D and SIMATIC TDC.

Guide

As first time user, we recommend that this Manual is used as follows:

- Please read the first section on using the software in order to get to know some of the terminology and basic procedure.
- Then use the particular sections of the Manual if you wish to carry-out certain processing steps (e.g. loading programs).

If you have already executed a small project, and have gained some experience, then you can read individual sections of the Manual in order to get up to speed about a specific subject.

A&D Technical Support

Can be accessed globally at any time of the day:

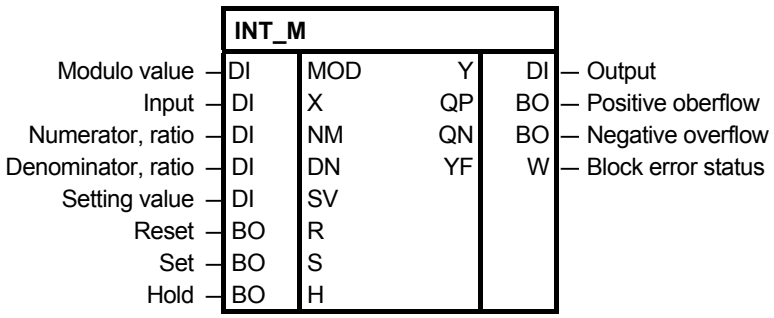
World-wide (Nürnberg) **Technical Support** Local time: 0:00 to 24:00 / 365 days Phone: +49 (180) 5050-222 Fax: +49 (180) 5050-223 E-Mail: adsupport@siemens.com GMT: +1:00		
Europe / Africa (Nürnberg) **Authorization** Local time: Mo.-Fr. 8:00 to 17:00 Phone: +49 (180) 5050-222 Fax: +49 (180) 5050-223 E-Mail: adsupport@siemens.com GMT: +1:00	**United States** (Johnson City) **Technical Support and Authorization** Local time: Mo.-Fr. 8:00 to 17:00 Phone: +1 (423) 262 2522 Fax: +1 (423) 262 2289 E-Mail: simatic.hotline@sea.siemens.com GMT: -5:00	**Asia / Australia** (Peking) **Technical Support and Authorization** Local time: Mo.-Fr. 8:00 to 17:00 Phone: +86 10 64 75 75 75 Fax: +86 10 64 74 74 74 E-Mail: adsupport.asia@siemens.com GMT: +8:00
Technical Support and Authorization speak generally German and English.		

Contents

1 Closed-loop control blocks

1.1 INT_M Modulo integrator for axis cycle correct integration

Symbol



Brief description the virtual master block INT_M is used to generate position reference values in angular synchronism.

Mode of operation The block sums the input values X, weighted with ratio NM and DN.

If the sum of the modulo value MOD exceeds or falls below 0, the modulo value is subtracted or added, and an overflow bit QP or QN is set for the duration of the sampling time.

I/O

MOD	Modulo value, value range 1 . . . 2^{30}	(default: 0)
X	Input quantity of the integrator e.g. velocity (ramp-function generator output)	(default: 0)
NM	Numerator value for the ratio (gearbox factor) NM ∗ X may not exceed 2^{31}, value range: -2^{30} to $+2^{30}$	(default: 1)
DN	Denominator value for the ratio (gearbox factor), value range: -2^{30} to $+2^{30}$	(default: 1)
SV	Setting value Is the value which is set to the output Y with S=1.	(default: 0)
R	Reset R=1 → Y=0	(default: 0)
S	Setting Bit to set the output value Y to the setting value SV S=1 → Y=SV (initial offset)	(default: 0)
H	Hold Holds the instantaneous value at output Y H=1 → $Y=Y_{old}$	(default: 0)

Y	Output quantity of the integrator R=S=H=0 → $Y=Y_{old}+X*NM/DN$	(default: 0)
QP	Positive overflow QP=1 → Y + X ≥ MOD (Y=Y-MOD)	(default: 0)
QN	Negative overflow QN=1 → Y+X < 0 (Y=Y+MOD)	(default: 0)
YF	Error status of the block YF=0 no error, YF > 0 coded error output	(default: 0)

Coded error output

The error status is output in a coded form at output YF of the modulo integrator INT_M. The last error event is always displayed.

Value	Significance
1	MOD > 2^{30} or < 1
4	Division overflow, positive
8	Division overflow, negative
16	Overflow, rest positive
32	Overflow, rest negative

Configuringdata

Computation time [µs]	T400 / PM5 60,0 FM458 / PM6 19,8
Can be inserted online	Yes
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

2 Input/output blocks

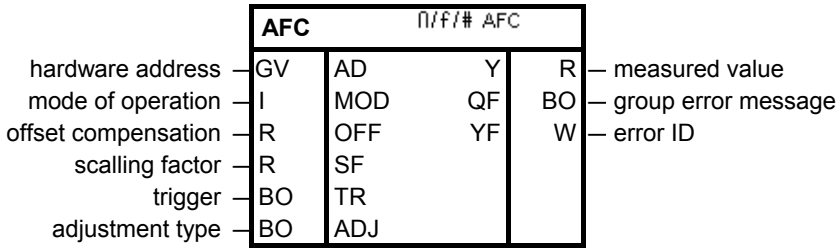
Assignment of the input/output blocks to processor- and peripheral devices

Block	Module										
	PM5	PM6	T400	IT41	IT42	EA12	EB11	FM 458	EXM 438	EXM 448*)	ITSL*)
AFC					X						
BIQT			X								
SBM										X	X

*) with SBM2-Modul

2.1 AFC Analog input via V/f/D converter

Symbol



Brief description

- analog input with V/f/D conversion (voltage/frequency/digital conversion).
- each hardware address may only be assigned once as a result of the measuring technique.
- the sampling times, in which the function block can be configured, are limited.

Mode of operation

This function block converts an analog voltage into a digital value with voltage/frequency/digital conversion and, after multiplying this value with SF and subracting OFF, outputs it at Y.
The hardware address of the analog input, from which the analog voltage is to be read, is specified at input AD.
Each hardware address may only be assigned once.

The following is valid for converting analog voltage V into digital value Y:

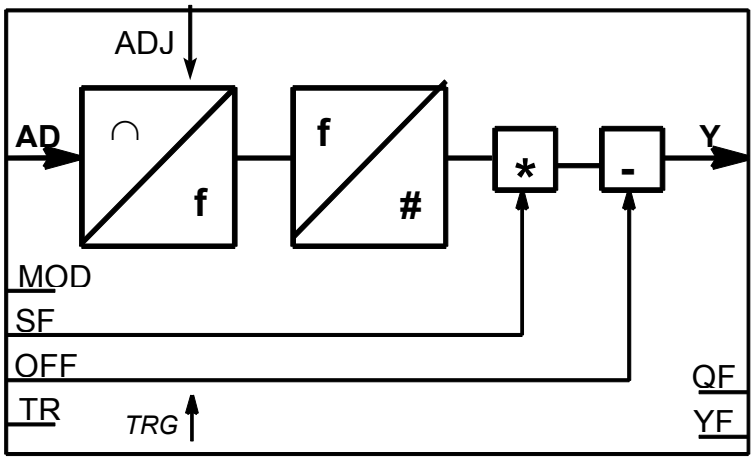
$$Y = \frac{1}{t_i \cdot 5V} \int_0^{t_i} U(t)dt \cdot SF - OFF$$

with: V - input voltage in volts
ti - integration (measuring) time

The measuring technique integrates continuously (without any gaps) between the start and the end of the measurement.

The permissible sampling time is limited due to the measuring technique used.
The following is valid: 1 ms <= TA <= 130 ms.

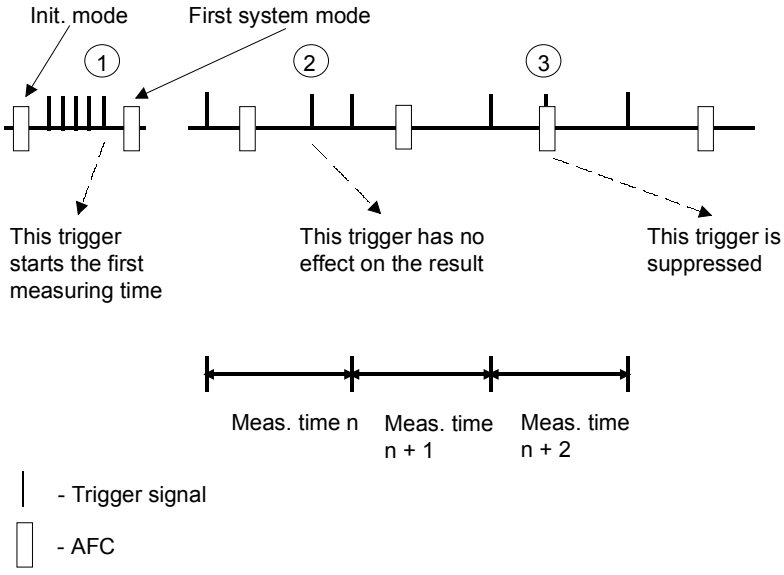
Block diagram



TRG - binary signal input via the front panel

Operating modes The operating mode is set at input MOD.

MOD = 0	The integration time is the sampling time. A conversion is realized in each sampling time.
MOD = 1	Conversion is triggered via the "trigger" input TR. The actual measuring time is terminated when the edge at TR goes from 0->1, the output value is calculated and a new measuring time is started. The integration time is a multiple of the sampling time. The first edge at TR after a reset starts the first measurement.
MOD = 2	Triggering by an external trigger signal. The end of the current measuring time and the start of a new measuring time is determined by an external signal. The last trigger signal, which was received between the initialization mode and the start of the first system mode starts the first conversion (refer to 1 in the following diagram). The integration time is terminated by the last trigger signal between two consecutive FB executions (refer to 2 in the following diagram). This means that if several triggers are received between 2 consecutive FB executions, only the last is effective and terminates the actual measuring time. The trigger signal is input via a plug connector on the front panel of the module. If a trigger is simultaneously received when the FB is being read-accessed, the trigger is suppressed and has no effect (refer to 3 in the following diagram).



Operating mode 2

Adjustment

The adjustment is controlled via binary input ADJ:

ADJ	Adjustment type
0	No adjustment
0 > 1	Adjustment in the current sampling cycle
1	Adjustment after 65 536 sampling cycles

Adjustment is always executed during initialization. During adjustment, no actual value is available at output Y for 5 sampling cycles. The last calculated value is kept.

Resolution

The V/f/D conversion has, due to the measuring technique, a resolution of

$$A(V) = \frac{(U + 20)[V]}{fc \cdot t_i}$$

With fc = 16 MHz and
ti dependent on the operating mode MOD

Fault messages

Output QF is set to 1, if there is a conversion error. The error cause is coded in the fault Word at block output YF. Bits 1 to 8 contain errors from cyclic operation, bits 9 to 16, initialization errors. The errors and the response of the function block are listed in the following table.

Bit 1 is the LSB, bit 16 the MSB of the fault Word.

YF	
Bit 1	Hardware fault in the V/f converter. No measuring pulses have been received in the last measurement interval. The channel is faulted. Response: Y = 0 is output up to the next reset.
Bit 2	Not used
Bit 3	Not used
Bit 4	Time counter overflow. Response: When converting: Y is not updated. When compensating: Adjustment is aborted and is then repeated.
Bit 5 **Bit 6** **Bit 7**	Not used Not used Not used
Bit 8	Adjustement error. The values received at adjustment lie outside the tolerance range. The channel is faulted. Response: Y = 0 is output up to the next reset.
Bit 9	Configuring error, sampling time. Sampling time TA lies outside the range, 1 ms to 130 ms. Response: TA < 1 ms: Adjustment is only executed during initialization, independent of ADJ. TA > 130 ms: There is potential danger of a time counter overflow. The channel is faulted and Y = 0 is output.
Bit 10	System error, sampling time cannot be determined. Response: Y = 0 is output up to the next reset.
Bit 11	Not used
Bit 12 **Bit 13**	Not used Not used
Bit 14	Not used
Bit 15	Adjustement error. The values received during adjustment lie outside the tolerances. The channel is faulted. Response: Y = 0 is output up to the next reset.
Bit 16	Incorrect operating mode. An invalid value is entered at input MOD. Response: Internally it is assumed that MOD = 0.

I/O

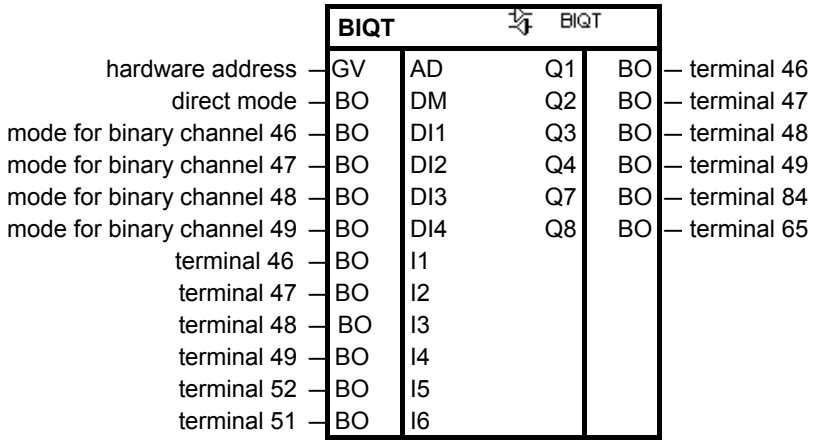
AD	Hardware address	(no default)
MOD	Operating mode with the following value range: 0 <= MOD <= 2 (initialization input). The value at the input is limited to 0 when it is negative, and is also limited to 0 for values >= 3.	(default: 0)
OFF	Offset compensation	(default: 0.0)
SF	Scaling factor	(default: 5.0)
TR	Trigger	(default: 0)
ADJ	Adjustment type	(default: 0)
Y	Output	(default: 0.0)
QF	Group error message	(default: 0)
YF	Error ID	(default: 16#0000)

Configuringdata

Computation time [µs]	PM5 5,8 PM6 1,9
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode System mode Normal mode
Special features	Sampling time: 1ms <= TA <= 130ms

2.2 BIQT Binary input/output on the T400

Symbol



Brief description

The function block BIQT is a block which has been specifically designed for the T400 technology module, for binary input/output. This block controls

- 2 binary outputs (with the block inputs I5 and I6),
- 2 binary inputs (with the block outputs Q7 and Q8) and
- 4 bi-directional inputs/outputs (I1 ... I4 or Q1 ... Q4).

The function block can principally be configured a multiple number of times. However, it should be observed, that the blocks mutually overwrite the output data and mode on settings, corresponding to the sequence in which they are configured.

Mode of operation

The binary values at block inputs I5 and I6 are output at the module terminals. Block outputs Q7 and Q8 output the binary values of the assigned module terminals.

Function block I/O I1 ... I4, Q1 ... Q4 and DI1 ... DI4 are responsible for the bi-directional inputs/outputs. The same end digits refer to the same terminal. The function block inputs DI1 ... DI4 define the operating mode: '0' is an input and '1' is an output.

Examples

DI3='1' defines binary channel 3 as output, and activates the associated output driver of the module. The value at function block input I3 is output at the module terminal. The associated connection Q3 in this mode always has the inverted value of connection I3. The actual signal level is not read-in at the terminal.

DI2='0' defines binary channel 2 as input. The value at I2 is ignored, as the output driver of the module is inactive. Q2 outputs the logical level of the signal at terminal 47.

I/O

AD:	Hardware address (as entered in HWConfig)
DM:	Direct mode. For DM='0', the output is made in the system mode, otherwise in the

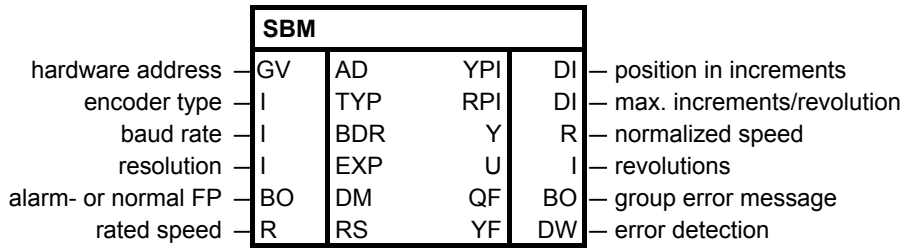
	standard mode. This means, if the block is computed in its configured sequence corresponding to the sampling time. (Initialization input) (Default value: 1)
DI1...DI4:	Mode for bi-directional inputs/outputs. Each mode input is assigned a bi-directional binary channel. '0' defines the associated terminal as input; '1' as output. (Initialization input) (Default value : 0)
I1...I4:	Binary values for the bidirectional binary channels. The value is only output, if the associated mode input is set to '1'.. (Default value: 0)
I5, I6:	Binary signal level at the output terminals of the module (terminals 52 and 51). (Default value: 0)
Q1...Q4:	Signal level at the terminals 46-49 of the bi-directional binary channels. For the channels, which are configured as output, the inverted output signal level is output. (Default value: 0)
Q7, Q8:	Binary signal level at the input terminals of the module (terminals 84 and 65). (Default value: 0)

Configuringdata

Computation time [µs]	T400 / PM5 4,0 FM458 / PM6 1,3
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode System mode Normal mode
Special features	Only configure the FB a multiple number of times in exceptional cases. (Access is always made to the same hardware components

2.3 SBM Rotary encoder block

Symbol



Brief description

The SBM function block is used to realize the following tasks:

- Initialize the rotary encoder, which is connected at the SBM2 module
- Determine the position and speed from the encoder data
- Error handling when communication errors develop between the encoder and SBM2 module

Mode of operation

During the initialization phase of the system, the initialization I/O are read and the appropriate mode set at the SBM2 module. The following settings are made for the EQN1325 encoder:

- The encoder power supply is set to 5 V
- Number of revolutions to 4096
- Signal periods per revolution 8192

After the mode has been set, the zero position is determined, and the starting values for the position and the speed output at the connections.

In the standard mode, the block can assume four different statuses:

- NRM
  The values read-out from the SBM2 module (position and speed) are displayed at the block connections. If an error is detected, the block goes into the ERR error condition.
- ERR
  The following errors can occur in operation:
  - Encoder is defective or is not connected
  - Encoder was disconnected
  - Data transfer error for serial communications between the encoder and SBM2 module
  - SBM2 module not available

  In the first three cases, the block goes into the "INI“ initialization status and in the latter case into the "OFF" status.

- INI
  as for the "initialization phase“ mode
- OFF
  Output QF is set and processing terminated.

I/O

AD	Hardware address of the SBM2	(initialization input)
TYP	Encoder type TYP = 0 not available TYP = 1 EQN1325 TYP > 1 incorrect encoder type	(initialization input default: 1)
BDR	Baud rate BDR = 0 100 kHz BDR = 1 500 kHz BDR = 2 1 MHz BDR = 3 2 MHz BDR > 3 incorrect baud rate	(initialization input default: 0)
EXP	Resolution in bits Value range: $16 \leq EXP \leq 32$	(default: 23)
DM	Configure the block in cyclic tasks or interrupt tasks DM=0 SBM in interrupt tasks This mode is only practical in conjunction with the alarm-controlled SIMOLINK events (sync interrupt from SLB). Using this sync interrupt, in this mode, the values of the SBM module are de-latched. The block should then be configured in the alarm task started by the same event. If the block is computed in interrupt tasks, then the SBM2 module register is read-out with a falling edge on the SYNC_DNE line. This signal also generates the interrupt for the interrupt task in which the block is configured. The contents of the register are then read-out and the values for the output connections computed. DM=1 SBM in cyclic tasks If the block is computed in cyclic tasks, then the SBM2 module register is read-out in the system mode. The contents of the register are then read-out in the normal mode and the values for the output connections computed.	(initialization input default: 0)
RS	Rated speed in revolution/min (RS>0)	(default: 1.0)
YPI	Position in increments	(default: 0)
RPI	Max. number of increments per revolution (depending on the input connection EXP)	(default: 0)
Y	Normalized speedform the rotary encoder $\frac{RPMmin}{RS}$	(default: 0.0)
U	Revolutions	(default: 0)
QF	Group error message QF=0 no error, QF=1 for error (if YF≠0)	(default: 0)
YF	Error status of the block YF=0x0000 no error, YF>0x0000 (refer to error statuses)	(default: 16#0000 0000)

Error statuses

Value	Significance
Nibble 1	
0x0001	Initialization mode
0x0002	No SBM2 module available
0x0004	SBM2 module is processed from another SBM
0x0008	Encoder defective/not available
Nibble 2	
0x0010	Unknown carrier or illegal module code
0x0020	Incorrect hardware address
0x0040	Encoder fault/error → Check the hardware (encoder, cable etc.)
0x0080	No voltage or short-circuit
Nibble 3	
0x0100	No data transfer from or to the encoder → check the hardware (encoder, cable etc.)
0x0200	Erroneous data transfer from or to the encoder → check the hardware (encoder, cable etc.)
0x0400	Invalid mode parameterized
0x0800	Invalid encoder parameterized
Nibble 4	
0x1000	Invalid speed normalization parameterized
0x2000	Invalid baud rate parameterized
0x4000	Sampling time too high; speed computation not possible →Sampling time: ≤ 4.0 ms
0x8000	Error for the request to save
Nibble 5	
0x10000	Invalid resolution parameterized
0x20000	Function block is not configured in the alarm task
0x40000	Not defined: Reserve → Default: 0
0x80000	Not defined: Reserve → Default: 0
Nibble 6-8	Not defined: Reserve → Default: 0

Configuringdata

Computation time [µs]	T400 / PM5 40,0 FM458 / PM6 13,2
Can be inserted online	No
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	Can only be used with an EQN 1325 encoder

3 Communication blocks

3.1 Communications utility, display control

NOTE Additional information on this group of function blocks, e.g. symbol, mode of operation, I/O and technical data are provided in the online help for the particular block.

3.1.1 @DIS Display device central block

Brief description

- The function block controls a maximum of 31 display units (OP2 or VD1) connected to a USS bus.
- This block must be configured when using even just one display device. Communications between SIMADYN D and the display device are realized via the USS master coupling. Thus, a USS central block @CSU (or @USS_M on T400) must be configured.
- To transfer data or binary values to a display device, it is also necessary to configure display device-specified process data- or binary value blocks (DIS...). The message output block MSI is required to transfer messages.
- It is recommended to configure the block in one sampling time TA (30 ms=<TA<=300 ms). The central block and all of the associated process data- and binary value blocks must be configured in the same sampling time!
- The specified computation time is valid for one display unit. For information regarding computation time for several display devices, refer to: Communication configuring, utility „Display“.

3.1.2 DISA, DISA_B, DISA_I, DISA_D, DISA_W, DISA_T Display device, actual value acquisition

Brief description

- the function block is used to display an actual value on up to 31 operator control devices (OP2 or VD1)
- this function block only operates in conjunction with the function block @DIS, which is required to initialize and control the operator control/display devices.

- the function blocks DISA, DISA_x differ by the data type of actual value input X:
  DISA: REAL
  DISA_B: BOOL
  DISA_I: INT
  DISA_D: DINT
  DISA_W: WORD
  DISA_T: SDTIME
  Other data types (BYTE, DWORD, STRING, GLOBAL) cannot be configured.

- the specified computation time is valid for one operator control device. For information regarding the computation time for several operator control devices, refer to Communication Configuring, Utility "Display".

3.1.3 DISA1B Display device, binary actual value acquisition

Brief description

- this function block is used to output a binary actual value at up to 31 display devices (OP2).

- the binary value can be selected at all devices under the same binary value number. If the number should differ at various display devices, a dedicated block must be configured for each display device.

- this function block only operates in conjunction with function block @DIS, which is required to initialize and control a display device.

- the specified computation time is only valid for one display device. For information regarding the computation times for several display devices, refer to: Communications Configuring, Utility ”Display”.

3.1.4 DISS, DISS_B, DISS_I, DISS_D, DISS_W, DISS_T Display device setpoint acquisition

Brief description

- this function block is used to display and change a setpoint at up to 31 operator control units (OP2)

- this function block only operates in conjunction with function block @DIS, which is required to initialize and control operator control/display units.

- function blocks DISS, DISS_x only differ by the data type of setpoint output Y (and the alternative setpoint XAL as well as MIN and MAX):
  DISS: REAL
  DISS_B: BOOL
  DISS_I: INT
  DISS_D: DINT
  DISS_W: WORD
  DISS_T: SDTIME
  Other data types (BYTE, DWORD, STRING, GLOBAL) cannot be configured.

- a setpoint can only be changed at one operator control device at any one time.

- the block supports an alternative setpoint from other sources. It uses inputs XAL and ENI for this purpose.

the specified computation time is only valid for one operator control unit. For information regarding the computation times for several operator control units, refer to: Communication Configuring, Utility „Display“.

3.1.5 DISS1B Display device, binary setpoint acquisition

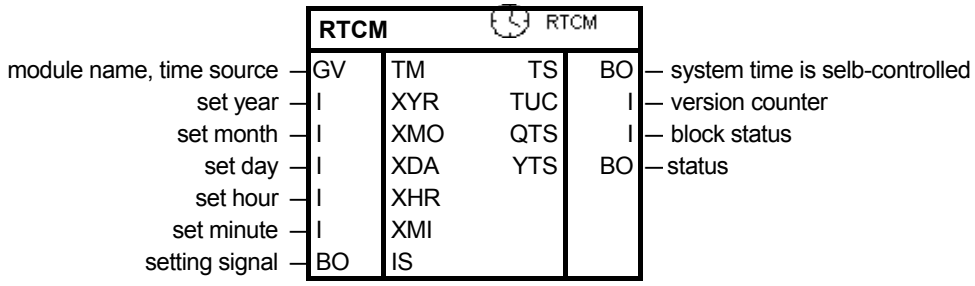
Brief description

- this function block displays and changes a binary setpoint at up to 31 display devices (OP2).
- the binary values can be selected under the same binary value number at all display devices. If the numbers at the various display devices are also to be different, then a dedicated block must be configured for each display device.
- this function block only operates in conjunction with function block @DIS, which is required to initialize and control a display device.
- the block supports an alternative setpoint input from other sources. Inputs IAL and ENI are used for this purpose.
- the specified computation time is only valid for one display device. For information regarding the computation times for several display devices, refer to: Communications Configuring, Utility ”Display”.

3.2 Communications utility, time of day synchronization

3.2.1 RTCM System time distribution

Symbol



Brief description

- this function block is used to synchronize and distribute the system time throughout the subrack and to set the system time. In this case, system time means the date and time of day.
  The system time is distributed via CS12/13/14.
- the RTCM function block can only be configured in a sampling interval 128 ms <= TA <= 512 ms.
- the RTCM function block may only be configured once for each subrack, and then only on the CPU which is located the furthest to the left in the subrack.

Mode of operation

The RTCM function block searches in the initialization mode, using the TM input, for the module on which the system time source (master system time) is controlled for the complete subrack. The master system time can come from its "own" CPU, a CSH11, an MM3, or a CS22.

The function block then searches all CS12/13/14 modules to distribute the system time to the other subracks.

After all of the initialization tasks have been completed, the function block updates the system time cyclically every 10 seconds on the communications buffer (for system time synchronization on the particular subrack) and on all CS12/13/14 modules.

Within any subrack, the system time is automatically synchronized between the CPUs.

If the configured name of its own CPU is specified at input TM, then it defines the system time itself. In this case, the block inputs XYR, XMO, XDA, XHR and XMI are read-in when the signal at input IS changes from 0 to 1, and transferred as system time. As long as the IS block input is not set, then the system time starts to run with the time buffered by the battery or from the pre-setting 1.1.1993 00:00.

Permissible data for the setting quantities:

Setting input	Setting input range	Units
XYR	**00, 01, ..., 99**	**Year**
XMO	**01, 02, ..., 12**	**Month**
XDA	**01, 02, .., 31**	**Day**
XHR	**00, 01, ..., 23**	**Hour**
XMI	**00, 01, ..., 59**	**Minute**

If illegal values are present at the block inputs to set month, day, hour and minute, an entry is made in the communications error field and the function block becomes inactive (further, the error number is output at YTS).

If a module name is specified at the TM connection which is different than that configured, then the block inputs XYR, XMO, XDA, XHR, XMI and IS are only evaluated if the configured source has failed.

Block output TS indicates whether the system time was only received in the current processing cycle (TS = 0) or was self-controlled (TS = 1).

Normally, the system time is received from the module, whose configured name was specified at input TM. If the system time is no longer generated there, then the RTCM automatically switches-over to its own system time and uses this as master system time. This changeover is flagged at output TS.

If a deviation of more than 100 ms is identified between the master system time and its own time, between two synchronizing intervals, then the RTCM evaluates the deviation as system time adjustment (e.g. when changing-over from summer- to winter time).
Block output TUC indicates how many system time adjustments the function block has already identified (does not apply for the waiting time of MM3; for MM3 as time master, only one failure of the MM3 results as source to an increase at connector TUC).

I/O

TM	Initialization input for the configured coupling module name which should be used for the master system time.
XYR	Year, permissible entry: XYR = 00 to XYR = 99. The block input is only read when IS changes from 0 to 1 and if the configured name of its own CPU module is specified at TM. (default : 97)
XMO	Month, permissible entry: XMO = 01 to XMO = 12 (prerequisites as for block input XYR). (default : 1)
XDA	Day, permissible entry: XDA = 01 to XDA = 31 (prerequisite as for block input XYR). (default : 1)
XHR	Hour, permissible entry: XHR=01 to XHR=23 (prerequisite as for block input XYR).

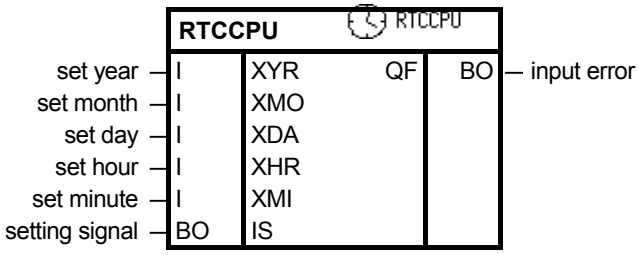
	(default : 0)
XMI	Minutes, permissible entry XMI=01 to XMI=59 (prerequisite as for block input XYR). (default : 0)
IS	Setting trigger: When this changes from 0 to 1, the master system time is updated corresponding to block inputs XYR, XMO, XDA, XHR and XMI, and if required, block output TUC is incremented (for deviations greater than 100 ms). The IS input is only processed, if its own module name was configured at input TM. (default : 0)
TS	System time source. This output flags whether the master system time is received from the module configured at input TM (TS = 0) or is self-controlled (TS = 1), e.g. if the master system time fails. (default : 0)
TUC	System time version counter. If a deviation of more than 100 ms is identified between the master system time and its own time, between two synchronizing intervals, then the RTCM evaluates the deviation as system time adjustment. The TUC block output is incremented at each system time adjustment (for MM3, only for a failure, not when the time is changed). (default : 0)
YTS	All temporary faults/errors and irreparable faults/errors are indicated at this block output. For values at YTS, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (default : 0)
QTS	Output QTS indicates whether the block was correctly initialized (QTS = 1), or, after entering a communications error message, became inactive (QTS = 0). (default : 0)

Configuringdata

Computation time [µs]	T400 / PM5 50,0 FM458 / PM6 16,5
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

3.2.2 RTCCPU Setting the module clock

Symbol



Brief description

This function block is used to set the system time on the CPU, i.e. date and time.

The RTCCPU function block may only be configured once in each subrack, and more specifically only in the "farthest left" CPU as the system time from this CPU is distributed within the subrack via operating system mechanisms.

This FB is not suitable to distribute and synchronize the system time over several subracks. In this case, the RTCM function block should be used.

Mode of operation

The function block accepts the time, available at inputs XYR, XMO, XDA, XHR and XMI for a positive edge at input IS. It then sets the system time to the new time.

If an illegal value is present at one of the inputs which is used to enter the time (refer to the subsequent table), then the input error bit at binary output QF is set to 1. In this case, the system time remains unchanged.

When the system first runs-up, and after the battery back-up of the real-time clock fails, the system time starts at the 1st of January 1993 00:00. If battery back-up is present, the clock continues to run, even when the CPU is powered-down, and is used as system time when the system runs-up.

The synchronization of all of the clocks of all CPUs within a subrack is realized, as operating system service, by the CPU which is inserted the furthest left. Synchronization is realized every minute.

If the RTCM function block is simultaneously configured, after a RESET, the RTCM initializes the time and also distributes the system time in cyclic operation.

Permissible input range

Input	Permissible input range	Unit
XYR	1984 ... 2083	Year
XMO	1 ... 12	Month
XDA	1 ... 31	Day
XHR	0 ... 23	Hour
XMI	0 ... 59	Minute

I/O

XYR	Year setting; the year must be entered as a four-digit number (Default: 1999)
XMO	Month setting; (Default: 1)
XDA	Day setting; (Default: 1)
XHR	Hour setting; (Default: 0)
XMI	Minute setting; (Default: 0)
IS	Setting signal; The values are transferred into the CPU real-time clock using a positive edge at this input. The values are checked before being transferred. If a value is illegal, it is not transferred, and is displayed with QF=1 at the output "input error". Output QF is reset when the values are transferred. (Default: 0; the input is always set to 0 in the initialization mode of the FB)
QF	Input error; this output indicates whether the last setting has been transferred (QF=0), or whether the transfer was rejected due to an illegal value (QF=1). Configuring error (QF=1) The FB was configured on a T400. In this case, it is not possible to set the system time. (Default: 0)

Configuringdata

Computation time [µs]	PM5 4,0 FM458 / PM6 1,2
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

3.3 Central coupling blocks

NOTE Additional information on this group of function blocks, e.g. symbol, mode of operation, I/O and technical data are provided in the online help for the particular block.

3.3.1 @CEP EP coupling central block

Brief description

- the function block initializes and monitors the coupling to EP modules (EP3).
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

Block output CDM indicates the coupling status. The output is 1 if the coupling is enabled for general transmit/receive operation. The CDM block output is 0 as long as the coupling is being initialized or re-initialized (after a temporary fault) or while the memory is being re-formatted (refer to the CDV input).

The computation time information in the technical data refers to typical task processing. During re-organization, the computation time is extended over several processing cycles.

3.3.2 @CMM Communications buffer coupling central block

Brief description

- the central block @CMM initializes and monitors the communications buffer coupling. The communications buffer coupling can be set-up on all communications buffer modules.
- the function block may only be configured once for each subrack, as there is only one communications buffer module for each subrack. Multiple configuring is identified during initialization and results in an entry in the communications error field.
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

3.3.3 @CS1 Subrack coupling (master) central block

Brief description

- the function block initializes and monitors the master side of a subrack coupling. The data interface is located, for this coupling, on a CS12, CS13 or CS14 module:
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise an entry is made in the communications error field.

If the CDV block input is set again, this is only taken into account if the CDV input was reset (i.e. was at 0) for at least 2 sampling times. Otherwise the data at the input is ignored.

Block output CDM indicates the coupling status. The output is 1 if the coupling is enabled for general transmit/receive operation. The CDM block output is 0 as long as the coupling is being initialized or re-initialized (after a temporary fault) or while the memory is being re-formatted (refer to the CDV input).

The computation time information in the technical data refers to typical task processing. During re-organization, the computation time is extended over several processing cycles.

3.3.4 @CS2 Subrack coupling (slave) central block

Brief description

- the function block initializes and monitors the subrack coupling on the slave side. The slave side means in this case the subrack in which the CS22 module is inserted.
- the data interface (master side) for this coupling is located on a CS12-, CS13-, or CS14 module.
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

3.3.5 @CSD01 DUST1 coupling central block

Brief description

- the function block initializes and monitors the DUST1 coupling (CS7 with SS4 module).
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

3.3.6 @CSD02 DUST2 coupling central block

Brief description

- The function block initializes and monitors the DUST2 coupling (CS7 with SS4 module)
  The DUST2 coupling is the printer coupling.
- The function block may only be configured in the sampling interval 32 ms <= TA <=256 ms and may only be configured in the communications FP "Transmit". Otherwise, an entry is made in the communications error field.

3.3.7 @CSD03 DUST3 coupling central block

Brief description

- the function block initializes and monitors the DUST3 coupling (CF7 with SS4 module).
  The DUST3 coupling is a point-to-point connection to SIMATIC S5 or TELEPERM M.

- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

3.3.8 @CSD07 DUST7 coupling central block

Brief description

- the function block initializes and monitors the DUST7 coupling (CS7 with SS4 module).
  The DUST coupling is a point-to-point connection with ASCII protocol.
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

3.3.9 @CSH11 SINEC H1 coupling central block

Brief description

- the function block initializes and monitors the SINEC H1 coupling (CSH11 module).
- the function block may only be configured in the sampling interval 32ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

3.3.10 @CSL2F PROFIBUS FMS coupling central block

Brief description

- the function block initializes and monitors the PROFIBUS FMS coupling (CS7 and SS5 module).
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms and only in the communications FP "Transmit". Otherwise, an entry is made in the communications error field.

3.3.11 @CSL2L PROFIBUS FDL central block

Brief description

- the function block initializes and monitors the PROFIBUS FDL coupling (CS7 and SS5 module).
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms and only configured in the communications FP "transmit". Otherwise an entry will be made in the communications error field.

3.3.12 . @CSMPI MPI coupling central block

Brief description

- the function block initializes and monitors the MPI coupling (CS7 with SS52 module).
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

3.3.13 @CSPRO Central block PROFIBUS DP coupling

Brief description

- the function block initializes and monitors the PROFIBUS DP coupling (CS7 and SS52 module).
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise an entry is made in the communications error field.

3.3.14 @CSU USS master central block

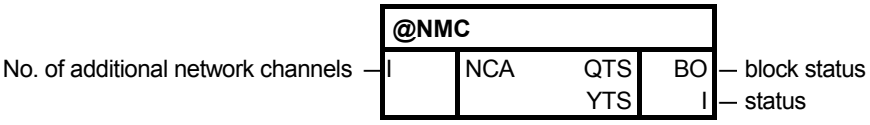
Brief description

- the function block initializes and monitors the USS master coupling (CS7 with SS4 module).
- the function block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

3.4 Network

3.4.1 @NMC Network central block

Symbol



Brief description

- the @NMC central block is the network manager. It is responsible for all of the logistical tasks of the three network components: "rigid network", "freely-selectable network" and "network status".
- in addition to function block @NMC, function blocks NRI and/or function blocks NTC/NTD should also be configured.
  It is possible to interrogate the network status via function blocks NSI/NSL.
- @NMC may only be configured once per subrack.
  In addition, a communications buffer module with C bus connection should be configured (e.g. MM11 or MM3) as well as at least one CS peripheral module (CS12/13/14, CS22, CSH11 or CS7).
- when creating the networks, it should be ensured that the configurable subrack names are unique throughout the complete network.
- in addition, all of the configured module names must be precisely six characters long and the last character must correspond to the following module type identification:
  1-8 = CPU modules (PM5, PM6, ...)
  A = Communication buffer modules (MM11, MM3, MM4, ...)
  B = Subrack coupling modules (CS12/13/14 or CS22)
  C = Other communication modules (CSH11, CS7 with SS4, SS5 or SS52)
- All of the module types which are not listed are not taken into account by the network, and therefore are not subject to the specified conventions.
- The conventions regarding name assignment are not checked; the configuring engineer is solely responsible in ensuring this.

Mode of operation

The @NMC central block retrieves and administers all of the information required to process the network tasks, and, if required, makes them available to one of the three network components.

@NMC "knows" all of the data interfaces in "its" subrack and all of the subracks in the network. A subrack is automatically in the network, if @NMC is configured on a CPU.

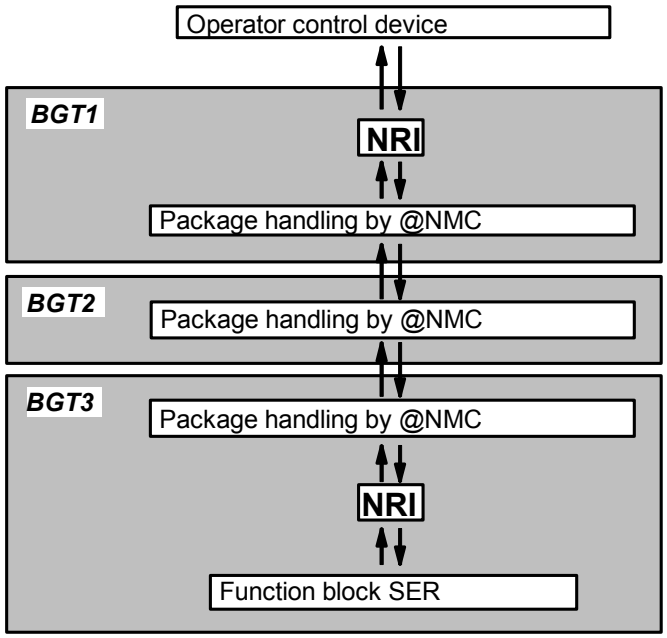
The network consists of three independent components:

1. Freely-selectable network:

The freely-selectable network can be compared with Datex-P: Network channels to the "adjacent" network subracks are initialized on all network subracks (i.e. subracks, in which a @NMC is configured) from each @NMC. The number of network channels corresponds to the information at the initialization input NCA plus one (i.e. for NCA = 0, a network channel is initialized and processed).
@NMC use these channels to transfer network information and to handle data packages for the freely-selectable network.

For this type of network, data packages (tasks or responses) are entered in to the network via a function block NRI. The @NMC function block transfers the data packages to the specified destination, where they again exit the network through an additional NRI function block NRI. Thus, the function blocks NRI represent the interfaces between the freely-selectable network and the two communicating partners.

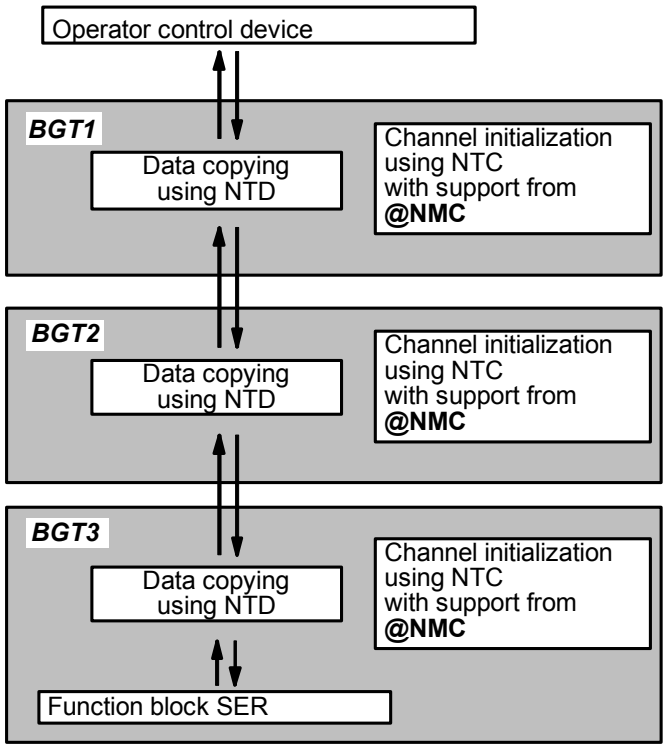
Example: An operator control device is to commun-icate with a service device via the freely-selectable network. The operator control device is connected at subrack 1 (BGT1); the service block is configured on BGT3
BGT1 and BGT3 can communicate with one another via BGT2 (e.g. via the rack coupling). For this particular case, the NRI- and @NMC function blocks should be configured as follows on the three subracks:



2. Rigid network:

The rigid network can be illustrated by comparing it with a telephone line. Initially, the channels are initialized at various data interfaces (using NTC- and @NMC function blocks) in order to establish a connection between the two communicating partners. These channels are then purely reserved for these two partners and cannot be used by the other function blocks. Data is copied between two data interfaces using NTD function blocks.

Example: An operator control device is to communicate with a service device via the rigid network. The operator control device is connected at subrack 1 (BGT1); the service device is configured on BGT3. BGT1 and BGT3 can communicate with one another via BGT2 (e.g. via rack coupling). For this particular case, NTD-, NTC- and @NMC function blocks should be configured as follows on the three subracks:



3. Network status:

The two function blocks NSI and/or NSL should be configured for the network status. NSI initializes and processes an interactive data interface. The function block provides, with support from @NMC, information regarding the network status (e.g. how many and which subracks are known in the network).
The NSL transfers network status tasks and responses between two configured data interfaces.

The computation time of the @NMC is essentially dependent on the scope of the configured communication tasks in a subrack, and the number of subracks used in the network. The computation time cannot be explicitly specified, as the task processing is in the form of continuous system processing, and must therefore be considered as general system load.
The computation time information in the technical data only refers to the cyclic function block processing.

I/O

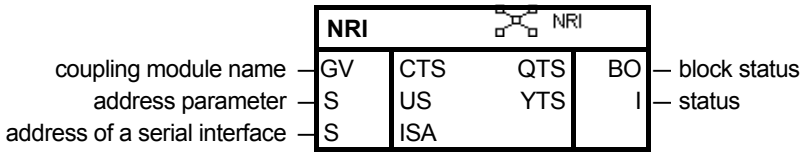
NCA	Initialization input for the number of additional network channels for the freely-selectable network (for NCA=0, a network channel is initialized and processed; for NCA=1, 2 are processed etc.). This information defines how many network channels are initialized and processed by the central block for the freely-selectable network. The more channels which are set-up and operated, then the higher is the "through flow" of freely-selectable network telegrams, i.e. that many more freely-selectable network telegrams can be "transferred" in parallel. (default : 0)
QTS	Output QTS indicates whether the block was able to be correctly initialized (QTS=1) and is operating error-free or, after entering a communications error message, became inactive (QTS=0). (default : 0)
YTS	Status display for temporary or irreparable errors. For values at YTS, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (default : 0)

Configuringdata

Computation time [µs]	T400 / PM5 2,0 FM458 / PM6 0,7
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	The function block may not be disabled per task group

3.4.2 NRI Freely selectable network interface block

Symbol



Brief description

- the function block NRI establishes, in the "freely selectable" network, a connection between the network and an interactive interface. In this case, an interactive interface is a transmit- and a receive channel, via which tasks and responses can be transferred. In addition, the function block can be optionally used to copy, in the freely-selectable network, data blocks between two serial interfaces.
- when using this function block, the central network block (@NMC) must be configured in the same subrack.
- the NRI may only be configured at a utility function block, depending on the utility type, for each CPU (e.g. only one SER function block can be coupled with an NRI for each CPU).

Mode of operation

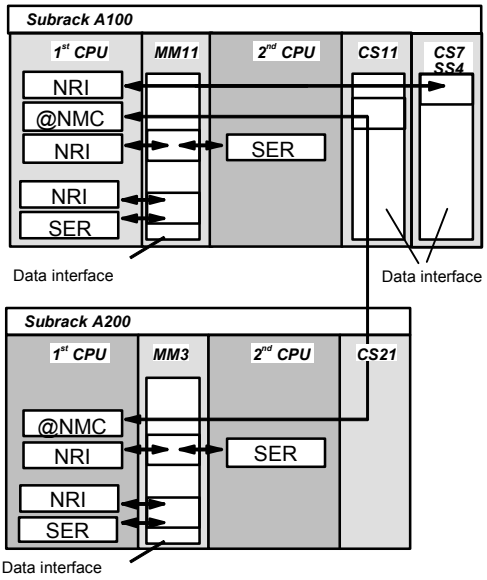
NRI first initializes 2 channels on the configured data interface (corresponding to the data entry at connections CTS and US).

The freely-selectable network can only be used in conjunction with interactive utility function blocks (e.g. SER or @TCI).

The NRI handles the following tasks:

- It processes a serial coupling (e.g. DUST1 or SINEC H1) to couple-in and couple-out tasks and responses to and from utility function blocks (e.g. SER or @TCI) from the freely selectable network.
- It processes an interactive interface to a utility function block. In this case, the NRI is the interface between the network and the utility function block.

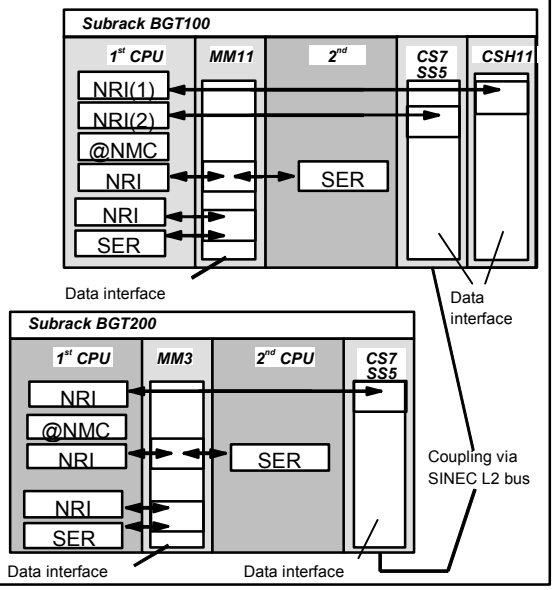
Example 1: In the following example, the freely-selectable network involves subracks A100 and A200. Two CPUs, each with a SER function block are configured in each subrack, which are to be coupled to the freely-selectable network. The service functionality is to be used on all CPUs using a central visualization device via the serial DUST1 interface on the A100 (CS7 with SS4).
Five NRIs should be configured: Four NRIs for the four SER and one NRI for the serial DUST1 interface (CS7 with SS4). In this case, the data entries at inputs US and CES are identical with that of an SER and an NRI.
For freely-selectable networks, data transfer is realized using the @NMC between the subracks.



- It transfers data blocks from a serial interface (corresponding to the data entry at input CTS) to an additional serial interface (corresponding to the data entry at input ISA).
  In this case, the 2nd serial interface can be in the same subrack as the 1st, or it can also be configured in a different subrack.
  If the second interface is not configured in the same subrack, then it is not necessary to configure a rigid network to transfer data blocks to and from the second interface
  For this processing task, an NRI should also be configured for the second serial interface, whose data entry at input ISA, refers to the first serial interface.

Example 2: In the following configuration, 2 subracks (BGT100 and BGT200) are coupled with one another via SINEC L2 FMS (CS7 with SS5). The service functionality of all of the configured CPUs is to be used via a central operator control station via the CSH11 interface. In this case, seven NRIs and 4 SER are to be configured: Four NRI . for the four SER, one NRI for the CSH11 interface, one NRI for data transfer between CSH11- and CS7/SS5 interface on the BGT100, 1 NRI for the CF7/SS5 interface on the BGT200.

It is assumed, that the configured CSH11 name is "H1BUS", and the configured CS7 name in the BGT100 is called "FMSBUS" (and was configured at the first connector). Then, the following should be specified at "NRI (1)" at the ISA input:"BGT100.FMSBUS.X01". The following should be configured at "NRI(2)" at input ISA: "BGT100.H1BUS".



The computation time of the NTD is essentially dependent on the number of bytes to be copied.

I/O

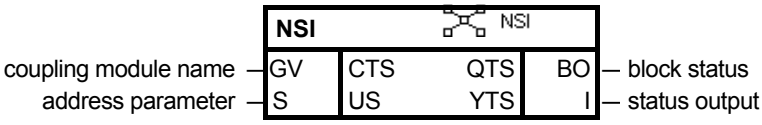
CTS	The configured name of the module, on which the data interface is set-up, and where the task and response channel are located, is specified at initialization input CTS. (default : 0)
US	The address for the task and response channel is specified at initialization input US. The data entry consists of a channel name and in addition, depending on the coupling type (e.g. DUST1 or SINEC H1), also of 1 or 2 address stages. (default : empty string)
ISA	Initialization input for data transfer to an additional serial interface. The configured data entry consists of a subrack name, module name and connector (optional). The three data entries are separated by points. The data entry may be a maximum of 17 characters (6 characters for the subrack name, 6 characters for the module name, 3 characters for the connector and two separating points; e.g. ”BGT100.CS700C.X01” or ”A100.D17H1C”) (default : empty string)
QTS	Block output which indicates whether the block is operating error-free (QTS = 1), or, after entering a communications error message, became inactive (QTS = 0). (default : 0)
YTS	At block output YTS, during normal operation, the data transfer status is indicated. If the function block became inactive after an entry in the communications error field, then the appropriate error number is output at YTS. For values at YTS, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (default : 0)

Configuringdata

Computation time [µs]	T400 / PM5 400,0 FM458 / PM6 132,0
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

3.4.3 NSI Network status interface block

Symbol



Brief description

- the function block NSI provides information regarding the network status from the perspective of the subrack in which it is configured.
- when using the NSI, the @NMC function block must be configured on the same CPU module and also a communications buffer module with C bus connection (e.g. MM11).
- the NSI may only be configured once for each subrack. If it is configured a multiple number of times this is identified when the block is being initialized. The NSI then makes an entry in the communications error field and becomes inactive.

Mode of operation

The NSI first initializes a task and a response channel corresponding to the data entries at initialization inputs CTS and US.

The task channel has the "multiple" data transfer mode; the response channel the "select" mode. Thus, it is possible that all of the NSI, configured in the network can "share" the same channel, if the tasks from a data interface are to be made available to all of the NSI configured in the network.

There are two types of tasks:

- NSI returns all of the names of the network nodes known at the time the request was made (configured names of all the known subracks, including its own).
- NSI returns the configured subrack names and coupling statuses ("active" or "faulted") of all of the subrack couplings configured in the subrack.

Block output QTS indicates whether the NSI is operating error-free (QTS = 1) or not (QTS = 0).
When the output of QTS changes from a 1 to a 0, the function block has identified an irreparable error, it makes an entry in the communications error field and becomes inactive. The inactive status is final.

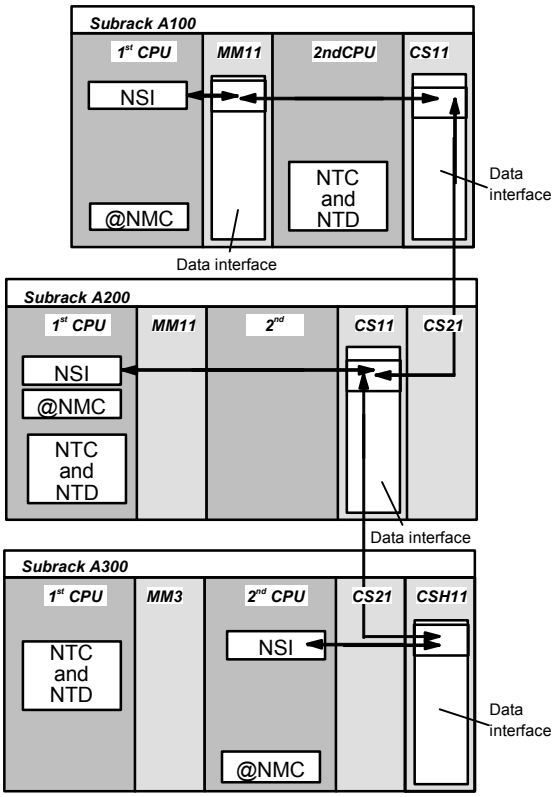
Block output YTS indicates the status of the data transfer. If NSI becomes active, the error cause is indicated at block output YTS and can be identified using an error number.

Example: NSI are configured on all three subracks.
Different data interfaces are configured at their CTS inputs (MM11, CS11 and CSH11). The CSH11 interface is specified as target address at their US inputs

The rigid network establishes a data transfer path between the CSH11 interface and all NSI blocks

In this case, all of the NSI use the same channel on the CSH11 interface. A channel is initialized on CS11 in subrack A200 which is used by the NSI in A100 and A200.

All of the configured NSI can use the same channel without channel processing errors occuring, using the "select" and "multiple" channel modi. In addition to NSI, NTD (rigid. network) process the channels so that the tasks are communicated in all subracks. Thus, for each network status task, which is entered into the network via the CSH11 interface, is also automatically flagged to all NSI blocks The functionality of NSI is structured so that only that NSI responds, to which the task was addressed. All other NSI blocks ignore the task. This thus prevents collisions between NSI blocks.



I/O

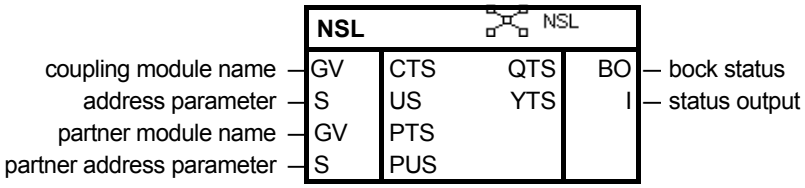
CTS	Initialization input for the configured coupling module name; name of the module (and optionally, the names of connectors X01, X02 or X03), on which the data interface of the task- and response channel is to be set-up. (default : 0)
US	The address for the task- and response channel is specified at initialization input US. The data entry consists of a channel name and in addition, depending on the coupling type (e.g. DUST1 or SINEC H1), also of 1 or 2 address stages. When used in a rigid network, the necessary network data must be configured. (default : empty string.)
QTS	Displays whether the block is operating error-free (QTS = 1) or after entering a communications error message, became inactive (QTS = 0). (default : 0)
YTS	Indicates the status of the data transfer. If the function block became inactive after making an entry in the communications error field, then the appropriate error number is output at YTS. For values at YTS, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (default : 0)

Configuringdata

Computation time [µs]	T400 / PM5 100,0 FM458 / PM6 33,0
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

3.4.4 NSL Network status transfer block

Symbol



Brief description

The function block NSL is used to transfer network status tasks and responses between two serial couplings (e.g. between SINEC H1 and SINEC L2 FMS).

Mode of operation

The function block NSL transfers network status tasks from the data interface which was specified at the CTS input, to the data interface, which was specified at the PTS output. **Task transfer in this direction is mandatory!** It is not possible to transfer tasks in the reverse direction from the PTS data interface towards the CTS data interface.
The response is appropriately transferred only from the PTS data interface to the CTS data interface.

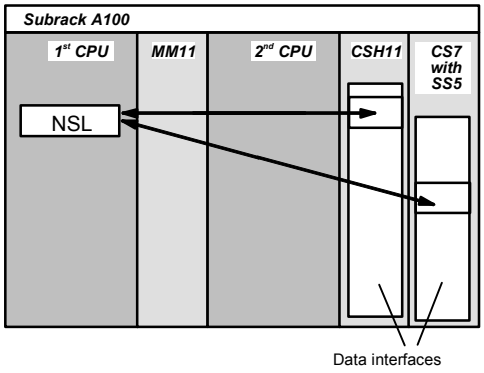
The receive channel for the network status tasks is logged-on in the "multiple" mode on the CTS data interface, and the transmit channel for the network status responses in the "select" mode.
The receive channel for the network status tasks is logged-on in the "refresh" mode on the PTS data interface, and the transmit channel for the network status responses in the "handshake" mode.

Thus, the NSL on the CTS data interface can share the task- and response channel with an NSI (the data entries at input US must be identical for NSI and NSL).

The tasks and responses are not interpreted, but only copied.

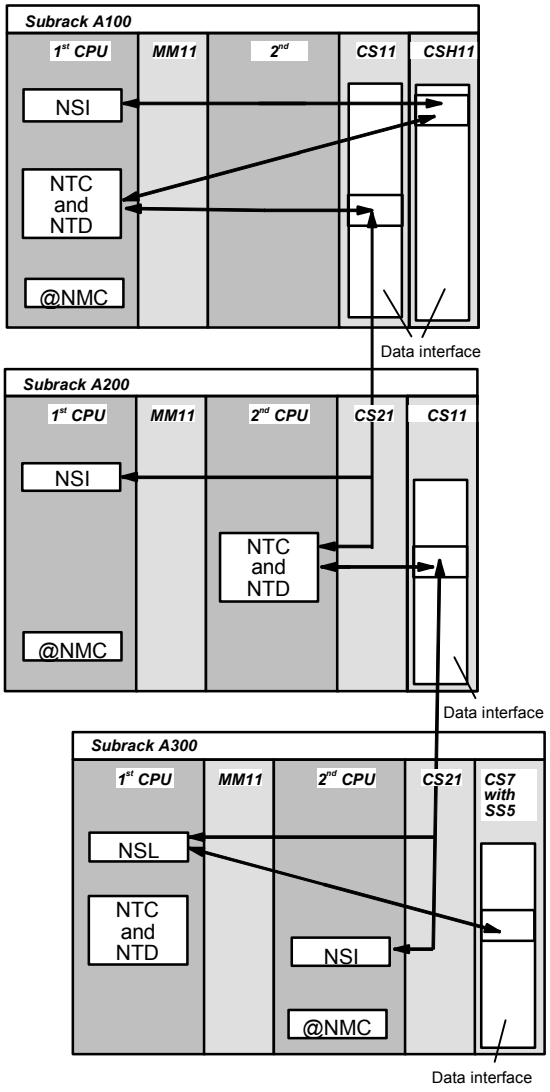
The NSL can also be used in conjunction with rigid networks. In this case, the configuring associations for rigid networks must also be observed.

Example 1: In this case, NSL is used without a rigid network. It copies the tasks from the CSH11 interface into the CS7/SS5 interface. The responses from the CS7/SS5 interface are copied into the CSH11 interface. As the NSL can directly access both interfaces, it is not necessary to configure the rigid network (function blocks @NMC, NTC, NTD)



Example 2: NSI blocks are configured on all three subracks, and an NSL is also configured on subrack A300.

The NSL shares the channels, logged-on from the NSI, using the rigid network. The NSL, configured on A300, has the task to transfer network status tasks from the CSH11 interface A100) to the CS7/SS5 interface (A300), and to copy network status responses in the opposite direction. The rigid network establishes the data transfer path between the CSH11 interface (A100) and the CS21 interface (A300) and is responsible for the data transfer along this path.
The NSL copies the network status tasks responses between the CS7/SS5 interface on A300 to the CS21 interface on A300.



I/O

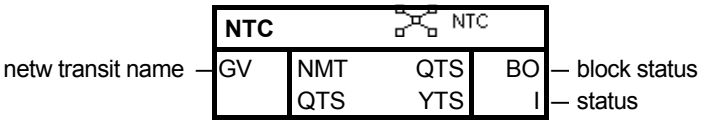
CTS	Initialization input for the configured coupling modules names; name of the module (and optionally the names of the connector X01, X02 or X03), on whose data interface the network status tasks are received and the network status responses are transmitted (default : 0)
US	The address of the task- and response channel is specified at initialization input US. The data entry consists of a channel name and in addition, depending on the coupling type (e.g. DUST1 or SINEC H1), also of 1 or 2 address stages. When used in a rigid network, the additional network data must be configured. (default : empty string)
PTS	Initialization input for the configured coupling module names; name of the module (and optionally the names of connector X01, X02 or X03), on whose data interface the network status tasks are to be transmitted and the network status responses received. (default : 0)
PUS	The address for the task and response channel is specified at initialization input PUS. The data entry consists of a channel name and in addition, depending of the coupling type (e.g. DUST1 or SINEC H1), also of 1 or 2 address stages. Additional network data must be configured when used in a rigid network. (default : empty string)
QTS	Block output to display whether the block is operating error-free (QTS = 1) or, after entering a communications error message, became inactive (QTS = 0). When QTS changes from 1 to 0, NSL remains inactive. (default : 0)
YTS	Block output YTS indicates, during normal operation, the status of block NSL. If the function block has become inactive, after an entry in the communications error field, the appropriate error number is output at YTS. For values at YTS, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (default : 0)

Configuringdata

Computation time [µs]	T400 / PM5 100,0 FM458 / PM6 33,0
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

3.4.5 NTC Rigid network monitoring block

Symbol



Brief description

- In the "rigid network", the function block NTC has the task to find new copying tasks for the function blocks NTD, to inform the NTD of these and define the necessary destination data interfaces.
- Only one NTC may be configured for each CPU. In addition to the NTC, at least one NTD must be configured on the same CPU.
- Further, the @NMC central network block must be configured (it does not have to be in the same CPU, but it must be in the same subrack), and a communications buffer memory should also be configured with C-bus connection (e.g. MM11).
- If the complete data transfer route between the transmitter and receiver is not unique, i.e. if the subrack configuration allows different data transfer routes between transmitter and receiver, then it should be noted, that all of the subracks of the network NTD- and NTC function blocks are configured.
  The length of the data transfer route and whether all of the data interfaces along this data transfer route have sufficient memory for the data blocks to be copied, defines which data transfer route is selected between transmitters and receivers in the rigid network.

Mode of operation

Function block @NMC assigns a specific number of subrack couplings, and possibly MM11 communications buffer modules to function block NTC. The NTC searches for "network-capable" channels on these modules.

A network-capable channel is a channel, which the coupling partner cannot directly access.
NTC searches, using the @NMC in the subrack, for a data interface, which can be implemented via the shortest data transfer route to the coupling partner (under certain circumstances, this is the data interface on which the coupling partner is configured).

Once this data interface has been found, the NTC initializes an appropriate channel, and assigns the NTD a copy task for this channel. Its task for this particular data transfer route has now been completed, and it now searches for the next network-capable channel.

NTC only searches on CS12/13/14, CS22 or communication buffer modules for network-capable channels. Therefore, the data interfaces must be the transmitter or receiver, between which a data transfer route is to be established, which are configured on this module type.

If there are several NTC function blocks in the subrack, which are configured as subrack coupling modules, each receives a subrack coupling, from the first initialized NTC function block, i.e., the superfluous NTC function blocks become inactive (QTS = 0).
If fewer NTC function blocks are configured, then one or several NTC are responsible for more than one subrack coupling.

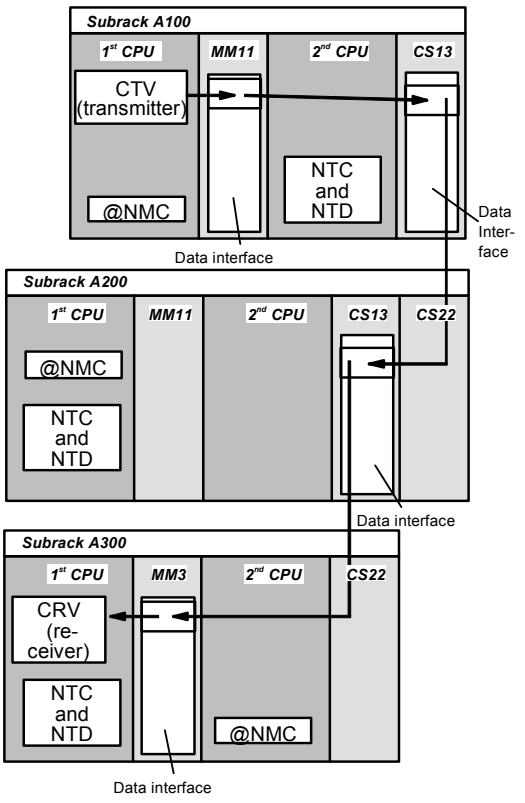
Example 1: The transmit block CTV has as target address the MM3 communications buffer module on subrack A300 (is configured as network data entry at connection AT). The MM11 communications buffer module name on A100 is specified as the direct data interface (this is specified at its CTS connection). The receive block CRV has as target address (is configured as network data entry at connection. AR) the MM11 communications buffer module on subrack A100. The MM3 communications buffer module name on A300 was specified as direct data interface (specified at its CTS connection).

The rigid network establishes a data transfer route between the transmitter and reciever.

The NTC on A100 finds the network-capable channel of the CTV on MM11, identifies using @NMC, the target, and then initializes a channel on CS13, on A100.

The NTC and A200 find the network-capable channel on CS13 and A100, identify, using @NMC, the target, and then initialize a channel on CS13 on A200.

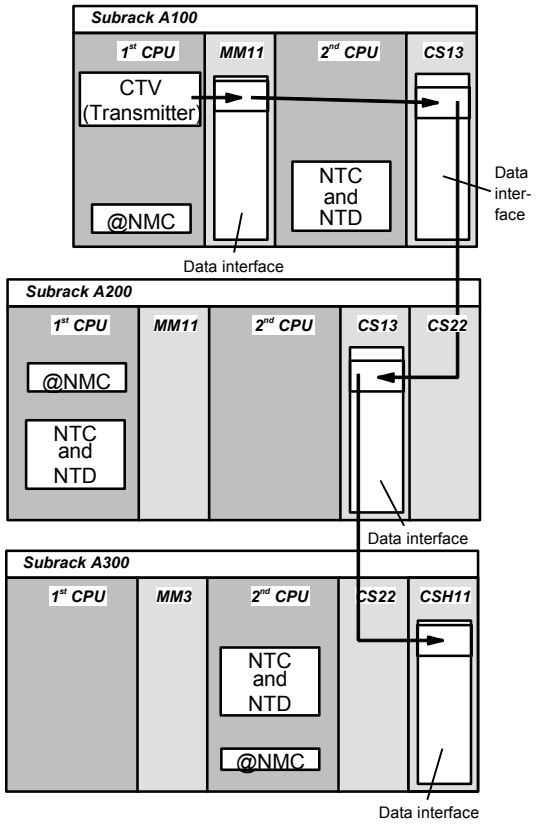
In turn, the NTC on A300 finds the network-capable channel on CS13 on A200, and searches, alone for the receiver, as it should be in the same subrack. The channels, logged-on from CRV and MM3 are then synchronized. Thus, the data transfer route is complete and the NTD function blocks copy data blocks from the MM11 channel on A100 into the MM3 channel to the A300.



Example 2: The transmit block CTV has, as target address the CSH11 interface on subrack A300 (is configured as network data entry at connection AT).
The MM11 communications buffer module name on A100 is specified as direct data interface (this is specified at its CTS connection.

The rigid network establishes a data transfer route between the transmitter and the CSH11 interface.

The NTC on A100 finds the network-capable channel of the CTV on MM11, identifies, using the @NMC, that the target exists and then initializes a channel on CS13, on A100.
The NTC on A200 finds the network-capable channel on CS13 on A100, identifies, using the @NMC, that the target exists, and then initializes a channel on CS13, on A200.
In turn, the NTC on A300 finds the network-capable channel on CS13, on A200, and logs-on the channel to the.
CSH11 interface. The CSH11 firmware then synchronizes to this channel. Thus, the data transfer route is complete and the NTD function blocks copy the data blocks from the MM11 channel to A100 in the CSH11 interface on a 300



If a data transfer route ends or starts on a CSH11 or CS7 (which submodule is irrelevant), then the following restriction exists regarding the data transfer modi (e.g. handshake):

- If the function block utility is in the transmit mode (e.g. message output block MSI), then, for the "multiple" data transfer mode, the data transfer route is not established.

- If the function block utility operates in the receive mode (e.g. receive block @CRV), then, for the "select" data transfer mode, the data transfer route is not established.

The sampling time, in which function block NTC is configured, only has influence on the time in which a rigid network circuit is established. The NTC has no influence on the actual data transfer rate; the NTD function block is responsible for this.

The NTD copying blocks only start to transfer data after the complete data transfer route has been set-up.

When selecting the route, only the shortest connection to the target subrack is follows. If there are several routes having the same distance, then all of these routes are tried..

Block output QTS indicates whether the NTC is operating error-free (QTS = 1) or not (QTS = 0).
When the output changes from a 1 to a 0, the function block has identified an irreparable error; an entry was made in the communications error field, and then the block became inactive (final status).

The computation time of the NTC is essentially dependent on the scope of the configured communications task in a subrack and the number of configured, rigid network circuits.

I/O

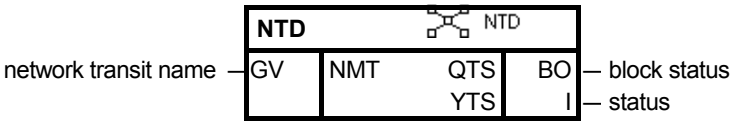
NMT	Referencing name for NTC and NTD for the configuring interface. The name is not evaluated. (default : 0)
QTS	Block output to display whether the block is error-free (QTS=1), or, after entering a communications error message, became inactive (QTS=0). (default : 0)
YTS	At block output YTS, the block status during normal operation is indicated. If the function block has become inactive after making an entry in the communications error field, then the appropriate error number is output at YTS. For values at YTS, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (default : 0)

Configuringdata

Computation time [µs]	T400 / PM5 500,0 FM458 / PM6 165,0
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

3.4.6 NTD Rigid network copying block

Symbol



Brief description

- function block NTD copies data blocks between two data interfaces.
- when using a function block, an NTC function block must be configured on the same CPU.
- further, it is also necessary to configure the central network block @NMC (it need not be on the same CPU, but it must be in the same subrack), and also a communications buffer module with C-bus connection must also be configured (e.g. MM11).
- if the overall data transfer route between the transmitter and receiver is not unique (i.e. if the subrack configuration allows various data transfer routes between transmitters and receivers), it should be observed that NTD- and NTC function blocks are configured on all of the network subracks.
  The length of the data transfer route and whether all of the data interfaces along this data transfer route have sufficient memory for the data blocks to be copied, defines which data transfer route is selected between transmitters and receivers in the rigid network.

Mode of operation

NTD is a pure data copying block. Function block NTC defines which data blocks from which data interface are to be copied where.

The data block length is not limited. Please observe that the computation time for each copy operation is dependent on the data block length. If the copy time is too long in relationship to the configured sampling time, then a computation overflow occurs (overrun).

The NTD only copies one data block in each processing cycle. The "throughput" can be increased, by configuring several function blocks NTD.

The data transfer time for a data block over the complete route between transmitter and receiver is dependent on the number of intermediate stations, i.e. how often the data block is copied-over before it reaches the receiver. Further, the sampling time in which the function blocks NTD are configured also plays a role and the network load (network utilization).

If NTD only has to execute one cyclic copy task, then the data block is copied in each NTD processing cycle. If the NTC assigns it two cyclic copy tasks, the data transfer time is doubled.

Block output QTS indicates as to whether the NTD is operating error-free (QTS = 1) or not (QTS = 0).
When the QTS output changes from 1 to 0, the function block has identified an irreparable error, it then made an entry into the communications error field and became inactive. The inactive status is final.

Block output YTS indicates the status of the data transfer. If NTD becomes inactive, the cause of the error is indicated at block output YTS (error number).

The computation time of NTD is essentially dependent on the number of bytes to be copied.

I/O

NMT	Referencing name for NTC and NTD for the configuring interface. The name is not evaluated. (default : 0)
QTS	Block output to indicate whether the block is operating error-free (QTS = 1) or, after entering a communications error message, became inactive (QTS = 0). (default : 0)
YTS	Block output YTS indicates, during normal operation, the status of block NTD. If the function block became inactive after entry in the communications error field, then the appropriate error number is output at block output YTS. For values at YTS, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (default : 0)

Configuringdata

Computation time [µs]	T400 / PM5 200,0 FM458 / PM6 66,0
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

3.5 T400-specific couplings and parameter processing

NOTE Additional information on this group of function blocks, e.g. symbol, mode of operation, I/O and technical data are provided in the online help for the particular block.

3.5.1 @PEER Peer-to-peer central block on the T400

Brief description

The block initializes a peer-to-peer coupling on the T400, connector X02. (X01 is not possible).

A CRV function block and/or CTV function block are required to receive and send process data.

The block may only be configured on a T400 module. It can be configured in a slow sampling time.

The block can be completely de-activated with EN=0. The configured communications interface can then be used for other purposes. The associated send- and receive blocks should be configured in a task group which can be disabled and also de-activated. The function block cannot be changed in operation.

3.5.2 @USS_M USS master central block on T400

Brief description

The block initializes a USS master coupling on the T400.

The process data function blocks CRV and CTV must be configured for communications with drives. "Display" function blocks and message output blocks must be configured for communications with an OP2 or VD1.

Due to resource limitations, a maximum of approximately 18 slaves can be connected.

The block may only be configured on a T400 module. It can be configured in a slow sampling time.

The block can be completely de-activated with EN=0. The configured communications interface can then be used for other purposes. The associated send- and receive blocks should be configured in a task group which can be disabled and also de-activated. The function block cannot be changed in operation.

3.5.3 @USS_S USS slave central block on the T400

Brief description

The block initializes a USS slave coupling on the T400.

The USS slave coupling is required to connect a MasterDrives OP1 or SIMOVIS to visualize and change parameters (refer to "SIMADYN D, Communication Configuring D7-SYS, Chapter Parameterizing SIMADYN D " User Documentation and FB-@DRIVE). To receive and send process data, each require that a CRV and CTV function block are configured (one for send, one for receive).

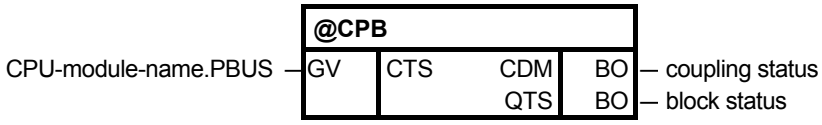
The USS master can be monitored (time) using the I/O CNX and MAC.

The block may only be configured on a T400 module. It can be configured in a slow sampling time.

3.6 FM 458-specific coupling

3.6.1 @CPB P-bus, central coupling block

Symbol



Brief description

The central block for the P-bus coupling can only run with an FM 458 application module.

- This function block is responsible for initializing and monitoring the P bus coupling.
- The function block can only be configured once for each application module FM 458, as there is only one P-bus coupling for each FM 458. If a function block is configured a multiple number of times, this is detected when initializing, and results in an entry in the communications error field.
- The block may only be configured in the sampling interval 32 ms <= TA <=256 ms. Otherwise, an entry is made in the communications error field.

Mode of operation

When initializing the function block, general preparations are made to enable the coupling. The coupling is only enabled after the standard mode has been run-through (executed) several times.

After the coupling has been enabled, the central block monitors that senders and receivers are correctly registered. Further, if required, it re-organizes and updates the block output CDM at each processing cycle.

The function block cannot be used to initialize another P-bus coupling or monitor this. It can only initialize its own P-bus coupling on which CPU is configured. An entry is made in the communications error field if another module name is specified at the CTS input (other than its own).

The CDM block output provides information about the coupling status. The connection is a 1, if the coupling is enabled for general send/receive operation. The CDM block output is 0, as long as the coupling is still being initialized, or is being re-initialized (after a temporary fault).

I/O

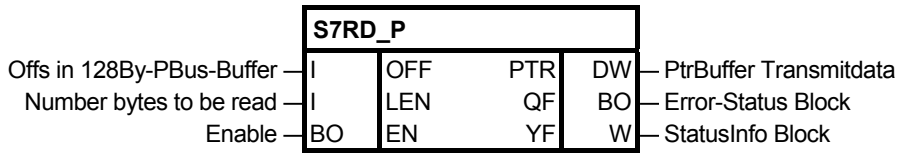
CTS	The configured name of its own CPU is specified at this initialization input.	
CDM	Specifies the coupling status (faulted = 0, not faulted = 1).	(default: 0)
QTS	Operating status of the function block There is an irreparable fault for QTS = 0, for QTS = 1, the function block operates error-free.	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 50,0 FM458 / PM6 16,5
Available online	no
Can be configured in	Cyclic tasks
Executed in	Normal mode Initialization mode
Special features	-

3.6.2 S7RD_P Reading data from a SIMATIC-CPU (P Bus)

Symbol



Brief description

This block can only be used for the SIMATIC application module FM 458-1 DP.
A SIMATIC-CPU can transfer up to 128 bytes to the FM 458-1 DP in its output area of the P bus. Block S7RD_P reads this data from the P-Bus and provides it, via its pointer interface, to the read blocks (DRD…, CPY_Y) for further processing in the CFC configured software.

Mode of operation

This block operates similar to the telegram block CRV_P. A maximum of 128 bytes can be accessed via the pointer interface. These bytes are sent from the SIMATIC-CPU to the FM 458-1 DP via the P bus.
Data can be read using the read blocks (DRD…) or the copy block (CPY_P).

This block only communicates with a SIMATIC-CPU. This means that the required byte or **word swap** operations are automatically made (depending on the data type of the connected read/write blocks). The entry, which is normally required at the SW-connection of the read/write block, is not evaluated and is therefore not required.

The **computation time** essentially depends on the amount of data transferred. A base computation time of approx. 10 µs as well as approx. 1 µs/byte can be assumed as nominal value.

Associated blocks The following blocks can be connected to this block (pointer input):
DRD, DRD_8, DRD_8D, DRD_8I, DRD_BY, DRD_D, DRD_I, CPY_P

I/O

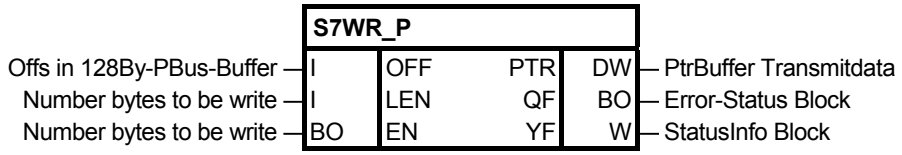
		Default:
OFF	Offs in 128By-PBus-Buffer Offset of the value to be sent within the 128 byte memory relative to the start of the buffer; max. offset: Buffer length - length of the data type	0
LEN	Number bytes to be read Number of bytes which are read by the SIMATIC-CPU via the P bus. Max. number: 128 bytes	0
EN	Enable For EN=1 at each call, the data sent from the SIMATIC-CPU (max. 128 bytes) is read.	1
PTR	PtrBuffer Transmitdata Pointer to the telegram data buffer; to connect with the same connection type of other pointer-based communication blocks. The CFC connection can be changed online. The connection also includes monitoring information to ensure correct configuring.	16#00000000
QF	Error status block QF=1: There is an error; for details, refer to YF	0.0
YF	StatusInfo Block §§ as for the DRD block!	16#0000

Configuring data

Computation time [µs]	T400/PM5 30,0 + 1 for each byte FM458/PM6 10,0 + 1 for each byte
Can be inserted online	Yes
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	The block must be configured in the **same sampling time** as the blocks, connected via the pointer interface (CFC connection via connections PTR). This can only be used for the FM 458-1 DP! Several S7RD_P blocks can be configured. Although this is not a typical application, it can make sense if, for example, the 128 byte area should be read in several blocks or if data is required in different sampling times.

3.6.3 S7WR_P Sending data to a SIMATIC-CPU (P Bus)

Symbol



Brief description

This block can only be used for the SIMATIC application module FM 458-1 DP.
An FM 458-1 DP can send up to 128 bytes to the SIMATIC-CPU via the P-Bus. The block S7WR_P sends data which were previously loaded with write blocks via the pointer interface.

Mode of operation

This block operates similar to the telegram block CTV_P. A maximum of 128 bytes can be transferred via this pointer interface and via the P bus to the SIMATIC CPU. This data is previously loaded into the telegram buffer using write blocks DWR… of the copy block CPY_Y.

This block only communicates with a SIMATIC-CPU. This means that the required byte or **word swap** operations are automatically made (depending on the data type of the connected read/write blocks). The entry, which is normally required at the SW-connection of the read/write block, is not evaluated and is therefore not required.

The **computation time** essentially depends on the amount of data transferred. A base computation time of approx. 5 µs as well as approx. 0.7 µs/byte can be assumed as nominal value.

Associated blocks

The following blocks can be connected to this block (pointer input):
DWR, DWR_8, DWR_8D, DWR_8I, DWD_BY, DWR_D, DWR_I, CPY_P

I/O

		Default:
OFF	Offs in 128By-PBus-Buffer Offset of the value to be sent within the 128 byte memory relative to the start of the buffer; max. offset: Buffer length - length of the data type	0
LEN	Number of bytes to be written Number of bytes which are to be sent to the SIMATIC CPU via the P bus. Max. number: 128 bytes	0
EN	Enable For EN=1, at each call, the telegram buffer (max. 128 bytes) is sent to the SIMATIC-CPU.	1

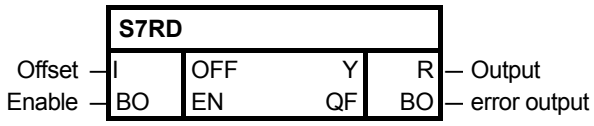
PTR	PtrBuffer Transmitdata Pointer to the telegram/data buffer; to connect with the same connection type of other pointer-based communication blocks. The CFC connection can be changed online. The connection also includes monitoring information to ensure correct configuring.	16#00000000
QF	Error status block QF=1: There is an error; for details, refer to YF	0.0
YF	StatusInfo Block §§ as for the DRD block!	16#0000

Configuring data

Computation time [µs]	T400/PM5 FM458/PM6	15,0 + 0.7 for each byte 5,0 + 0.7 for each byte
Can be inserted online	Yes	
Can be configured in	Interrupt tasks Cyclic tasks	
Executed in	Initialization mode Normal mode	
Special features	The block must be configured in the **same sampling time** as the blocks, connected via the pointer interface (CFC connection via connections PTR). This can only be used for the FM 458-1 DP! Several S7WR_P blocks can be configured. Although this is not a typical application, it can make sense if, for example, the 128 byte area should be written in several blocks or if data is required in different sampling times.	

3.6.4 S7RD, S7RD_B, S7RD_I, S7RD_D Read from the peripheral area of the S7-CPU

Symbol



Brief description

The function blocks, read from the peripheral area of the S7-CPU, can only run with an FM 458 application module.

The S7RD, S7RD_B, S7RD_I, S7RD_D blocks only differ by the data type at the output, which must correspond with the parameters to be read:

- S7RD: REAL
- S7RD_B: BOOL
- S7RD_I: INT
- S7RD_D: DINT

Mode of operation

With this block, data can be read into the assigned net data area of the SIMATIC S7-CPU, (periphery output) assigned to the FM 458 application module. This PE area is 128 bytes.

If the enable signal is set, the appropriate value is read from the PA area and made available at output Y.

The offset determines at which location in the PA area, the value is retrieved.

Depending on the block- or data type, the offset is specified as follows:

- for REAL data type in 4-byte steps (data length)
  value range of the offset: 0 . . . 31
- for BOOL data type in 1-byte steps (data length).
  value range of the offset: 0 . . . 127
- for INT data type in 2-byte steps (data length).
  value range of the offset: 0 . . . 63
- for DINT data type in 4-byte steps (data length).
  value range of the offset: 0 . . . 31

Output QF has the value 1, if an invalid offset was selected, or the block is not configured on the FM 458.

I/O

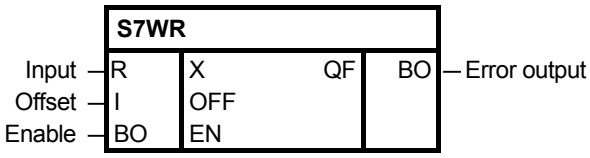
OFF	Offset	(default: 0)
EN	Enable	(default: 0)
Y	Output	(default: 0.0)
QF	Error output	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Available online	yes
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Normal mode Initialization mode
Special features	-

3.6.5 S7WR, S7WR_B, S7WR_I, S7WR_D Write into the peripheral area of the S7-CPU

Symbol



Brief description

The function blocks, write the peripheral area (I/O) of the S7-CPU can only run with one FM 458 application module.

The S7WR, S7WR_B, S7WR_I, S7WR_D blocks differ by the data type at the input, which must correspond with the parameters to be written:

- S7WR: REAL
- S7WR_B: BOOL
- S7WR_I: INT
- S7WR_D: DINT

Mode of operation

Using this block, data can be written into the net (useful) data area of the SIMATIC S7-CPU, assigned to the FM 458 application module (periphery input). This PE area is 128 bytes. If the enable signal is set, the input value is accepted via the input and entered in the PE area.

The offset determines at which position in the PE area, the input value is saved. Depending on the block- or data type, the offset is specified as follows:

- for REAL data type in 4 byte steps (data length).
  value range of the offset: 0 . . . 31
- for BOOL data type in 1 byte steps (data length).
  value range of the offset: 0 . . . 127
- for INT data type in 2 byte steps (data length).
  value range of the offset: 0 . . . 63
- for DINT data type in 4 byte steps (data length).
  value range of the offset: 0 . . . 31

Output QF has the value 1, if an invalid offset was selected, or the block is not configured on the FM 458 application module.

I/O

X	Input	(default: 0.0)
OFF	Offset	(default: 0)
EN	Enable	(default: 0)
QF	Error output	(default: 0)

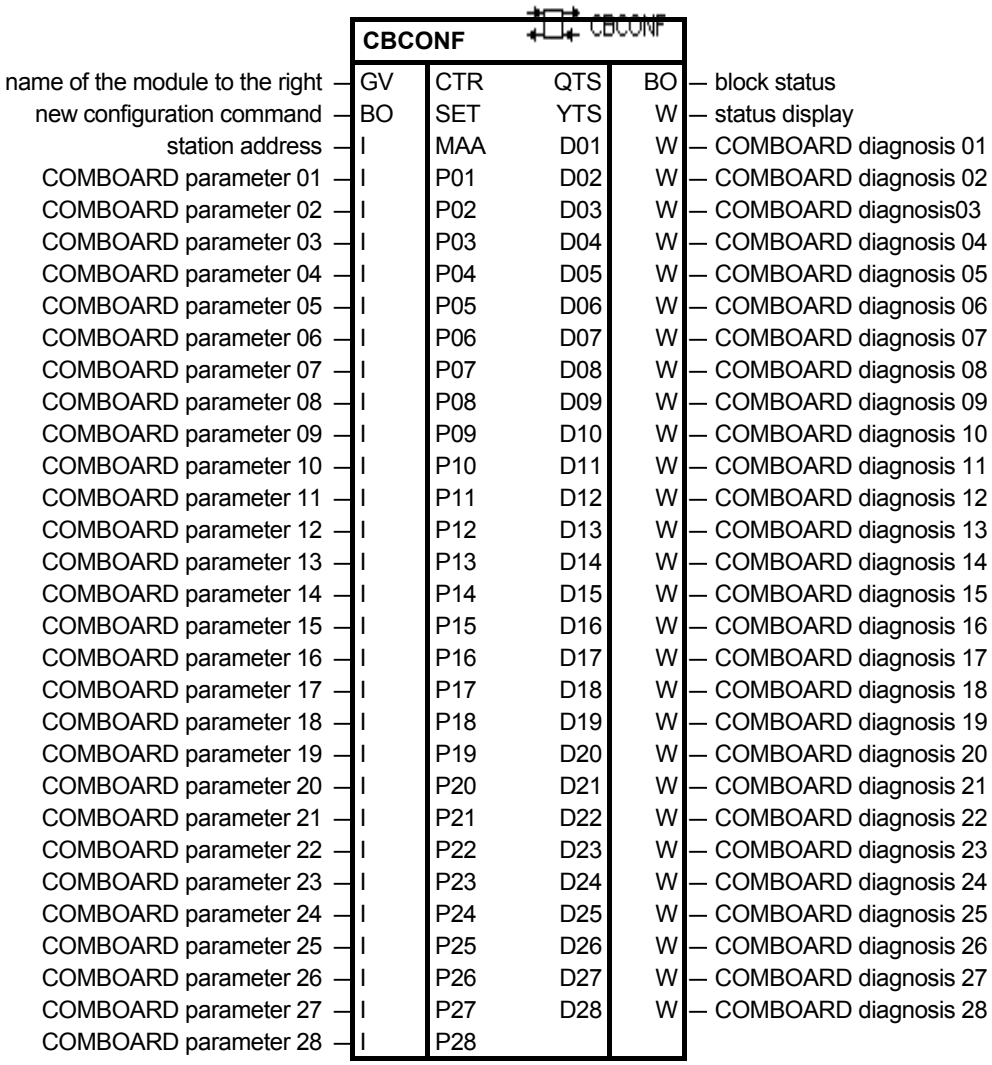
Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Available online	yes
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Normal mode Initialization mode
Special features	-

3.7 Parameterizing SIMADYN D

3.7.1 CBCONF COMBOARD configuration

Symbol



Brief description

FB CBCONF can be configured on the following modules:

- T400 technology module
- CPU modules

Configuring on the T400 technology module

Using this block, a BASEBOARD-T400 or a TECHBOARD-T400 configures a COMBOARD (CBx or SCBx).

This block is required when using a T400 with an adapter board with a maximum of two COMBOARDs in the SRT400 or when using a T400 with one BASEBOARD and an adapter board with a maximum of two COMBOARDs.

The block can only be configured on a T400 module and only once. The FB-@DRIVE is required.

If a BASE- and TECHBOARD are both present, a COMBOARD in the X01 slot of the adapter board is always configured through the BASEBOARD. The function block CBCONF, which should configure this board, disables itself, in this case, with an error signal at output YTS. A COMBOARD, which is inserted in slot X02 of an adapter board, is always configured via a function block CBCONF on the T400.

The function block can be configured in a slow sampling time.

Configuring on a CPU module

The function block CBCONF may only be configured once on any CPU module per COMBOARD. It is configured on the CPU module on which the function block @CSPAR was configured for the appropriate COMBOARD.

Mode of operation

The block saves the configured configuration data in the admin. area of the COMBOARD. It executes this once after run-up and user-controlled in the RUN mode. In the RUN mode, it outputs diagnostics data from the COMBOARD at its outputs.

New configuration data can be transferred online to COMBOARD with a positive edge at input SET.

I/O

CTR	Configured name of the "righthand" adjacent module (initialization connection). The following data can be entered: CTR=0 if an adjacent module was not configured CTR=<module name> or CTR=<module name>.<connector> if an adjacent board is configured. (default value: -)
SET	The configuration data is transferred online to the COMBOARD with a rising edge at this input. (Default value: 0)
MAA	The station number should be assigned depending on the particular protocol (e.g. USS: 0..30, PROFIBUS DP: 3..125). (Default value: 0)
P01...P28	Max. 28 additional COMBOARD-specific configuration parameters. (Default value: 0)
QTS	Block status: 1: Block is operational. 0: The block is disabled with an error output at YTS
YTS	Status display, possible values - 0: OK status - 7CB3: T400 operates as TECHBOARD and a BASEBOARD is available ... Additional values, refer to: D7-SYS Online Help " Help on events" (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D".) (Default value: 0)
D01...D28	Max. 28 words of diagnostics data of the COMBOARD (Default value: 0)

Significance of the configuring input for several COMBOARDs

The "CB-Param" and "SCB-Param" columns establish the assignment to the COMBOARD User Manuals.

Input	CB-Param new/old	CB1: DP	CBP: DP	CBP2: DP	CBP2: USS	CB2: CAN
MAA	P918	Bus address	Bus address	Bus address	Bus address	Bus address
P01	P711/ P696	(not used)	Diagnostic selection	Diagnostic selection	-	PKW task
P02	P712/ P697	PPO-Typ	PPO-Typ	PPO-Typ	-	PZD receive
P03	P713/ P698	(END)	(END)	Protocol selection: 0: Profibus-DP 2: USS		PZD send
P04	P714/ P699			SIMATIC OP writes in: 0: EEPROM 1. RAM	-	PZD send length
P05	P715/ P700			Slave to slave transfer failed: 0: Error 1: Warning	-	PZD send rate
P06	P716/ P701			(END)	-	PZD receive Broadcast
P07	P717/ P702				-	PZD receive Multicast
P08	P718/ P703				Baud rate 6 = 9,6 kBaud 7 = 19,2 kBaud 8 = 38,4 kBaud	PZD receiver cross
P09	P719/ P704				PKW: 0:no, 127:yes, 3:one word, 4:one D word	PKW task Broadcast
P10	P720/ P705				PZD: No. of words	Baud rate
P11	P706.1				(END)	CAN layer
P12	P706.2					Bus timing
P13	P706.3					(END)
P14	P706.4					
...						
P28						

Input	SCB-Param	SCB2: USS-Slave	SCB2: Peer	SCB1: CAN
MAA	P683.2	Bus address	(not used)	
P01	P682	SCB1/SCB2-protocol selection: 0:CAN, 1:USS 4-wire, 2:USS-2-wire, 3:Peer		
P02	P685.2	PKW: 0:no, 127:yes, 3:one word, 4:one D word	(not used)	
P03	P686.2	Process data: No. of words	(not used)	
P04	P684.2	Baud rate		
P05	P687.2	Telegram failure time		
P06		(END)	(END)	
P07				
P08				
P09				
P10				
P11				
P12				
P13				
P14				
...				
P28				

Significance of the diagnostic outputs

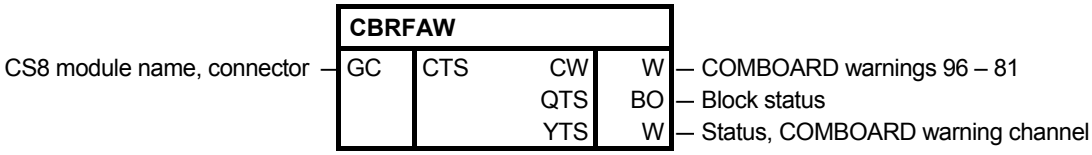
Refer to the COMBOARD User Manuals

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode System mode Normal mode
Special features	• The block may only be configured on the T400. • Additional block required: @DRIVE

3.7.2 CBRFAW Receiving warnings from a COMBOARD

Symbol



Brief description

- The block can only be configured on a CPU module, and not on a T400 module.
- This block receives warnings A81 to A96 of a COMBOARD (communications submodule of SIMOVERT MASTER DRIVES, e.g. CBP2 for PROFIBUS DP).
- Input CTS of the CBRFAW function block is used to define from which COMBOARD the warnings are to be received.
- Function block CBRFAW may only be configured once on any CPU module of each COMBOARD. It is configured on the CPU module, on which a @CSPAR function block was also configured for the appropriate COMBOARD.

I/O

Initialization inputs:

CTS	Configured name of the CS8 coupling module and connector X01 or X02, separated by ".". (Default: -)

Outputs:

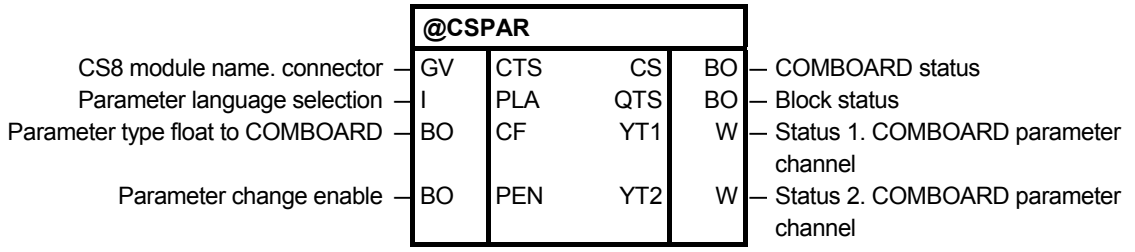
CW	Outputs COMBOARD warnings A81 to A96 (Default: 0)
QTS	Block status: • QTS=1: Block is being processed and is operating error-free. • QTS=0: Block is shut down due to a fault with error output at YTS YTS. (Default: 0)
YTS	Status of the COMBOARD warning channel: YTS=0: OK condition For additional values, refer to: D7-SYS online help "Help on events". (press the F1 key in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D".) (Default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	• The block can only be configured once for each communications submodule. • Additionally required block: @CSPAR

3.7.3 @CSPAR Parameter processing on CPU modules

Symbol



Brief description

The FB @CSPAR can only be configured on a CPU module and not on a T400 module.

FB @CSPAR monitors the COMBOARD (communications submodule of the SIMOVERT MASTER DRIVES, e.g. CBP for PROFIBUS DP) and processes the parameter tasks which are defined for it.

Several @CSPAR central blocks for various COMBOARDs can be configured on a CPU module.

It should be configured in a slow sampling time (approx. 100 ms). The maximum permissible sampling time is 200 ms (as a result of the monitoring using adjacent modules).

The existence and correction functioning of the COMBOARD is automatically identified and is displayed at output CS.

Only one COMBOARD may be configured using FB @CSPAR.

Parameter processing:

Parameters are configured in the comment at each I/O. If the comment starts with "@TP_", then this I/O is designated as parameter. Every parameter can be allocated a parameter name (FB-PNAME). Further, a setting parameter can also be allocated a minimum and a maximum (FB-PLIM).

Mode of operation

The block handles the following tasks:

- Checks the module code of the COMBOARD
- Monitors the COMBOARD (lifebit counter)
- Transfers the configuration data to the COMBOARD
- Processes the parameter channels
- In standard operation, processes the parameter tasks (in the sampling time cycle).

The name of the COMBOARD which is to be processed, is configured at input CTS of the FB @CSPAR. If a name has not be configured at input CTS, then the FB @CSPAR shuts itself down with an error signal at output YTS.

NOTE

- @CSPAR must be configured on all of the appropriate CPU modules for the same COMBOARD to process parameters on various CPU modules.
- Function blocks CRV and CTV may only be configured once. They can be configured on any and on different processor modules. However, parameter processing is possible for all processor modules.

Initialization I/O:

CTS	Configured name of the CS8 coupling module and connector X01 or X02, separated by ".". (Default: -)
CF	Parameter data type to transfer SIMADYN D data types REAL and SDTIME via the parameter channel of the COMBOARD: • CF=1: Parameter data type, float • CF=0: 32-bit integer "I4" (Default: 1)
PLA	Parameter language selection (parameter language): The parameter names are activated, which are configured at all PNAME function blocks, whose PLA input has the same value (Default: 0)

Inputs:

PEN	Enables the parameter change: • PEN=1: allows the operator control parameters to be changed through all of the parameter channels • PEN=0: inhibits operator control parameter changes via all parameter channels (Default: 1)

Status outputs:

CS	COMBOARD status: • CS=1, COMBOARD is operational. • CS=0, COMBOARD has failed or is not available. (Default: 0)

Diagnose outputs:

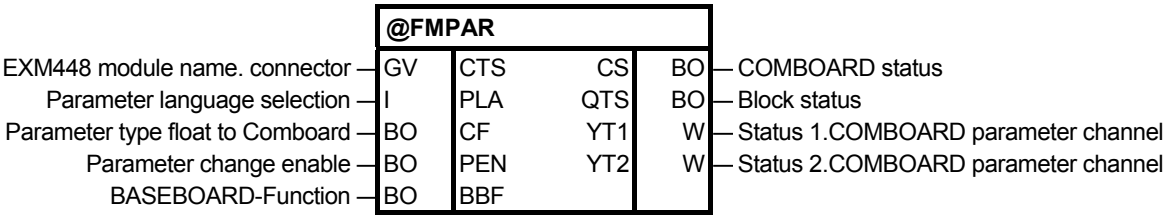
QTS	Block status: • QTS=1: Block is operational and is operating error-free. • QTS=0: Block is shutdown due to a fault with an error output at YTS (Default: 0)
YT1	• YT1=0: OK status • Initialization mode: status of the block initialization • Standard mode: Status of the 1st parameter channel from COMBOARD For additional values, refer to: D7-SYS online help "Help on Events". (press the F1 key in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D".) (Default: 0)
YT2	• YT2=0: OK status • Intialization module: Status of the block initialization • Standard mode: Status of the 2nd parameter channel of COMBOARD For additional values, refer to: D7-SYS online help "Help on events ". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D".) (Default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	• 10<=sampling time<=200 ms • Block may not be switched-in or switched-out per task group.

3.7.4 @FMPAR Parameter processing on FM458 modules

Symbol



Brief description

The FB @FMPAR can only be configured on a FM458 module and not on a T400 module.

FB @FMPAR monitors the COMBOARD (communications submodule of the SIMOVERT MASTER DRIVES, e.g. CBP for PROFIBUS DP) and processes the parameter tasks which are defined for it.

Several @FMPAR central blocks for various COMBOARDs can be configured on a FM458 module.

It should be configured in a slow sampling time (approx. 100 ms). The maximum permissible sampling time is 200 ms (as a result of the monitoring using adjacent modules).

The existence and correction functioning of the COMBOARD is automatically identified and is displayed at output CS.

Only one COMBOARD may be configured using FB @FMPAR.

Parameter processing:

Parameters are configured in the comment at each I/O. If the comment starts with "@TP_", then this I/O is designated as parameter. Every parameter can be allocated a parameter name (FB-PNAME). Further, a setting parameter can also be allocated a minimum and a maximum (FB-PLIM).

Mode of operation

The block handles the following tasks:

- Checks the module code of the COMBOARD
- Monitors the COMBOARD (lifebit counter)
- Transfers the configuration data to the COMBOARD
- Processes the parameter channels
- In standard operation, processes the parameter tasks (in the sampling time cycle).

The name of the COMBOARD which is to be processed, is configured at input CTS of the FB @FMPAR. If a name has not be configured at input CTS, then the FB @FMPAR shuts itself down with an error signal at output YT1/2.

NOTE Function blocks CRV and CTV may only be configured once. They can be configured on any and on different processor modules. However, parameter processing is possible for all processor modules.

Initialization I/O:

CTS	Configured name of the EXM448 coupling module and connector X02, separated by ".". (Default: -)
CF	Parameter data type to transfer SIMADYN D data types REAL and SDTIME via the parameter channel of the COMBOARD: • CF=1: Parameter data type, float • CF=0: 32-bit integer "I4" (Default: 1)
PLA	Parameter language selection (parameter language): The parameter names are activated, which are configured at all PNAME function blocks, whose PLA input has the same value (Default: 0)

Inputs:

PEN	Enables the parameter change: • PEN=1: allows the operator control parameters to be changed through all of the parameter channels • PEN=0: inhibits operator control parameter changes via all parameter channels (Default: 1)
BBF	BASEBOARD-Function • BBF=0: SIMATIC FM458 operates as TECHBOARD (parameter number from external view 1000..1999, 3000..3999) • BBF=1: SIMATIC FM458 operates as BASEBOARD (parameter number from external view 0..999, 2000..2999) (Default: 0)

Status outputs:

CS	COMBOARD status: • CS=1, COMBOARD is operational. • CS=0, COMBOARD has failed or is not available. (Default: 0)

Diagnose outputs:

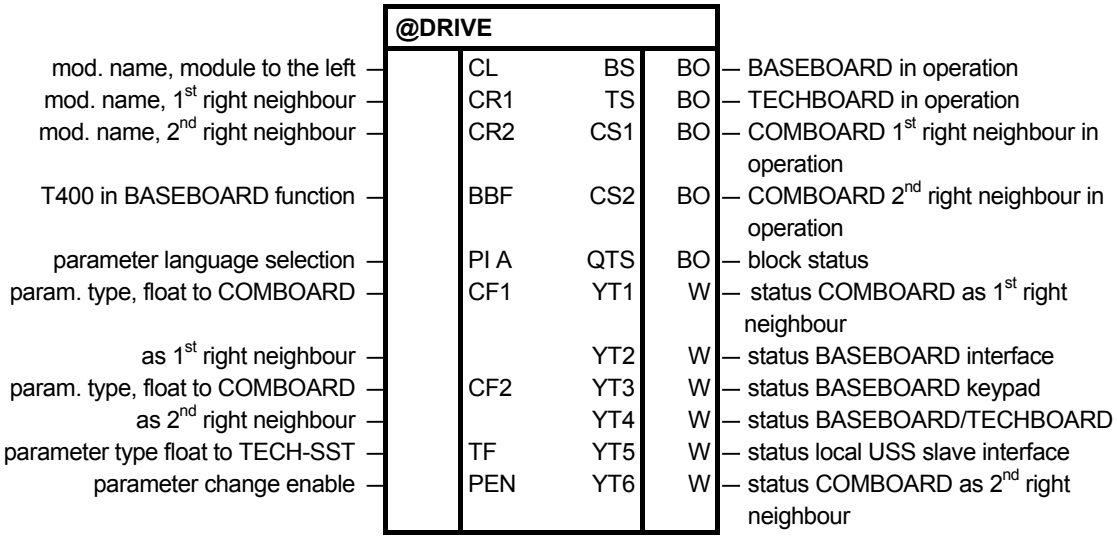
QTS	Block status: • QTS=1: Block is operational and is operating error-free. • QTS=0: Block is shutdown due to a fault with an error output at YT1/2 (Default: 0)
YT1	• YT1=0: OK status • Initialization mode: status of the block initialization • Standard mode: Status of the 1st parameter channel from COMBOARD For additional values, refer to: D7-SYS online help "Help on Events". (press the F1 key in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D".) (Default: 0)
YT2	• YT2=0: OK status • Intialization module: Status of the block initialization • Standard mode: Status of the 2nd parameter channel of COMBOARD For additional values, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D".) (Default: 0)

Configuringdata

Computation time [µs]	FM458 3,3
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	• 10<=sampling time<=200 ms • Block may not be switched-in or switched-out per task group.

3.7.5 @DRIVE Device coupling and parameter processing on T400

Symbol



Brief description

FB @DRIVE can only be configured on a T400 module but not on a CPU module.

The block initializes and monitors the dual port RAM couplings and parameter processing on a T400 module according to the way that "Parameterizing SIMADYN D" was specified.

The block can only be configured on a T400 module, and only once. It should be configured in the slowest sampling time (approx. 100 ms). The maximum permissible sampling time is 200 ms (as a result of the monitoring by the adjacent modules).

The T400 module can be used with the BASEBOARD function using input BBF (left as the second T400 in the SRT400).

The availability and functioning of adjacent modules is automatically identified and is indicated at the BS, TS, CS1 and CS2 outputs.

We recommend that you configure slot X01 before slot X02.

Parameter processing :

Parameters are configured in the comments for a particular I/O. If the comments start with "@TP_ ", then this I/O is designated as parameter.

Each parameter can be assigned a parameter name (FB-PNAME). A setting parameter can be additionally assigned a minimum and a maximum (FB-PLIM).

Mode of operation

The block has two tasks:

1) It checks the availability of BASE-, TECH- and COMBOARD. It initializes and monitors the interfaces to the adjacent modules.

2) It creates parameter lists, which can be accessed via various parameter channels (BASEBOARD interface, BASEBOARD operator control panel, COMBOARD, local USS slave interface). In standard operation, it processes parameter tasks (in the sampling time clock cycle).

Initialization I/O:

CL	Configured name of the first "righthand" adjacent module. The following data can be entered: CL=0, if a module has not been configured. CL=<module name>, if a module was configured. (default value: -)
CR1	Configured name of the "lefthand" adjacent module. The following data can be entered: CR1=0 if a module has not been configured. CR1=<module name> or CR1=<module name>.<connector> if a module was configured. (default value: -)
CR2	Configured name of the second "righthand" adjacent module. This input is only evaluated, if input CR1 was configured with <module name>.<connector>. The following data can be entered: CR2=0 if a module was not configured. CR2=<module name>.<connector> if a module is configured. (default value: -)
BBF	BBF=0: T400 operates as TECHBOARD (parameter numbers from an external perspective 1000..1999, 3000..3999) BBF=1: T400 operates as BASEBOARD (parameter numbers from an external perspective 0..999, 2000..2999) (Initialization input) (Default value: 0)
PLA	Parameter language selection (language parameter): The parameter names are activated which are configured at all "PNAME" function blocks, whose PLA input has the same value. (default value: 0)
CF1	SIMADYN D REAL and SDTIME data types are transferred via the COMBOARD parameter channel as float parameter data type (CF1=1) or as 32 bit integer "I4" (CF1=0). (default value: 1)
CF2	SIMADYN D REAL and SDTIME data types are transferred via the COMBOARD parameter channel as float parameter data type (CF2=1) or as 32 bit integer "I4" (CF2=0). (default value: 1)

TF	SIMADYN REAL and SDTIME data types are transferred via the parameter channel of the TECHBOARD interface as float parameter data type (TF=1) or as 32-bit integer "I4" (TF=0). (default value: 1)

Inputs:

PEN	Parameter can be changed: PEN=1 enables changes to the operator control parameters through all parameter channels, PEN=0 inhibits these. (default value: 1)

Status outputs:

BS	BASEBOARD status • BS=0: BASEBOARD not available or not operational • BS=1: BASEBOARD available and operational (Default value: 0)
TS	TECHBOARD status • TS=0: TECHBOARD not available or not operational • TS=1: TECHBOARD available and operational (Dafault value: 0)
CS1	COMBOARD1 status • CS1=0: First COMBOARD not available or not operational • CS1=1: First COMBOARD available and operational (Dafault value: 0)
CS2	COMBOARD2 status • CS2=0: Second COMBOARD not available or not operational • CS2=1: Second COMBOARD available and operational (Dafault value: 0)

Diagnostic outputs:

QTS	Block status: 1: Block is operational. 0: Block is disabled with an error output at YT1 (Default value: 0)
YT1	Status, parameter channel from the COMBOARD and principle status of the block.
YT2	Status, parameter channel from the BASEBOARD interface to the TECHBOARD.
YT3	Status, parameter channel from the BASEBOARD operator panel to the TECHBOARD.
YT4	Status, parameter channel from the TECHBOARD to the BASEBOARD.
YT5	Status, parameter channel from the local USS slave interface.

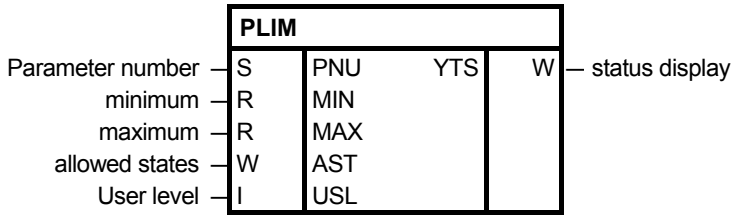
YT6	Status, parameter channel from the second COMBOARD.
YT1...YT6	Status display, possible values: - 0: OK status - 7C70: Parameter channel not operational due to configuration - 7C7A: Block sampling time not in the range 10...200ms For additional values refer to: D7-SYS Online Help "Help on events " (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D"). (Default value: 0)

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	• The block may only may only be configured once on the T400. • 10 <= sampling time <= 200 ms • The block may neither be enabled nor disabled per task group.

3.7.6 PLIM, PLIM_B, PLIM_I, PLIM_D Operator control parameter limiting

Symbol



Brief description

The block can be configured to a setting parameter, if

- this setting parameter should be assigned a minimum and/or a maximum to limit the input
- this setting parameter should only be changed in certain equipment statuses and access levels.

The function block can be configured on the following modules:

- T400 technology module (@DRIVE function block is required)
- CPU module in the SIMADYN D subrack (@CSPAR function block is required)

The block can be configured in the slowest sampling time.

The function blocks PLIM, PLIM_B, PLIM_I, PLIM_D differ by the data type of inputs MIN and MAX, which must correspond to the data type of the parameter to be limited:

- PLIM: REAL (and SDTIME)
- PLIM_B: BOOL
- PLIM_I: INT (and WORD)
- PLIM_D: DINT

The input limit is only effective when the I/O is changed per parameter. Entries using CFC are not checked!

Mode of operation

The values of the connections (I/O) are only evaluated while the block is being initialized. Changes made during operation do not affect the parameter attributes.

I/O

PNU	The parameter number (e.g.: "H123") establishes the assignment to the setting parameter ("@TP_H123"). (Initialization input) (Default value: Empty string)
MIN	Minimum (Initialization input) (Default value: REAL: -1.0e38; INT: -32768; DINT: -2147483648)
MAX	Maximum (Initialization input) (Default value: REAL: 1.0e38; INT: 32767; DINT: 2147483647)
AST	Allowed States: Enters the statuses in which the parameter can be changed, in a hexadecimal form. For each status n, in which the parameter should be able to be changed, bit n are set to 1 and the remaining bits are set to 0.. For example, a parameter is to be able to be changed in statuses 1, 2, 7, 12: this corresponds to binary value 2#000100001000011 and as hexadecimal value at input AST=16#843. The value at input AST is only effective, if block PSTAT was configured (Default value: 16#FFFF)
USL	Access level: Specifies the minimum required access level in order to obtain write authorization for this parameter. The value at input USL is only effective, if the PSTAT block was configured. If input USL = 0, then this parameter can be changed independent of the access level at function block PSTAT. Permissible values: 0 to 8 (Default value: 0)
O2	(This input is only available at FB-PLIM_I.) O2=1 converts the SIMADYN data type "integer" into the "O2" parameter data type, instead of normally "I2". This can be practical, if data type "O2" parameters are required. In this case, it is not permissible that the "integer" value is negative. (Initialization input) (Default value: 0)

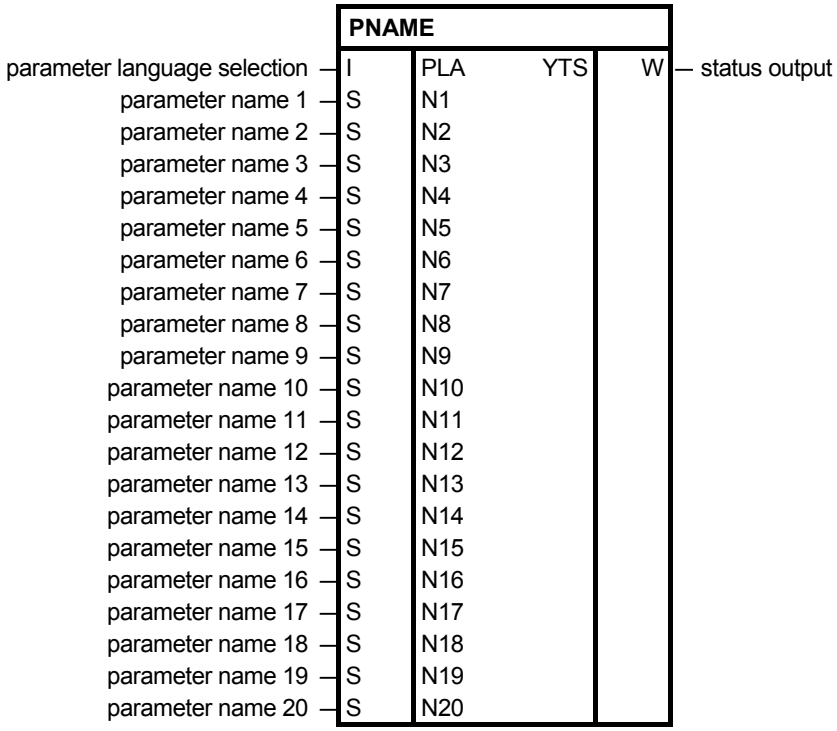
YTS	Status display: - 0: OK- Status Configuring error: - 7CDB: Illegal entry at input USL - 7CDC: "0" was configured at input AST. "0" does not correspond to a valid equipment status. - 7CAB: The parameter to the configured number is a visualization parameter (output) - 7CAC: The parameter to the configured number is not available. - 7CAD: Data types are not identical - 7CAF: MIN is greater than MAX Additional values, refer to: D7-SYS Online Help "Help on events" (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (Default value: 0)

Configuringdata

Computation time [µs] (PLIM, PLIM_I, PLIM_D)	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode
Special features	• additionally required block on T400: @DRIVE • additionally required block on the CPU modules: @CSPAR

3.7.7 PNAME Parameter names on the T400

Symbol



Brief description

The block is required to configure names for parameters.

The PNAME function block can be configured on the following modules:

- T400 technology module (@DRIVE function block is required)
- CPU module in the SIMADYN D subrack (@CSPAR function block is required)

The block can be configured in the slowest sampling time.

Mode of operation

The block saves the configured names in the parameter list of the FB-@DRIVE or @CSPAR, and then disables itself.

I/O

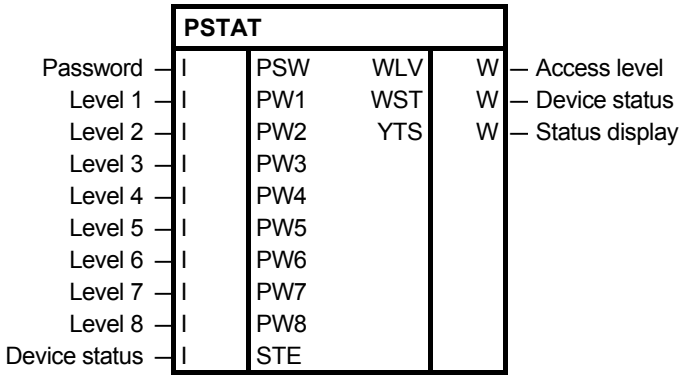
PLA	Parameter language selection (parameter langage): The configured parameter names are exactly activated when the data coincides with the PLA input at the @DRIVE or @CSPAR block. (Initialization input) (Default value: 0)
Nnn	The parameter number and the parameter name, separated by a colon are specified at the Nnn inputs. Example: "H123: parameter name". The parameter number must always consists of a letter (H or L) and three digits. The parameter name should be a maximum of 16 characters long; longer names will be cut-off and shorter names, filled with blanks. . (Initialization input) (Default value: Empty string)
YTS	Status display, possible values - 0: OK status (all of the names are activated). Alarms: - 1: The names are not activated, as another language is set at FB-@DRIVE or @CSPAR - 2: For at least one parameter number, there is no parameter (the name is ignored) Additional values, refer to: D7-SYS Online Help "Help on events" (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") (Default value: 0)

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	• additionally required block on T400: @DRIVE • additionally required block on the CPU modules: @CSPAR

3.7.8 PSTAT Change enable for parameters

Symbol



Brief description

Using the function block, the following can be realized

- a current device status can be configured,
- the access level can be defined by entering a password,
- the device status and the access level is used to define whether a parameter may be changed.

The statuses and access level, in which a parameter is to be inhibited or enabled, are defined using the PLIM function block.

Function block PSTAT may only be configured once in each CPU module or T400.

I/O

PSW	Current password: If password PSW does not coincide with the PWi values, then this corresponds to access level 0: this does not permit any change. If password PSW coincides with a value of PWi, then this corresponds to access level i and all lower access levels. In access level 8, there are no access authorizations as a result of the access level (all other access restrictuions, e.g. using the device status, are retained). (Default: 0)
PWi	Appropriate password for access level i (password i): (Default: 0)
STE	Actual "device status": There are 16 statuses. Permissible entry range: 1 to 16 (Default: 1)

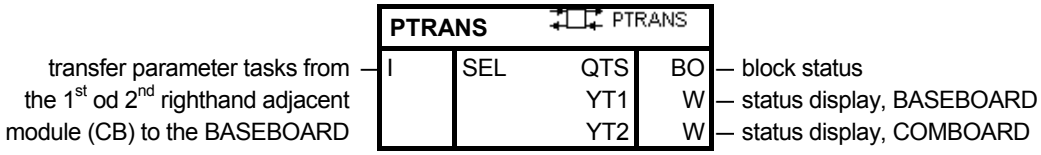
WLV	Actual access stage i (word level): The access stage i, determined by the entry at input PSW, is output as binary value. For access stage n, bit n is set to 1 and all of the other 15 bits, are set to 0. e.g. for access level = 7, WLVcorresponds to 2#0000000001000000. (Default: 2#0000000000000000)
WST	Device status (word state): The actual device status STE is output as a binary value. For the current device status ST=n, bit n is set to 1 and all of the other 15 bits are set to 0. e.g. for STE=7, WST corresponds to 2#000000001000000. (Default: 2#0000000000000001)
YTS	Status display: • 7C78: Function block is configured several times • 7CCA: no @DRIVE or @CSPAR function block configured • 7CF9: one or several incorrect entries were made at input PWi • 7CFA: illegal entry at input STE (Default: 0) For additional values, refer to: D7-SYS online help "Help on events". (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D".)

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Alarm-Tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	• Function block may only be configured once per CPU module or T400 • Function block additionally required on T400: @DRIVE and PLIM • Function block additionally required on the CPU modules: @CSPAR and PLIM

3.7.9 PTRANS Parameter transfer on the T400

Symbol



Brief description

Using this block, a TECHBOARD T400 transfers parameter tasks and responses between the COM- and BASEBOARD.

The block may only be configured on a T400 module and only once. An FB @DRIVE is required. It only makes sense to use this, if, in addition to the T400 as TECHBOARD, BASEBOARD **and** COMBOARD are available. If there are several COMBOARDs, then the SEL input is used to specify from which COMBOARD, the parameter tasks are to be transferred to the BASEBOARD.

The parameter transfer should be configured using this block, so that the user can adapt the sampling time to his particular requirements.

Mode of operation

I/O

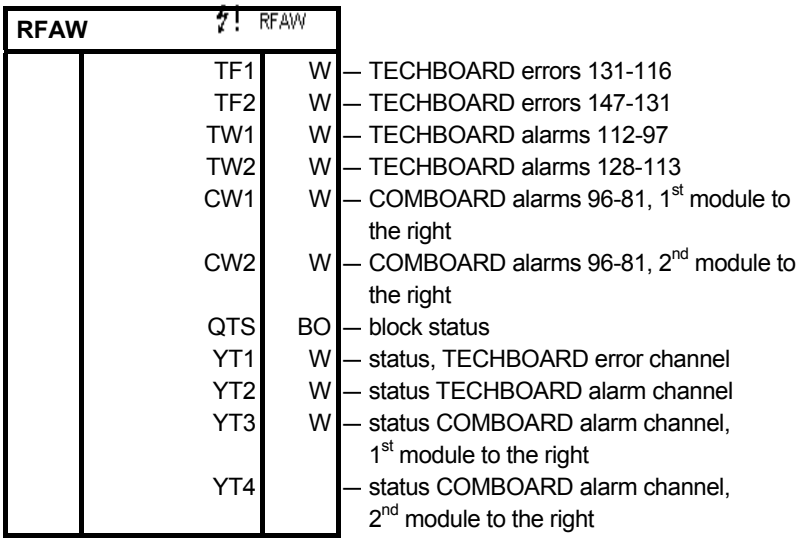
SEL	Selector to decide from which righthand adjacent module, the parameter tasks should be transferred to the BASEBOARD. The following data entries can be made: SEL=0 (transfer parameter tasks from slot X01 of the COMBOARD) SEL=1 (transfer parameter tasks from slot X02 of the COMBOARD) (default value: 0)
QTS	Block status: 1: Block is operational. 0: Block is disabled with an error output at YT1
YT1, YT2	Status display: - 0: OK status Alarms: - 1: No operator control rights - 2: Block is not operational as neither BASE- nor COMBOARD are available Additional values, refer to: D7-SYS Online Help "Help on events" (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D")

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode System mode Normal mode
Special features	• The block may only be configured on the T400. • Additional block required: @DRIVE

3.7.10 RFAW Receives errors and alarms on a BASEBOARD-T400 from a TECH-/COMBOARD

Symbol



Brief description This block receives errors and alarms on a BASEBOARD-T400 from the TECHBOARD or alarms from the COMBOARD.

The block may only be configured on a T400 module and only once. The FB-@DRIVE is required.

Mode of operation If the T400 module operates as TECHBOARD, the block remains inactive.

I/O

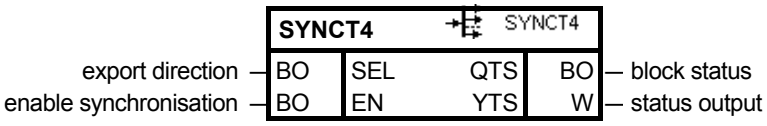
TF1, TF2, TW1, TW2, CW1, CW2	(refer to FB-TFAW)
QTS	Block status: 1: Block is operational. 0: Block is disabled with error output at YT1
YT1...YT4	Status display: 0: OK status Additional values, refer to: D7-SYS Online Help "Help on events "(press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D") .

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode System mode Normal mode
Special features	• The block may only be configured once on the T400. • Additional block required: @DRIVE (BBF = 1)

3.7.11 SYNCT4 Synchronizing to T400

Symbol



Brief description

The block generates a synchronizing signal on a T400 module to an adjacent module (e.g. BASEBOARD or COMBOARD).

The block can only be configured on a T400 module
A maximum of two sync blocks can be configured, one for export to the "left" and one to the "right".

Additional synchronizing possibilities on the T400 (e.g. import or export of the basic clock) are configured using HWConfig. The synchronizing signal "export" must also be enabled there using this synchronization block.

Mode of operation

The block generates a synchronizing signal (0.5 ms pulse), if a "1" is present at input EN. The signal is immediately generated.

I/O

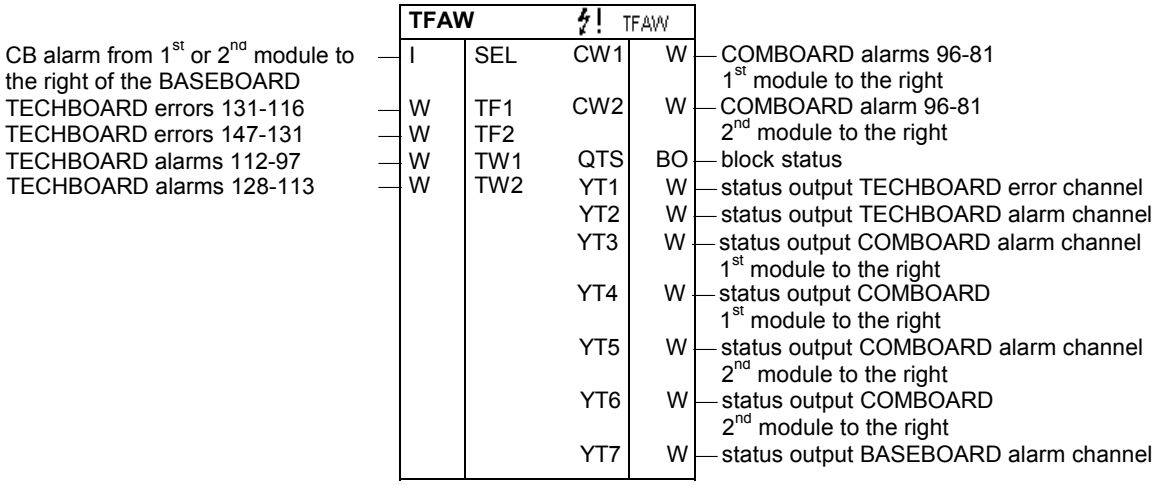
SEL	Selects the adjacent module, to which the synchronizing signal is exported. SEL=0: to the "left" (BASEBOARD) SEL=1: to the "right" (COMBOARD) (Initialization input) (Default value: 0)
EN	Generates a synchronizing signal (status-controlled): EN=1 generates a synchronizing signal, EN=0 no synchronizing signal is generated. (Default value: 0)
QTS	Block status: 1: Block is operational. 0: Block is disabled with error output at YTS
YTS	Status display: - 0: OK status Additional values, refer to D7-SYS Online Help "Help on events" (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D")

Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode System mode Normal mode
Special features	The block may only be configured on the T400.

3.7.12 TFAW Sends errors and alarms from a TECHBOARD-T400 to a BASEBOARD

Symbol



Brief description

This block sends TECHBOARD errors and alarms on a TECHBOARD-T400 to the BASEBOARD.

The block can only be configured on a T400 module or only once. If there are several communication modules in an adapter board, input SEL is used to define from which communication modules, the alarms are to be transferred to the BASEBOARD.

It receives alarms from a maximum of two COMBOARDs and outputs these at CW1 or CW2. Depending on the SEL input, the appropriate alarms are transferred to the BASEBOARD.

Mode of operation

If the T400 module operates as BASEBOARD, the block remains inactive.

The block makes the status at its inputs TF1, TF2, TW1 and TW2 available to the BASEBOARD for further evaluation.

I/O

SEL	Selector to decide from which righthand adjacent module, the alarms should be transferred to the BASEBOARD. The following data entries can be made: SEL=0 (transfer alarms from slot X01 of the COMBOARD) SEL=1 (transfer alarms from slot X02 of the COMBOARD) (default value: 0)
TF1, TF2	TECHBOARD error Nos. 116-147, bit-coded, displayed at the BASEBOARD (e.g.): "F116" (default value: 0)
TW1, TW2	TECHBOARD alarms Nos. 97-128, bit-coded, displayed at the BASEBOARD with (e.g.) "A97" (default value: 0)
CW1	COMBOARD alarms from the second righthand adjacent module (COMBOARD is located in an adapter board at slot X01)
CW2	COMBOARD alarms from the second righthand adjacent module (COMBOARD is located in an adapter board at slot X02)
QTS	Block status: 1: The block is operational. 0: Block is disabled with error output at YT1
YT1...YT6	Status display: 0: OK status Additional values, refer to: D7-SYS Online Help "Help on events" (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D")
YT7	Status display of the alarm channel, which is used to transfer alarms from the COMBOARD to the BASEBOARD 0: OK status Additional values, refer to: D7-SYS Online Help "Help on events" (press key F1 in the CFC and call-up the topic "Help on events" under "CFC for SIMADYN D")"

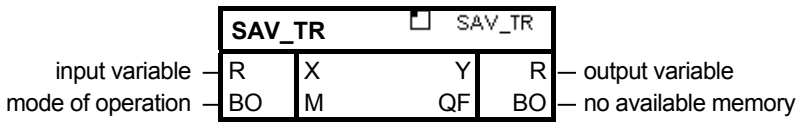
Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode System mode Normal mode
Special features	• The block may only be configured once on the T400. • Additional block required: @DRIVE

4 Logic blocks

4.1 SAV_TR Save FB for NOV_RAM

Symbol



Brief description

A REAL type quantity is saved in the NOV-RAM of a technology module.

Mode of operation

The function block is a read/write memory for a REAL value. It is only active, if a 0 at output QF indicates that the memory space in the NOVRAM is available. The function block operating mode is selected at input M:

Write operating mode (M = 1)

- The quantity to be saved is entered at input X. It is transferred to output Y.
- Further, input quantity X is entered in the NOV-RAM of the module. In this case, a value, already contained in the NOV-RAM is overwritten.

Read operating mode (M = 0)

- The last input quantity, saved in the **write operating mode**, is output at Y.
- The NOV-RAM is deleted from the operating system each time the configured software changes (even when the system is configured for the first time), i.e. zeros are written into it. If the NOV-RAM is then read, without having previously written a value into the NOV RAM, then the initialization value of the NOV RAM (zero) is output at Y.

INIT Operating mode

In the INIT operating mode of the function block, memory is made available to accept a REAL value. Output QF is set to 1 if this is not (no longer) possible. The function block is then inactive in the RUN operating mode.

I/O

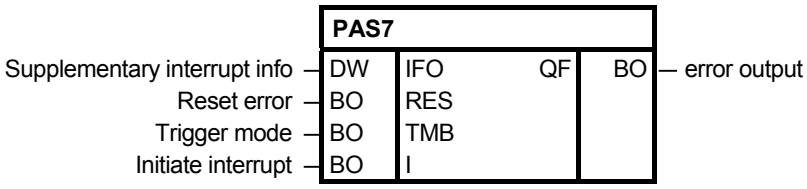
X	Input quantity	(default: 0.0)
M	Operating mode	(default: 0)
Y	Output quantity	(default: 0.0)
QF	No free memory	(default: 0)

Configuringdata

Computation time [µs]	T400 1,7
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

4.2 PAS7 Initiate process interrupt at the S7-CPU

Symbol



Brief description This function block, which initiates a process interrupt to the SIMATIC S7-CPU, can only run with an FM 458 application module.

Mode of operation The function block initiates a process interrupt at the associated S7 CPU.

The IFO double word is transferred to the S7-CPU as supplementary interrupt information.

NOTE A process interrupt is only acknowledged after the process interrupt OBs (organization block) has been executed on the S7-CPU.
The block does not wait for the acknowledgment. The OB is parameterized in the HWConfig for the associated S7-CPU.

The process interrupt is only initiated, if the S7-CPU is not processing a process interrupt from the FM 458 application module.

Output QF has the value 1, if a new process interrupt is initiated, although the last process interrupt was still not acknowledged or the block was not configured on FM 458.

Output QF has the value 0, if the acknowledgment from the S7-CPU has been received, or if input RES has the value 1.

The interrupt is initiated as a function of the input TMB:

- for TMB = 0, if a signal changes from 0 to 1 at input I, or.
- for TMB = 1, if any signal transition occurs at input I.

I/O

IFO	Supplementary interrupt information	(default: 0)
RES	Reset error	(default: 0)
TMB	Trigger mode, both edges	(default: 0)
I	Initiate an interrupt	(default: 0)
QF	Error output	(default: 0)

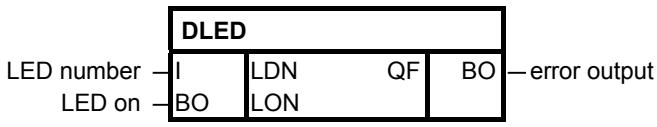
Configuringdata

Computation time [µs]	T400 / PM5 10,0 FM458 / PM6 3,3
Available online	no
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Normal mode
Special features	-

5 Service-/diagnostic blocks

5.1 DLED Control diagnostics LED

Symbol



Brief description

Function block to drive a diagnostics LED. The function block can **only run on a T400 module**.

Mode of operation

The function block is only active if error output QF has the value 0. If there is a 1 at input LON (LED on), then the LED, selected using LDN in the INIT operating mode, is lit. The LED goes dark for LON=0.

If an error occurs when trying to access the LED, the error output is set to 1

INIT operating mode

The LED number is transferred to the function block as initialization value. It must be in the range 1 = < LDN < = 3, otherwise the error output is set to 1.

The diagnostics LED, selected by a permissible LED number, is driven so that it is dark. If an error is identified (e.g. it is not running on the T400 module), the error output is set to 1.

0 is present at the error output after error-free initialization.

I/O

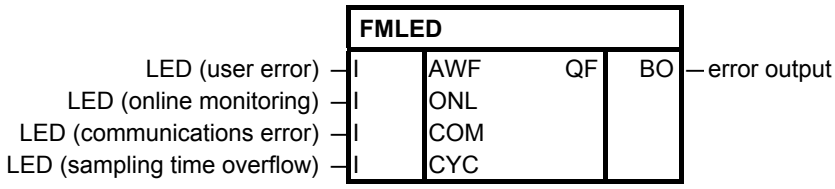
LDN	LED number	(default: 1)
LON	LED on	(default: 0)
QF	Error output	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 12,3 FM458 / PM6 4,1
Can be inserted online	yes
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

5.2 FMLED Control FM 458 diagnostics LED

Symbol



Brief description

The function block, which controls the FM 458 diagnostic LEDs, can only run with an FM 458 application module.

Mode of operation

The LEDs of the FM 458 application module can be controlled using this block.

The LED display is canceled for a value of 0 at the appropriate input; for a value of 1, it is set and for a value of -1, its status is retained, unchanged. The value of -1 is required, as this block has been configured a multiple number of times.

Output QF has the value 1, if the inputs have invalid values, or if the block is not configured on the FM458 application module.

I/O

AWF	LED for user error	(default: -1)
ONL	LED for online monitoring	(default: -1)
COM	LED for communications error	(default: -1)
CYC	LED for sampling time overflow	(default: -1)
QF	Error output	(default: 0)

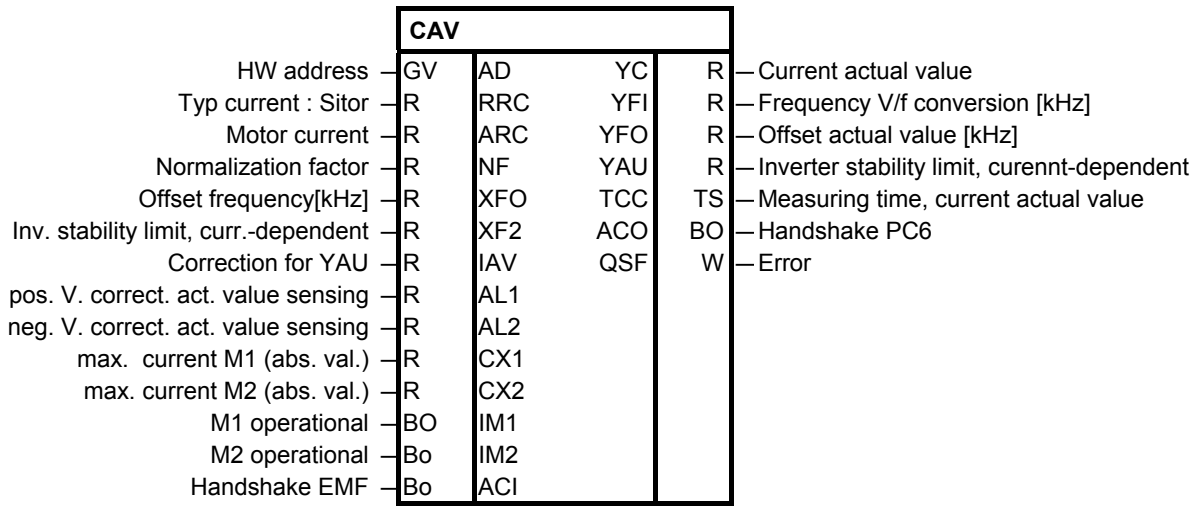
Configuringdata

Computation time [µs]	T400 / PM5 3,0 FM458 / PM6 1,0
Available online	yes
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Normal mode Initialization mode
Special features	-

6 Drive converter-specific blocks

6.1 CAV Current actual value sensing

Symbol



Brief description

This block senses the frequency-converted current actual value via the SITO interface

Mode of operation

The current actual value of the line-commutated converter is sensed and is converted into a measuring frequency using V/f conversion. The frequency is converted into a value on the module.
The mapping range of the current actual value is ±10[V] = 2* rated current, corresponding to ±30[kHz]. The frequency at zero current is 60[kHz].

With the closed-loop thyristor current control disabled, the function block detects an offset error of the V/f converter in the Sitor and outputs the frequency at YFO.

$$f_I = 60[kHz] + 15[kHz] \cdot \frac{I_{Sitor}}{ARC}$$

Frequency range: 30 ← 45 ← 60 → 75 → 90 [kHz]

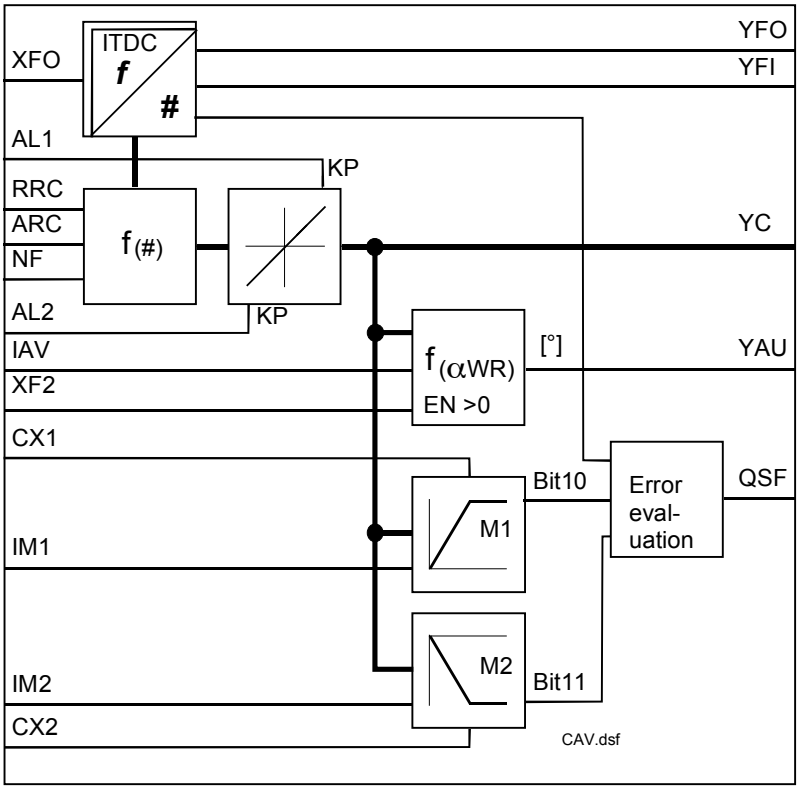
$-2* \quad -1* \quad I=0 \quad 1* \quad 2*I_{rated}$

The current actual value YC is calculated as follows:

$$YC = \frac{RRC * NF}{ARC} \cdot \left(\frac{f_I - 60[kHz] - XFO}{15[kHz]} \right)$$

Output YC is signed.

Function chart



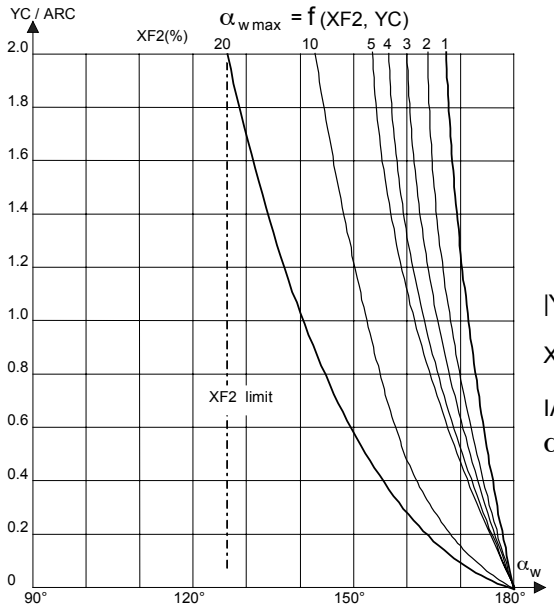
The current actual value sensing in the converter is either bipolar or unipolar, e.g. as for the Sitor set. For a signed current actual value, the actual value is checked to see whether it violates limits CX1 and CX2.
YC > CX1 ⇒ QSF \ bit10 = 1 overcurrent, torque direction 1
YC < CX2 ⇒ QSF \ bit 11= 1 overcurrent, torque direction 2
For a unipolar sensing, the current actual value, after selecting with intputs IM1 , IM2, is checked against limits CX1 and CX2, and error bits set.

If the V/f conversion manifests a gain error, then this can be corrected, within limits using parameters CAV.AL1 /AL2. The absolute value at CAV.AL1 acts on positive values; input CAV.AL2, correspondingly for negative values. The corrected actual value is provided at CAV.YC.

Dynamic inverter stability limits

The current-dependent control of the "inverter stability limit" function is activated with factor XF2 > 0. The inverter stability limit is normally permanently saved at FB-PC6 with a value. If the maximum output voltage is to be used, the limit should be moved depending on the current, as the overlap angle is greater due to the extended commutation. In this case, the inverter stability limit must be reduced in order to prevent "inverter commutation faults".
The inverter stability limit is calculated as follows:

$$YAU = 180° - \left(90° - \arcsin\left(1 - \frac{YC}{ARC} * \frac{XF2}{IAV} \right) \right) \qquad \text{, with XF2} > 0$$



|YC| Current actual value (abs. value)
XF2 Inductive voltage drop of the converter
IAV Correction for YUA
α_w Firing angle end position: Inverter

The bandwidth of IAV always becomes lower because XF2 → 0.

I/O

AD	Hardware address	
RRC	Rated DC current of the SITOR set [A] Condition: RRC ≥ ARC , otherwise, QSF\bit 12 = 1	(Initialization connection/ default: 0.0)
ARC	System/rated motor current [A] Condition: RRC ≥ ARC ≠ 0 , otherwise, QSF\bit 12 = 1	(Initialization connection/ default: 0.0)
NF	Normalization of the current actual value at YC NF= 1 (YC = normalized value), NF= ARC (YC = absolute value) When the value is changed over, this effects the setting of the controller parameters ! Condition: NF > 0 , otherwise, QSF\bit 12 = 1	(Initialization connection/ default: 1.0)
XFO	Offset adjustment of the frequency of the V/f conversion [kHz] Adjustment : XF0 = **-** YFO ! Meas. value for I=0 A ! Condition: -6 kHz ≤ XFO ≤ 6 kHz, otherwise, QSF\bit12=1 (max. 10% of the rated frequency)	(Initialization connection/ default: 0.0) {≥-6.0…+6.0≤}
XF2	Current-dependent inverter stability limit [1] XF2 corresponds to the 'inductive voltage drop' of the converter. XF2=0 % ⇒ stability limit calculation disabled. This intervention is not required for standard applications. Condition: 0.0 ≤ XF2 ≤ 0.2, otherwise, QSF\bit 12 = 1	(Initialization connection/ default: 0.0) {≥0.0…0.2≤}
IAV	Correction for the stability limit [1] Changes as a result of the line supply can be taken into account here. The bandwidth continues to decrease with CAV.XF2 ⇒ 0. Changes as a result of the line supply can be taken into account here. Condition: 0.7 ≤ IAV ≤ 1.3, otherwise, QSF\bit 12 = 1	(Initialization connection/ default: 1.0) {≥0.7…1.3≤}
AL1	Positive correction of the current actual value sensing gain	(Initialization connection/

	Condition: -0.1 ≤ AL1 ≤ 0.1, otherwise, QSF\bit 12 = 1	default: 0.0)
AL2	Negative correction of the current actual value sensing gain Condition: -0.1 ≤ AL2 ≤ 0.1, otherwise, QSF\bit 12 = 1	(Initialization connection/ default: 0.0)
CX1	Max. current for torque direction M1 (absolute value) (observe the normalization!)	(default: 0.1)
CX2	Max. current for torque direction M2 (absolute value) (observe the normalization!)	(default: 0.1)
IM1	Torque direction M1 in operation ⇒ '+' = CX1 is used.	SOL.Q01 → CAV.IM1
IM2	Torque direction M2 in operation ⇒ '-' = CX2 is used.	SOL.Q02 → CAV.IM2
ACI	Handshake from the EMF block	EMF.ACO → CAV.ACI
——		
YC	Current actual value (signed)	CAV.YC → CPI.XC → SOL.XC → EMF.XC (default: 0.0)
YFI	Frequency [kHz] of the current actual value V/f conversion (uncorrected value)	(default: 0.0)
YFO	Offset actual value [kHz] YFO = YFI - 60[kHz] - XFO With the closed-loop thyristor current control disabled (I=0), the frequency at YFO corresponds to the offset error of the V/f converter in the Sitor. The output indicates values up to 10% of the system current.	(default: 0.0)
YAU	Limit of the current-dependent inverter stability limit [°] Interdependencies: Value > 0 if XF2 > 0 (if this is used, then establish a connection)	(default: 0.0) CAV.YAU → CPI.CLU → PC6.AWS
TCC	Internal measuring time of the current actual value conversion [ms]	(default: 0 ms)
ACO	Handshake for PC6 block	CAV.ACO → PC6.ACI (default: 0)
QSF	Error	CAV.QSF → SOL.QSC (default: 16#0000)

Error messages in error word QSF

The errors are bit-coded in the word and are listed in the following table :

Bit 1-8	Logical 0
Bit 9	Hardware fault Cause: Actual value sensing frequency not available from the drive converter → check the current actual value sensing (hardware)
Bit 10	Overcurrent torque direction M1 → check the system values RRC, ARC, NF, XFO, AL1, CX1
Bit 11	Overcurrent torque direction M2 → check the system values RRC, ARC, NF, XFO, AL2, CX2
Bit 12	Configuring error → check RRC, ARC, AL1, AL2, IAV, XF2, NF, XFO
Bit 13-16	Logical 0

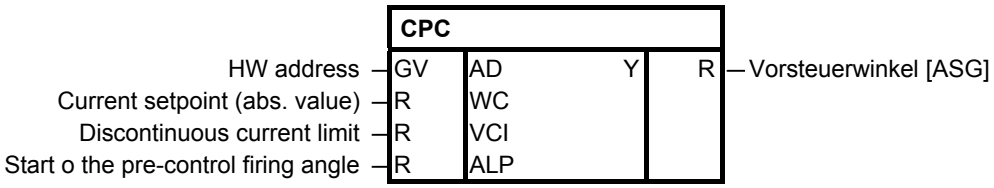
Configuringdata

Computation time [µs]	T400 / PM5	38,7
	FM458 / PM6	13,4

Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	Sampling time of the cyclic tasks ≤ equivalent sampling time

6.2 CPC Current pre-control

Symbol



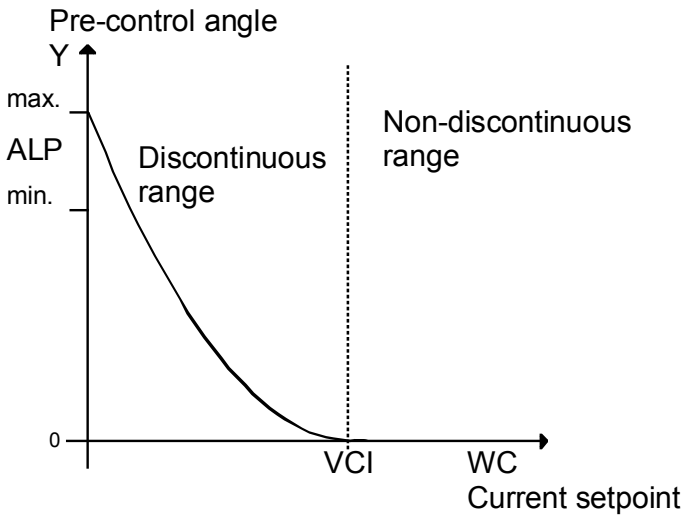
Brief description The current pre-control required in the discontinuous range is calculated.

Mode of operation The control loop has a different behavior in the discontinuous range than in the continuous range.
The current controller is optimized for the continuous range.
Characteristic Vd / Id is no longer linear in the discontinuous range.
This means that either the controller has to be adapted or the firing angle has to be pre-controlled corresponding to the current setpoint.
The FB calculates a pre-firing angle from the current setpoint according to the following formula:

$$Y = \mathrm{ALP}\left(\frac{1-\frac{2}{\pi}*\arcsin\left(1-\frac{WC}{4*VCI*NFI}\right)}{1-\frac{2}{\pi}*\arcsin\left(1-\frac{1}{4}\right)}-1\right)$$

$$NFI = \text{internal normalization of current FB} - \mathrm{CAV}$$

Output Y must be 0 at the discontinuous/continuous limit PA6.YIT<1, as otherwise the pre-control and controller will oppose each and this can generate a current spike. The value at VCI must correspond to the current setpoint at the end of the discontinuous range.



I/O

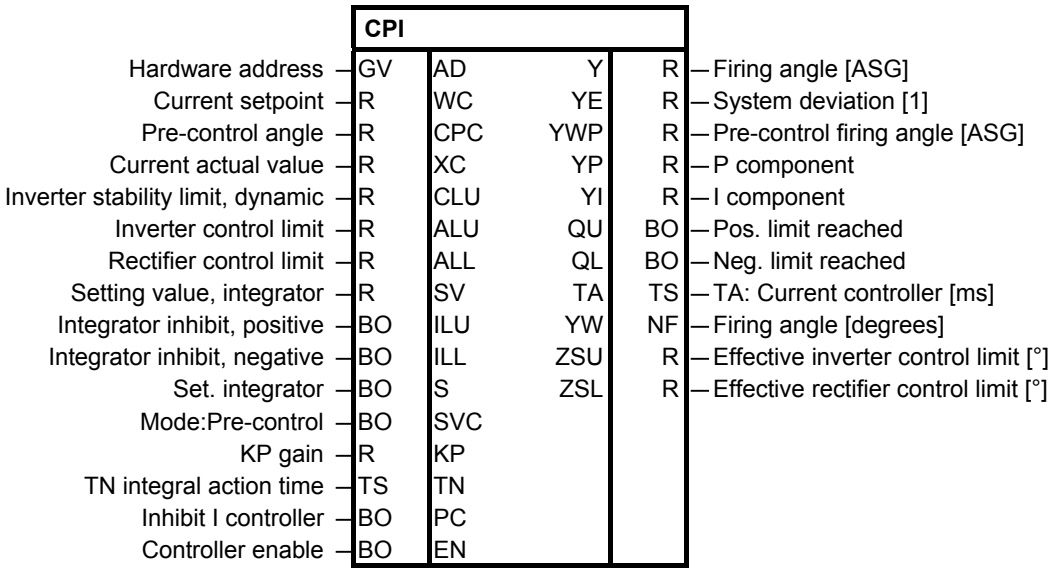
AD	Hardware address	
WC	Current setpoint (absolute value)	SOL.WC → CPC.WC
VCI	Current setpoint at the discontinuous/continuous limit, normalized to the motor current CAV.ARC (discontinuous limit is determined using PA6.YIT.).	(default: 0.1) { 0 < VCI < discontinuous limit}
ALP	Pre-control angle in the discontinuous range [°], Start of the current flow	(default: 25.0) {≥25°…30°≤}
Y	Pre-control firing angle in the discontinuous range [ASG]	CPC.Y → CPI.CPC

Configuringdata

Computation time [µs]	T400 / PM5 43,0 FM458 / PM6 15,0
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	Sampling time of the cyclic task ≤ equivalent sampling time

6.3 CPI Current controller

Symbol



Brief description

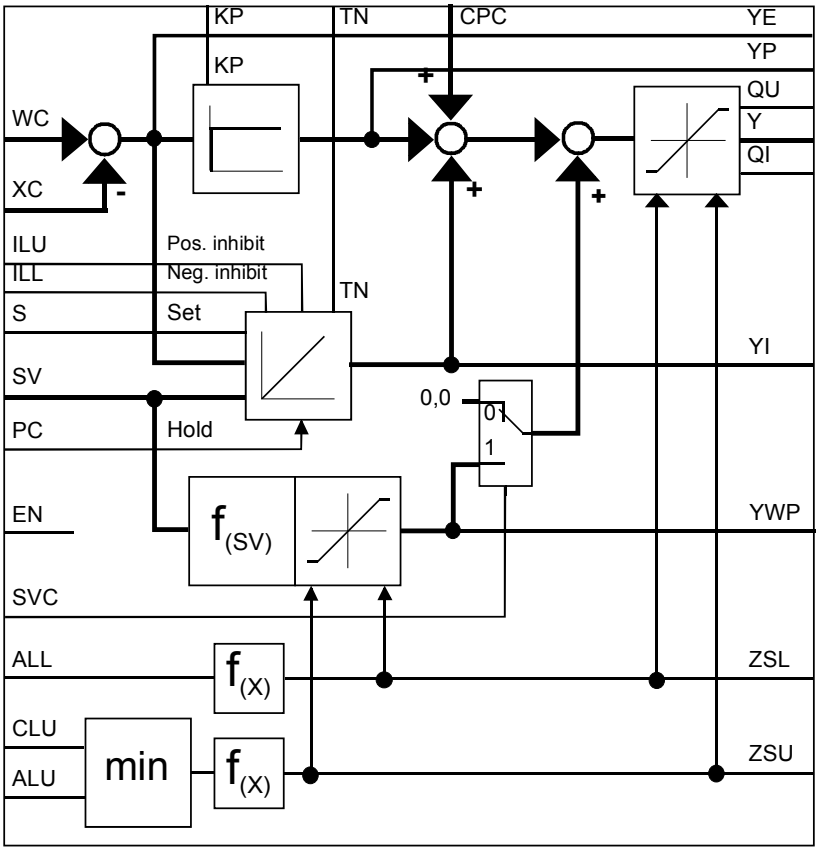
- The current controller is a PI controller
- The integrator (I component) can be inhibited.
- The firing angle is limited in inverter and rectifier operation

Mode of operation

The current controller has PI characteristics and only uses the absolute current setpoint value. The I component of the controller can be permanently disabled via PC=1. The integrator can be briefly held for large setpoint changes, in order to stop the signal integrating away. In this case, the integrator is not internally limited by the control limit AUL and ALL.
The integrator value runs, without any intervention, up to the format limit (R=+-3,4e38) !
The ILL and ILU inputs only limit the values in 'their direction'.
The integrator is loaded with the value at input SV as long as input S is set.

When the torque direction reverses, the switch-over logic is set to the value at SV. The old integrator value Y1 is set with the calculated EMF value.

Function chart



EN = Enable controller			X=irrelevant
	S = Set integrator with the setting value		
		SVC = Mode pre-control	
0	X	X	Controller inhibit Outputs Y,YE,YWP,YP,YI are set to 0
1	0	0	Formal function $Y = YP + YI$
1	0	1	With continuous tracking $Y = YP + YWP \quad , \quad YI = 0$
1	1	0	Setting mode $Y = YP + YI \quad , \quad YI = SV$
1	1	1	Setting mode with continuous tracking $Y = YP + YI + YWP \quad , \quad YI = SV$

Tabelle 6-1 Behavior of the control input

Pre-control angle YWP

The pre-control angle is limited to the internal effective limit ZSU ,ZSL. The value is a function of input SV and is enabled with input S.

$$YWP = f_{(SV)} = \frac{2}{\pi} * \arcsin(SV) \Rightarrow -1 \le SV \le 1$$
$$= +1 \quad \Rightarrow \text{if } SV > +1$$
$$= -1 \quad \Rightarrow \text{if } SV < -1$$

Dynamic inverter control limit

The inputs ALU and CLU directly limit the inverter end control position. The minimum of the two inputs is used if the dynamic inverter stability limit function at SB-CAV is enabled, then the connection CAV.YAU → CPI.CLU , PC6.AWS must be configured.
If the connection is deleted again, a constant should be configured at connection CPI.CLU (e.g. CLU=150°).

I/O

AD	Hardware address	
WC	Current setpoint (absolute value)	SOL.YWC → CPI.WC
CPC	Pre-control angle in the discontinuous range	CPC.Y → CPI.CPC (default: -0.333333 = 30[ASG])
XC	Current actual value (with sign)	CAV.YC → CPI.XC
CLU	Limit of the current-dependent inverter stability limit [°], if the function is not required, CLU=ALU must be set to 150 degrees [°]	CAV.YAU → CPI.CLU (default: 150.0)
ALU	Inverter control limit in degrees [°] The minimum of CLU and ALU is used	(Initialization connection/ default: 150.0)
ALL	Rectifier control limit in degrees [°]	(Initialization connection/ default: 30.0)
SV	Setting value for the torque reversal or continuous tracking only active for S = 1 (SV corresponds to the motor EMF at torque reversal)	SOL.YSV → CPI.SV {>-1…+1<}
ILU	Integrator inhibit, positive direction	CSP.QIU → CPI.ILU (default: 0)
ILL	Integrator inhibit, negative direction	CSP.QIL → CPI.ILL (default: 0)
S	Set integrator with value SV	SOL.SCC → CPI.S
SVC	Mode: CPI pre-control	(default: 0)
KP	Proportional gain [1]	(default: 0.01)
TN	Integral action time [ms]	(default: 10000 ms)
PC	Inhibit integrator component (PC=1 ⇒ the integrator is canceled)	(default: 0)
EN	Controller enable (for EN=0, all Yxx are immediately set to zero)	SOL.QCE → CPI.EN
———		
Y	Firing angle [ASG]	CPI.Y → PC6.WAS (default: 0.0)
YE	System deviation YE = WC – XC	(default: 0.0)
YWP	Pre-control angle [ASG]	(default: 0.0)
YP	P component	(default: 0.0)

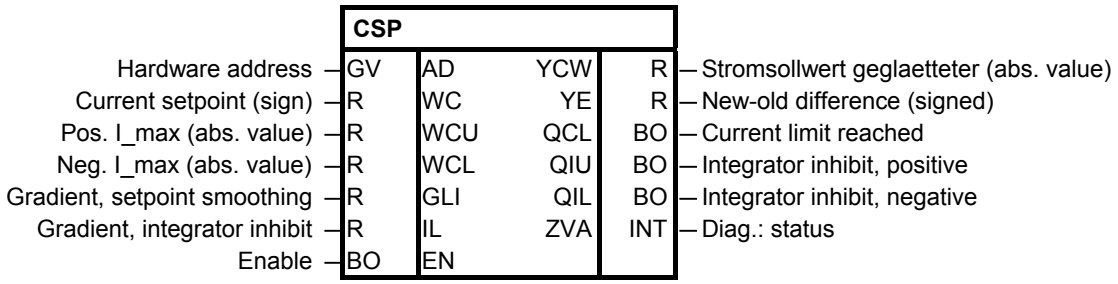
YI	I component	(default: 0.0)
QU	Controller at its positive limit (M1)	(default: 0)
QL	Controller at its negative limit (M2)	(default: 0)
TA	Sampling time : Current controller (configured)	(default: 0 ms)
YW	Firing angle [°] (same Y only in another format)	(default: 0.0)
ZSU	Effective inverter control limit [°] (internally used limits f(ALU,CLU) is displayed)	(default: 0.0)
ZSL	Effective rectifier control limit [°] (ALL limit is displayed)	(default: 0.0)

Configuringdata

Computation time [µs]	T400 / PM5 54,0 FM458 / PM6 20,0
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	Sampling time of the cyclic tasks ≤ equivalent sampling time

6.4 CSP Current setpoint calculation

Symbol



Brief description The current setpoint is smoothed and checked against limits.

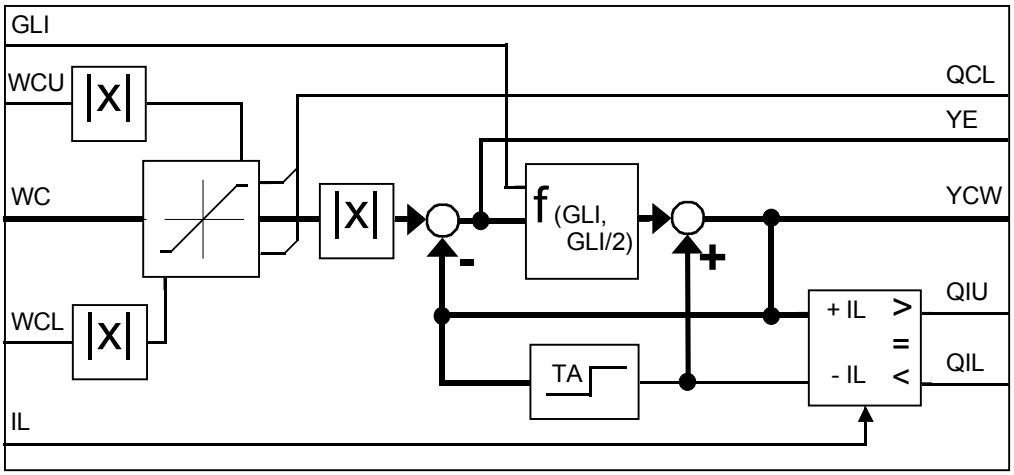
Mode of operation The current setpoint SOL.YWC is limited to the absolute value of current limits WCU and WCL.
To smooth the absolute setpoint value, the difference between the setpoint WC, and the current setpoint YCW, output in the previous cycle, is generated and output at YE.

The difference compared with parameter GLI defines how output YCW changes.
If the difference > GLI , the value of GLI is output.
If the difference < GLI , but > GLI/2 then this is limited to GLI/2.
If the difference <GLI/2, then this is transferred without any correction.
The result which is determined (difference) is added to output YCW with the correct sign. The absolute value of the smoothed and limited current setpoint WC is output at YCW .

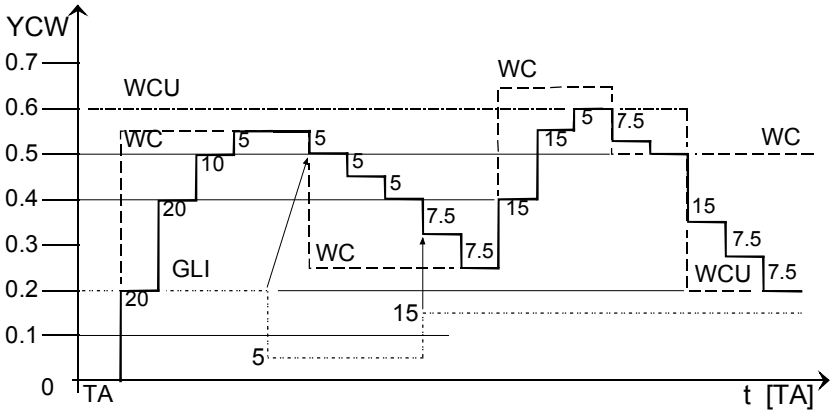
If the difference > +IL or < -IL, the integrator component of the current controller is inhibited with signals QIU or QIL in the particular direction.

When changing-over the current direction, the current is reduced with a current setpoint = 0.
To realize this, the switch-over logic additionally withdraws enable EN with the setting command for the drive converter SOL.SCC. The current is then increased again from zero in the other direction.

Function chart



Example 1: Setpoint smoothing with step in WC



I/O

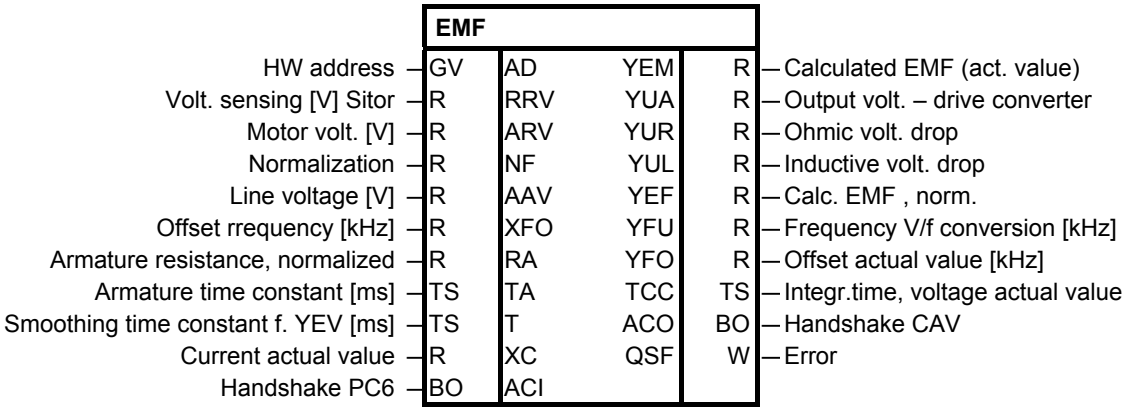
AD	Hardware address	
WC	Current setpoint (signed)	SOL.YWC → CSP.WC (default: 0.0)
WCU	Positive current limit (absolute value)	(default: 1.0)
WCL	Negative current limit (absolute value)	(default: 1.0)
GLI	Gradient for setpoint smoothing The actual value from WC is used for the calculation.	(default: 0.6)
IL	Gradient for integrator inhibit	(default: 0.6)
EN	Enable	SOL.SCC → CSP.EN (default: 1)
——		
YCW	Smoothed current setpoint (absolute value)	CSP.YCW → CPI.XC
YE	Difference : WC - YCW (signed)	
QCL	Pos. or neg. current limit reached	
QIU	Integrator inhibit of CPI, positive values	CSP.QIU → CPI.ILU
QIL	Integrator inhibit of CPI, negative values	CSP.QIL → CPI.ILL
ZVA	Diagnostics: Status	

Configuringdata

Computation time [µs]	T400 / PM5 7,8 FM458 / PM6 2,6
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	Sampling time of the cyclic task ≤ equivalent sampling time

6.5 EMF Voltage actual value sensing

Symbol



Brief description

- This block senses the voltage actual value via the Sitor interface
- The EMF is calculated from the voltage actual value, current actual value and relative voltage drop

Mode of operation

The voltage actual value of the drive converter output is sensed in the Sitor set and is converted into the measurement frequency.

$$f_V = 60[\text{kHz}] + 30[\text{kHz}] \cdot \frac{V_{\text{Sitor}}}{\text{RRV}} \qquad \text{frequency range: } 30 \leftarrow 60 \rightarrow 90 \text{ [kHz]}$$

$$-1 * \quad V = 0 \quad +1 * \quad V_{\text{rated}}$$

$$\text{RRV} = \text{Sensed Sitor rated voltage (e.g. Sitor} = 1000[\text{V}])$$

The actually measured frequency [kHz] is output at YFU. The instantaneous Sitor output voltage is available at output YUA .

$$\text{YUA} = \frac{\text{RRC} * \text{NF}}{\text{ARC}} \cdot \left(\frac{f_U - 60[\text{kHz}] - \text{XFO}}{30[\text{kHz}]} \right)$$

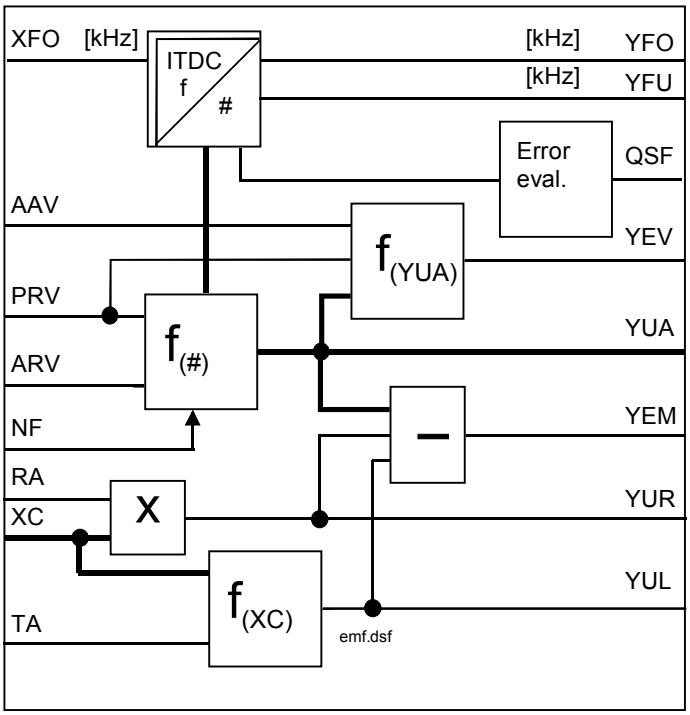
An offset error [kHz] of the V/f conversion in the SITOR set can be read when powered-down and in the no-voltage condition (the drive is stationary) at output YFO, as long as the output voltage < 10% of the rated motor voltage. The correction value of YFO should be entered at XFO with the inverse sign and a restart initiated.

The value for the armature time constant TA should be determined and entered.

The value for connection RA should be calculated from the measured armature resistance according to the following formula.

$$\text{RA} = R_{Armature}[\Omega] * \frac{\text{NF} \quad (\text{EMF})}{\text{ARV} \, (\text{EMF})} * \frac{\text{ARC} \, (\text{CAV})}{\text{NF} \quad (\text{CAV})}$$

Function chart



I/O

AD	Hardware address	
RRV	Rated Sitor voltage, sensed [V]. (e.g. Sitor = 1000[V] PT = 30[kHz]) Condition: RRV ≥ ARV, otherwise, QSF\bit 14 = 1	(Initialization connection/ default: 0.0)
ARV	Rated system/motor voltage [V] Condition: RRV ≥ ARV ≠ 0, otherwise, QSF\bit 14 = 1	(Initialization connection/ default: 0.0)
NF	Normalization of the voltage actual value at YUA NF= 1 (YUA = normalized value), NF= ARV (YUA , YEM = absolute value) If the value is changed-over, this has an effect on the setting of the controller parameters !	(Initialization connection/ default: 1.0)
AAV	Line supply voltage [V]. Condition: $AAV \geq \cdot ARV \frac{\sqrt{2} * \pi}{3}$,otherwise, QSF\bit 14 = 1	(default: 0.0)
XFO	Offset frequency of the V/f converter [kHz] Measurement, drive converter output voltage = 0[V] ! Adjustment : XFO = **-** YFO ! Condition: -6 kHz ≤XFO≤ 6 kHz, otherwise, QSF\bit 14 = 1	(Initialization connection/ default: 0.0)
RA	Normalized armature resistance (this should be calculated from the value which was determined)	(default: 0.0)
TA	Armature time constant [ms]	(default: 0 ms)
T	Smoothing time for YEV value (for T=0, smoothing is disabled)	(default: 20 ms)

XC	Current actual value (signed) to calculate the voltage drop of the armature quantities	CAV.YC → EMF.XC
ACI	Handshake from the PC6 block	PC6.ACO → EMF.ACI
——		
YEM	Calculated EMF actual value $YEM = YUA - YUR - YUL$ (This value is too inaccurate for other calculations, as the value calculated for YUL is only approximate!)	(default: 0.0)
YUA	Converter output voltage	(default: 0.0)
YUR	Ohmic voltage drop at the DC motor $YUR = R_{\Sigma} * I_{Armature} = RA * XC$	(default: 0.0)
YUL	Inductive voltage drop at the DC motor $YUL = L\frac{di}{dt} = \frac{RA}{TA} * (XC_n - XC_{n-1})$	(default: 0.0)
YEV	Output voltage, normalized to the line supply voltage $YEV = \frac{\pi}{3\sqrt{2}} * \frac{RRV}{AAV} * YUA$ (smoothed with time T)	EMF.YEV → SOL.XEV (default: 0.0)
YFU	Voltage actual value frequency [kHz] (of the V/f conversion) without correction	(default: 0.0)
YFO	Offset actual value [kHz] $YFO = YFI - 60[kHz] - XFO$	(default: 0.0)
TCC	Voltage measurement time	(default: 0 ms)
ACO	Handshake for CAV block	EMF.ACO → CAV.ACI (default: 0)
QSF	Error	EMF.QSF → SOL.QSM (default: 16#0000)

Error messages in error word QSF

The errors are bit-coded in the word and are listed in the following table :

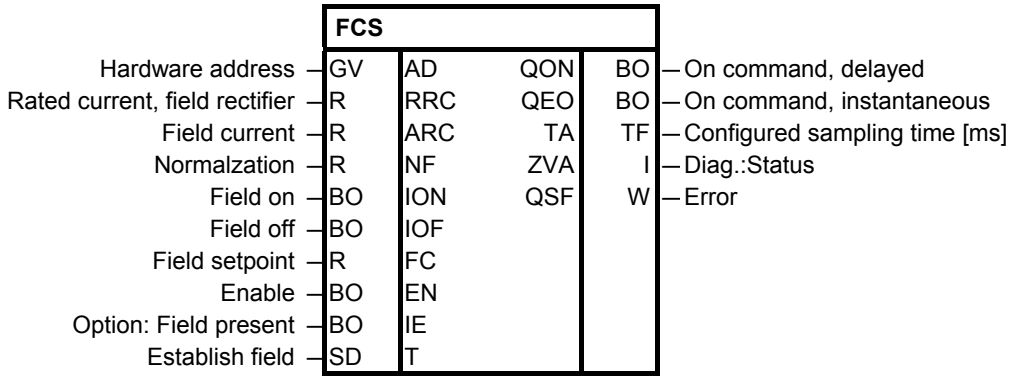
Bit 1-12	Logical 0
Bit 13	Hardware fault Cause: Actual value sensing frequency not available → Check the voltage actual value sensing (hardware)
Bit 14	Configuring error → Check RRV, ARV, AAV, XFO
Bit 15	Configuring error → AAV voltage specified too high (1.35*AAV > 2*ARU)
Bit 16	Logical 0

Configuringdata

Computation time [µs]	T400 / PM5 49,0 FM458 / PM6 19,0
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	Sampling time of the cyclic tasks ≤ equivalent sampling time

6.6 FCS Field current setpoint output

Symbol



Brief description This function block enters an analog field current setpoint into a SITOR drive converter with the field device option, via the SITOR interface.

Mode of operation This function block implements the sequence control to switch-in and switch-out the excitation field and a fault logic.

The value, present at input FC, is written into the analog output. The output voltage DA of the D/A converter is obtained from the following algorithm:

$$V_a = 10[\mathrm{V}] * \frac{\mathrm{FC} * ARC}{NF * RRC}$$

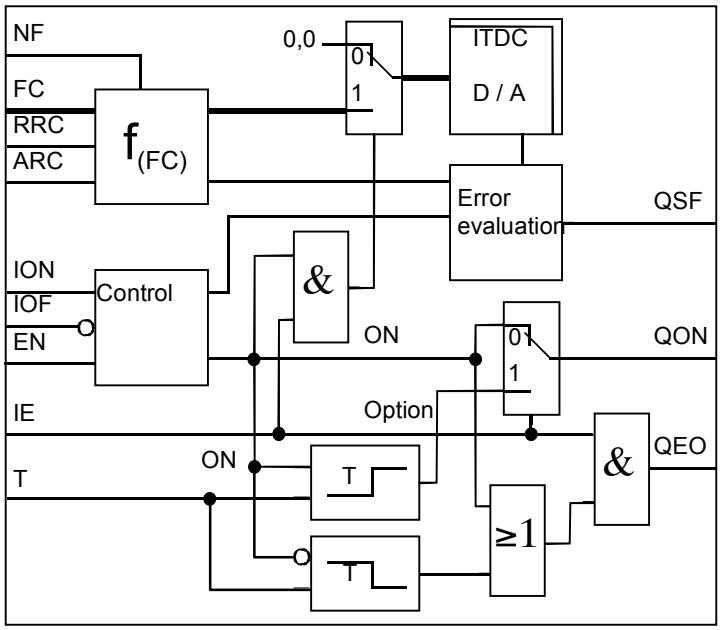
D/A converter resolution (12 bit) = $\frac{\mathrm{RRC}}{4096}$

The optional field device for the Sitor set is a single-phase rectifier (B2HKFU) and requires a field current setpoint FC ≥ 0 . Negative values are set to 0 and result in a configuring error.

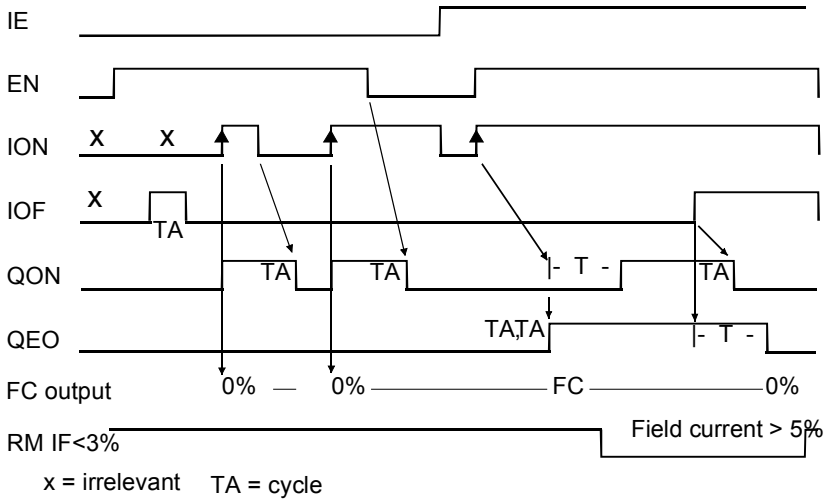
Note: When configuring the FCS block, analog output 2 from the ITDC-X5 is changed-over to the Sitor interface. This means that channel 2 is not available for other configured software!

If a configuring error is identified, outputs QON / QEO and the field current setpoint are reset to 0.

Function chart



Switching conditions



I/O

AD	Hardware address	
RRC	Rated field current of the rectifier [A] Condition: RRC ≥ ARC ≠ 0, otherwise, QSF\bit 12 = 1	(Initialization connection/ default: 0.0)
ARC	Rated DC motor field current [A] Condition: RRC ≥ ARC ≠ 0, otherwise, QSF\bit 12 = 1	(Initialization connection/ default: 0.0)
NF	Normalization factor to interpret the setpoint NF= 1 (FC=1 [1] $\hat{=}$ rated field current =ARC) NF=ARC (FC=ARC [A] $\hat{=}$ rated field current =ARC)	(Initialization connection/ default: 1.0)
ION	On command, field current A positive edge switches the field setpoint through, if IE and EN = 1 and IOF = 0	(default: 0)
IOF	The field setpoint output is switched-out after time T and QON is reset	(default: 0)
FC	Field current setpoint is output at analog output 2, observe the normalization ! Condition: FC ≥ 0 otherwise, QSF\bit 12 = 1	(default: 0)
EN	Enables inputs ION,IOF The current setpoint input is enabled with EN=1 and IE=1. The field is reduced to zero with EN=0, as for ION=1	(default: 0)
IE	Option : Field present If IE = 0, a setpoint of 0 [V] is permanently output. A switch-on command ION=1 ⇒ QON=1 instantaneous	(default: 0)
T	Delay time at switch-on or switch-off, as long as option, IE=1 has been acknowledged. QON is output, delayed by time T. This means that the switch-over logic is only switched-in if the field has been established. When switching-off, QEO is only reset after time T. Condition: 0 ≤ T ≤ 100000 ms, otherwise, QSF\bit 12 = 1.	(Initialization connection/ default: 1500 ms)
——		
QON	On command is output, ION=1 , for IE=1, QON is set, delayed by time T QON is reset 1 cycle after the switch-off command (ION=0 or IOF=1).	FCS.QON → SOL.ION (default: 0)
QEO	Checkback signal, setpoint output (only for IE=1) The output is only reset after time T has expired.	(default: 0)
TA	Diagnostics: Configured sampling time	(default: 0 ms)
ZVA	Diagnostics : Status ‘field state machine'	(default: 0)
QSF	Error	FCS.QSF → SOL.QSS (default: 16#0000)

Error messages in error word QSF

The errors are bit-coded in the word and are listed in the following table:

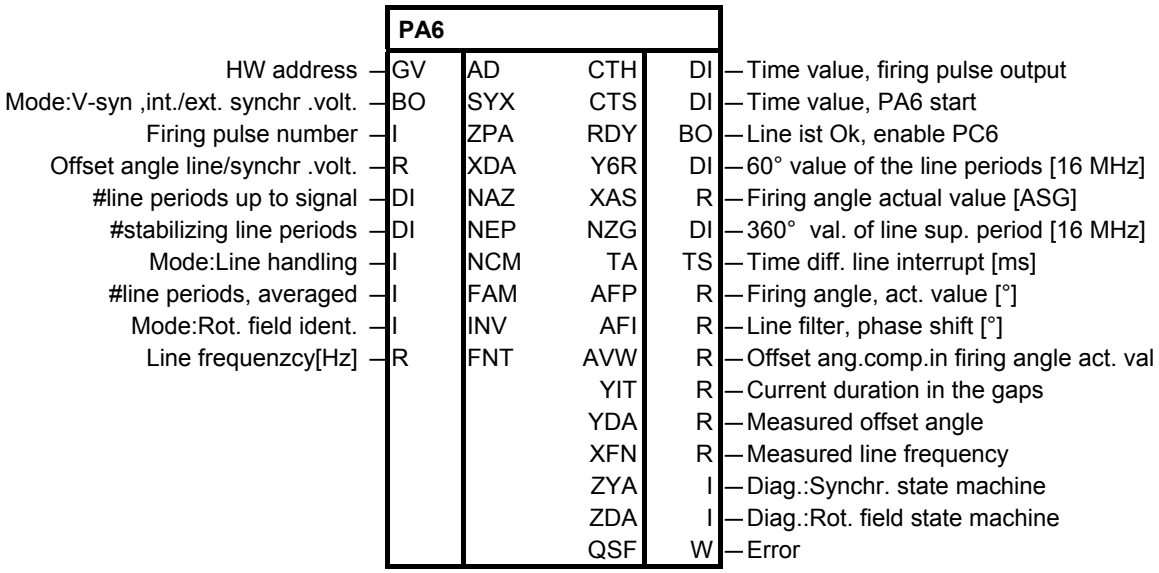
Bit 1-11	Logical 0
Bit 12	Configuring error → check RRC, ARC, FC
Bit 13	Logical 0
Bit 14	Field current fault for the programmed FC block > 5% and field current actual value < 3% ARC → check the field control/connection
Bit 15-16	Logical 0

Configuringdata

Computation time [µs]	T400 / PM5 19,7 FM458 / PM6 7,6
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

6.7 PA6 Synchronization

Symbol



Brief description

Continuous synchronization of the firing angle to the line supply for 6-pulse line-commutated drive converters, versions B6C and anti-parallel circuit configuration B6(A)B6(C) .
The line supply is identified after power-on and it is checked as to whether it is a stable. The position of the firing pulses is sensed.

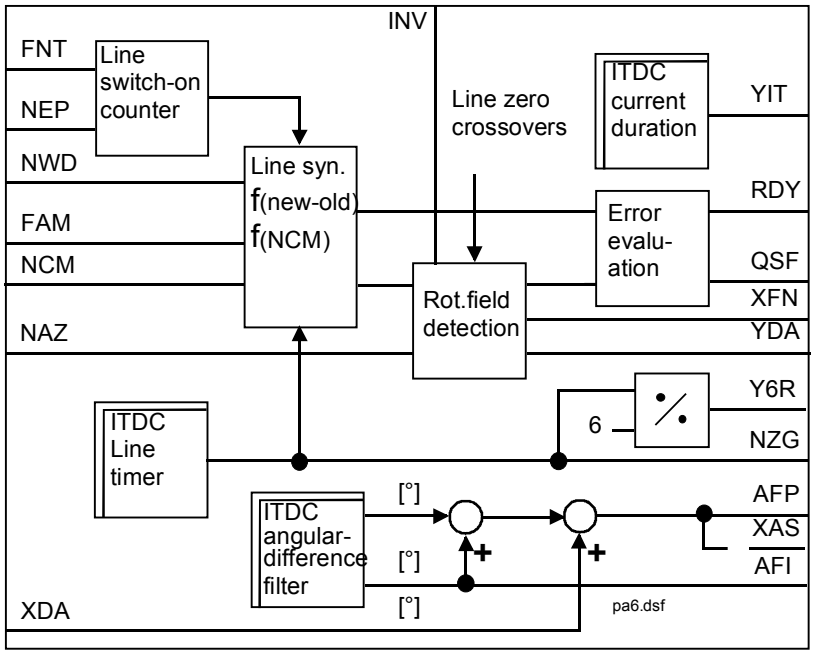
Mode of operation

This function block determines the rotating field from the phase shift of the zero crossovers L12 , L13
from the Sitor set.

As soon as the Sitor is connected to the line supply, PA6 runs with the pre-set frequency FNT.
The pre-synchronization, over NEP periods, harmonizes the interrupt frequency of the continuously measured line supply frequency XFN. If the deviation is <10% of the line supply periods for NEP x consecutive times, the firing angle actual value XAS for the control (FB-PC6) is enabled using the RDY signal.
The line frequency is emulated with a 16MHz counter (21 bit) [16MHz] (50Hz $\hat{=}$ 320000)
in the line supply value.

The firing angle actual value is determined taking into account the input filter and the offset angle.

Function chart

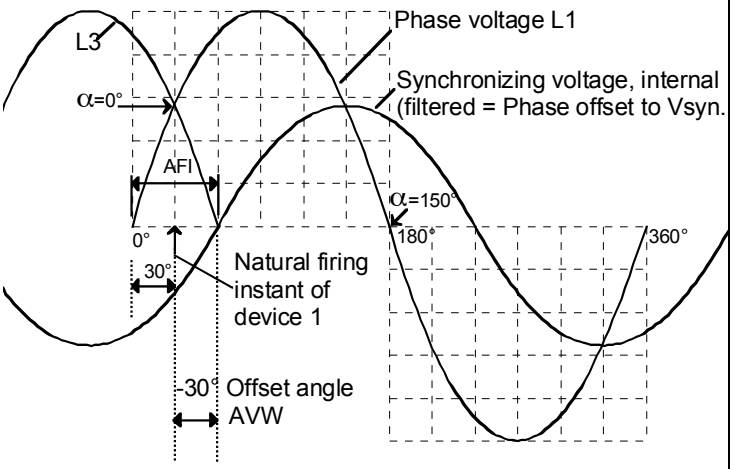


The ITDC generates, as function of internal counter statuses, the interrupt to start the FB-PA6 via the local extension bus (LE). This is realized in synchronism with the firing pulses.
The interrupts are every 3.3 ms for a steady-state operating firing angle = const. in the 50 Hz line supply.

The current conduction time YIT in the discontinuous range is determined using the zero current signal from the Sitor. A value of 1 identifies the limit of the non-discontinuous range.

I/O

AD	Hardware address	
SYX	Mode: Synchronizing voltage source (Phase L1 is normally used) SYX=0: internal via the SITOR interface (ITDC-X7:18,34) SYX=1: external via connector (ITDC-X5:5)	(Initialization connection/ default: 0)
ZPA	Firing pulse number of the active main pulse for the active torque direction.	PC6.ZPA → PA6.ZPA { 1…6 }

XDA	Offset angle The specified angle corrects the phase shift between the natural firing instant of valve 1 (semiconductor device 1) and the zero crossover of the filtered synchronizing voltage (ITDC) e.g. XDA=0.0 ⇒ AVW = -30 [°] XDA=10.0 ⇒ AVW = -20 [°] Offset angle and natural firing instant (α=0°):  	(default: 0.0) { -180°…+180° } ≙
NAZ	No. of failed synchronizing voltage line supply periods until a signal is output. Condition: 0 ≤ PA6.NAZ ≤ 3050, otherwise, QSF\bit 9 = 1	(Initialization connection/ default: 8)
NEP	No. of line supply periods until the system can be considered to have stabilized and can be switched-on Condition: 0 ≤ PA6.NEP ≤ 5000, otherwise, QSF\bit 9 = 1	(Initialization connection/ default: 5)
NCM	Mode: Line supply processing (also refer to connector FAM) Corrects the counter value of the line supply value (period duration and phase position) before transferring the result to FB-PC6. 0 = The line supply value is not processed 1 = Refer to NCM=4 2 = The average from the last (max.8), line supply values, defined with the number at FAM. 3= Line supply value fluctuations are corrected using PLL (P controller). The phase difference is only taken into account with 1/FAM. 4 = Line supply value fluctuations are corrected using PLL (PI controller). The phase difference is only weighted with 1/FAM and the last average with (FAM-1)/FAM. (NCM > 0 is used for weak line supplies or for "polluted" synchronizing voltages. For single synchronizing voltage faults, NCM=4 with FAM=20…40 is most suitable)	(default: 0) { 0…4 , >4= 0 } FAM { ≥1…<8 } FAM { ≥1…≤1000 } FAM { ≥1…≤1000 }
FAM	For NCM=1: refer to 4 For NCM=2: Number of saved line supply periods to generate the average value For NCM=3: Factor to decrease a measured phase difference For NCM=4: Factor to decrease a measured phase step	(default: 0) { ≥1…<8 } { ≥1…≤1000 } { ≥1…≤1000 }

INV	Mode for rotating field identification INV=0 continuous monitoring, INV=1 the rotating field is determined once when starting INV=2 no monitoring	(Initialization connection/ default: 0)
FNT	Line supply frequency [Hz] for the start of synchronization after the line supply has been connected Condition: 6 ≤ PA6.FNT ≤ 600, otherwise, QSF\bit 9 = 1	(Initialization connection/ default: 50)
———		
CTH	Firing pulse output, time value (the value changes in each cycle)	PA6.CTH → PC6.CTH (default: 0)
CTS	Time value at the start of FB-PA6 (the value changes in each cycle)	PA6.CTS → PC6.CTS (default: 0)
RDY	Enable, firing pulse controller FB-PC6 , Internal interrupt frequency is harmonized to the line supply frequency	PA6.RDY → PC6.EN (default: 0)
Y6R	Numerical value $\hat{=}$ 60° $\hat{=}$ 1/6 of the line supply periods [16 MHz] NZG / 6	PA6.Y6R → PC6.X6R (default: 0)
XAS	Firing angle actual value [ASG]	PA6.XAS → PC6.XAS (default: 0.0)
NZG	Numerical value $\hat{=}$ Line supply frequency (360°) [16 MHz] (dependent on NCM)	(default: 0) {50Hz = 320000} {60Hz = 384000}
TA	Time between the actual and last firing pulse [ms]	(default: 0 ms)
AFP	Firing angle actual value [°]	(default: 0.0)
AFI	Phase shift angle of the line supply filter ITDC-HW [°] $AFI = \arctan(f / 50 * \tan 60°)$ (e.g. f = 50Hz ,AFI = 60°)	(default: 0.0)
AVW	Offset angle component in the firing angle actual value (refer to XDA) $AVW = XDA + 30° - AFI$	(default: 0.0)
YIT	Current conduction time in the discontinuous range (YIT <1 $\hat{=}$ current discontinuous, =1 $\hat{=}$ continuous current)	(default: 0.0) { >0…1<}
YDA	Offset angle , Calculated from the zero crossovers of the synchronizing voltage and the phase-to-phase line supply. YDA should be equal to XDA	(default: 0.0)
XFN	Measured line supply frequency [Hz] = f (NZG)	(default: 0.0)
ZYA	Diagnostics : Status ‘synchronizing state machine'	(default: 0)
ZDA	Diagnostics : Status ‘rotating field state machine'	(default: 0.0)
QSF	Error	PA6.QSF → SOL.QSA (default: 16#0000)

Error messages in error word QSF

The errors are bit-coded in the word and are listed in the following table:

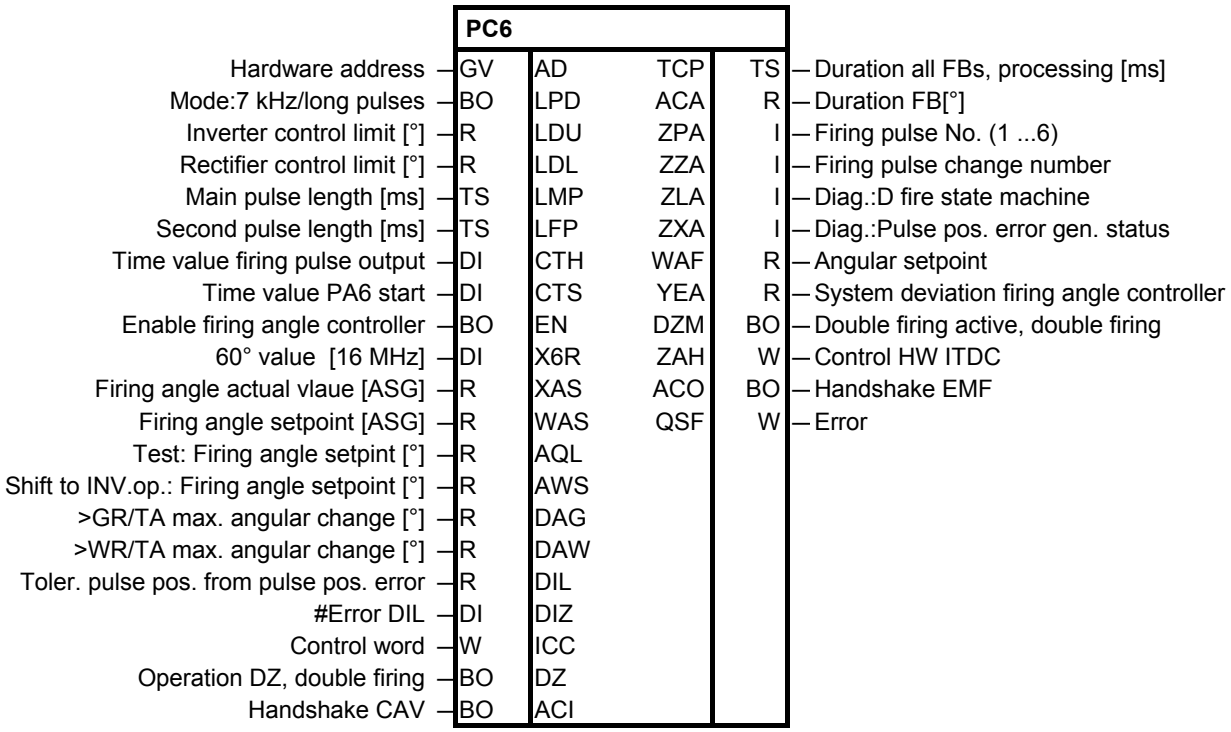
Bit 1	Synchronizing voltage not available/failed → check the synchronizing voltage connection (hardware)
Bit 2	Synchronizing voltage erroneous : Frequency step >10%/period → check the synchronizing voltage (hardware)
Bit 3	Zero crossovers UL12 missing (Sitor), available min. 1 x → check the line supply connection or INV
Bit 4	Zero crossovers UL13 missing (Sitor), available min. 1 x → check the line supply connection or INV
Bit 5	Logical 0
Bit 6	Rotating field error = no clockwise rotating field or UL12 and UL13 = 0 → check the line supply connection or INV
Bit 7-8	Logical 0
Bit 9	PA6 block, configuring error → check NAZ, NEP, NWD, INV, FNT
Bit 10-16	Logical 0

Configuringdata

Computation time [µs]	T400 / PM5 108,0 FM458 / PM6 43,0
Can be inserted online	--
Can be configured in	Interrupt tasks
Executed in	Initialization mode Normal mode
Special features	Only configure in an alarm interrupt, which is initiated by a pulse interrupt (L1 or L3)

6.8 PC6 Firing angle controller

Symbol



Brief description

Firing pulse generation for a 6-pulse line-commutated drive converter, versions
B6C and anti-parallel circuit configuration B6(A)B6(C)

Firing pulse generation for a six-pulse line-commutated drive converter for a bridge B6C and a second bridge in a circulating current-free anti-parallel circuit configuration B6(A)B6(C).

The gating unit has an automatic frequency adaptation for 50 and 60 [Hz] line supplies.

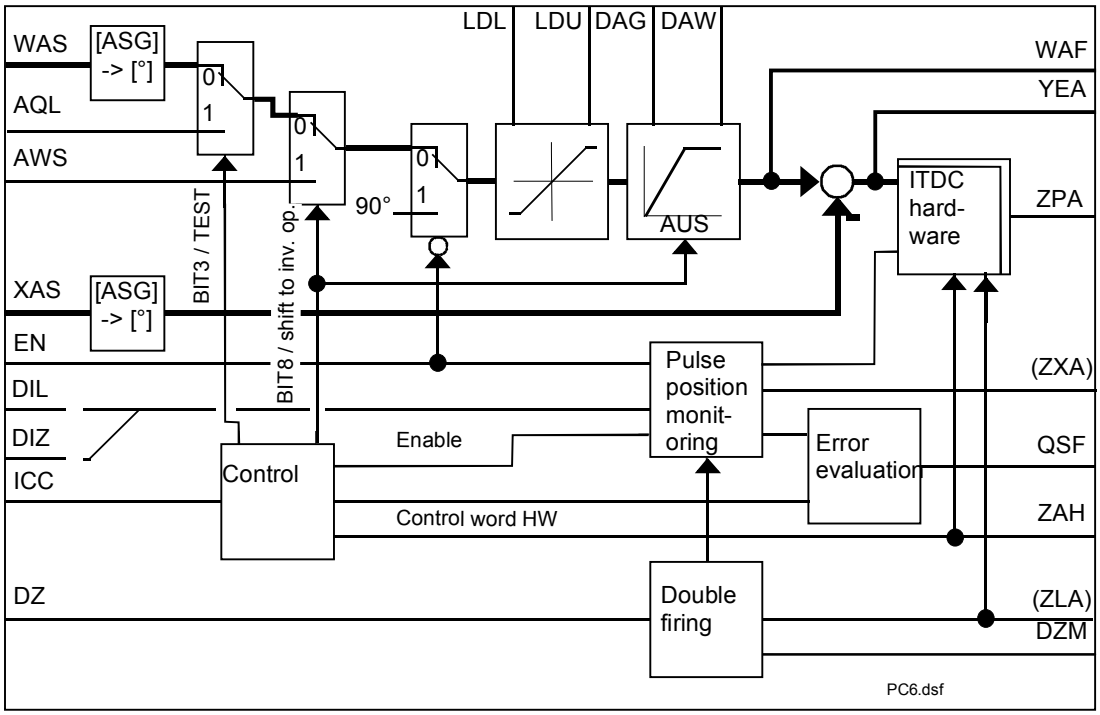
Mode of operation

The function block generates firing pulses for the SITOR set thyristors. The firing pulses are either generated as pulse chains or as long pulses. The Sitor sets always require pulse chains. Long pulses are required for special gating systems. The pulse lengths must be adapted to the line supply frequency. The pulse duration may not exceed 45 [°el].

Synchronization to the line supply is either realized with the internal single-phase synchronizing voltage (Vsyn.), derived from the SITOR set electronics power supply, or with an external voltage at connector ITDC-X5.

The gating unit calculation is started using interrupts in synchronism with the firing pulses. In steady-state operation (e.g. 50 Hz line supply and constant firing angle), the interrupts occur every 3.3 ms via the local expansion bus (LE bus) between ITDC and PM.
The PC6 block is calculated as last block of the interrupt task.

Function chart



Operation: Double firing results in a special status of the closed-loop thyristor current control. When activated at SOL.DZM, the output voltage goes to 0 and free-wheeling branch is enabled. The first firing pulse following the enable, is continuously output with the associated firing pulse of the same phase. The DC circuit is de-coupled from the line supply. The system can be switched-on in rectifier operation at any time; this is not true for inverter operation. After the double firing has been de-activated, the firing pulses are again generated in synchronism with the line supply.

I/O

AD	Hardware address	
LDP	Selects the firing pulse shape: LDP = 0 : 7kHz pulse chain, LDP = 1 : Long pulses All Sitor drive converters require 7kHz.	(Initialization connection/ default: 0)
LDU	Absolute inverter (INV) control limit [°] Condition: 90 ≤ PC6.LDU ≤ 180, otherwise, QSF\bit 9 = 1 (180° is a theoretical value. The angle includes the hold-off, pulse cancellation time and the overlap due to the commutation.)	(Initialization connection/ default: 150)
LDL	Absolute rectifier (RECT) control limit [°] Condition: 0 ≤ PC6.LDL ≤ 90, otherwise, QSF\bit 9 = 1 (the limit should be symmetrical by 90° to the inverter control limit.)	(Initialization connection/ default: 30)
LMP	Main pulse length [ms] Conversion in degrees according to the line supply frequency f : $LMP[°] = LMP[ms] * f[Hz] * 10^{-3} * 360[°] \Rightarrow LMP \geq 0.05ms$ LMP is limited to 50 μs if the configured value is lower.	(default: 1.1ms) { < 45[°] el. }

LFP	Second pulse length [ms] We recommend that the value of LMP is kept. (processed according to connection LMP)	(default: 1.1ms) { < 45[°] el. }
CTH	Firing pulse output, time value (the value changes in each cycle)	PA6.CTH → PC6.CTH
CTS	Time value at the start of FB-PA6 (the value changes in each cycle)	PA6.CTS → PC6.CTS
EN	Enable, firing angle controller realized if Vsyn. and line supply = ok	PA6.RDY → PC6.EN
X6R	Numerical value $\hat{=}$ 60° of the line supply periods [16 MHz] (50 Hz $\hat{=}$ 320000[1])	PA6.Y6R → PC6.X6R { 2^{21} }
XAS	Firing angle actual value [ASG]	PA6.XAS → PC6.XAS {-1...0...+1}
WAS	Firing angle setpoint [ASG]	CPI.Y → PC6.WAS
AQL	Test operation: Firing angle setpoint [°] Input limited with LDL ≤ AQL ≤ LDU The firing angle which is transferred is directly implemented! Enter small changes in order to prevent overcurrent conditions.	(default: 150)
AWS	Shift to inverter operation : Firing angle setpoint [°] The angle becomes the setpoint with signal SOL.QPI. The current controller is switched-out. Condition: 90 ≤ AWS ≤ 180, otherwise, QSF\bit 9 = 1	(Initialization connection/ default: 150)
DAG	Max. angular change/sampling cycle towards rectifier operation condition Condition: 0 ≤ PC6.DAG ≤ 180, otherwise, QSF\bit 9 = 1	(Initialization connection/ default: 60)
DAW	Max. angular change/sampling cycle towards inverter operation Condition: 0 ≤ PC6.DAW ≤ 180, otherwise, QSF\bit 9 = 1	(Initialization connection/ default: 150)
DIL	Tolerance, pulse position [°] Limit for the setpoint-actual value difference of the firing angle.	(default: 1.0)
DIZ	Number of permissible, continuous limit violations DIL	(default: 3)
ICC	Control word (assignment, refer below)	SOL.QCC → PC6.ICC
DZ	Operation: Double firing For DZ=1, a firing pulse pair of a phase is constantly output in the constellation 1-4, 2-5, 3-6 or 4-1, 5-2, 6-3.	(default: 0)
ACI	Handshake from the CAV block	CAV.ACO → PC6.ACI
———		
TCP	Processing time of all FBs [ms]	(default: 0 ms)
ACA	Processing time in [°] (incl. 100 μs safety margin)	(default: 0.0)
ZPA	Number of the firing pulse	PC6.ZPA → PA6.ZPA (default: 0)
ZZA	Diag.: Firing pulse change number (Indicates the change of the number, only for changes > 60°.)	(default: 0) {-3...0...+4}
ZLA	Diag.: status ‘double firing state machine'	(default: 0)
ZXA	Diag.: status ‘pulse position error generation'	(default: 0)
WAF	Firing angle setpoint α [°] (max. changes/TA are limited by DAG or DAW)	(default: 0.0)

YEA	System deviation, firing angle controller	(default: 0.0)
DZM	Operation: Double firing active	PC6.DZM → SOL.DZM (default: 0)
ZAH	Control word, hardware (assignment, refer below)	(default: 16#0000)
ACO	Handshake for EMF block	PC6.ACO → EMF.ACI (default: 0)
QSF	Error word	PC6.QSF → SOL.QSP (default: 16#0000)

Control word, hardware (ZAH)

Displays the hardware register control on the ITDC module

Bit 1	Torque direction M1 enabled
Bit 2	Torque direction M2 enabled
Bit 3	Second pulse enabled
Bit 4	Operation : Double firing enabled
Bit 5	Pulse inhibit for undervoltage (refer to selection, SOL.UNM)
Bit 6	Chain pulses activated
Bit 7	Logical 0
Bit 8	Int./ext. synchronizing voltage (0/1) , (relay changeover of the inputs)
Bit 9-16	Logical 0

Control word (ICC) from the switch-over logic

Bit 1	SOL.QON	-closed-loop current control in operation
Bit 2	SOL.QPL *	-pulse inhibit
Bit 3	SOL.QPS *	-shift to inverter operation
Bit 4	SOL.QCE	-enable current controller
Bit 5	SOL.Q01	-torque direction M1 in operation
Bit 6	SOL.Q02	-torque direction M2 in operation
Bit 7	SOL.QCS *	-set current controller
Bit 8	SOL.QSE *	-test operation, controlled active

Bit used, designated with *.

Error messages in the error word QSF

The errors are bit-coded in the word and are listed in the following table :

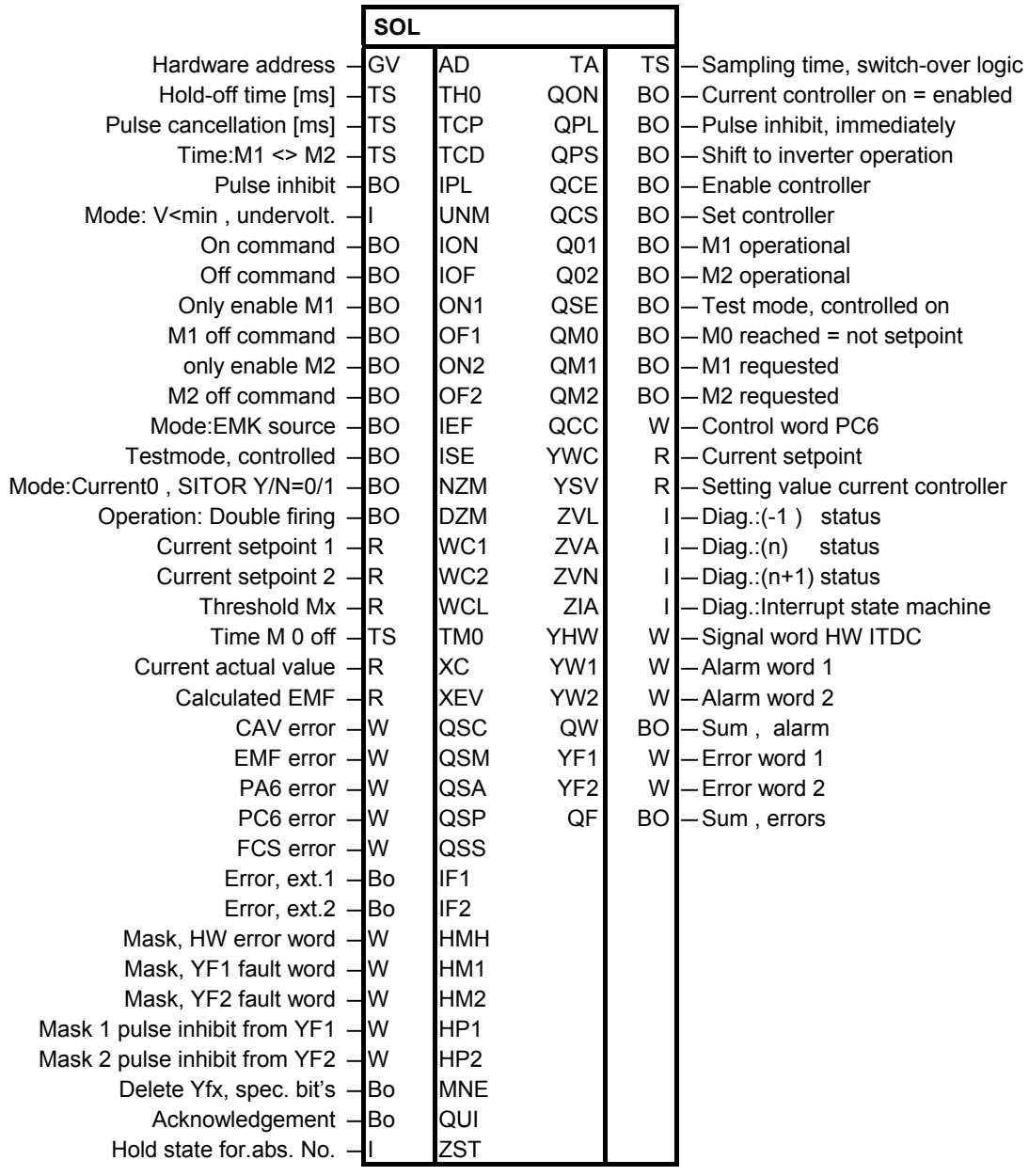
Bit 1-4	Logical 0
Bit 5	Erroneous pulse position → check line supply values, DIL, DIZ
Bit 6-8	Logical 0
Bit 9	PC6 block, configuration error → check LDU, LDL, AWS, DAG, DAW
Bit 10-16	Logical 0

Configuringdata

Computation time [µs]	T400 / PM5 94,3 FM458 / PM6 37,1
Can be inserted online	--
Can be configured in	Interrupt tasks
Executed in	Initialization mode Normal mode
Special features	Only configure in an alarm interrupt, which is initiated by a pulse interrupt (L1 or L3)

6.9 SOL Switch-over logic

Symbol



Brief description

Switch-over logic for:

- 4Q drives with drive converter in a circulating current-free anti-parallel circuit configuration comprising two fully-controlled three-phase bridge circuits
- 1Q drives with drive converter in a fully-controlled three-phase bridge circuit configuration.

Mode of operation

The switch-over logic controls the command sequence when switching-in and switching-out the closed-loop thyristor current control (1Q and 4Q drives) and the torque and current direction reversal (4Q drives).

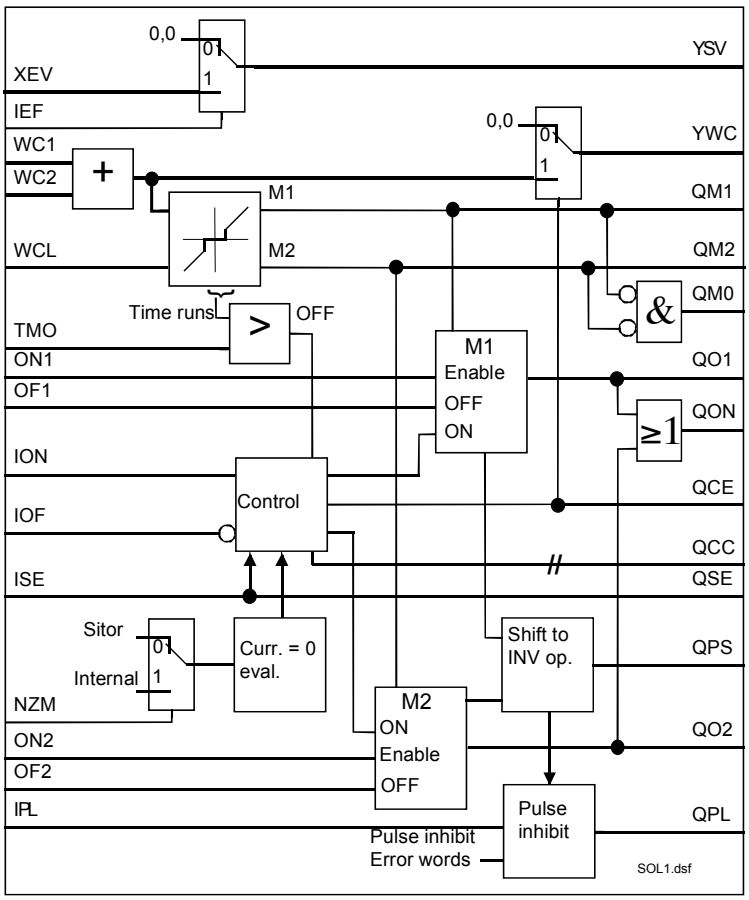
The torque direction is derived from the sign (polarity) of the complete current setpoint (WC1 + .WC2)
from a higher-level closed-loop control. The following relationship exists:

- Positive setpoint Torque direction M1
- Negative setpoint Torque direction M2

If a torque direction is not requested, i.e. the setpoint WC1+WC2 < WCL, the 'virtual torque direction M0' is reached and output QM0 set'. Outputs QMX are only controlled from the setpoint.

For a 1Q drive with Sitor set (B6C), the firing pulses of torque direction 1 are always used. This is the reason torque direction M2 must be constantly inhibited with off commands OF2 = 1.

Function chart, control



The switch-over logic computes a pre-control angle from the calculated ‘EMK’ from FB-EMF.
This is pre-assigned for the current controller at torque reversal. The value is used with the selection: Continuous intervention for each calculation.

The switch-over logic executes the following command when switching-off or changing-over:

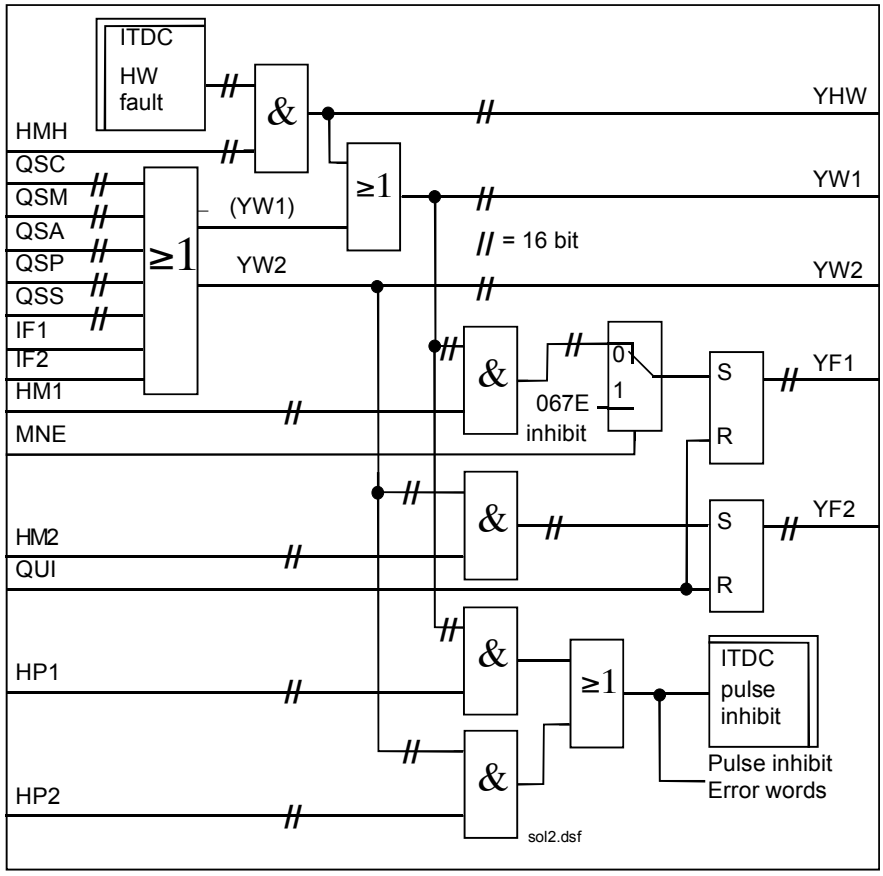
- The pulses are shifted to inverter operation (the current is reduced to 0) QPS
- Waits for the zero current signal NZM
- Deletes the pulses and starts the hold-off interval THO
- Switches-in the new torque direction after the hold-off time THO and pulse cancellation time TCP have expired.

The no-current interval at torque reversal is defined by the I = 0 signal and the thyristor waiting times and is approx. 6.6 to 10 ms (this depends on the motor inductance).
The monitoring time for the torque change TMO acts as delay when switching-off.

The checkback signals QON, QO1, QO2 are only set for a setpoint > WCL. The pulses are enabled at this instant.

All of the faults/errors are concentrated and evaluated in the switch-over logic.
The errors of the FBs and 2 user-specific, external errors and those from the ITDC hardware are combined to two alarm words YW1 and YW2.
The bits from the ITDC hardware are enabled with the hex mask HMH and are entered into YW1 / 2.
The mask bits are output in word YHW.
The bits of alarm words are switched-through into words for faults YF1, YF2 and saved, with masks HM1, HM2. Each bit initiates the 'shift to inverter operation' QPS=1, and the closed-loop current control is disabled. The errors should be acknowledged, QUI=1.
The bits of the fault words for immediate pulse inhibit QPL=1 are enabled with masks HP1, HP2. When this function is enabled, this can cause inverter commutation faults !
All specific faults/errors associated with the line supply monitoring and from the Sitor set are deleted with input MNE = 1.

Function chart, error message



I/O

AD	Hardware address	
TH0	Thyristor hold-off interval [ms] Condition: 0.5 ms ≤ TH0 ≤ 131 ms, otherwise, YW2\bit10=1	(Initialization connection/ default: 10 ms)
TCP	Thyristor pulse cancellation time [ms] Condition: 0.0 ms ≤ TH0 ≤ 20000 ms , otherwise, YW2\bit10 = 1	(Initialization connection/ default: 20 ms)
TCD	Monitoring time for torque change M1 ⇔ M2 (reversal > (TCP + THO + TCD) ⇒ fault)	(default: 50 ms)
IPL	Pulse inhibit = 1 this becomes immediately effective! (This has the same priority as the hardware pulse inhibit ITDC-X5:10.) (For high currents and speed, this can result in inverter commutation faults.)	(default: 0)
UNM	Mode: Undervoltage processing (Sitor) UNM=0: Undervoltage signal as alarm (YW1\bit 6) UNM=1: Transition into the status: Pulse inhibit UNM=2: Transition into the status: Pulse inhibit + Total pulse inhibit (HW-ITDC)	(default: 2)
ION	Switch-on command for the closed-loop thyristor current control only if IOF = 0. ION is only level-controlled ! A transition from off ⇒ operation is only realized if the sum of the setpoints WC1+WC2 ≥ WCL.	(default: 0)

IOF	Off command for the closed-loop thyristor current control IOF has priority, especially over other control inputs.	(default: 0)
ON1	Enable, only torque direction M1 , for OF1 = 0 & OF2 = 0	(default: 0)
OF1	Off command, torque direction M1 With QON = 1, only negative setpoints are executed.	(default: 0)
ON2	Enable, only torque direction M2 , for OF2 = 0 & OF1 = 0	(default: 0)
OF2	Off command, torque direction M2 With QON = 1, only positive setpoints are executed.	(default: 0)
IEF	Mode : Use computed EMF value (FB-EMF available) Use the value at XEV to output at YSV	(default: 1)
ISE	Change over to open-loop controlled test mode. Input is only effective for ION=0. Changes at the firing angle controller PC6 : • PC6.AQL=150 (firing angle setpoint in the open-loop controlled mode) • PC6.AWS (init. value) = 150 (firing angle setpoint for shift to inverter operation) Setpoints WC1/2 are not relevant in the test mode (ISE=1), only the sign!	(default: 0)
NZM	Zero current signal from the SITOR set Y/N=0/1 (if NZM=1 there is no signal ⇒ time monitoring TCD sets a hardware fault)	(default: 0)
DZM	Operating signal, double firing from the firing angle controller PC6	PC6.DZM → SOL.DZM
WC1	Current setpoint 1 $WC1 + WC2 = YWC$	(default: 0.0)
WC2	Current setpoint 2	(default: 0.0)
WCL	Switch-on threshold for torque direction (absolute value)	(default: 0.01)
TM0	Monitoring time for torque direction M0 $\left(\lvert WC1 + WC2\rvert \le WCL\right) \,\&\, \left(t_{act} \rangle TM0\right) \Rightarrow QM0 = 1$	(default: 2000ms)
XC	Current actual value (signed)	CAV.YC → SOL.XC
XEV	Calculated EMF value (referred to Vdi) at torque reversal and continuous tracking of FB-CPI	EMF.YEV → SOL.XEV
QSC	Fault word from CAV	CAV.QSF → SOL.QSC
QSM	Fault word from EMF	EMF.QSF → SOL.QSM
QSA	Fault word from PA6	PA6.QSF → SOL.QSA
QSP	Fault word from PC6	PC6.QSF → SOL.QSP
QSS	Fault word from FCS, if FCS used (optional for a 6QG3x SITOR set with option : Excitation)	FCS.QSF → SOL.QSS , otherwise = 0.
IF1	Fault, external 1 (appears in YW1\bit 9)	(default: 0)
IF2	Fault, external 2 (appears in YW1\bit 12)	(default: 0)
HMH	Enables the bits for hardware message word YHW and therefore connection to YW1	(default: 16#FFFF)
HM1	Enables the bits for control word YF1	(default: 16#FFFF)
HM2	Enables the bits for control word YF2	(default: 16#FFFF)

HP1	Enables the bits from YF1 for immediate pulse inhibit WARNING: 'Inverter commutation fault' possible!	(default: 16#0000)
HP2	Enables the bits from YF2 for immediate pulse inhibit WARNING: 'Inverter commutation fault' possible !	(default: 16#0000)
MNE	Group inhibit, error words YF1 and YHW Deletes defined bits (refer to the table below : ∅ = deleted bits)	(default: 067E)
QUI	Acknowledges faults YF1 and YF2 Acknowledgment only with ION=0 !	
ZST	Diagnostics function: Stop in the status of the specified number (ZVA) (only trained personnel may modify the default value!)	(default: 100)
——		
TA	Sampling time, switch-over logic	(default: 0 ms)
QON	Closed-loop current control operation (enable only without fault/error and after a switch-on command and setpoint WC1+WC2 > WCL > 0.0)	(default: 0)
QPL	Pulse inhibit (status is displayed at connector ITDC-X5:15 = 0)	(default: 0)
QPS	Pulses are shifted to inverter operation (the firing angle PC6.AWS is active.)	(default: 0)
QCE	Enable current controller	SOL.QCE → CPI.EN (default: 0)
QCS	Set or track the current controller FB-CPI	SOL.SCC → CPI.S (default: 0)
Q01	Torque direction M1 operational (setpoint is switched-through to YWC)	SOL.Q01 → CAV.IM1 (default: 0)
Q02	Torque direction M2 operational (setpoint is switched-through to YWC)	SOL.Q02 → CAV.IM2 (default: 0)
QSE	Test-mode switched-in	(default: 0)
QM0	M0 requested , current setpoint < WCL = neither M1 nor M2 requested	(default: 0)
QM1	M1 requested	(default: 0)
QM2	M2 requested	(default: 0)
QCC	Control word for FB-PC6	SOL.QCC → PC6.ICC (default: 16#0000)
YWC	Current setpoint	SOL.YWC → CPI.WC (default: 0.0)
YSV	Setting value, current controller, even when tracking is switched-in	SOL.YSV → CPI.SV (default: 0.0)
ZVL	Diag.:(n-1) status	(default: 0)
ZVA	Diag.:(n) status , control state machine	(default: 0)
ZVN	Diag.:(n+1) status	(default: 0)
ZIA	Diag.:status , interrupt state machine	(default: 0)
YHW	Message word, hardware ITDC (masked by HMH)	(default: 16#0000)
YW1	Alarm word 1	(default: 16#0000)
YW2	Alarm word 2	(default: 16#0000)

QW	Sum, alarms 1 bit in YW1 or YW2 = 1	(default: 0)
YF1	Error word 1 (masked by HM1)	(default: 16#0000)
YF2	Error word 2 (masked by HM2)	(default: 16#0000)
QF	Sum, error message 1 bit in YF1 or YF2 = 1	(default: 0)

Switching combinations which do not appear to be practical (e.g. ON1 ∧ OF1 ∨ ON2 ∧ OF2),
generally result in the closed-loop thyristor current control being shutdown.

Control word (QCC) for PC6

Bit 1	QON	-Closed-loop current control in operation
Bit 2	PI	-Pulse inhibit
Bit 3	QPI	-Shift to inverter operation
Bit 4	QCE	-Enable current controller
Bit 5	Q01	-Torque direction M1 operational
Bit 6	Q02	-Torque direction M2 operational
Bit 7	SCC	-Set current controller
Bit 8	YXS	-Test mode switched-in
Bit 9	QM0	-Torque direction M0 requested
Bit 10	QM1	-Torque M1 requested
Bit 11	QM2	-Torque M2 requested
Bit 12-16	Logical 0	

Fault messages

The hardware faults which have occurred, are coded in fault word YHW and listed in the following table.

YHW (masked with HMH)

Bit 1		Logical 0
Bit 2	∅	Fuse monitoring (Sitor) → check for blown fuse
Bit 3	∅	Temperature monitoring (Sitor) → check for overtemperature
Bit 4	∅	Undervoltage (Sitor) → check the line supply values or connector SOL.UNM
Bit 5	∅	External pulse inhibit if voltage is not present at the input → ITDC-X5:10 > 15 V $\hat{=}$ Enable pulses
Bit 6	∅	Logical 0 $\hat{=}$
Bit 7	∅	Hardware watchdog ITDC Causes: Defective module, → replace the module Task overflow in the PMx → change the configured software
Bit 8		Total pulse inhibit (display:ITDC-X5:15) Cause: Voltage missing, software pulse inhibit, HW-ITDC fault → Remove the fault status
Bit 9-16		Logical 0

The alarm message from YW1 or YW2 is transitioned into a fault message YF1 (HM1 bit x=1) or YF2 (HM2 bit x=1) by setting bits 1-16 at HM1 or HM2. The closed-loop thyristor current control is switched-off if there is a fault message in fault word YF1 or YF2.

The closed-loop thyristor current control can only be switched-in again after:

- the fault has been removed
- the fault has been acknowledged (edge : QUI = 0 → 1)
- renewed switch-on command (transition: ION = 0 → 1)

The faults which have occurred are coded in the fault words and are listed in the following tables.

YW1 / YF1 (masked using HM1)

Bit 1		Synchronizing voltage not present/failed → check the synchronizing voltage connection (hardware)
Bit 2	∅	Erroneous synchronizing voltage Frequency step > 10% / periods → check the synchronizing voltage (hardware)
Bit 3	∅	UL1-2 zero crossovers missing (Sitor) only if the signal was not present once. → check the line supply connection or initialization connection PA6.INV
Bit 4	∅	UL1-3 zero crossovers missing (Sitor) only if the signal was not present once. → check the line supply connection or initialization connection PA6.INV
Bit 5	∅	Rotating field fault = no clockwise rotating field of Vsin, or both zero crossovers missing. (dependent on mode : INV) → check the line supply connection or initialization connection PA6.INV
Bit 6	∅	Undervoltage (Sitor). (dependent on the mode : UNM) → check the line supply values or connector SOL.UNM
Bit 7	∅	Logical 0
Bit 8		Pulse inhibit , software (.IPL = 1) + HW hardware command: Total pulse inhibit
Bit 9		Fault external 1 (SOL.IF1= 1)
Bit 10	∅	Fuse monitoring (Sitor) → check for fuse failure
Bit 11	∅	Temperature monitoring (Sitor) → check for overtemperature
Bit 12		Fault, external 2 (SOL.IF2 = 1)
Bit 13		External pulse inhibit if the voltage is missing at the input + HW command: Total pulse inhibit → ITDC-X5:10 > 15 V $\hat{=}$ Enable pulses

Bit 14	Excitation current fault (optional for SITOR set 6QG3x with excitation option) Cause: FCS.FC > 5% and field current actual value < 3% FCS.ARC → check field control/connection
Bit 15	Hardware watchdog ITDC + HW command: Total pulse inhibit Causes: Defective module, → replace the module Task overflow in the PMx → revise the configured software
Bit 16	HW command: Total pulse inhibit (ITDC-X5:15) → Remove the fault states

∅ = suppressed with MNE=1

YW2 / YF2 (Masked using HM2)

Bit 1	Hardware fault, current actual value sensing (Sitor) ITDC : Current actual value has not been latched. Cause: V/f conversion frequency not present → check the current actual value sensing (60 kHz) or ITDC
Bit 2	Overcurrent M1 → check plant/system values, connector CAV.CX1 and Initialization connections CAV: RRC, ARC, NF, XFO, AL1
Bit 3	Overcurrent M2 → check plant/system values, connector CAV.CX2 and Initialization connections CAV: RRC, ARC, NF, XFO, AL2
Bit 4	CAV configuring error → check the initialization connections CAV: RRC, ARC, AL1, AL2, IAV, XF2, NF, XFO
Bit 5	Hardware fault : Voltage actual value sensing (Sitor) ITDC : Voltage actual value is not latched. Cause: -V/f conversion frequency not available → check voltage actual value sensing (60kHz) or ITDC
Bit 6	EMF configuring error → check the initialization connections EMF: RRV, ARV, AAV, XFO
Bit 7	Pulse position error (PC6) Cause: Pulse position erroneous → Check the line supply values and connectors PC6: DIL, DIZ
Bit 8	Configuring error → AAV voltage specified too high (1.35*AAV > 2*ARU)
Bit 9	Error/ fault, current zero signal for M1 ⇔ M2 (NZM=0 , Sitor) or Iact >3% → check the zero current signal from the SITOR interface (only with NZM=0)
Bit 10	SOL configuring error → check the initialization connections SOL: TH0, TCP
Bit 11	SOL block, internal status fault/error → check the ITDC-HW
Bit 12	FCS configuring error → check the initialization connection FCS: RRC, ARC or connector FC
Bit 13	PA6 configuring error → check the initialization connections PA6: NAZ, NEP, NWD, INV, FNT

Bit 14	PC6 configuring error → check the initialization connections PC6: LDU, LDL, AWS, DAG, DAW
Bit15-16	Logical 0

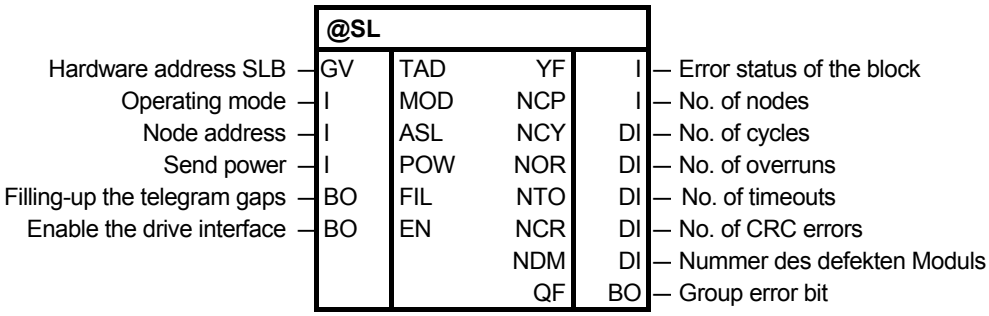
Configuringdata

Computation time [µs]	T400 / PM5 108,5 FM458 / PM6 37,0
Can be inserted online	--
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	Sampling time of the cyclic task ≤ equivalent sampling time

7 SIMOLINK blocks

7.1 @SL SIMOLINK central block

Symbol



Brief description

The @SL central block allows the initialization and monitoring of communications with an SLB module.

An SLB module is a system hardware component, which can be an ITSL-, an EXM 448-1 module or an optional SLB (**S**IMO**L**INK **B**oard) of the ITSL module.

The @SL central block may only be configured in a cyclic task and once per SIMOLINK ring.

The following parameters must be set for an SLB module:

- Hardware address SLB (TAD)
- Operating mode (MOD)
- Node address (ASL), only relevant when operating mode 0 is selected
- Send power (POW) for the SLB module

Mode of operation

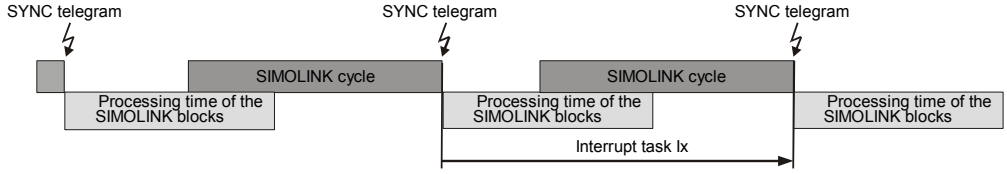
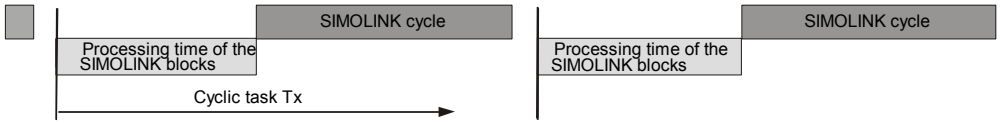
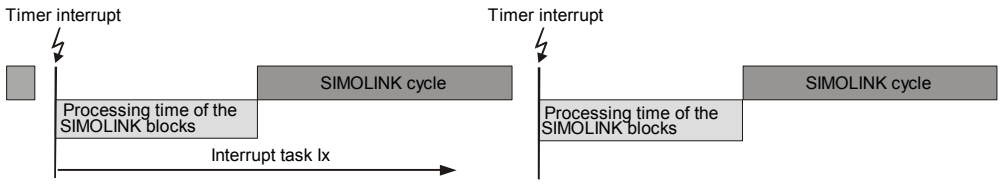
1. The @SL central block executes the following steps while the system is being initialized:
   - Checks the validity of the value ranges at the input connections
   - Checks whether additional @SL central blocks have been configured at the same hardware address (input TAD)
   - Initializes the SLB module corresponding to the data at the initialization connections
   - Sends an initialization sequence (SIMOLINK) and monitors the starting sequence

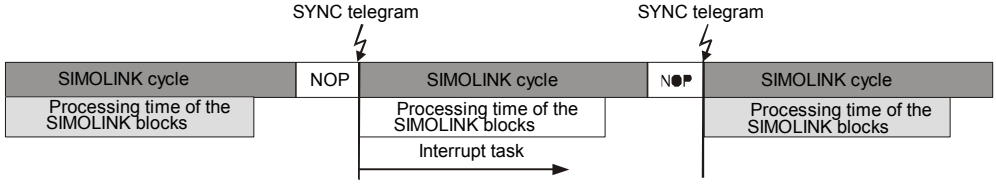
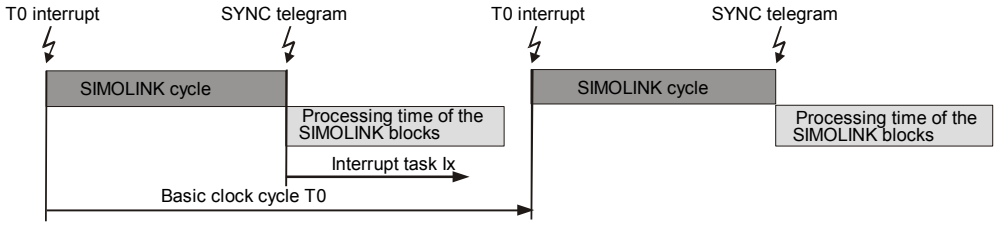
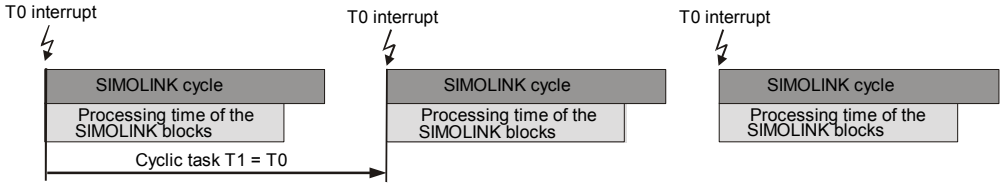
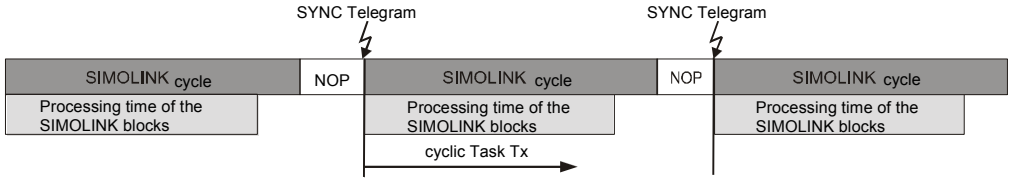
2. The @SL central block executes, in the standard mode ("RUN“ operating status) of the system, the following operating steps:
   - Monitors communications of the SIMOLINK drive interface
   - Outputs fault messages when communication faults occur at the outputs
   - Outputs information about the drive coupling
   - New values for the node address (ASL) and send power (POW) are only transferred after the SIMOLINK drive coupling restarts.

Operating mode

An SLB module can be initialized and can operate in 6 different operating modes.

When configuring, the different time characteristics of the SIMOLINK blocks for the selected operating modes at input MOD.

0	**Slave mode** The SLB module operates as slave. The SIMOLINK blocks in the CFC chart must be configured in an interrupt task Ix (x=1 . . . 8). Timing: an interrupt is initiated each time a SYNC telegram is received, and therefore starts execution of interrupt task Ix. The received values are read and the values to be sent are written into the write buffer of the SLB module. 
1	**Asynchronous mode** The SLB module operates as master. The SIMOLINK blocks in the CFC chart must be configured in a cyclic task Tx (x=1 . . . 5). Timing: The blocks are executed each time cyclic task Tx starts. The SIMOLINK telegrams are sent after the last SIMOLINK block has been calculated. 
2	**Timer mode** The SLB module operates as master. The SIMOLINK blocks in the CFC chart must be configured in an interrupt task Ix (x=1 . . . 8). Timing: A timer of the ITSL/EXM 448-1 module initiates, corresponding to the equivalent sampling time, an interrupt, and therefore execution of interrupt task Ix. The SIMOLINK telegrams are sent after the last SIMOLINK block has been calculated. 

3	**Automatic mode** The SLB module operates as master. The SIMOLINK blocks in the CFC chart must be configured in an interrupt task Ix (x=1 . . . 8). Timing: Each SYNC telegram which is received, initiates an interrupt, and therefore execution of the interrupt task Ix. The SIMOLINK bus cycle is automatically re-initiated each time a SYNC telegram is received. SIMOLINK telegrams are sent and received in parallel with the signal processing (internal calculations). 
4	**External mode** The SLB module operates as master. The SIMOLINK blocks in the CFC chart must be configured in an interrupt task Ix (x=1 . . . 8). Timing: The bask clock cycle T0 from the system initiates that telegrams are sent, and therefore the start of the SIMOLINK cycle. A subsequently received SYNC telegram initiates an interrupt and therefore execution of interrupt task Ix. The signal processing (internal calculations) are realized after the SIMOLINK telegram has been sent and received. 
5	**External cyclic mode** The SLB module operates as master. The SIMOLINK blocks in the CFC chart must be configured in a cyclic task T1=T0. Timing: The basic clock cycle T0 initiates that telegrams are sent (starts the SIMOLINK cycle) and the SIMOLINK blocks are processed in T1=T0. The signals are processed (internal calculation) at the same time as sending and receiving SIMOLINK telegrams. 
10	**Cyclic-automatic-mode 10** The cyclic-automatic-mode 10 offers the advantage to place the function block configuration in cyklic tasks, in opposed to mode 3. 

NOTE It is necessary to set interrupt task sources for operating modes 0, 2, 3, 4 and 10, in order to initiate the configured interrupt tasks. The settings must be made in the HWConfig in the properties window under the "Interrupt tasks" tab. They are dependent on the configured hardware components.

interrupt task settings

Operating mode	Interrupt source to be set for the interrupt task Ix of the SIMOLINK blocks, if:			
	first SLB module at slot 1	**first SLB module at slot 2**	**second SLB module at slot 1**	**second SLB module at slot 2**
0	LE bus interrupt 1	LE bus interrupt 3	LE bus interrupt 2	LE bus interrupt 4
2	LE bus interrupt 5	LE bus interrupt 6	LE bus interrupt 7	LE bus interrupt 8
3	LE bus interrupt 1	LE bus interrupt 3	LE bus interrupt 2	LE bus interrupt 4
4	LE bus interrupt 1	LE bus interrupt 3	LE bus interrupt 2	LE bus interrupt 4

NOTE The first SLB module can be an EXM 448-1- or an ITSL module without optional SLB. The settings for the second SLB module are only relevant for an ITSL module with optional SLB.

I/O

TAD	Hardware address SLB (name of the SLB module), which can be configured in HWConfig.	
MOD	Operating mode Sets the required operating mode (initialization connection)	(default: 0)
ASL	Node address Address of the slave (1 . . . 200) in the SIMOLINK ring (this is only relevant, if operating mode 0 was selected at MOD) (initialization connection)	(default: 0)
POW	Send power Send power of the SLB module (if a lower send power is used, the aging processing of the fiber-optic cables is slowed down and errors in the medium can be more easily identified at start-up). Value range: 1 . . . 3 (small, medium large); (initialization connection)	(default: 3)
FIL	Filling-up the telegram gaps For FIL=1, if there is a gap between two bus cycles, then this is filled-up with NOP telegrams. Note: if the sampling time T0 is synchronized, then filling-up only operates correctly if the equivalent sampling time is precisely set to the value of the cycle time that is used for synchronization. (initialization connection)	(default: 0)
EN	Bus enable Start/stop of the SLB module for telegram data transfer EN=0 no telegrams are sent EN=1 telegrams are sent corresponding to the selected operating mode	(default: 1)
YF	Error status of the block YF=0 No error, YF > 0 refer to coded error output	(default: 0)
NCP	Number of nodes Number of nodes in the SIMOLINK ring (including SL master)	(default: 0)
NCY	Number of cycles Number of SIMOLINK cycles which have been executed or the number of SIMOLINK telegrams	(default: 0)
NOR	Number of overruns The number of statuses, where the configured function blocks have not be able to provide the data or retrieve the data up to the start of the next SIMOLINK cycle. The data remains consistent, even for errors such as these and the SIMOLINK cycle is started with old data. In order to resolve this problem, the interrupt tasks, in which the SIMOLINK blocks were configured, must be relieved.	(default: 0)
NTO	No. of timeouts on the SIMOLINK ring A timeout means that a telegram has failed (not been received).	(default: 0)
NCR	Number of CRC errors in the SIMOLINK ring A node sends a telegram with a CRC error.	(default: 0)
NDM	Nummer des defekten Moduls bzw. Nummer des Teilnehmers, der den Fehler in der Leitung erkannt hat.	(Vorbesetzung: 0)
QF	Group error bit QF=0 No error, QF=1 for error (if YF≠0)	(default: 0)

coded error output

Error statuses which occur for the appropriate block are output in a coded form at outputs YF of the SIMOLINK blocks. Only the last error event is displayed.

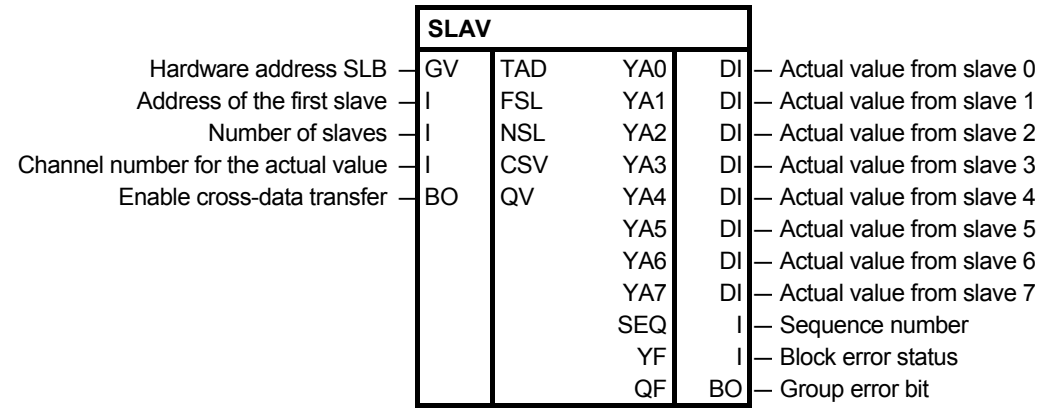
Value	Significance
2	TAD input is incorrectly connected
3	SLB module not inserted or hardware defective
4	SLB module is already being used by another central block @SL
5	Memory problem
6	Central block @SL not configured
7	No SIMOLINK block available
8	Memory register was not set-up
9	Software does not support the hardware combination
10	Block must be configured in an interrupt task
11	Block must be configured in a cyclic task
12	Block must be configured in a cyclic task with TX=T0
13	Equivalent sampling time must be equal to T0
14	Interrupt source for the alarm task is incorrect
15	Blocks must be configured in the same sampling time
16	Operating mode is (still) not supported
17	Node address at input ASL is too high
18	No send- and receive blocks available Note: However, if send and receive blocks are configured, then the fault messages at these blocks should be carefully observed!
19	Maximum number of SIMOLINK telegrams (max. 1021 net telegrams) exceeded → increase SIMOLINK cycle time or configure fewer SIMOLINK blocks
20	Slave address too high
21	Channel number too high
22	Slave attempts to write to the incorrect address
23	Cross-data transfer is only possible in one direction per slave (sending or receiving)
30	Physical data transfer along the SIMOLINK ring is faulted → increase the send power at one of the partial segments, or the fiber-optic cable medium or connector is defective
31	CRC error (check sum error)
32	Timeout error in the SIMOLINK ring
33	Only for MOD=0: signaled SIMOLINK cycle time (in the special telegram from the SL master) does not correspond to the configured equivalent sampling time

Configuringdata

Computation time [µs]	T400 / PM5 210,0 FM458 / PM6 69,3
Can be inserted online	No
Can be configured in	Cyclic task
Executed in	Initialization mode Normal mode
Special features	-

7.2 SLAV, SLAVE_R SIMOLINK receive block for one actual value

Symbol



Brief description

A max. of 8 actual values can be transferred from max. 8 slaves using the SLAV receive block. Each slave can only receive one actual value, and for all of the slaves, only the same channel number is addressed.

The SLAVE and SLAVE_R function blocks are functionally identical. The only difference is the data type of the actual value connections YA0 to YA7:

SLAVE: DINT
SLAVE_R: REAL

Mode of operation

1. The SLAV function block executes the following steps while the system is being initialized
   - Checks the task assignment,
   - Initializes the task list of the SLB module corresponding to the data configured at the inputs
2. In the normal system mode ("RUN“ operating status), the SLAV function block executes the following steps:
   - Checks that the inputs are within the permissible value range
   - Reads-out the actual values to be received from the receive buffer of the SLB module#

I/O I

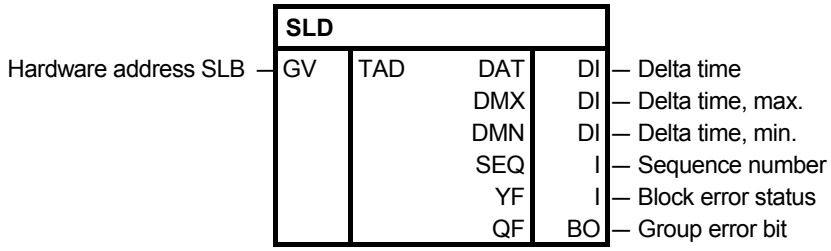
TAD	SLB hardware address (name of the SLB module), which can be configured in HWConfig	
FSL	Address of the first slave from which the actual value YA0 should be received, value range 1 . . . 200 (initialization connection)	(default: 1)
NSL	No. of slaves, from which actual values are to be received, value range 1. . . 8 (initialization connection)	(default: 1)
CSV	Channel number on which the actual value is received, value range 0 . . . 7 (initialization connection)	(default: 0)
QV	Enable cross-data transfer This is used, if data is to be sent to a slave in the same cycle which is physically located in front in the SIMOLINK ring (e.g. from slave 4 to slave 1).	(default: 0)
YA0 to YA7	Actual value YA from slaves 1 to 8 A maximum of 8 actual values can be received.	(default: 0)
SEQ	Sequence number Number of the block in the SIMOLINK block sequence The value supplies info as to whether the block was correctly initialized.	(default: 0)
YF	Error status of the block YF=0 no error, YF > 0 refer to coded error output @SL	(default: 0)
QF	Group error bit QF=0 no error, QF=1 for error (if YF≠0)	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 105,0 FM458 / PM6 34,7
Can be inserted online	No
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

7.3 SLD SIMOLINK delta evaluation

Symbol



Brief description A sampling time failure can be detected using function block SLD. The counter status is interrogated at each SYNC interrupt (this is generated at the end of every telegram cycle). The block can calculate and output the difference to the old (previous) value.

Mode of operation The blocks reads the interrogated value of the counter and generates the difference to the value which was saved in the old (previous) cycle. This value is output at DT.
The minimum and maximum values of DT are kept for monitoring purposes.

I/O

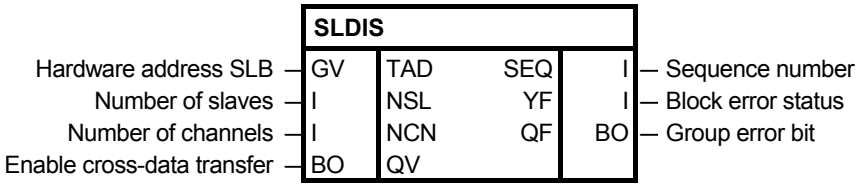
TAD	SLB hardware address (name of the SLB module), which can be configured in HWConfig	
DT	Delta time Difference to the last SIMOLINK cycle duration	(default: 0)
DMX	Delta time, max. Maximum value of DT	(default: 0)
DMN	Delta time, min. Minimum value of DT	(default: 0)
SEQ	Sequence number Number of the block in the SIMOLINK block sequence This value provides information as to whether the block was correctly initialized.	(default: 0)
YF	Error status of the block YF=0 no error, YF > 0 refer to coded error output @SL	(default: 0)
QF	Group error bit QF=0 no error, QF=1 for error (if YF≠0)	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 60,0 FM458 / PM6 19,8
Can be inserted online	No
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

7.4 SLDIS SIMOLINK dispatcher

Symbol



Brief description A dispatcher mode is prepared in-line with the SIMOLINK specifications (as for MASTERDRIVES drive converters) using the SLDIS function block.

Mode of operation The block registers the telegrams for all NSL slaves and all NCN channels.

I/O

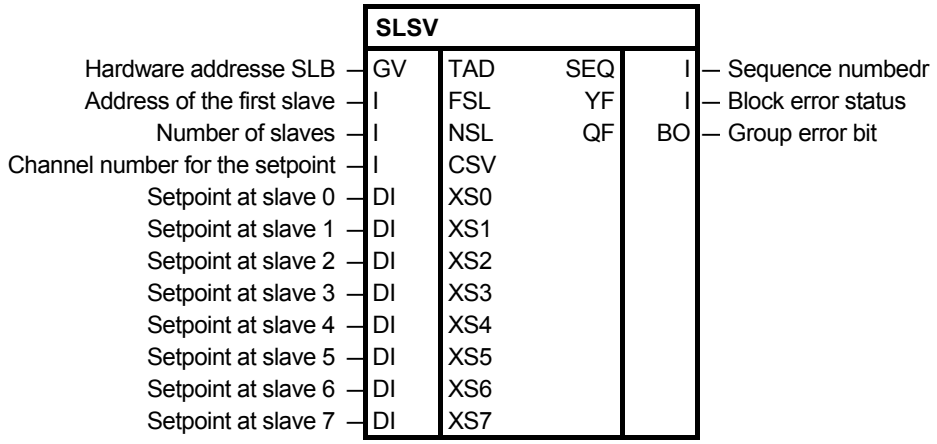
TAD	Hardware address SLB (name of the SLB module), which can be configured in HWConfig	
NSL	Number of all of the slaves in the SIMOLINK ring (initialization connection)	(default: 1)
NCN	Number of all of the channels (initialization connection)	(default: 1)
QV	Enable cross-data transfer This is used, if data are to be sent to a slave in the same cycle, which is located physically in front in the SIMOLINK ring (e.g. from slave 4 to slave 1).	(default: 0)
SEQ	Sequence number Number of the block in the SIMOLINK block sequence This value provides information as to whether the block was correctly initialized.	(default: 0)
YF	Error status of the block YF=0 no error, YF > 0 refer to coded error output @SL	(default: 0)
QF	Group error bit QF=0 no error, QF=1 for error (if YF≠0)	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 45,0 FM458 / PM6 14,7
Can be inserted online	No
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

7.5 SLSV, SLSV_R SIMOLINK send block for one setpoint

Symbol



Brief description

A maximum of 8 setpoints can be transferred to a maximum of 8 slaves using the SLSV send block. Only one setpoint can be sent to each slave, and for all of the slaves, only the same channel number can be addressed.

The SLSV and SLSV_R function blocks are functionally identical. The only difference is the data type of the setpoint connections XS0 to XS7:

SLSV:	DINT
SLSV_R:	REAL

Mode of operation

1. The SLSV send block executes the following steps while the system is being initialized:
   - Checks the task assignment
   - Initializes the task-list of the SLB module corresponding to the data configured at the inputs
2. In the normal system mode ("RUN" mode), the SLSV send block executes the following:
   - Calculates the setpoints
   - Checks that the inputs are within the permissible value ranges
   - Enters the setpoints to be sent into the write buffer of the SLB module

I/O

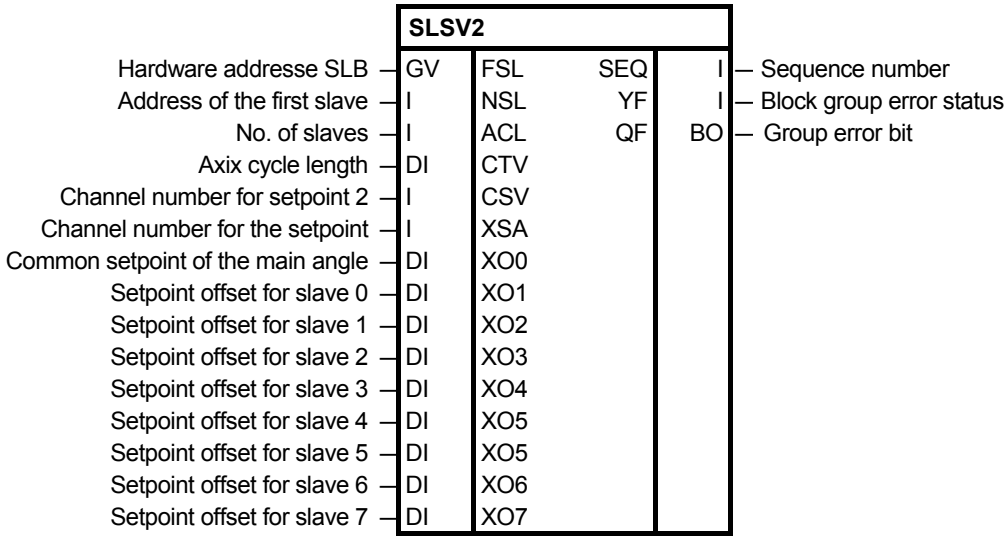
TAD	Hardware address SLB (name of the SLB module), which can be configured in HWConfig	
FSL	Address of the first slave to which setpoint XS0 should be sent, value range 1 . . . 200 (initialization connection)	(default: 1)
NSL	Number of slaves to which the setpoint should be sent, value range 1. . . 8 (initialization connection)	(default: 1)
CSV	Number of the channel on which the setpoint is sent, value range 0 . . . 7 (initialization connection)	(default: 0)
XS0 to XS7	Setpoint XS for slaves 1 to 8, A maximum of 8 setpoints can be sent.	(default: 0)
SEQ	Sequence number Number of the blocks in the SIMOLINK block sequence This value provides information as to whether the block was correctly initialized.	(default: 0)
YF	Error status of the block YF=0 no error, YF > refer to coded error output @SL	(default: 0)
QF	Group error bit QF=0 no error, QF=1 for error (if YF≠0)	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 105,0 FM458 / PM6 34,7
Can be inserted online	No
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

7.6 SLSV2, SLSV2R SIMOLINK send block for 2 setpoints

Symbol



Brief description

2 setpoints can be sent to each slave using the SLSV2 send block. In this case, the block can handle a maximum of 8 slaves. The first setpoint is transferred to all of the slaves.

This functionality can be used to implement a virtual shaft, especially if the time and the position/angular setpoint must be transferred to the slaves.

The SLSV2 and SLSV2R function blocks are functionally identical. The only difference is the data type of the setpoint connections XO0 to XO7:

SLSV2: DINT
SLSV2R: REAL

Mode of operation

1. The SLSV2 send block executes the following steps while the system is being initialized:
   - Checks the task assignment
   - Initializes the task list of the SLB module corresponding to the data configured at the inputs
2. In the normal system mode ("RUN" mode), the SLSV2 send block executes the following steps:
   - Calculates the setpoints
   - Checks that the inputs are within the permissible value ranges
   - Enters the setpoints to be sent into the write buffer of the SLB module

I/O

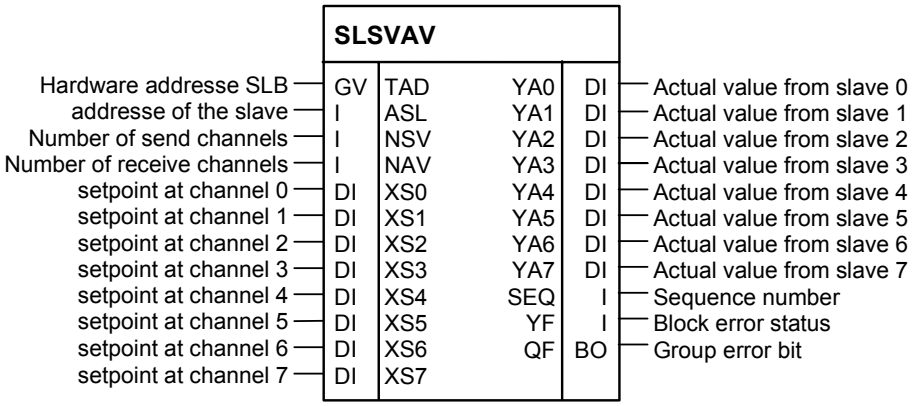
TAD	Hardware address SLB (name of the SLB module), which can be configured in HWConfig	
FSL	Address of the first slave to which setpoint XO0 should be set, value range 1 . . . 200 (initialization connection)	(default: 1)
NSL	Number of slaves to which the setpoint should be sent, value range 1. . . 8 (initialization connection)	(default: 1)
ACL	Axis cycle length Upper integrator limit value	(default: 0)
CTV	Channel number for setpoint 2, value range 0 . . . 7 (initialization connection)	(default: 0)
CSV	Number of the channel on which the setpoint is sent, Value range 0 . . . 7 (initialization connection)	(default: 0)
XSA	Common setpoint XS of the main angle/position for all NSL slaves	(default: 0)
XO0 to XO7	Setpoint offset XO for slaves 1 to 8, A maximum of 8 setpoint offsets can be sent.	(default: 0)
SEQ	Sequence number Number of the block in the SIMOLINK block sequence This value provides information as to whether the block was correctly initialized.	(default: 0)
YF	Error status of the block YF=0 no error, YF > 0 refer to coded error output @SL	(default: 0)
QF	Group error bit QF=0 no error, QF=1 for error (if YF≠0)	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 120,0 FM458 / PM6 39,6
Can be inserted online	No
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

7.7 SLSVAV SIMOLINK send and receive block for one slave

Symbol



Brief description

A maximum of

- 8 setpoints and
- 8 actual values

can be transfered to and from one slave. The number of addressed channels for the setpoints and the actual values is configured at the inputs.

Mode of operation

1. The SLSVAV send and receive block executes the following steps while the system is being initialized:

- Checks the task assignment
- Initializes the task-list of the SLB module corresponding to the data configured at the inputs

2. In the normal system mode ("RUN" mode), the SLSVAV send and receive block executes the following:

- Checks that the inputs are within the permissible value range
- Enters the setpoints to be sent into the write buffer of the SLB module
- Reads-out the actual values to be received from the receive buffer of the SLB module

I/O

TAD	Hardware address SLB (name of the SLB module), which can be configured in HWConfig	
ASL	Address of the slave for dataexchange, value range 1 . . . 200 (initialization connection)	(default: 1)
NSV	Number of channels for the setpoint to be sent, value range 0. . . 8 (initialization connection)	(default: 0)
NAV	Number of channels for the actual values to be received, value range 0 . . . 8 (initialization connection)	(default: 0)
XS0 to XS7	Setpoint XS for channel 0 to 7, A maximum of 8 setpoints can be sent.	(default: 0)
YS0 to YS7	Actual values YS from channel 0 to 7, A maximum of 8 actual values can be received.	(default: 0)
SEQ	Sequence number Number of the blocks in the SIMOLINK block sequence This value provides information as to whether the block was correctly initialized.	(default: 0)
YF	Error status of the block YF=0 no error, YF > 0 coded error output	(default: 0)
QF	Group error bit QF=0 no error, QF=1 for error (if YF≠0)	(default: 0)

Configuringdata

Computation time [µs]	T400 / PM5 105,0 FM458 / PM6 34,7
Can be inserted online	no
Can be configured in	Interrupt tasks Cyclic tasks
Executed in	Initialization mode Normal mode
Special features	-

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