SIEMENS

SIMATIC
Process Control System PCS 7
Driver Blocks

Reference Manual

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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 that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning
indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution
indicates that minor personal injury or property damage can result if proper precautions are not taken.

Note
draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only qualified personnel should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:

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

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

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A Appendix

1 Notes

1.1 Notes on Using Driver Blocks

General

- The OBs in which the blocks are installed are given in the description of the driver blocks. Please note that not all OBs listed here are generated in all CPUs. Relevant information can be found in the Online Help of the respective OBs.
- In the event that the driver blocks of PCS 7 Driver Blocks V52 are used by the driver generator, a firmware version V3.0 or faster is required in the target system.

Signal Processing Blocks

Three types of channel blocks for signal processing are available in this library of the driver blocks:

1. **Standard Channel Blocks**:
   CH_AI, CH_AO, CH_DI, CH_DO.
   They are used exclusively for signal processing of S7-300/400 SM modules. Please use these standard blocks if you want to achieve memory and run-time optimization and do not need to process any PA devices.
2. **Universal Channel Blocks**:
   CH_U_AI, CH_U_AO, CH_U_DI, CH_U_DO.
   These blocks are used for signal processing of S7-300/400 SM modules or a PA field device. The advantage of these blocks is that you can create CFC charts regardless of the hardware peripherals to be used later. As a disadvantage, the universal blocks require more memory and run-time.
3. **PA Channel Blocks**:
   PA_AI, PA_AO, PA_DI, PA_DO, PA_TOT
   These blocks are designed especially for use with PA field devices. They are used mainly where the special features of these devices should be used. In contrary to the CH blocks, the PA channel blocks process not only the signal itself, but also all variables according to the desired configuration of the hardware of the device.

1.2 General information on the block description

The block descriptions always have the same structure. The number of sections may vary depending on the block functions. The most common sections have the following meanings:

Heading of the block description

Example: RACK: Rack Monitoring

The header begins with the type name of the block (RACK). This name is entered in the symbol name and has to be unique within your project.
The type name also includes information on the task/function of the block (Rack Monitoring).

Object name (Type + Number)

FB x

The object name for the block type is made up of the realization type Function block = FB, Function = FC and the Block number = x.

Command button for the displaying the block connections

Example:

You can jump directly to the list of block connections of the designated block by clicking on the "Block Connections" command button. The preceding block symbol is used as an eye-catcher in order to find the command button rapidly.
Note: The button is not visable in the paper printout.

Area of Application

You can see here which tasks the block should accept and other information about its use in CFC if necessary.

Calling OBs

Here you will find information relating to the organization blocks (OBs), in which the described block must be installed. When using the CFC installation is carried out in the cyclic OB (watchdog interrupt) and automatically into the OBs which are listed in the task list of the block (for example in OB100 for restarting).

CFC creates the required OBs while compiling. If you use the blocks without CFC, you have to program these OBs and call the instance of the block in them.

Use in CFC

If it is not already mentioned under "Area of Application", you can find the information here accepted by the driver generator. (the driver generator is called in SIMATIC manager by the selected chart folder and with the menu command **Options > Charts > Generate Module Drivers...** or as an option in the dialog box of the CFC "Compile Charts as Program").

Function and Operating principle

This briefly describes the function of the block.
Detailed information is displayed on complex blocks e.g. on the function of individual inputs, operating modes, time sequences etc..

Error handling

You will find the error display in the CFC chart at the Boolean block output **ENO**. The value corresponds to the **BIE** (Binary result in STEP 7-STL after ending the block) or the **OK** bit (in SCL notation) and means:

ENO=BIE=OK=1 (TRUE) ->The result of the block is OK.

ENO=BIE=OK=0 (FALSE) ->The result or the conditions for its calculation (e.g. input values, operating modes, etc.) are not valid.

In addition, for FBs, you will find the inverted BIE in output **QERR** of the instance DB:

QERR=NOT ENO

The error display arises by two independent routes:

The operating system recognizes a processing error (for example: value overflow, called system functions supply an error code with binary input bit=0).
This is a system utility and is not mentioned specifically in the individual block description.

The block algorithm checks values and operating modes for their functional legality. These error cases are documented in the description of the block.

The evaluation of the error indication can be used, for example, to generate messages (refer to the section on alarm blocks) or to utilize substitute values for invalid results.

Start-up characteristics

A difference is made between:

- Initial start
  The block is called for the first time from the OB, in which it is installed. As a rule this is the OB in which normal, process-specific processing occurs (for example: the watchdog interrupt OB).
  The block enters the status corresponding to the input parameters. These can be initial values (also refer to the Connections) or values which you have already been configured, for example in CFC. The initial-start behavior is not described separately unless the block deviates from this rule.

- Start-up
  The block is executed once during a CPU start-up. This is achieved by calling the block from the start-up OB (where it is additionally installed either automatically via ES or manually by you via STEP 7). In this case the start-up characteristics are described.

Time response

The block with these characteristics must be installed into a watchdog interrupt OB. Reference is then made to the time characteristic when instructed by the block.

Message characteristics

The block with these characteristics signals various events to the higher-ranking OS. If they exist, the parameters required to generate messages are documented. Blocks not having message characteristics can be complemented by additional alarm blocks. A reference to the message characteristics in contained in the description of the individual blocks with signaling capabilities.

Connections of ...

The connections provide the data interface of the block. In addition you can transfer data to the block and fetch results from the block.

Connection (parameter)	Meaning	Data type	Default	I/O	OC&M
SUBN1ERR	1=Error in DP master system	BOOL	0	O	+
.....					

The "Connections" table lists all the input and outputs of the block type, which the user can access with the configuration tools. They are alphabetically. Elements which can only be accessed from the algorithm of the block are not listed (so-called internal variables).
The columns have the following meaning:

Connection = Name of parameter, derived from the English designation. Wherever laid down by SIMATIC conventions, the same name rules have been used.

The state of delivery of the block display in CFC is identified as follows: Connection name **bold** = Connection displayed, normal = Not displayed.

Meaning = Function (possibly short description)

Data type = S7 data type of the parameter (BOOL, REAL, etc.).

Initial (Default) = The value of the parameter before the block is executed for the first time (unless changed by configuration).

I/O = Type of access of the block algorithm to the parameter. Differentiates between inputs, non-interacting inputs and outputs (see table)

Abbre-viation	I/O
I	Input. Initialize block with parameters (representation in CFC: left-hand block side).
O	Output. Output value (representation in CFC: right-hand block side).
IO	Input/output. Non-interacting input which is written and which can be written back from the block (representation in CFC: left-hand block side).

OC&M= Parameters marked with "+" can be operator controlled and monitored via the corresponding OS block.

Operator control and monitoring

The blocks from this library do not have preconfigured faceplates which control and monitor the OS. If individual faceplates are used for specific diagnostic blocks, the predetermined variables are transferred from the instance block to the OS. This has to be set for the driver generator in the dialog box "Settings – Generate Module Drivers" where the option "Operate C and M capability for diagnostic blocks" can be set. Default: Option is not set.

2 Signal blocks and diagnostic drivers

2.1 OB_BEGIN: CPU diagnostics and AS connection diagnostics

Object name (Type + Number)

FB 100

Area of Application

The block is used for CPU diagnostics and connection diagnostics of the automation systems (AS). Installing the block in CFC creates all the acyclic priority classes (OBs) in which the blocks of the Driver Blocks library run.

If the CFC function "**Generate Module Driver**" is used, the OB_BEGIN is installed automatically.

Calling OBs:

OB1	Cyclic processing
OB32	Watchdog interrupt (connection diagnostics with SFC 87) *)
OB70	I/O redundancy error
OB72	CPU redundancy error
OB80	Timeout
OB81	Power failure fault
OB82	Diagnostic interrupt
OB83	Withdrawn/plugged alarm
OB84	CPU hardware error
OB85	Program execution error
OB86	Rack failure
OB100	Restart:
OB121	Programming error
OB122	I/O access error

*) If you do not position the OB_BEGIN with the function "Create Module Driver" in the CFC chart, but insert it manually into a CFC chart, it is installed in the OB specified by "Predecessor for Installation". This may not be the OB32.
Please note that only one watchdog interrupt OB is allowed.

Function and Operating principle

The block is used to signal and display CPU events and states. It reads the starting information of the priority classes (OBs), the diagnostic data of the I/O devices and enables the respective blocks on the basis of the start events.

From the starting information of the SFC6 (RD_SINFO) or SFB 54 (RALRM) the OB_BEGIN determines the current OB in which it is running.

In as far as it does not exist, it converts the logical basic address from the starting information into the geographic address. It is contained in the respective OBs of the output structure CPU_DIAG, which the downstream blocks can access. On the basis of the geographic address it enables the respective SUBNET blocks for further evaluation of the starting information.

With the SFB 54 the diagnostic data are saved synchronously with the starting information in the CPU_DIAG.OB82 structure in a diagnostic case (OB82). Diagnostic (alarm) information longer than 59 bytes have to call the respective driver blocks themselves.

The OB_BEGIN generates messages which are emitted with ALARM_8P to WinCC (see message characteristics). The SFC 87 C_DIAG is called in a watchdog interrupt OB (OB32) after 10 cycles have expired for connection diagnosis. Up to 64 connections are monitored.

In the case of H systems the current state of the two H-CPUs is determined in the same watchdog interrupt OB by reading the system state list 71 (SSL71). For a detailed description of the meaning of the SSL71 please refer to the reference manual "System Software for S7-300/400 System and Standard Functions".

Note

The messages "Failure or redundancy loss connection ID" are generated at every CPU of the two connected AS. Exception at the failure of the CPU (or both H-CPUs) of an AS.

Error handling

The block evaluates the error information of ALARM_8P and writes it to the corresponding output parameters.
See Error information of the MSG_STAT output parameter.
The block may only be installed in a watchdog interrupt OB. Otherwise QERR = TRUE is set and operation is continued with the watchdog interrupt OB which first called the block after the restart/initial start.

If the block installation sequence OB_BEGIN, xx blocks, ..., OB_END is not observed, the message "Incorrect installation OB_END, no OB8x processing" is output and QERR = TRUE is set. In this case no evaluation is carried out in the acyclic OBs. The downstream blocks are not enabled.

Start-up characteristics

The OB_BEGIN initializes the messages of ALARM_8P. In the case of H systems (CPU_DIAG.H_MODE = TRUE) the current state of the two H-CPUs is determined by reading the SSL71 (see Function).

In as far as a CPU with SFC 87 exists, the connection diagnosis is initialized. The system then waits for 120 cycles in the watchdog interrupt OB until the connection diagnosis messages are generated.

Initial-start behavior

The starting information is read with SFC 6.

Time response

The block is installed into the required OBs (refer to the Function section) automatically during structuring by the ES, including into the watchdog interrupt OB32. The latter OB installations can be changed as required.

Message characteristics

The ALARM_8P multiple-instances are only called when a message of the OB_BEGIN is to be emitted. Effected acknowledgments of preceding messages are not updated by the respective ALARM block until this moment. If the connection to WinCC is interrupted, each ALARM_8P can save a maximum of two message states of an Event-ID.

A **programming error** (OB121) is only generated by the CPU as a coming event. In the OB1 the respective generated coming message "Programming error" is reset as going. In order to avoid an overload of programming error messages these are counted within an interval of 1 minute. If more than 5 programming errors are noted within one minute, the subsequent ones are rejected. The maximum of 5 "Programming error" messages are then not generated until at least one minute has passed.

Messages of the OB_DIAG block

The OB-DIAG blocks are connected to the system structure OB_LOCK. If the OB82 is blocked by the OB_DIAG block, a message "OB82 failure SUBNET:xx RACK:yy SLOT:zz" is generated. If the OB86 is blocked by the OB_DIAG block, a message "OB86 failure SUBNET:xx RACK:yy SLOT:zz" is generated.

The block generates the following messages in the OBs listed below:

OB	Starting event	Message
OB1	Cyclic processing	Going message: - Timeout - Program execution error - Programming error
OB32	1 sec. watchdog interrupt or alternative watchdog interrupt OB	Failure connection ID: xx coming/going Redundancy loss connection ID: xx coming/going
OB72	CPU redundancy loss	CPU redundancy loss/return
OB80	Timeout	Coming message at timeout: - Cycle time exceeded - OB request: OBxx still being processed - OB request: Overflow PRIOxx - Time interrupt xx expired
OB81	Power failure fault	- Central controller battery failure coming/going - Central controller backup voltage failure coming/going - Central controller 24 V supply failure coming/going - Redundant central controller battery failure coming/going - Redundant central controller backup voltage failure coming/going - Redundant central controller 24 V supply failure coming/going
OB84	CPU hardware error	MPSS error coming/going
OB85	Program execution error	Coming message at program execution error - OBxx not loaded - Access-error error xx: ...
OB100	Restart:	Initializing ALARM_8P
OB121	Programming error	Programming error coming

Operator control and monitoring

The block does not have a faceplate (display block).

Note:

In "Connection of OB_BEGIN" the variables are identified (with a "+" in the column OCM) which are transferred from this instance block to the OS when the option "Operator C and M capability for diagnostic blocks" in the "Generate Module Driver" settings is selected. Default: option is not set.

2.1.1 Connections of OB_BEGIN

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O	OC &M	Valid values
CPU_DIAG	System Structure CPU-Diagnosis	STRUCT		O		
CPUERR_0	1=CPU Failure in Rack 0	BOOL	0	O	+	
CPUERR_1	1=CPU Failure in Rack 1	BOOL	0	O	+	
EN_SUBx	Enable SUBNET x (xx=00 - 14)	BOOL	0	O		
EV_IDx	EVENT IDx Message Number ALARM_8P_x (x = 1 - 19)	DWORD	0	I		(is assigned by ES)
MASTER_0	1=Master CPU in Rack 0	BOOL	0	O	+	
MASTER_1	1=Master CPU in Rack 1	BOOL	0	O	+	
MSGSTATx	Message Status Output STATUS output of the ALARM_8P_x (x = 1 - 19)	WORD	0	O		
OB_LOCK	LOCKED OB	STRUCT		O		
QERR	1=Error	BOOL	1	O		
QMSGERx	Message Error Error output of the ALARM_8P_x (x = 1 - 19)	BOOL	0	O		
SUB0IDxx	SUBNET primary ID (xx = 00 - 14)	BYTE	255	I		
SUB1IDxx	SUBNET secondary ID (xx=00 - 14)	BYTE	255	I		
SZL_71	System Structure SSL71	STRUCT		O		

The structure of the CPU_DIAG is implemented as OUT in the OB_BEGIN, and in all other blocks with this connection as IN_OUT (column: I/O).

2.1.2 Assignment of the control system messages of the OB_BEGIN

The control system messages are assigned as follows with ALARM_8P at EV_ID1

Message block ALARM_8P	Mess. No.	OB No.	Default message text	Message class
EV_ID1				
	1	OB80	Cycle time exceeded: OB@1%d@ms OB@2%d@	S
	2	OB86	OB86 Failure SUBNET:@7%d@ RACK:@8%d@	S
	3	OB84	MPI error	S
	4	-	Error installation OB_BEGIN/OB_END: No OB@10%d@ Processing Stack @9%d@	-
	5	-	Reserve	-
	6	OB122	Read error I/O device: @4%2s@@5%d@ Addr: @6%d@	S
	7	OB122	Write error I/O device: @4%2s@@5%d@ Addr: @6%d@	S
	8	OB72	CPU redundancy loss in Rack @3%d@	S

Messages 1, 6 and 8 are only coming events. They are reset as "going" during a normal run (OB1) of the block.

Auxiliary process values of the EV_ID1

The control system messages are generated via ALARM_8P with EV_ID1 with six auxiliary process values. The table shows the assignment of the auxiliary process values to the block parameters.

Message block ALARM_8P	Auxiliary process value	Block parameter	Data type
EV_ID1	1	OB80_Supplementary_Info 1	WORD
	2	OB80_1. Byte supplementary info 2_3	BYTE
	3	Rack No. of the CPU	BYTE
	4	OB122_BLK_TYP	WORD
	5	OB122_BLK_NUM	WORD
	6	OB122_MEM_ADDR	WORD
	7	OB86 Subnet_ID	BYTE
	8	OB86 RACK_NO	BYTE

The control system messages are assigned as follows with ALARM_8P at EV_ID2

Message block ALARM_8P	Mess. No.	OB No.	Default message text	Message class
EV_ID2				S
	1	OB81	Battery failure CPU in Rack 0	S
	2	OB81	Battery failure CPU in Rack 1	S
	3	OB81	Backup voltage failure CPU in Rack 0	S
	4	OB81	Backup voltage failure CPU in Rack 1	S
	5	OB81	24V supply failure CPU in Rack 0	S
	6	OB121	24V supply failure CPU in Rack 1	S
	7	OB121	Programming error @1%d@: @2%2s@@5%d@ /@6%d@/@4%d@/@3%d@	S
	8	OB82	OB82 Failure SUBNET:@7%d@ RACK:@8%d@ SLOT:@9%@	S

Message 7 is only a coming event. It is reset as "going" during a normal run (OB1) of the block. It is to be interpreted as follows in accordance with the error code number before the colon:

OB121_BLK_TYP/OB121_BLK_NUM/OB121_PRG_ADDR/OB121_FLT_REG/OB121_RESERVED_1.

For a description please refer to the reference manual "System Software for S7-300/400 System and Standard Functions".
Example: 10.05.00 10:30:45 Programming error 35: FB44/1234/5/9

Auxiliary process values of the EV_ID2

The control system messages are generated via ALARM_8P with EV_ID2 with six auxiliary process values. The table shows the assignment of the auxiliary process values to the block parameters.

Message block ALARM_8P	Auxiliary process value	Block parameter	Data type
EV_ID2	1	OB121_SW_FLT	BYTE
	2	OB121_BLK_TYP	WORD
	3	OB121_RESERVED_1	BYTE
	4	OB121_FLT_REG	WORD
	5	OB121_BLK_NUM	WORD
	6	OB121_PRG_ADDR	WORD
	7	OB82 SUBNET_ID	BYTE
	8	OB82 RACK_NO	BYTE
	9	OB82 SLOT_NO	BYTE

The control system messages are assigned as follows with ALARM_8P at EV_ID3

Message block ALARM_8P	Mess. No.	OB No.	Default message text	Message class
EV_ID3	1	OB80	OB request: OB@2%d@ still being processed	S
	2	OB80	OB request: Overflow PRIO@3%d@	S
	3	OB80	Time interrupt OB@1%d@ expired	S
	4	OB85	OB @4%d@ not loaded	S
	5	OB85	Access-error error @4%d@: @7%2s@@5%d@/@6%d@	S
	6	-	Reserve	-
	7	-	Reserve	-
	8	-	Reserve	-

Messages 1, 2, 3, 4 and 5 are only coming events. They are reset as "going" during a normal run (OB1) of the block.

Auxiliary process values of EV_ID3

The control system messages are generated via ALARM_8P with EV_ID3 with six auxiliary process values. The table shows the assignment of the auxiliary process values to the block parameters.

Message block ALARM_8P	Auxiliary process value	Block parameter	Data type
EV_ID3	1	OB80_Supplementary_Info 1	WORD
	2	OB80_1. Byte supplementary info 2_3	BYTE
	3	OB80_2. Byte supplementary info 2_3	BYTE
	4	OB85_Supplementary_Info 1	WORD
	5	OB85_HW_Supplementary_Info 2_3	WORD
	6	OB85_LW_Supplementary_Info 2_3	WORD
	7	OB85_DKZ2_3	WORD

The control system messages are assigned as follows with ALARM_8 at EV_ID4 to EV_ID19:

Message block ALARM_8P	Mess. No.	Default message text	Message class
EV_ID4 to EV_ID11			
	1	Failure connection ID: @1%d@	S
	2	Failure connection ID: @2%d@	S
	3	Failure connection ID: @3%d@	S
	4	Failure connection ID: @4%d@	S
	5	Failure connection ID: @5%d@	S
	6	Failure connection ID: @6%d@	S
	7	Failure connection ID: @7%d@	S
	8	Failure connection ID: @8%d@	S
EV_ID12 to EV_ID19			
	1	Redundancy loss connection ID: @1%d@	S
	2	Redundancy loss connection ID: @2%d@	S
	3	Redundancy loss connection ID: @3%d@	S
	4	Redundancy loss connection ID: @4%d@	S
	5	Redundancy loss connection ID: @5%d@	S
	6	Redundancy loss connection ID: @6%d@	S
	7	Redundancy loss connection ID: @7%d@	S
	8	Redundancy loss connection ID: @8%d@	S

Auxiliary process values from EV_ID4 to EV_ID19

The control system messages are generated via ALARM_8P with EV_ID4 to EV_ID19 with eight auxiliary process values. The table shows the assignment of the auxiliary process values to the block parameters.

Message block ALARM_8P	Auxiliary process value	Block parameter	Data type
EV_ID4... EV_ID19	1	Connection_ID 1+x	WORD
	2	Connection_ID 2+x	WORD
	3	Connection_ID 3+x	WORD
	4	Connection_ID 4+x	WORD
	5	Connection_ID 5+x	WORD
	6	Connection_ID 6+x	WORD
	7	Connection_ID 7+x	WORD
	8	Connection_ID 8+x	WORD

x = 0 at EV_ID4, x = 8 at EV_ID5, x = 16 at EV_ID6 etc. to x = 56 at EV_ID12

x = 0 EV_ID13, x = 8 at EV_ID14, x = 16 at EV_ID15 etc. to x = 56 at EV_ID19

2.2 OB_END: Reset stack pointer of the OB_BEGIN

Object name (Type + Number)

FC 280

Area of Application

The block is used to reset the stack pointer of the OB_BEGIN.

Calling OBs

The OB_END has to be installed at the end of the OB in which an OB_BEGIN is installed. An OB_END may not be installed in OBs in which no OB_BEGIN is installed.

If the CFC function "**Generate Module Driver**" is used, the OB_END is installed automatically in the OBs of the run sequence.

OB1	Cyclic processing
OB32	Watchdog interrupt (connection diagnostics) *)
OB70	I/O redundancy error
OB72	CPU redundancy error
OB80	Timeout
OB81	Power failure fault
OB82	Diagnostic interrupt
OB83	Withdrawn/plugged alarm
OB84	CPU hardware error
OB85	Program execution error
OB86	Rack failure
OB100	Restart:
OB121	Programming error
OB122	I/O access error
*) If you do not position the OB_END block with the function "Create Module Driver" in the CFC chart, but insert it manually into a CFC chart, it is installed in the OB specified by "Predecessor for Installation". This may not be the OB32. Ensure that you use the watchdog interrupt OB of the OB_BEGIN.	

Function and Operating Principle

The block decrements the stack pointer (NUM_CNT) of the OB_BEGIN. In case of an interruption it enters the last interrupted OB number from the CPU stack into the structure CPU_DIAG.

Error handling

Does not exist

Start-up characteristics

Do not exist

Initial-start behavior

Does not exist

Time response

Does not exist

Message characteristics

Do not exist

Operator control and monitoring

The block does not have a faceplate (display block).

2.2.1 Connections of OB_END

Connection (parameter)	Meaning	Data type	I/O
CPU_DIAG	CPU diagnostics (System Structure)	STRUCT	I/O

2.3 OB_DIAG: OB diagnostics to avoid CPU stop

Object name (Type + Number)

FC 281

Area of Application

The block is used in order to avoid a CPU stop when there is a defective DP slave. It recognizes a DP slave failure. If DP slaves are activated in the H system, it indicates the preferred channel of the DP slave.

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB82	Diagnostic interrupt
OB83	Withdrawn/plugged interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The OB_DIAG block is installed after the SUBNET block.
- Configuration of
  - The inputs RACK_NO, DADDR, SUBN1_ID, SUBN2_ID and SUBN_TYP.

- Interconnection of
  - The EN input with the output of an AND block. Its inputs are interconnected to the output EN_SUBx (x = No. of the DP Master System) of the OB BEGIN block and to the output EN_Rxxx (xxx = Rack/Station Number) of the SUBNET block.
  - The OUT structure CPU_DIAG of the OB_BEGIN and SUB_DIAG of the SUBNET block with the INOUT structures of the same name of the OB_DIAG block.

Function and Operating principle

The block counts the frequency of the calls of an acyclic OB of a block instance before an OB1 can be executed.

OB_DIAG displays higher-level errors of the CPU, DP Master and DP Slave (SUBN1ERR, SUBN2ERR). If DP slaves are activated, it determines the preferred channel (SUBN1ACT, SUBN2ACT). The group error information RACK_ERR displays the failure of the DP Master and the failure of the DP Slave. This means if RACK_ERR = 1, the corresponding DP Slave has failed, if SUBN1ERR or SUBN2ERR = FALSE.

The start and diagnostic information is read from the structure CPU_DIAG which is interconnected to the structure CPU_DIAG of the block OB_BEGIN.

The block determines the currently active preferred channel (SUBN1ACT, SUBN2ACT) in the case of redundant PROFIBUS DP interfaces by evaluating the error events and, if required, the diagnostic address ADDR of the DP slave.

If the DP Slave is connected to a DP Master system which is operated in the DP V1 Mode, V1-MODE = TRUE is set.

Overload behavior

The OB_DIAG counts the frequency of the calls of the acyclic OB82 and OB86 (exception DP Master system failure, see SUBNET block). If the counter DIAG82_CNT > 5 or DIAG86_CNT > 5, EN_F = FALSE is set (disable function block). The counters are reset in the OB1. In all the other OBs the output EN_F = TRUE (enable function block) is set.

If there is a malfunction of the OB82 or of the OB86, the OB_BEGIN block then signals this malfunction with geographic address of the DP Slave in the OB1 or OB82 or OB86 respectively.

The event is not evaluated due to the disabling of the OB82 or OB86 respectively at an overload. The outputs cannot correspond to the current state of the DP Slave. After a waiting period of approx. 1 minute the state of the DP Slave is checked and the variable EN_86DIAG is set to TRUE in case of the OB86 failure. Updating of the state of the DP Slave can take several cycles.

If there is an OB82 failure, the variable EN_82DIAG is set to TRUE. The interconnected DP Slave block can then fetch the current diagnostic data of the DP Slave.

Redundancy

The block supports the redundancy of the DP Master systems at an H system (only distributed I/O devices). To this purpose the inputs of the OB_DIAG block SUBN1_ID (connection to CPU 0) and SUBN2_ID (connection to CPU 1) are to be configured with the numbers of the redundant DP Master systems. If there is no redundancy of the DP Master systems, the remaining input must have the value 16#FF (default) assigned.

Start-up characteristics

A check whether the DP Slave is available is carried out. In the case of H systems the preferred channel of the DP Slave is determined.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Time response

Does not exist.

Message characteristics

See OB_BEGIN block

Operator control and monitoring

The block has no faceplate.

2.3.1 Connections of OB_DIAG

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
ACC_ID	1=Accept MODE settings	BOOL	0	I/O
CPU_DIAG	System Structure: CPU diagnostics	STRUCT		I/O
DADDR	Diagnostic Address of DP-Slave	INT	0	I/O
EN_82DIAG	1=Read Diagnosis (OB82)	BOOL	0	O
EN_86DIAG	1=Read Diagnosis (OB86)	BOOL	0	O
EN_F	1= Enable Function/Function Block	BOOL	0	O
LOCK_82	1= Locked OB82	BOOL	0	I/O
LOCK_86	1= Locked OB86	BOOL	0	I/O
LOCK_82_TM	Delay Time Locked OB82	DINT	0	I/O

Connection (parameter)	Meaning	Data type	Initial	I/O
LOCK_86_TM	Delay Time Locked OB86	DINT	0	I/O
MSTR1ERR	Reserve	BOOL	0	I/O
MSTR2ERR	Reserve	BOOL	0	I/O
OB82_CNT	Counter OB82	INT	0	I/O
OB86_CNT	Counter OB86	INT	0	I/O
OB_LOCK	System Structure: Locked OB	STRUCT		I/O
PARA	Reserved	BOOL	0	I/O
QRACKF	1=Rack Error	BOOL	0	O
RACKF	Reserve	BOOL	0	I/O
RACK_NO	Rack Number	BYTE	0	I/O
SL1ERR	Reserve	BOOL	0	I/O
SL2ERR	Reserve	BOOL	0	I/O
SUB_DIAG	OB_Start Information	STRUCT		I/O
SUBN_TYP	1=External DP interface	BOOL	0	I/O
SUBN1_ID	ID of Primary DP master system	BYTE	255	I/O
SUBN1ACT	1=Slave 1 Active	BOOL	0	O
SUBN1ERR	1= Primary DP master system failure	BOOL	0	O
SUBN2_ID	ID of Redundant DP master system	BYTE	255	O
SUBN2ACT	1=Slave 2 Active	BOOL	0	O
SUBN2ERR	1= Redundant DP master system failure	BOOL	0	O
SSL75	Reserve	BOOL	0	I/O
SSL92a	Reserve	BOOL	0	I/O
SSL92b	Reserve	BOOL	0	I/O
V1_MODE	1=DPV1-Mode	BOOL	0	O

2.4 SUBNET: Runtime group control for driver blocks

2.4.1 SUBNET: DP Master system monitoring

Object name (Type + Number)

FB 106

Area of Application

The block is used to reduce the acyclic OB processing times. Only the blocks actually affected can be called in case of an acyclic event.

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB81	Power failure fault
OB82	Diagnostic interrupt
OB83	Withdrawn/plugged interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- Creating runtime groups with driver blocks organized by racks.
- Configuration of
  - The inputs SUBN1_ID, SUBN2_ID and SUBN+TYP.

- Interconnection of
  - The outputs EN_Rxxx with the respective blocks (for example RACK).
  - The INOUT structure CPU_DIAG with the OUT structure of the OB_BEGIN block.
  - The OUT structure SUB_DIAG with the INOUT structures of the respective blocks (for example RACK).

Function and Operating principle

The SUBNET block monitors a DP Master system and enables the blocks (for example RACK) for executing the connected DP Slaves (for example ET200M). Corresponding messages are generated and the output variables SUBN1ERR and SUBN2ERR set at a failure or redundancy loss of a DP master system. The output structure SUB_DIAG contains the geographic address of the DP Master system (and DP Master system 2 at H systems) as well as the group area information SUBN0_ERR (for DP Master system 1) and SUBN1_ERR (for DP Master system 2). If SUBN0_ERR = 1 or SUBN1_ERR = 1, the corresponding DP Master system is **not** available.

The SUBNET block is installed per connected DP Master system or once for the centrally plugged I/O devices into the OBs listed above and is enabled by the OB_BEGIN block. The start and diagnostic information is read from the I/O structure CPU_DIAG. It has to be interconnected to the structure CPU_DIAG of the OB_BEGIN block (is implemented automatically with the CFC function "Generate Module Driver"). The SUBNET block has one enable output per connectable rack or DP Master system (per expansion rack in the case of centralized I/O devices). It uses the starting information of the calling OB to determine whether the signaled result has occurred at its DP Master (or at the centrally plugged I/O devices) and then sets the output for the respective rack or for the DP Master system (EN_Rx).

If redundant DP Master systems are used (only for H-CPUs), a rack (for example ET200M) is connected to the two DP Masters and has the same station number at both. The SUBNET block has two inputs (SUBNx_ID) and the type identifier SUBN_TYP. If the DP Master is the integrated interface of the CPU module, SUBN_TYP = FALSE is to be set. Otherwise SUBN_TYP = TRUE is to be set.

If a DP line fails, all EN_Rxxx are set to TRUE and the redundancy loss or failure is signaled. The redundancy or DP Master return is signaled as soon as a failed DP slave has established the connection again.

The state of the DP Master system, the set SUBNx_ID with type identifier, is saved in the output structure SUB_DIAG.

If the event "Power failure fault" (OB81) occurs, the SUBNET block only enables the RACK blocks if they are expansion racks. Expansion racks exist if SUBNx_ID = 0.

If you want to change the inputs SUBN1_ID (connection to CPU 0) and SUBN2_ID (connection to CPU 1) online without using the CFC function "Generate Module Driver", you have to set the input ACC_ID = TRUE. This updates the output values.

Redundancy

The SUBNET block supports the redundancy of DP Master systems of the CPU 417H in case of distributed I/O devices. To this purpose the inputs SUBN1_ID (connection to CPU 0) and SUBN2_ID (connection to CPU 1) are to be configured with the numbers of the redundant DP Master systems. If there is no redundancy, the remaining input must have the value 16#FF (default) assigned.

Error handling

Error handling of the block is limited to the error information of ALARM_8P. Refer to Error information of the MSG_STAT output parameter

Start-up/Initial-start behavior

The SUBNET block initializes the messages of ALARM_8P.

The operating mode of the DP Master system is sampled and entered in the structure SUB_DIAG.V1_MODE with SSL 0X90H (0 = compatibility mode, 1= DPV1 mode). If the DPV1 mode is active, the structure CPU_DIAG.MODE_V1 is also set to TRUE.

Overload behavior

The SUBNET block counts the OB86 calls (only failures). The counter is reset in the OB1. If more than two OB86 failure events occur successively before the cycle checkpoint (OB1) is reached, these are rejected and a message "Failure OB86 DP Master system:x" is emitted. If an OB86 call is rejected, the DP Master system is registered as having failed.

Time response

Does not exist.

Message characteristics

After being called by an OB86, OB70 and OB72 the block analyzes the state of the DP master system assigned to it and generates the corresponding messages for redundancy loss and DP Master system failure by emitting an ALARM_8P. Messaging can be de-activated by using EN_MSG = FALSE.

The SUBNET block generally only signals events whose cause lies within the DP Master system monitored by it.

Exception CPU failure in the H system:

- Non-redundant DP Master system: Message "DP Master failure".
- Redundant DP Master system: Message "DP Master redundancy loss".

Operator Control and Monitoring

The block has no faceplate.

Note:

In "Connection of SUBNET" the variables are identified (with a "+" in the column OCM) which are transferred from this instance block to the OS when the option "Operator C and M capability for diagnostic blocks" in the "Generate Module Driver" settings is selected. Default: option is not set.

2.4.2 Connections of SUBNET

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O	OC&M
ACC_ID	1=Accept MODE settings	BOOL	0	I/O	
CPU_DIAG	CPU diagnostics	STRUCT		I/O	
EN_MSG	1=Enable message	BOOL	1	I	
EN_Rxxx	1=Enable Rack xxx	BOOL	0	O	
EV_ID	Message ID	DWORD	0	I	
MSG_STAT	Message Failure	WORD	0	O	
SUB_DIAG	System Structure: CPU diagnostics	STRUCT		O	
SUBN_TYP	1=External DP-Interface	BOOL	0	I/O	
SUBN1_ID	ID of Primary DP master system	BYTE	255	I/O	
SUBN1ERR	1= Error in primary DP Master system	BOOL	0	O	+
SUBN2_ID	ID of Redundant DP master system	BYTE	255	I/O	
SUBN2ERR	1= Error in Redundant DP master system	BOOL	0	O	+

Note

The number of racks possible results from the address volume of PROFIBUS. All available CPUs can thus be used. The entire address volume is used by the CPU 417-4.

2.4.3 Message texts and auxiliary process values of SUBNET

Assignment of message text and message class

Message No.	Default message text	Message class
1	DP master @1%d@: Redundancy loss	S
2	DP master @2%d@: Redundancy loss	S
3	DP master @1%d@: Failure	S
4	DP master @2%d@: Failure	S
5	Multiple line failure @2%d@OB86 lock	

Assignment of the auxiliary values

Value	Block parameter
1	Primary DP Master system number (SUBN1_ID)
2	Redundant DP Master system number (SUBN2_ID)

2.5 RACK: Signal rack failure

2.5.1 RACK: Rack monitoring

Object name (Type + Number)

FB 107

Area of Application

The block monitors the state of a rack, a DP/PA or Y-Link DP V1 and signals the corresponding error events.

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB81	Power failure fault
OB82	Diagnostic interrupt
OB83	Withdrawn/plugged interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The RACK block is installed automatically in the run sequence after the SUBNET block.
- Configuration of
  - The inputs RACK_NO, DADDR, SUBN1_ID, SUBN2_ID and SUBN_TYP.
- Interconnection of
  - The EN input with the output of an AND block. Its inputs are interconnected to the output EN_SUBx of the OB BEGIN block and to the output EN_Rxxx of the SUBNET block.
  - The OUT structure CPU_DIAG of the OB_BEGIN and SUB_DIAG of the SUBNET block with the INOUT structures of the same name of the RACK block.
  - OS operation: (LINK_MAN = 0): Low-speed and high-speed operation can be switched on via the input SP1_ON and SP2_ON repectively and the input MOT_OFF stops the operation. The enablings (S1_OP_EN, S2_OP_EN or OFFOP_EN) have to be available.

Function and Operating principle

The RACK block generates a process control system fault message for the OSs in case of redundancy losses and rack or stations failures. In addition it indicates faults within the rack/the station (SUBN1ERR, SUBN2ERR) and the preferred channel (SUBN1ACT, SUBN2ACT) when the DP slaves are activated at the outputs. The output structure RAC_DIAG contains the geographic address of the rack as well as the group error information RACK_ERR.
If RACK_ERR = 1, the corresponding rack is not available.

The block is installed into the OBs listed above for each connected station and once for the centrally plugged I/O devices. The runtime groups, in which the RACK block is installed is enabled by the SUBNET block. The start and diagnostic information is read from the I/O structure CPU_DIAG. It has to be interconnected to the structure CPU_DIAG of the OB_BEGIN block (is implemented automatically with the CFC function "Generate Module Driver"). The RACK block has one enable output per slot of the rack (station).

The RACK block generates the number of a corresponding message (see Message Behavior) on the basis of the start information of the calling OBs if the current block is affected.

The block determines the currently active preferred channel (SUBN1ACT, SUBN2ACT) in the case of redundant PROFIBUS DP interfaces by evaluating the error events and, if required, the diagnostic address ADDR of the DP slave.

If you want to change the inputs SUBN1_ID (connection to CPU 0) and SUBN2_ID (connection to CPU 1) online without using the CFC function "Generate Module Driver", you have to set the input ACC_ID = TRUE. This updates the output values.

Redundancy

The RACK block supports the redundancy of DP Master systems within the H systems in case of distributed I/O devices. To this purpose the inputs of the RACK block SUBN1_ID (connection to CPU 0) and SUBN2_ID (connection to CPU 1) are to be configured with the numbers of the redundant DP Master systems. If there is no redundancy, the remaining input must have the value 16#FF (default) assigned.

Error handling

Error handling of the block is limited to the error information of ALARM_8P.

Refer to Error information of the MSG_STAT output parameter

Start-up characteristics

The RACK block initializes the messages of ALARM_8P. A check whether the station is available is carried out. In the case of H systems the preferred channel of the station is determined.

The structure SUB_DIAG.V1_MODE (0 = compatibility mode, 1= DPV1 mode) is transferred to the structure RAC_DIAG.V1_MODE.

Overload behavior

The RACK block counts the OB86 calls (exception DP Master system failure, see SUBNET block). The counter is reset in the OB1. If more than two OB86 events occur successively before the cycle checkpoint (OB1) is reached, these are rejected and a message "Failure OB86 DP Master:x Rack:y" is emitted. If an OB86 call is rejected, the rack (station) is registered as having failed.

Time response

See Message characteristics

Message characteristics

After being called by OB70, OB72, OB85 or OB86 the block analyzes the state of the CPU, DP master and DP slaves assigned to it. If necessary, it generates the corresponding messages for redundancy losses and rack (station) failures in the rack by emitting an ALARM_8P. Messaging can be de-activated by using EN_MSG = FALSE.

The block generally only signals events whose cause lies within the rack monitored by it. Redundancy loss and station failures which are caused by the failure of a DP masters or of a CPU, are initially neither signaled nor indicated at the outputs SUBN1ERR and SUBN2ERR.

The DELAY input allows a signal delay, which can be configured, for an outgoing higher-order error. If, for example, the RACK block recognizes an outgoing error in a DP master connected to it, it initially assumes that there is a faulty assigned DP slave in the rack monitored by it and sets the corresponding output SUBNxERR. The error is not canceled until the DP slave returns (in this case: OB86, OB70). The RACK blocks suppress the potential slave failure for DELAY seconds in order not to trigger a wave of messages from the DP slaves which are not synchronized yet after the master returns. An error message is not output to the OSs unless a DP slave does not report its return before this period expires.

Note

You should not set the value of DELAY too high. Otherwise DP slaves which were removed during the master failure or which are defective will be reported back to the OSs after the master returns with a correspondingly high delay period.

The RACK block generates the following messages in the OBs listed below:

OB	Starting event	Message
OB1	Cyclic processing	Repeat updating ALARM_8P outputs / messages, if necessary
OB70	Redundancy loss	DP Slave redundancy loss/return
OB81	Power failure fault	- Rack battery failure coming/going - Rack backup voltage failure coming/going - Rack 24 V supply failure coming/going
OB85	I/O access error	Rack failure going
OB86	Rack monitoring	Rack failure coming/going
OB100	Restart:	Initializing ALARM_8P

2.5.2 Connections of RACK

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O	O&M
ACC_ID	1=Accept MODE settings	BOOL	0	I/O	
CPU_DIAG	CPU diagnostics (System Structure)	STRUCT		I/O	
DADDR	Diagnostic Address of DP-Slave	INT	0	I	
DELAY	Alarm Delay (s)	INT	15	I	
EN_MSG	1 = Enable message	BOOL	1	I	
EN_Mxx	1=Enable module xx (xx = 00 – 30)	BOOL	1	I	
EV_ID	Message number	DWORD	0	I	
MSG_STAT	Message error information	WORD	0	O	
RAC_DIAG	System Structure (reserve):	STRUCT		I	
RACK_NO	Rack Number	BYTE	0	I	
SUB_DIAG	OB_Start Information	STRUCT		I/O	
SUBN_TYP	1=External DP interface	BOOL	0	I/O	
SUBN1_ID	ID of Primary DP master system	BYTE	255	I/O	
SUBN1ACT	1=Slave 1 Active	BOOL	0	O	+
SUBN1ERR	1=Error in Primary DP master system	BOOL	0	O	+
SUBN2_ID	ID of Redundant DP master system	BYTE	255	I/O	
SUBN2ACT	1=Slave 2 Active	BOOL	0	O	+
SUBN2ERR	1=Error in Redundant DP master system	BOOL	0	O	+

2.5.3 Message texts and auxiliary process values of RACK

Assignment of message text and message class

Message No.	Default message text	Message class
1	Station @1%d@/ @3%d@: Redundancy loss	S
2	Station @2%d@/ @3%d@: Redundancy loss	S
3	Station @1%d@/ @3%d@: Failure	S
4	Station @2%d@/ @3%d@: Failure	S
5	Station @1%d@/ @3%d@: Backup battery failure	S
6	Station @1%d@/ @3%d@: Backup voltage failure	S
7	Station @1%d@/ @3%d@: 24 V supply failure	S
8	Multiple line failure @1%d@/ @3%d@ OB86 Lock	S

Assignment of the auxiliary values

Value	Block parameter
1	Primary DP Master system number (SUBN1_ID)
2	Redundant DP Master system number (SUBN2_ID)
3	Rack or station number (RACK_NO)

Special case at OB81 (Power failure fault): If SUBN1_ID = 16#FF, auxiliary process value 1 = SUBN2_ID is set.

2.6 PO_UPDAT: Update process image

Object name (Type + Number)

FC 279

Area of Application

The block ensures the functions "Hold last value" and "Apply substitution value" of the output modules when a CPU is restarted (OB100).

Calling OBs

The block must be installed at the end of the OB100. This is carried out for you by the CFC function "Generate Module Driver".

Functional description

When a CPU is restarted (OB100), the CH_AO, CH U AO, CH_DO and CH_U_DO blocks write the start values to the process image. The PO_UPDAT block sends all the (part) process images to the modules at the end of the OB100 in order for these values to be active immediately when the CPOU passes to RUN. The output PO_MAP indicates the part process images updated or used in the system (BIT0: Process image 0, BIT15: Part process image 15).

Connections of PO_UPDAT

Connection (Parameter)	Meaning	Data type	Defalt.	Type
PO_MAP	(Part) Process images updated or used in system (BIT0: OB1 process image, BIT1 - 15: part process image 1 - 15)	WORD	0	O

2.7 IM_DRV: Transferring time-stamped process signal changes

Object name (Type + Number)

FB 90

Calling OBs

If you use CFC, the block is installed automatically in the run sequence.

OB1	Cyclic program
OB40	Process interrupt 0
OB100	Restart (warm start)

Alternatively to OB40 the block can also be installed in another process interrupt (OB41 to OB47).

Area of Application

The block is used to transfer time-stamped process signal changes and non-signal-specific events (special messages) to the OS.

Functional description and Operating principle

In an AS the block forms the interface between an IM151-2 or IM153-2 and the OS (WinCC). It reads the messages from the message buffers (max. of 20 messages each) of an IM and uses the pseudo message function ALARM_T to transfer these to the OSs.

- **Process interrupt:** The IM creates a process interrupt when there are new messages. The status of the time stamp with the number of the record to be fetched of the IM and the number of messages in the record are stored for cyclic processing from the start information of the process interrupt OB (refer to the process interrupt data). The information of up to 17 process interrupts can be stored. If the maximum number is exceeded, the new information is lost.
- **Cyclic processing:** If messages are ready to be fetched, the respective record (message buffer) is read by the SFC 59/RD_REC (read record). If several records are to be fetched, the record with the oldest messages (oldest process interrupt) is fetched. A maximum of 20 messages of a record (current number of messages is listed in the process interrupt data) are saved temporarily in the instance of the block
  As soon as a record has been read, new messages can be entered again from

the IM. If all the records are occupied, the IM enters the special message "Buffer overflow coming" into the message buffer. The special message "Buffer overflow going" is entered as the first message into the first free record. Messages which occur between the occurrence of a buffer overflow and the enabling of a record are lost.
The slot no./channel no. of the stored messages are compared with the input parameters of the block for the slot no./channel no. (S_CH_xxx). If they agree, the message is assigned to the corresponding event ID (EV_ID_xxx) and signal number (1 to 8) of the pseudo ALARM_T (ALARM_8P) block. The time stamp of the message (8 bytes) is entered in the ARRAY of byte (index corresponding to the signal number of the pseudo ALARM_T). When all the messages have been assigned, the pseudo ALARM_T blocks which are to transfer the new messages to OSs are called up. The return signals of the pseudo ALARM_T and of the process control system message block ALARM_8P (STAT_xx, M_ACK_xx) are available at the block output. If STAT_xx = 11 (previous job not yet completed) the pseudo ALARM_T or ALARM_8P is called again in the next cycle. In all other cases messages can be lost. If no agreement can be found with the input parameters at a message, the output QBPARF is set TRUE for one cycle (see error handling). The event is signaled (see Message characteristics).

Addressing/Configuration

Also refer to Addressing

The logical address of the IM determined with HW Config (corresponds to the diagnostic address) is entered at the block input (LADDR) of the driver. Each change to the LADDR block input leads to a single check corresponding to the start-up characteristics of the block. Saved process interrupt data are deleted.

If you run the DP master system in the DPV1 mode, you have to enter the E address of the IM at the block input (LADDR).

The RACK into which the IM is plugged is monitored by the RACK block. You have to connect the input RAC_DIAG with the output RAC_DIAG of the corresponding RACK block. The rack number is set at the RACK block.

Process signals which are to be provided with a time stamp and are detected via an IM must be configured correspondingly in the HW Config.

Each signal which is provided with a time stamp from the IM has a unique assignment through its slot in combination with the corresponding channel number. There are 128 inputs of data type WORD for 128 signals. The slot number of the respective digital input module is entered in the higher-value byte and the channel number (signal of the digital input module) in the lower-value byte. The slot and signal number of the process signals are entered in the block inputs (S_CH_xxx) (hexadecimal format).

Example:

You have set the digital signal 10 of a digital input module plugged into slot 5 of an ET200M to 10 ms exact time stamp by means of HW Config. You have to enter the number 16#050A at the first free input S_CH_xxx of the IM_DRV.

Error handling

I/O access error:	
QPERAF	The block could not access IM. A record could not be read. If it is not stored in the IM, these messages are lost.
Block processing error:	
QERR	An error has occurred while the block was being processed.
Module configuration error:	
QPARF	Incorrect module configuration (incorrect logical basic address entered).
Configuration error:	
QBPARF	The block was configured incorrectly. The slot/channel number of an IM message does not agree with any slot/channel number of the block input parameters (message is lost).
Rack error:	
QRACKF	Failure of the rack in which the IM is plugged or a failure of IM

Start-up characteristics of the IM

When the IM is started up/restarted process interrupts are emitted again for those records which were occupied before restarting but had not been fetched.

The special message "Begin start-up data" is entered as the first message into the first free record. Then all the digital signals to be monitored are checked for changes after the restart and a message is triggered, if appropriate. The special message "End start-up data" is generated finally.

Start-up characteristics of the driver block IM_DRV

Initialization of the ALARM_8P and the pseudo ALARM_T blocks with the data stored before the STOP state of the CPU. At a start-up the signal state is initialized to "Zero".

At a start-up/initial start the driver checks whether there is an IM under the logical address LADDR. Otherwise the driver sets its output QPARF = TRUE and does not carry out any further I/O accesses in the subsequent cycles. Not until the right module has been plugged or until after new configuration does QPARF = FALSE and is the I/O access enabled. Stored process interrupt data which were not processed before the restart are deleted.

Redundancy

In the case of H systems with two IM units redundancy exists with regard to the time stamp if

- The communication between the two IM units runs via the communication bus,
- Updating of the active and passive IM has been completed free of errors

A redundancy loss (failure of an IM) is signaled outside the IM_DRV by means of the SUBNET and RACK blocks.

The time stamp function is interrupted during a changeover between the active and passive IM. The interruption period is displayed with the special message "Changeover at redundancy beginning/end".

In a normal case the active informs the passive IM of the current I/O device state. If this communication is faulty, the special message "Redundancy_Info_Loss coming" is output. As soon as the I/O device state between the active and passive IM has been compared, the special message "Redundancy_Info_Loss going" is output.

Time response

Does not exist.

Message characteristics

The block uses one ALARM_8P and 17 pseudo ALARM_T blocks which are installed as multiple instances. Transferring of the 8 time-stamp values per pseudo ALARM_T call is carried out via an ARRAY [0..65] of BYTE. The ARRAY is structured as follows:

BYTE 0 – 1:	Format identifier of the following date/time stamp
BYTE 2 – 9:	Date/time stamp for Signal_1
BYTE 10 – 17:	Date/time stamp for Signal_2
. .	. .
BYTE 58 – 65:	Date/time stamp for Signal_8

The format identifier of the bytes 0 -1 specifies the bit coding of the time stamp structure (8 bytes are assigned to one time stamp value):

Format identifier: 0	Date/time in SIMATIC S7 BCD format (DATE_AND_TIME)
1	Date/time in ISP format

Year		Month	
Day		hours	
Minutes		Seconds	
1/10 s	1/100 s	1/1000 s	Weekday

Time stamp in ISP format

Complete time by ISP method (time since 1.1.1900; 00:00 h). The 4 bytes for seconds allows the time which has passed since 1.1.1900; 0:00 h to be expressed in seconds.

BYTE	0	Seconds (4 Bytes)
	3	
	4	Second fragments (4 Bytes)
	7	

The time stamps provided by IM were passed on unchanged by the driver in ISP format.

In cyclic operation of the driver the pseudo ALARM_T blocks and the process control system message block ALARM_8P are only called when the signal states have changed. This reduces unnecessary runtimes.

Operator control and monitoring

The block does not have a faceplate (display block).

2.7.1 Connections of IM_DRV

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
EV_ID	Message ID for ALARM_8P	DWORD	0	I
EV_ID_xx	Message ID for ALARM_T_xx (xx = 00 – 16)	DWORD	0	I
LADDR	Logical Address IM	WORD	0	I
M_ACK_xx	Message acknowledge (xx = 00 – 16) x	WORD	0	I
Q_ERR_xx	Message failure (xx = 00 – 16)	BOOL	0	O
QBPARF	1: Param. failure block	BOOL	0	O
QERR	1: Block processing error (inverted value of ENO)	BOOL	1	O
QPARF	1: Param. failure module	BOOL	0	O
QPERAF	1: I/O access failure	BOOL	0	O
QRACKF	1:Rack Failure	BOOL	0	O
RAC_DIAG	Rack Status Information	STRUCT		I/O
S_CH_xxx	Slot-/channel-No.(xxx = 000 – 127)	WORD	0	I
STAT_xx	STATUS Output (xx = 00 – 16)	WORD	0	O

2.7.2 Message texts and auxiliary process values of the IM_DRV

Assignment of message texts and message classes to the signal and special messages

An ALARM_8P block is used for the process control system messages in the following table. The geographic address of the IM is entered in Auxiliary Process Value 1 = Slot number of the message, Auxiliary Process Value 2 = Channel number of the message and Auxiliary Process Value 3 = RET_VAL of the SFC 59 (RD_REC) at an I/O access error.

ALARM_8P_16 Message No.	Output parameter	Default message text	Message class
1	QBPARF	Error S_CHxx: Slot=@1%d@ Channel=@2%d@	S
2	QPERAF	I/O access error: Ret_Val@3%d@	S
3	QPARF	Parameter assignment error	S

The following special messages which can be contained in the message buffer are generated with ALARM_8P_00 (multiple-instanced call of the pseudo ALARM_T) The format identifier and the 8 time-stamp values are entered in the first auxiliary value

ALARM_8P_00 Message No.	Default message text	Message class
1	Start-up data BEGINNING/END	S
2	Time-of-day message failure COMING/GOING	S
3	Time difference between message and internal clock endangers precision	S
4	Time difference between message and internal clock > 1 second POSITIVE/NEGATIVE	S
5	STOP of the functionality time stamp COMING/GOING	S
6	Message loss at IM (buffer overflow) COMING/GOING	S
7	Changeover at redundancy BEGINNING/END	S
8	Redundancy_Info_Loss COMING/GOING	S

ALARM_8P_01 to ALARM_8P_16 (multiple-instanced call of the pseudo ALARM_T) can generate the following signal messages. The format identifier and the 8 time-stamp values are entered in the first auxiliary value

ALARM_8P_01 Message No.	Default message text	Message class
1	TEXT S_CH_000	S
2	TEXT S_CH_001	S
3	TEXT S_CH_002	S
4	TEXT S_CH_003	S
5	TEXT S_CH_004	S
6	TEXT S_CH_005	S
7	TEXT S_CH_006	S
8	TEXT S_CH_007	S

.....

ALARM_8P_16 Message No.	Default message text	Message class
1	TEXT S_CH_120	S
2	TEXT S_CH_121	S
3	TEXT S_CH_122	S
4	TEXT S_CH_123	S
5	TEXT S_CH_124	S
6	TEXT S_CH_125	S
7	TEXT S_CH_126	S
8	TEXT S_CH_127	S

2.7.3 Interface IM

The IM 153-2 / IM151-2 triggers a process interrupt when it wants to send messages to the AS. The user data of the IM are specified in the start information of the process interrupt as follows.

Hardware Interrupt Data

Element	Data type	Meaning
0	BYTE	Event class and identifiers: B#16#11 = Interrupt is active
1	BYTE	B#16#41 = Interrupt via interrupt line B#16#42 = Interrupt via interrupt line 2 (only for S7-400) B#16#43 = Interrupt via interrupt line 3 (only for S7-400) B#16#44 = Interrupt via interrupt line 4 (only for S7-400)
2	BYTE	Configured priority class: Default values: 16 (OB 40) to 23 (OB 47)
3	BYTE	OB No. (40 to 47)
4	BYTE	Reserved
5	BYTE	Input module: B#16#54 Output module: B#16#55
6	WORD	Logical basic address of the module which triggers the interrupt
7	BYTE	State of the time stamp (interrupt cause from the view of the time stamp)t Bit 7: State of the synchronization via time message = 0: No synchronization exists = 1: Synchronization exists Bit 6: (only 1 ms) State of the synchronization via optical fiber synchronization signal = 0: No optical fiber signal exists = 1: Optical fiber signal exists Bit 5: Renewed starting of the time stamp = 0: No renewed starting = 1: Renewed starting just started Bit 4: REDUNDANCY: Redundancy operation active/not active = 0: No redundant operation (no redundant plant or single operating mode or passive IM not yet ready) = 1: Redundant operation running (station in data exchange between active <-> passive IM) Bit 3: REDUNDANCY: active IM = 0: Right-hand IM active, = 1: Left-hand IM active Bit 2 = 1: Buffer overflow "internal" (messages are lost) Bit 1: = 1: Buffer overflow "external" (warning: message loss will occur soon) Bit 0: = 1: Message buffer is ready for fetching on the IM
8	BYTE	Record number if a record (message buffer) is to be fetched
9	BYTE	Number of messages contained in the record n: 1 – 20
10	BYTE	Reserved
11	DATE_AND_TIME	Date and time at which the OB was requested

The IM_DRV only evaluates Bit 5 in Byte 7 (status of the time stamp function). If the bit = 1, all the process interrupts which have been received before but not processed are rejected.

The bit is only set by the IM in the first process alarm after renewed starting.

Examples for renewed starting:
* REDUNDANCY: Changeover state active <-> passive IM
* Restarting of the time stamp function after a total failure

Record (message buffer)

An IM153-2 has 15 records (message buffers). Access to a record is specified by the record number supplied in the process interrupt data.

Structure of a record (message buffer) in the IM

Date	Number of bytes	Remarks
Message1	12	Signal or special message
. .	. .	. .
Message20	12	Signal or special message

A maximum of 20 signal or special messages can be stored in a message buffer.

Structure of a special message from IM

Element	Meaning	Data type	Remarks
1	Slot number of the header module	BYTE	Fixed = 2
2	Identifier of the special message	BYTE	01h: Start-up data (a) 02h: Time message failure Subsequent signal messages may have a precision worse than 10ms (b) 03h: Synchronization signal failure: Subsequent signal messages may have a precision worse than 1ms (b) 04h: Time difference between message and internal clock > 1 second (d) 05h: STOP of the functionality time stamp (b) 06h: Buffer overflow: Subsequent signal messages are lost until the buffer is free again (b)

Element	Meaning	Data type	Remarks
3	Characteristic of special message	BYTE	For further specification of the event 01h: BEGINNING 00h: END (a) or 01h: COMING 00h: GOING (b) (c) or 01h: POSITIVE 00h: NEGATIVE (d) positive: Internal clock lost and was reset negative: Internal clock gained and was reset:
4	Reserved	BYTE	Not used at present
5	Time of the signal change	ISP time (8 BYTES)	Complete time by ISP method (time since 1.1.1900; 00:00 h)

Structure of a signal message from IM

Element	Meaning	Data type	Remarks
1	Slot number of the module	BYTE	In connection with the channel number for address referencing of the digital signal. Range of values: 0, 1, 2, 3 Not assigned 4 ... 11 Slot number of the DI module 12 ... 255 Not assigned
2	Channel number of the module	BYTE	In connection with the slot number for address referencing of the digital signal. Range of values: 0, 1, ... 15 Channel number of the DI module 16 … 255 Not assigned
3	Signal state	BYTE	Bit 7 = 1: Signal coming = 0: Signal going Bit 6 ... Bit 0: Not used
4	Reserve	BYTE	Not used at present
5	Time of the signal change	ISP time (8 BYTE)	Complete time by ISP method (time since 1.1.1900; 00:00 h)

2.8 MOD_1: Diagnostic driver for S7-300/400 SM modules which cannot be diagnosed with 16 channels

2.8.1 MOD_1: Monitoring of S7-300/400 SM modules which cannot be diagnosed with 16 channels maximum

Object name (Type + Number)

FB 91

Area of Application

The block monitors S7-300/400 SM modules with 16 channels maximum which cannot be diagnosed (no mixed modules).

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB83	Withdrawn/plugged interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The MOD_1 block is installed behind the RACK block in the OBs mentioned above of the respective runtime group of the rack (station).
- Configuration of
  - The MODE_xx inputs (mode of the channels xx of the module).
  - The logical basic address of the LADDR module.

- Interconnection of
  - The OUT structures CPU_DIAG of the OB_BEGIN block and RAC_DIAG of the RACK block with the INOUT structures of the same name of the MOD_1.
  - The EN input with the output of an AND block.
    Its inputs are interconnected with the outputs EN_SUBx (x = Number of the DP Master system) of the OB_BEGIN block, EN_Rxxx (xxx = Rack/station number) of the SUBNET block and EN_Mxx (xx = Module number) of the RACK block.

Function and Operating Principle

The block analyzes all the events which affect a module and its channels acyclically. It forms the MODE and value status (quality code) for the signal processing blocks channel-specifically. Events are signaled with ALARM_8P.

The block is enabled for running by the higher-level RACK block. The event to be evaluated is entered in the start information (CPU_DIAG) of the OB_DIAG block. Each signal channel of the module has an input (MODE_xx). Here the configurations carried out with HW Config are signaled to the module channels. MODE_xx is read into the low word of the output OMODE_xx. This is only carried out during the start-up/initial start or if ACC_MODE = TRUE. The current value status of the channel is entered in the highest-value byte. If good, OMODE_xx = 16#80xxxxxx is set.

The following events lead to a value status "invalid value due to higher-level error" (OMODE_xx = 16#40xxxxxx):

• CPU redundancy loss (OB72)	(if not switched, output parameter QRACKF = TRUE)
• I/O access error (OB70)	(if not switched, output parameter QRACKF = TRUE)
• Rack failure (OB86)	(output parameter QRACKF = TRUE)
The above events are evaluated by the RACK block. The following ones by the MOD block:	
• I/O access error (OB85)	(output parameter QPERAF = TRUE)
• Module withdrawn (OB83)	(output parameter QMODF = TRUE)

The events "Module withdrawn" and "I/O access error" are signaled to the OSs by means of ALARM_8P. In the case of a diagnostic interrupt a difference is made between module and channel faults, whereby a message number is assigned to each channel.

During starting up the system checks whether the module is available (plugged). The module state information read here is available in the form of service output parameters (MOD_INF).

For detailed information on the faults: Please refer to the manual "System Software for S7-300/400 – System and Standard Functions".

Redundancy

Redundancy monitoring of the DP Master systems on an H system is carried out in the higher-level RACK block.

MODE setting

The inputs MODE_xx are available for a maximum of 16 signal channels. The initial value is "Zero" (no signal). Depending on the signal channel xx you have to set the type and, if appropriate, the coding of the measuring range of an analog module at the MODE_xx input.

Refer to MODE

Note

If you change the configuration of the MODE_xx inputs during operation, the change does not become active until the input ACC_MODE = 1 has been set at the outputs.

OMODE structure

Refer to OMODE

Addressing

Refer to Addressing

In the case of HART modules which access the process image in reading and writing mode configuration is carried out as for input modules. It is generally not permissible to specify different input and output ranges.

Example: SM332 AO 2x0/4..20mA HART 332-5TB00-0AB0:

Address input range HW Config	Address output range HW Config	LADDR (decimal / hex)
544	544	544 / 16#0220

Error handling

No plausibility checks are carried out with reference to the input parameters.

Also refer to: Error information of the output MSG_STAT parameter

Service information

In order to analyze faults you can read the module state information, which is entered during starting up, via the structured output parameter MOD_INF (refer to the reference manual "System software for S7-300/400 – System and standard functions", system state list, module state information).

Start-up characteristics

After a restart or an initial start the system checks whether the module is available under the logical base address. A restart (OB100) is signaled via the LSB in Byte 2 of the outputs OMODE_xx.

Time response

Does not exist.

Message characteristics

MOD_1 signals module faults by means of ALARM_8P. The inputs DELAY1 and DELAY2 are used to delay signaling of the I/O access error. DELAY1 is used to specify the time in seconds which the block waits after an I/O access error (OB85) for a higher-level error (rack failure or withdrawn/plugged), before it outputs the message. The message is turned off only when no higher-level fault is detected after the set time expires. DELAY2 determines the number of seconds which the block waits until it signals the I/O access error still existing after a higher-level error has passed. Both values have a default value of 2 seconds.
Messaging can be de-activated by using EN_MSG = FALSE.

Operator control and monitoring

The block does not have a faceplate (Display block).

Note: Under "Connections of …" the variables are marked (column OC&M "+") which are transferred to the OS, if the option "Can be operator controlled and monitored" is set in the object properties of the block in CFC. Default: Option not set.

2.8.2 Connections of MOD_1 / MOD_2

The connections of the blocks MOD_1and MOD_2 are identical with the exception of the number of the MODE_xx and OMODE_xx. The number of channels to be monitored determines the number of the respective input and outputs (xx).

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O	OC&M
ACC_MODE	1=Accept MODE Settings	BOOL	0	I/O	
CPU_DIAG	System Structure	STRUCT		I/O	
DELAY1	Alarm Delay 1 (s)	INT	2	I	
DELAY2	Alarm Delay 2 (s)	INT	2	I	
EN_MSG	1=Enable Message	BOOL	1	I	
EV_ID	Message ID	DWORD	0	I	
LADDR	Logical Address of Module	INT	0	I	

Connection (parameter)	Meaning	Data type	Initial	I/O	OC&M
MOD_INF	System Structure:Module Information	STRUCT		O	
MODE_xx	Mode Channel xx	WORD	0	I	
MSG_ACK	Message Acknowledged	WORD	0	O	
MSGSTAT	Message Failure	WORD	0	O	
OMODE_xx	Mode Channel xx	DWORD	0	O	+
QERR	1=Program Error	BOOL		O	
QMODF	1=Module Withdrawn/Out of Order	BOOL	0	O	+
QPERAF	1=Module I/O Access Failure	BOOL	0	O	
QRACKF	1=Rack/Station Failure	BOOL	0	O	
RAC_DIAG	Rack diagnostics (System Structure)	STRUCT		I/O	
RACK_NO	Rack Number	BYTE	0	I	
SLOT_NO	Slot Number	BYTE	0	I	
SUBN_TYP	1=External DP interface	BOOL	0	I	
SUBN1_ID	ID of Primary DP master system	BYTE	255	I	
SUBN2_ID	ID of Redundant DP master system	BYTE	255	I	

2.8.3 Message texts and auxiliary process values of MOD_1 / MOD_2

Assignment of message texts and classes to the block parameters of MOD_1 / MOD_2

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID	1		Module @1%d@/@2%d@/@3%d@: Withdrawn	S
	2	QPERAF	Module @1%d@/@2%d@/@3%d@: Access error	S
	3	QMODF	Module @1%d@/@2%d@/@3%d@: @4W%t#MOD_n_TXT@ (n = 1 or 2)	S

Assignment of the auxiliary process values for the block parameters of MOD_1 / MOD_2

Message block ALARM_8P	Auxiliary process value	Block parameter	Meaning
EV_ID	1	MOD_INF.SUBN_ID	Number DP Master system (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4		Text number from MOD_n_TXT (n =1or 2) (Message 1)

The event class/event number, the corresponding message texts and their text numbers of the text library MOD_n_TXT are listed in the text library for signal modules

2.9 MOD_2: Diagnostic driver for S7-300/400 SM modules which cannot be diagnosed with 32 channels

2.9.1 MOD_2: Monitoring of S7-300/400 SM modules which cannot be diagnosed with 32 channels

Object name (Type + Number)

FB 92

Area of Application

The block monitors S7-300/400 SM modules with 32 channels maximum which cannot be diagnosed (no mixed modules).

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB83	Withdrawn/plugged interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The MOD_2 block is installed behind the RACK block in the OBs mentioned above of the respective runtime group of the rack (station).
- Configuration of
  - The MODE_xx inputs (mode of the channels xx of the module)
  - The logical basic address of the LADDR module.
- Interconnection of
  - The OUT structures CPU_DIAG of the OB_BEGIN block and RAC_DIAG of the RACK block with the INOUT structures of the same name of the MOD_2.
  - The EN input with the output of an AND block.
    Its inputs are interconnected with the outputs EN_SUBx (x = Number of the DP Master system) of the OB_BEGIN block, EN_Rxxx (xxx = Rack/station number) of the SUBNET block and EN_Mxx (xx = Module number) of the RACK block.

Function and Operating principle

The block analyzes all the events which affect a module and its channels acyclically. It forms the MODE and value status (quality code) for the signal processing blocks channel-specifically. Events are signaled with ALARM_8P.

The block is enabled for running by the higher-level RACK block. The event to be evaluated is entered in the start information (CPU_DIAG) of the OB_DIAG block. Each signal channel of the module has an input (MODE_xx). Here the configurations carried out with HW Config are signaled to the module channels. MODE_xx is read into the low word of the output OMODE_xx. This is only carried out during the start-up/initial start or if ACC_MODE = TRUE. The current value

status of the channel is entered in the highest-value byte. If good, OMODE_xx = 16#80xxxxxx is set.

The following events lead to a value status "invalid value due to higher-level error" (OMODE_xx = 16#40xxxxxx):

• CPU redundancy loss (OB72)	(if not switched, output parameter QRACKF = TRUE)
• I/O access error (OB70)	(if not switched, output parameter QRACKF = TRUE)
• Rack failure (OB86)	(output parameter QRACKF = TRUE)
The above events are evaluated by the RACK block. The following ones by the MOD block:	
• I/O access error (OB85)	(output parameter QPERAF = TRUE)
• Module withdrawn (OB83)	(output parameter QMODF = TRUE)

The events "Module withdrawn" and "I/O access error" are signaled to the OSs by means of ALARM_8P. In the case of a diagnostic interrupt a difference is made between module and channel faults, whereby a message number is assigned to each channel.

During starting up the system checks whether the module is available (plugged). The module state information read here is available in the form of service output parameters (MOD_INF).

For detailed information on the faults: Please refer to the manual "System Software for S7-300/400 – System and Standard Functions".

Redundancy

Monitoring of the redundancy of the DP Master systems at an H system is carried out in the higher-level RACK block.

MODE setting

The inputs MODE_xx are available for a maximum of 32 signal channels. The initial value is "Zero" (no signal). Depending on the signal channel xx you have to set the type and, if appropriate, the coding of the measuring range of an analog module at the MODE_xx input.

Refer to MODE

Note

If you change the configuration of the MODE_xx inputs during operation, the change does not become active until the input ACC_MODE = 1 has been set at the outputs.

OMODE structure

Refer to OMODE

Addressing

Refer to Addressing

In the case of HART modules which access the process image in reading and writing mode configuration is carried out as for input modules. It is generally not permissible to specify different input and output ranges.

Example: SM332 AO 2x0/4..20mA HART 332-5TB00-0AB0:

Address input range HW Config	**Address output range HW Config**	**LADDR (decimal / hex)**
544	544	544 / 16#0220

Error handling

No plausibility checks are carried out with reference to the input parameters.

Also refer to: Error information of the output MSG_STAT parameter

Service information

In order to analyze faults you can read the module state information, which is entered during starting up, via the structured output parameter MOD_INF (refer to the reference manual "System software for S7-300/400 – System and standard functions", system state list, module state information).

Start-up characteristics

After a restart or an initial start the system checks whether the module is available under the logical base address. A restart (OB100) is signaled via the LSB in Byte 2 of the outputs OMODE_xx.

Time response

Does not exist.

Message characteristics

MOD_2 signals module faults by means of ALARM_8P. The inputs DELAY1 and DELAY2 are used to delay signaling of the I/O access error. DELAY1 is used to specify the time in seconds which the block waits after an I/O access error (OB85) for a higher-level error (rack failure or withdrawn/plugged), before it outputs the message. DELAY2 determines the number of seconds which the block waits until it signals the I/O access error still existing after a higher-level error has passed. Both values have a default value of 2 seconds.
Messaging can be de-activated by using EN_MSG = FALSE.

Operator control and monitoring

The block does not have a faceplate (display block).

Note

Under "Connections of …" the variables are marked (column OC&M "+") which are transferred to the OS, if the option "Can be operator controlled and monitored" is set in the object properties of the block in CFC. Default: Option not set.

2.10 MOD_D1: Diagnostic driver for S7-300/400 SM modules which can be diagnosed with 16 channels

2.10.1 MOD_D1: Monitoring of S7-300/400 SM modules which can be diagnosed with 16 channels maximum

Object name (Type + Number)

FB 93

Area of Application

The block monitors S7-300/400 SM modules with 16 channels maximum which can be diagnosed (no mixed modules).

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB82	Diagnostic interrupt
OB83	Withdrawn/plugged interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The MOD_D1 block is installed behind the RACK block in the OBs mentioned above of the respective runtime group of the rack (station).
- Configuration of
  - The MODE_xx inputs (mode of the channels xx of the module), SUBN1_ID, SUBN2_ID and SUBN_TYP.
  - The logical basic address LADDR of the module.
- Interconnection of
  - The OUT structures CPU_DIAG of the OB_BEGIN block and RAC_DIAG of the RACK block with the INOUT structures of the same name of the MOD_D1.
  - The EN input with the output of an AND block.
    Its inputs are interconnected with the outputs EN_SUBx (x = Number of the DP Master system) of the OB_BEGIN block, EN_Rxxx (xxx = Rack/station number) of the SUBNET block and EN_Mxx (xx = Module number) of the RACK block.

Function and Operating Principle

The block analyzes all the events which affect a module and its channels acyclically. It forms the MODE and value status (quality code) for the signal processing blocks channel-specifically. The events are signaled with ALARM_8P.

The MOD_D1 block is enabled for running by the higher-level RACK block. The event to be evaluated is entered in the start and diagnostic information (CPU_DIAG) of the CPU block. Each signal channel of the module has an input (MODE_xx). Here the configurations carried out with HW Config are signaled to the module channels. MODE_xx is read into the low word of the outputOMODE_xx. This is only carried out during the start-up/initial start or if ACC_MODE = TRUE. The current value status of the channel is entered in the highest-value byte. If good, OMODE_xx = 16#80xxxxxx is set.

The following events lead to a value status "invalid value due to higher-level error" (OMODE_xx = 16#40xxxxxx):

• CPU redundancy loss (OB72)	(if not switched, output parameter QRACKF = TRUE)
• I/O redundancy error (OB70)	(if not switched, output parameter QRACKF = TRUE)
• Rack failure (OB86)	(output parameter QRACKF = TRUE)
The above events are evaluated by the RACK block. The following ones by the MOD block:	
• I/O access error (OB85)	(output parameter QPERAF = TRUE)
• Module withdrawn (OB83)	(output parameter QMODF = TRUE)
• Diagnostic interrupt (OB82)	One differentiates between module faults and channels faults

Module faults are the following events (output parameter QMODF = TRUE):

• External auxiliary voltage lacking
• Front connector missing
• Module not configured
• Incorrect parameters in the module
• Module missing / incorrect
• Communication fault CPU module
• Time monitoring triggered (watchdog)
• Module-internal supply voltage failed
• Rack failure
• Processor failure
• EPROM fault
• RAM fault
• ADC/DAC fault
• Fuse tripped

Channel faults are the following events (value status "invalid value", OMODE_xx = 16#00xxxx):

• Configuration and parameterization errors
• Common-Mode error, only analog input/output
• P short-circuit
• M short circuit
• Output transistor has a break
• Wire breakage
• Reference channel error (only analog input)
• Measuring range underflow (only analog input)
• Measuring range overflow (only analog input)
• Load voltage lacking (only analog and digital output)
• Sensor supply lacking (only digital output)
• Fuse tripped (only digital output)
• Ground fault (only digital input/output)
• Overtemperature (only digital output)

The events "Module withdrawn", "I/O access error" and "Diagnostic interrupt" are signaled to WinCC by means of ALARM_8P.

In the case of a diagnostic interrupt a difference is made between module and channel faults, whereby a message number is assigned to each channel. Only one event each per channel can be signaled as coming/going. As long as an event of a channel is active as coming, further events of the same channel are lost.

During starting up the system checks whether the module is available (plugged). The module state information read here is available in the form of service output parameters (MOD_INF).

The detailed information on the faults (refer to the reference manual "System software for S7-300/400 – System- and standard functions", diagnostic data, Byte0 to Byte8, structure of the channel-specific diagnostic data) is entered in the output parameter DIAG_INF on the data type STRUCT.

Note

Even if you operate a HART module in the HART operating MODE MODE=16#070C, possible HART protocol errors and re-configurations are masked by the MOD_D1 driver block and are not signaled as channel errors.

Redundancy

Monitoring of the redundancy of the DP Master systems at an H system is carried out in the higher-level RACK block.

MODE setting

The inputs MODE_xx are available for a maximum of 16 signal channels. The initial value is "Zero" (no signal). Depending on the signal channel xx you have to set the type and, if appropriate, the coding of the measuring range of an analog module at the MODE_xx input.

Refer to MODE

Note

If you change the configuration of the MODE_xx inputs during operation, the change does not become active until the input ACC_MODE = 1 has been set at the outputs.

OMODE structure

Refer to OMODE

Addressing

Refer to Addressing

In the case of HART modules which access the process image in reading and writing mode configuration is carried out as for input modules. It is generally not permissible to specify different input and output ranges.

Example: SM332 AO 2x0/4..20mA HART 332-5TB00-0AB0:

Address input range HW Config	Address output range HW Config	LADDR (decimal / hex)
544	544	544 / 16#0220

Error handling

No plausibility checks are carried out with reference to the inputs .

Also refer to: Error information of the output MSG_STAT parameter

Service information

In order to analyze faults you can read the module state information, which is entered during starting up, via the structured output parameter MOD_INF (refer to the reference manual "System software for S7-300/400 – System and standard functions", system state list, module state information).

In addition detailed module diagnostic information is contained in the output parameters MODDIAG0 to MODDIAG8 after a diagnostic interrupt (refer to the reference manual "System software for S7-300/400 – System- and standard

functions", diagnostic data, Byte0 to Byte8). The output parameters CHDIAG00 to CHDIAG15 contain detailed channel state information (refer to the reference manual "System software for S7-300/400 – System- and standard functions", structure of the channel-specific diagnostic data).

The diagnostic information is reset after a going diagnostic interrupt (there are no channel errors or module faults).

Start-up characteristics

After a restart or an initial start the system checks whether the module is available under the logical base address. A restart (OB100) is signaled via the LSB in Byte 2 of the outputs OMODE_xx.

Overload behavior

The MOD_D1 block counts the OB82 calls. The counter is reset in the OB1. If more than two OB82 events occur successively before the cycle checkpoint (OB1) is reached, these are rejected and a message "Failure OB82 DP Master:x Rack:y Slot: z" is emitted.

Time response

Does not exist.

Message characteristics

MOD_D1 signals module faults by means of ALARM_8P_1. In addition the ALARM_8P_2 and ALARM_8P_3 specified for channel faults are called up. The inputs DELAY1 and DELAY2 are used to delay signaling of the I/O access error. DELAY1 is used to specify the time in seconds which the block waits after an I/O access error (OB85) for a higher-level erroe (rack failure or withdrawn/plugged), before it outputs the message. The message is turned off only when no higher-level error is detected after the set time expires. DELAY2 determines the number of seconds which the block waits until it signals the I/O access error still existing after a higher-level error has passed. Both values have a default value of 2 seconds. Messaging can be de-activated by using EN_MSG = FALSE.

Operator control and monitoring

The block does not have a faceplate (Display block).

Note

In "Connection of MOD_1 / MOD_2" the variables are identified (with a "+" in the column OCM) which are transferred from this instance block to the OS when the option "Operator C and M capability for diagnostic blocks" in the "Generate Module Driver" settings is selected. Default: option is not set.

2.10.2 Connections of MOD_D1 / MOD_D2

The connections of the blocks MOD_D1and MOD_D2 are identical with the exception of the number of the MODE_xx and OMODE_xx. The number of channels to be monitored determines the number of the respective input and outputs (xx).

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O	OC&M
ACC_MODE	1=Accept MODE Settings	BOOL	0	I/O	
CPU_DIAG	CPU diagnostics (System structure*)*	STRUCT		I/O	
DELAY1	Alarm Delay 1 (s)	INT	2	I	
DELAY2	Alarm Delay 2 (s)	INT	2	I	
DIAG_INF	Diagnostic Information	STRUCT		O	
EN_MSG	1=Enable Message	BOOL	1	I	
EV_IDx	Message ID	DWORD	0	I	
LADDR	Logical Address of Module	INT	0	I	
MOD_INF	Module Parameter	STRUCT		O	
MODE_xx	Mode Channel xx	WORD	0	I	
MSG_ACKx	Message Acknowledged x	WORD	0	O	
MSGSTATx	Message Failure x	WORD	0	O	
OMODE_xx	Mode Channel xx	DWORD	0	O	+
QERR	1=Program Error	BOOL	0	O	
QMODF	1=Module Withdrawn/Out of Order	BOOL	0	O	+
QPERAF	1=Module I/O Access Failure	BOOL	0	O	
QRACKF	1=Rack Failure	BOOL	0	O	
RAC_DIAG	Rack diagnostic	STRUCT		I/O	
RACK_NO	Rack Number	BYTE	0	I	
SLOT_NO	Slot Number	BYTE	0	I	
SUBN_TYP	1=External DP interface	BOOL	0		
SUBN1_ID	ID of Primary DP master system	BYTE	255	I	
SUBN2_ID	ID of Redundant DP master system	BYTE	255	I	

2.10.3 Message texts and auxiliary process values of MOD_D1

Assignment of message texts and classes to the block parameters of MOD_D1

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID1	1	QMODF	Module @1%d@/@2%d@/@3%d@: withdrawn	S
	2	QPERAF	Module @1%d@/@2%d@/@3%d@: Access error	S
	3	QMODF	Module @1%d@/@2%d@/@3%d@: @5W%t#MOD_D1_TXT@	S
	4		Module @1%d@/@2%d@/@3%d@: Multi.Diagnose OB82 lock	S
	5		BG @1%d@/@2%d@/@3%d@: @4W%t#MOD_D1_TXT@	S
EV_ID2	1	-	Module @1%d@/@2%d@/@3%d@: Channel 00 @4W%t#MOD_D1_TXT@	S
	... ...		... ...	... ...
	8	-	Module @1%d@/@2%d@/@3%d@: Channel 07 @10W%t#MOD_D1_TXT@	S
EV_ID3	1	-	Module @1%d@/@2%d@/@3%d@: Channel 08 @4W%t#MOD_D1_TXT@	S
	... ...		... ...	... ...
	8	-	Module @1%d@/@2%d@/@3%d@: Channel 15 @10W%t#MOD_D1_TXT@	S

The event class/event number, the corresponding message texts and their text numbers of the text library MOD_D1_TXT are listed in the text library for signal modules

Note

Detailed channel errors are only registered for modules with channels of channel type16#61, 16#63, 16#70, 16#71, 16#72, 16#73. Only the first 8 bits are registered for modules whose diagnostic bits per channel exceed 8 bits.

Non-detailed messages have the following structure (Example): BG 1/2/10: Error Channel15

Assignment of the auxiliary process values for the block parameters of MOD_D1

Message block ALARM_8P	Auxiliary process value	Block parameter	Meaning
EV_ID1	1	MOD_INF.SUBN_ID	Number DP Master system (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4		Text number (Message 1-3) from MOD_D1_TXT
EV_ID2	1	MOD_INF.SUBN_ID	Number DP Master system (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4		Text number (Message 1-8) from MOD_D1_TXT
EV_ID3	1	MOD_INF.SUBN_ID	Number DP Master system (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4		Text number (Message 1-8) from MOD_D1_TXT

2.11 MOD_D2: Diagnostic driver for S7-300/400 SM modules which can be diagnosed with 32 channels

2.11.1 MOD_D2: Monitoring of S7-300/400 SM modules which can be diagnosed with 32 channels

Object name (Type + Number)

FB 94

Area of Application

The block monitors S7-300/400 SM modules with 32 channels maximum which can be diagnosed (no mixed modules).

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB82	Diagnostic interrupt
OB83	Withdrawn/plugged interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The MOD_D2 block is installed behind the RACK block in the OBs mentioned above of the respective runtime group of the rack (station).
- Configuration of
  - The inputs MODE_xx (Mode of channels xx of the module) SUBN1_ID, SUBN2_ID and SUBN_TYP
  - The logical address LADDR of the module.
- Interconnection of
  - The OUT structures CPU_DIAG of the OB_BEGIN block and RAC_DIAG of the RACK block with the INOUT structures of the same name of the MOD_D2.
  - The EN input with the output of an AND block, of which the inputs are interconnected with the outputs EN_SUBx (x = ID of the DP master system) of the OB_BEGIN block, EN_Rxxx (xxx = Rack/Station ID) of the subnet block and EN_Mxx (xx = Module ID) of the rack block.

Function and Operating Principle

The block analyzes all the events which affect a module and its channels acyclically. It forms the MODE and value status (quality code) for the signal processing blocks channel-specifically. The events are signaled with ALARM_8P. The signaling function can be switched off.

The block is enabled for running by the higher-level RACK block. The event to be evaluated is entered in the start and diagnostic information (CPU_DIAG) of the CPU block. Each signal channel of the module has an input (MODE_xx). Here the configurations carried out with HW Config are signaled to the module channels. MODE_xx is read into the low word of the output OMODE_xx. This is only carried

out during the start-up/initial start or if ACC_MODE = TRUE. The current value status of the channel is entered in the highest-value byte. If good, OMODE_xx = 16#80xxxxxx is set.

The following events lead to a value status "invalid value due to higher-level error" (OMODE_xx = 16#40xxxxxx):

• CPU redundancy loss (OB72)	(if not switched, output parameter QRACKF = TRUE)
• I/O redundancy error (OB70)	(if not switched, output parameter QRACKF = TRUE)
The above events are evaluated by the RACK block. The following ones by the MOD block:	
• Rack failure (OB86)	(output parameter QRACKF = TRUE)
• I/O access error (OB85)	(output parameter QPERAF = TRUE)
• Module withdrawn (OB83)	(output parameter QMODF = TRUE)
• Diagnostic interrupt (OB82)	One differentiates between module faults and channels faults

Module faults are the following events (output parameter QMODF = TRUE):

• External auxiliary voltage lacking
• Front connector missing
• Module not configured
• Incorrect parameters in the module
• Module missing / incorrect
• Communication fault CPU module
• Time monitoring triggered (watchdog)
• Module-internal supply voltage failed
• Rack failure
• Processor failure
• EPROM fault
• RAM fault
• ADC/DAC fault
• Fuse tripped

Channel faults are the following events (value status "invalid value", OMODE_xx = 16#00xxxx):

• Configuration and parameterization errors
• Common-Mode error, only analog input/output
• P short-circuit
• M short circuit
• Output transistor has a break
• Wire breakage
• Reference channel error (only analog input)
• Measuring range underflow (only analog input)
• Measuring range overflow (only analog input)
• Load voltage lacking (only analog and digital output)
• Sensor supply lacking (only digital output)
• Fuse tripped (only digital output)
• Ground fault (only digital input/output)
• Overtemperature (only digital output)

The events "Module withdrawn", "I/O access error" and "Diagnostic interrupt" are signaled to WinCC by means of ALARM_8P.

In the case of a diagnostic interrupt a difference is made between module and channel faults, whereby a message number is assigned to each channel. Only one event each per channel can be signaled as coming/going. As long as an event of a channel is active as coming, further events of the same channel are lost.

During starting up the system checks whether the module is available (plugged). The module state information read here is available in the form of service output parameters (MOD_INF).

The detailed information on the faults (refer to the reference manual "System software for S7-300/400 – System- and standard functions", diagnostic data, Byte 0 to Byte 8, structure of the channel-specific diagnostic data) is entered in the output parameter DIAG_INF on the data type STRUCT.

Redundancy

The block supports the line redundancy of the CPU 417H in the case of decentralized I/Os To this purpose the inputs SUBN1_ID (connection to CPU 0) and SUBN2_ID (connection to CPU 1) are to be configured with the numbers of the redundant lines. If there is no line redundancy, the remaining input must have the value 16#FF (default) assigned.

MODE setting

The inputs MODE_xx are available for a maximum of 32 signal channels. The initial value is zero (no signal). Depending on the signal channel xx you have to set the type and, if appropriate, the coding of the measuring range of an analog module at the MODE_xx input.

Refer to MODE

Note

If you change the configuration of the MODE_xx inputs during operation, the change does not become active until the input ACC_MODE = 1 has been set at the outputs.

OMODE structure

Refer to OMODE

Addressing

Refer to Addressing

Error handling

No plausibility checks are carried out with reference to the input parameters.

Also refer to: Error information of the output MSG_STAT parameter

Service information

In order to analyze faults you can read the module state information, which is entered during starting up, via the structured output parameter MOD_INF (refer to the reference manual "System software for S7-300/400 – System and standard functions", system state list, module state information).

In addition detailed module diagnostic information is contained in the output parameters MODDIAG0 to MODDIAG10 after a diagnostic interrupt (refer to the reference manual "System software for S7-300/400 – System- and standard functions", diagnostic data, Byte 0 to Byte 10). The output parameters CHDIAG00 to CHDIAG31 contain detailed channel state information (refer to the reference manual "System software for S7-300/400 – System- and standard functions", structure of the channel-specific diagnostic data).

The diagnostic information is reset after a going diagnostic interrupt (there are no channel errors or module faults).

Start-up characteristics

After a restart or an initial start the system checks whether the module is available under the logical base address. A restart (OB100) is signaled via the LSB in Byte 2 of the outputs OMODE_xx.

Time response

Does not exist.

Message characteristics

MOD_D2 signals module faults by means of ALARM_8P_1. In addition the ALARM_8P_2, ALARM_8P_3, ALARM_8P_4 and ALARM_8P_5 specified for channel faults are called up. The inputs DELAY1 and DELAY2 are used to delay signaling of the I/O access error. DELAY1 is used to specify the time in seconds which the block waits after an I/O access error (OB85) for a higher-level error (rack failure or withdrawn/plugged), before it outputs the message. The message is turned off only when no higher-level error is detected after the set time expires. DELAY2 determines the number of seconds which the block waits until it signals the I/O access error still existing after a higher-level error has passed. Both values have a default value of 2 seconds.

The message can be turned off with EN_MSG = FALSE.

Operator control and monitoring

The block does not have a faceplate.

Note

In "Connection of MOD_1 / MOD_2" the variables are identified (with a "+" in the column OCM) which are transferred from this instance block to the OS when the option "Operator C and M capability for diagnostic blocks" in the "Generate Module Driver" settings is selected. Default: option is not set.

2.11.2 Message texts and auxiliary process values of MOD_D2

Assignment of message texts and classes to the block parameters of MOD_D2

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID1	1	QMODF	Module @1%d@/@2%d@/@3%d@: withdrawn	S
	2	QPERAF	Module @1%d@/@2%d@/@3%d@: Access error	S
	3	QMODF	Module @1%d@/@2%d@/@3%d@: @5W%t#MOD_D2_TXT@	S
	4		Module @1%d@/@2%d@/@3%d@: Multi.Diagnose OB82 lock	S
	5		BG @1%d@/@2%d@/@3%d@: @4W%t#MOD_D2_TXT@	S
	6	-		S
	7	-		S
	8	-		S
EV_ID2	1	-	Module @1%d@/@2%d@/@3%d@: Channel 00 @4W%t#MOD_D2_TXT@	S
	...		...	
	8	-	Module @1%d@/@2%d@/@3%d@: Channel 07 @4W%t#MOD_D2_TXT@	S
EV_ID3	1	-	Module @1%d@/@2%d@/@3%d@: Channel 08 @4W%t#MOD_D2_TXT@	S
	...		...	
	8	-	Module @1%d@/@2%d@/@3%d@: Channel 15 @4W%t#MOD_D2_TXT@	S
EV_ID4	1	-	Module @1%d@/@2%d@/@3%d@: Channel 16 @4W%t#MOD_D2_TXT@	S
	...		...	
	8	-	Module @1%d@/@2%d@/@3%d@: Channel 23 @4W%t#MOD_D2_TXT@	S
EV_ID5	1	-	Module @1%d@/@2%d@/@3%d@: Channel 24 @4W%t#MOD_D2_TXT@	S
	...		...	
	8	-	Module @1%d@/@2%d@/@3%d@: Channel 31 @4W%t#MOD_D2_TXT@	S

The event class/event number, the corresponding message texts and their text numbers of the text library MOD_D2_TXT are listed in the text library for signal modules

Assignment of the auxiliary process values for the block parameters of MOD_D2

Message block ALARM_8P	Auxiliary process value	Block parameter	Meaning
EV_ID1	1	MOD_INF.SUBN_ID	DP master system ID (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4	-	Text number (Message 1 - 3) from MOD_D2_TXT
EV_ID2	1	MOD_INF.SUBN_ID	DP master system ID (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4	-	Text number (Message 1 - 8) from MOD_D2_TXT
EV_ID3	1	MOD_INF.SUBN_ID	DP master system ID (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4	-	Text number (Message 1 - 8) from MOD_D2_TXT
EV_ID4	1	MOD_INF.SUBN_ID	DP master system ID (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4	-	Text number (Message 1 - 8) from MOD_D2_TXT
EV_ID5	1	MOD_INF.SUBN_ID	DP master system ID (byte)
	2	MOD_INF.RACK_NO	Rack / Station number (byte)
	3	MOD_INF.SLOT_NO	Slot number (byte)
	4	-	Text number (Message 1 - 8) from MOD_D2_TXT

2.12 CH_AI: Analog value input

Object name (Type + Number)

FC 275

Area of Application

The block is used for signal processing of an analog input value from S7-300/400 SM analog input modules.

Calling OBs

The calling OB is the watchdog interrupt OB3x into which the block is installed (for example OB 32).

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The MODE input is interconnected to the corresponding output OMODE_xx of the MOD block.

Function and Operating principle

The block cyclically processes all the channel-specific signal functions of an analog input module.

The block reads an analog non-linearized value from the (part) process image and adapts it to its physical size or determines a percentage value from it. The MODE input is used to determine in which form the non-linearized value exists and is to be processed. If the high byte of the MODE input parameter = 16#40 (value status = higher-level error), the non-linearized value is handled as invalid.

A quality code which can have the following states is generated for the resultant value

State	Quality code
Valid value	16#80
Simulation	16#60
Last valid value	16#44
Substitution value	16#48
Invalid value	16#00

Addressing

The symbol generated with HW Config (symbol table) for the analog input channel has to be interconnected with the input VALUE.

Non-linearized value check

Depending on the measured value and the measuring range a nominal range of the analog input module is obtained by converting the analog signal into a digital value (non-linearized value). In addition there is an over- and underrange in which the analog signal can still be converted. There is an overflow or underflow outside these limits. The block indicates whether the non-linearized value lies inside the nominal range of the module.
If the value drops below the nominal range, the output parameter value QCHF_LL = TRUE is set. If the value exceeds the nominal range, the output parameter value QCHF_HL = TRUE is set.
In case of an overflow or underflow QBAD = TRUE (channel error) is also set.

Note

In case of a wire breakage at 4 to 20 mA signals the module response is not uniform. Depending on the module either 16#7FFF (overflow) or 16#8000 (underflow) is written as the non-linearized value into the process image. The channel block CH_AI then correspondingly emits either an overflow (QCHF_HL = TRUE) or an underflow (QCHF_LL = TRUE), each together with QBAD = TRUE.
Exception: If you have set "Diagnostic interrupt" of the analog input module with HW Config, only QBAD = TRUE is set at a "Channel error" (for example wire break) at a diagnostic interrupt.

NAMUR limit check

The NAMUR guidelines for analog signal processing define limits for life zero (4 to 20 mA) analog signals which have a channel error:

3.6 mA = Analog signal = 21 mA

The above NAMUR limits are set as fixed defaults for limit monitoring. If you want to set other limits, you have to set the inputCH_F_ON = TRUE and set corresponding new limits in mA at the inputs CH_F_HL and CH_F_LL. If the lower or upper active limit is exceeded, QBAD = TRUE is set at a life zero analog signal.

Note

The selectable limits must lie below the upper limit of the overrange or above the lower limit of the underrange of the module. Values outside the NAMUR range are also possible in as far as the module does not limit the measured values automatically to these.

Normal value

The non-linearized value is adjusted according to ist physical size by the inputs VLRANGE, VHRANGE and MODE (see also OMODE_xx). The interconnectability of the settings of VLRANGE and VHRANGE with other block parameters are determined by the outputs OVLRANGE and OVHRANGE. The conversion algorithm depends on a linearized input signal. If VLRANGE = 0 and VHRANGE = 100 you get a percentage value. If VHRANGE = VLRANGE is set, you get the the input signal of the analog input module (e.g. mA) according to the MODE setting. If the non-linearized value is already a physical value, please set VLRANGE = 0 and VHRANGE = 1. The Quality Code is set to QUALITY = 16#80.

Note

In the measuring mode "Thermocouples external or internal comparison", the physiacl size is adjusted to +/- 80 mV in the modules of S7 300. You have to determine the temperature with reference to the conversion tables concerned.

The physical equivalence in mV is delivered by the module as non-linearized value, please set VHRANGE and VLRANGE +/- 80 mV here.

Simulation

With the input parameter SIM_ON = TRUE, the value of the input SIM_V is given with Quality Code QUALITY = 16#60. In simulation operation too, a valid operating mode has to be set in Low Word of the input MODE. Otherwise QBAD = 1 is output. Simulation has highest priority. If the block is in the simulation status, QSIM = TRUE is set.

Substitute value

With the input parameter SUBS_ON = TRUE, the value of the input SUBS_V is output as value, as long as the non-linearized value is invalid. The Quality Code is set as QUALITY = 16#48 and QBAD = 1.

Hold last value

With input parameter SUBS_ON = FALSE, the last valid output value (V_LAST) is output, if the non-linearized value is invalid. For V_DELTA > 0, the following applies:

ABS (V - V_LAST) > V_DELTA: V = V_LAST1 (next to last valid output value)

ABS (V - V_LAST) ≤ V_DELTA: V = V_LAST (last valid output value)

The Quality Code is set as QUALITY = 16#44 and QBAD = 1.

Accept value delay

After restart or if the Quality Code is changed from "BAD" to "GOOD", the Quality Code and value are not updated until the CNT_LIM cycles have passed. If CNT_LIM = 0 (Default setting), this function is switched off. During the accept value delay, the Quality Code = 16#00 and QBAD = 1. The last value remains during the accept value delay.

Error handling

No plausibility checks are carried out with reference to the input parameters. In case of invalid operating mode in the low word of the MODE input it is assumed that the non-linearized value is invalid.

Start-up characteristics

Does not exist.

Time response

Does not exist.

Message characteristics

The block does not have message characteristics.

Operator control and monitoring

The block does not have a faceplate (display block).

2.12.1 Connections of CH_AI

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
CH_F_HL	High Limit of Input Value (mA)	REAL	0	I/O
CH_F_LL	Low Limit of Input Value (mA)	REAL	0	I/O
CH_F_ON	1=Limit Failure Active	BOOL	0	I/O
CNT_LIM	Restart Counter Limit	INT	0	I/O
CNT_RES	Restart Counter	INT	0	I/O
DELTA_ON	Last Difference (V – V_LAST) exceeded	BOOL	0	I/O
LAST_BAD	Last QBAD	BOOL	0	I/O
MODE	Quality and Mode	DWORD	0	I/O
OVHRANGE	High Range of Process Value (Copy)	REAL	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
OVLRANGE	Low Range of Process Value (Copy)	REAL	0	O
QBAD	1=Bad Process Value	BOOL	0	O
QCHF_HL	1 = Overdriven Process Value	BOOL	0	O
QCHF_LL	1 = Underdriven Process Value	BOOL	0	O
QSIM	1 = Simulation Active	BOOL	0	O
QSUBS	1 = Failure Substitution Active	BOOL	0	O
QUALITY	Quality Code of Process Value	BYTE	0	O
SIM_ON	1 = Activate Simulation	BOOL	0	I/O
SIM_V	Simulation Value	REAL	0	I/O
SUBS_ON	1 = Enable Failure Substitution	BOOL	0	I/O
SUBS_V	Substitution Value	REAL	0	I/O
V	Process Value	REAL	0	O
VALUE	Process Image Input Value	WORD	0	I/O
VHRANGE	High Range of Process Value	REAL	100	I/O
VLRANGE	Low Range of Process Value	REAL	0	I/O
V_DELTA	Delta (V - V_LAST) Process Value	REAL	0	I/O
V_LAST	Last Valid Process Value	REAL	0	I/O
V_LAST1	Second-last Valid Process Value	REAL	0	I/O

2.13 CH_AO: Analog value output

Object name (Type + Number)

FC 276

Area of Application

The block is used for signal processing of an analog output value from S7-300/400 SM analog output.

Calling OBs

The calling OB is the watchdog interrupt OB3x into which the block is installed (for example OB 32) and the restart OB100.

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The MODE input is interconnected to the corresponding output OMODE_xx of the MOD block.
- The CH_AO block is installed after the MOD block assigned to it in the OB100.

Note

If you do not use the CFC function "Generate Module Driver", you have to ensure that the CH_AO block is installed after the MOD-/PADP block assigned to it in the OB100.

Function and Operating principle

The block processes all the channel-specific signal functions.

The block writes a process value as an analog non-linearized value into the (part) process image. The MODE input is used to determine in which form the non-linearized value is to be generated.
If the high byte of the MODE input = 0 (value status), the non-linearized value continues to be written into the (part) process image - however, a quality code "invalid value" is set.

The quality code can have the following states:

State	Quality code
Valid value	16#80
Open value limited	16#56
Lower value limited	16#55
Simulation	16#60
Invalid value	16#00

Addressing

The symbol generated with HW Config (symbol table) for the analog output channel has to be interconnected to the VALUE output .

Normal value

The parameters ULRANGE and UHRANGE map the process value U onto the non-linearized value VALUE (quantification stages) of the analog output module depending on the MODE. For example in the mode 4..20mA (16#0203) the non-linearized value for 4mA is output for U = ULRANGE and the non-linearized value for 20mA is output for U = UHRANGE.

PHYS_LIM is used to set the limitation of the VALUE non-linearized value. In the default setting (PHYS_LIM = 0) the VALUE output value is limited to the normalizing limits of the module. In accordance with the above example the block calculates the non-linearized value for 20 mA for U > UHRANGE and the non-linearized value for 4mA for U < ULRANGE Accordingly the quality codes 16#56 (upper value limited) and 16#55 (lower value limited) are applied at the QUALITY output instead of the 16#80 (valid value).

In order to output analog values outside the normalization values up to the physical limits of the module, you have to set PHYS_LIM = 1. The output values are not limited until, in the above example, the module limits are exceeded by specifying U = 200 (36mA) or U = -50 (-4mA) at ULRANGE = 0 and UHRANGE = 100. The output values are then limited to the physical limits specified in the data sheets of the modules and the corresponding quality codes are output.

The outputs QCHF_HL and QCHF_LL also provide information on whether the output values have been limited.

Simulation

If the input parameter SIM_ON = TRUE, the value of SIM_U is output with Quality Code (QUALITY) = 16#60. A valid mode must also be set in simulation mode in the low word of the input MODE. Otherwise QBAD = 1 is output. If there is a higher-level fault, QBAD = FALSE is set. Simulation has the highest priority. If the block is in simulation state, QSIM = TRUE is set.

I/O fault

If the high byte of the input MODE = 0 (value status), the quality code QUALITY = 16#00 is set. The current non-linearized value is always written into the (part) process image.

Value limiting

You can limit very low or very high process values which lead to an error (QBAD = TRUE) before entry in the (part) process image.

If the switch LIMIT_ON = TRUE, the process values (V) are limited:

- To V_HL, if V > V_HL.
- To LL_V, if V < V_LL.

Error handling

No plausibility checks are carried out with reference to the input parameters. In case of an invalid operating mode in the low word of the MODE input the digitized output value is set to 0 and QUALITY = 16#00 is output.

Start-up characteristics

The MOD blocks set the LSB in Byte 2 of their output OMODE_xx in the OB100. If the block recognizes this code, it acknowledges it and then reacts as follows:

If START_ON is not set, the process value U is processed and is transferred to the process image. Otherwise the non-linearized value corresponding to the START_U process value is written to the process image.

Time response

Does not exist.

Message characteristics

The block does not have message characteristics.

Operator control and monitoring

The block does not have a faceplate (display block).

2.13.1 Connections of CH_AO

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
LL_V	Process value if U < V LL	REAL	0	I/O
LIMIT_ON	1 = Limit control process value	BOOL	0	I/O
MODE	Quality and Mode	DWORD	0	I/O
PHYS_LIM	1=Enable Physical Module Limits	BOOL	0	I/O
QBAD	1=Bad Output Value	BOOL	0	O
QCHF_HL	1 = Process Value High Limit Failure	BOOL	0	O
QCHF_LL	1 = Process Value Low Limit Failure	BOOL	0	O
QSIM	1 = Simulation Active	BOOL	0	O
QUALITY	Quality Code of Output Value	BYTE	0	O
SIM_ON	1 = Activate Simulation	BOOL	0	I/O
SIM_U	Simulation Value	REAL	0	I/O
START_ON	1=Enable Startup Substitution Value	BOOL	0	I/O
START_U	Startup Substitution Value	REAL	0	I/O
U	Process Value	REAL	0	I/O
UHRANGE	High Range of Process Value	REAL	0	I/O
ULRANGE	Low Range of Process Value	REAL	0	I/O
V_HL	HART high limit value	REAL	0	I/O
V_LL	HART low limit value	REAL	0	I/O
VALUE	Process Image Output Value	WORD	0	O

2.14 CH_DI: Digital value input

Object name (Type + Number)

FC 277

Area of Application

The block is used for signal processing of a digital input value from S7-300/400 SM digital input modules or a PA field device (PA-Profile 3.0 Discrete Input).

Calling OBs

The calling OB is the watchdog interrupt OB3x into which the block is installed (for example OB 32).

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The MODE input is interconnected to the corresponding output OMODE_xx of the MOD block (or of the PADP block).

Function and Operating principle

The block processes all the channel-specific signal functions.

The block reads a digital value of the data type BOOL from the (part) process image. If the high byte of the input parameter MODE = 16#40 (value status = higher-level error), the digital value is treated as invalid. If the input parameter PQC = TRUE, the value status of the digital value is read from the (part) process image.

A quality code which can have the following states is generated for the resultant value:

State	Quality code
Valid value	16#80
Simulation	16#60
Last valid value	16#44
Substitution value	16#48
Invalid value	16#00

Addressing

The symbol generated with HW Config (symbol table) for the digital input channel has to be interconnected to the VALUE input. If the value status of the digital input channel is also in the (part) process image, you have to interconnect the corresponding symbol with the input VALUE_QC and set the input PQC = TRUE.

In the case of PA field devices (PA_ON = TRUE), the symbol generated with HW Config (symbol table) for the digital input channel has to be interconnected to the I_OUT_D input. The CFC function "Generate Module Driver" interconnects the symbol for the Quality Code of the digital input channel automatically to the input QC.

Normal value

The digital value of the (part) process image is output to the output parameter Q with Quality Code QUALITY = 16#80.

Simulation

If the input parameter SIM_ON = TRUE, the value of the input SIM_I (PA_ON = FALSE) or SIM_OUT (PA_ON = TRUE) is output to the output Q with Quality Code QUALITY = 16#60. Simulation has the highest priority. If there is a higher-level fault, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set.

Substitution value

If the input parameter SUBS_ON = TRUE, the value of the input SUBS_I is output to the output Q with Quality Code QUALITY = 16#48 and QBAD = 1, in as far as the digital value of the (part) process image is invalid.

Hold last value

If the input parameter SUBS_ON = FALSE, the last valid output parameter is output if the non-linearized value is invalid. The Quality Code is set to QUALITY = 16#44 and QBAD = 1.

- PA_ON = TRUE
  Last valid output value corresponds to V_LAST.
- PA_ON = FALSE
  Last valid output value corresponds to Q_LAST.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

Do not exist.

Time response

Does not exist.

Message characteristics

The block does not have message characteristics.

Operator control and monitoring

The block does not have a faceplate (display block).

2.14.1 Connections of CH_DI

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
MODE	Quality and Mode	DWORD	0	I/O
PQC	1=Use Process Image Quality Bit	BOOL	0	I/O
Q	Process Value	BOOL	0	O
Q_LAST	Last Valid Process Value	BOOL	0	I/O
QBAD	1=Bad Process Value	BOOL	0	I/O
QSIM	1 = Simulation Active	BOOL	0	O
QSUBS	1 = Failure Substitution Active	BOOL	0	O
QUALITY	Quality Code of Process Value	BYTE	0	O
SIM_I	Simulation Value	BOOL	0	I/O
SIM_ON	1 = Activate Simulation	BOOL	0	I/O
SUBS_I	Substitution Value	BOOL	0	I/O
SUBS_ON	1 = Enable Failure Substitution	BOOL	0	I/O
VALUE	Input Value	BOOL	0	I/O
VALUE_QC	Process Image Quality Bit	BOOL	0	I/O

2.15 CH_DO: Digital value output

Object name (Type + Number)

FC 278

Area of Application

The block is used for signal processing of a digital output value from S7-300/400 SM digital output modules.

Calling OBs

The calling OB is the watchdog interrupt OB3x into which the block is installed (for example OB 32) and the restart OB100.

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The MODE input is interconnected to the corresponding output OMODE_xx of the MOD block.
- The CH_DO block is installed after the MOD block assigned to it in the OB100.

Note

If you do not use the CFC function "Generate Module Driver", you have to ensure that the CH_DO block is installed after the MOD-/PADP block assigned to it in the OB100.

Function and Operating principle

The block processes all the channel-specific signal functions.

The block writes a digital value into a (part) process image. If the high byte of the MODE input parameter = 0 (value status), the digital value continues to be written into the (part) process image - however, a quality code "invalid value" is set.

The quality code can have the following states:

State	Quality code
Valid value	16#80
Simulation	16#60
Invalid value	16#00

Addressing

The symbol generated by HW Config in the symbol table for the digital output channel has to be interconnected to the VALUE output.

Normal value

The digital value I0 is written to the (part) process image and Quality Code (QUALITY) = 16#80 is set.

Simulation

If the input parameter SIM_ON = TRUE, the value of the input SIM_I (PA_ON = FALSE) or SIM_SP (PA_ON = TRUE) is written to the (part) process image and the Quality Code QUALITY = 16#60 is set. Simulation has the highest priority. If there is a higher-level error, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set.

I/O fault

If the high byte of the input MODE = 0 (value status), the quality code QUALITY = 16#00 is set. The current digital value is always written into the (part) process image.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

The MOD blocks set the LSB in Byte 2 of their outputs OMODE_xx in the OB100. If the block recognizes this code, it acknowledges it and then reacts as follows:

If START_ON is not set, the Process Value I is written to the process image. Otherwise START_I is used instead of the Process Value I.

Time response

Does not exist.

Message characteristics

The block does not have message characteristics.

Operator control and monitoring

The block does not have a faceplate (display block).

2.15.1 Connections of CH_DO

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
I	Process value	BOOL	**0**	I/O
MODE	Quality and Mode	DWORD	0	I/O
QBAD	1=Bad Output Value	BOOL	0	O
QSIM	1=Simulation Active	BOOL	0	O
QUALITY	Quality Code of Output Value	BYTE	0	O
SIM_I	Simulation Value	BOOL	0	I/O
SIM_ON	1=Activate Simulation	BOOL	0	I/O
START_I	Startup Substitution Value	BOOL	0	I/O
START_ON	1=Enable Startup Substitution Value	BOOL	0	I/O
VALUE	Process Image Output Value	BOOL	0	O

2.16 CH_U_AI: Analog value input (Universal)

Object name (Type + Number)

FC 283

Area of application

The block is used for signal processing of a analog input value from S7-300/400 SM analog input modules or a PA field device (PA-Profile 3.0 Analog Input).

Calling OBs

The calling OB is the watchdog interrupt OB3x into which the block is installed (for example OB 32)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The input PA_ON is configured in accordance with the I/O devices used (S7 signal modules (=0) or PA field devices (=1)).
- The symbol for the Quality Code of the analog input channel is interconnected to the input QC (at PA devices).
- The MODE input is interconnected to the corresponding output OMODE_xx of the MOD block (or of the PADP block).

Function and Operating principle

The block processes all the channel-specific signal functions and/or signals of a PA field device of data type REAL with or without Quality Code cyclically.

The block uses the switch position (input PA_ON) to differentiate between a analog non-linearized value and a REAL value of a field device with Quality Code(see Adressing).

PA_ON = TRUE

As the REAL value of a PA field device is always defined with a status byte (STATUS), PQC = TRUE has to be set.

The statusbyte contains information about the measured value and the status of the PROFIBUS PA field device. The quality code QUALITY for the process value is determined from the status of the input MODE and the output STATUS.

PA MODE recognizes a higher level error e.g. DP/PA Link failure via the input MODE If the high byte of the input MODE = 16#40 (value status = higher-level

error), the analog value will be handled as invalid. The Quality Code (QUALITY) is set to 16#44 or 16#48. The same is true for a STATUS with status "BAD". Otherwise STATUS and QUALITZ are identical.

PA_ON = FALSE

The block reads an analog non-linearized value from a (part) process image and adjusts ist physical size accordingly or evaluates a process value. The MODE input determines in which form the non-linearized value appears and to be processed. If the high byte of the MODE input = 16#40 (value status = higher-level error), the non-linearized value is set as invalid.

The quality code can have the following states:

State	Quality code
Valid value	16#80
Simulation	16#60
Last valid value	16#44
Substitute value	16#48
Invalid value	16#00

Addressing

The symbol generated by HW Config in the symbol table for the analog input channel has to be interconnected to the VALUE input or (with PA_ON = TRUE) OUT (process value) and QC (Quality Code). The CFC function “Generate Module Driver” interconnects the symbol for Quality Code automatically with the QC input.

Non-linearized value check

Only if PA_ON = FALSE: Depending on the measured value and the measuring range a nominal range of the analog input module is obtained by converting the analog signal into a digital value (non-linearized value). In addition there is an over- and underrange in which the analog signal can still be converted. There is an overflow or underflow outside these limits. The block indicates whether the non-linearized value lies inside the nominal range of the module.
If the value drops below the nominal range, the output parameter value QCHF_LL = TRUE is set. If the value exceeds the nominal range, the output parameter value QCHF_HL = TRUE is set.
In case of an overflow or underflow QBAD = TRUE (channel error) is also set.

Note

In case of a wire breakage at 4 to 20 mA signals the module response is not uniform. Depending on the module either 16#7FFF (overflow) or 16#8000 (underflow) is written as the non-linearized value into the process image. The channel block CH_U_AI then correspondingly emits either an overflow (QCHF_HL = TRUE) or an underflow (QCHF_LL = TRUE), each together with QBAD = TRUE. Exception: If you have set "Diagnostic interrupt" of the analog input module with HW Config, only QBAD = TRUE is set at a "Channel error" (for example wire break) at a diagnostic interrupt.

NAMUR limit check

Only if PA_ON = FALSE: The NAMUR guidelines for analog signal processing define limits for life zero (4 to 20 mA) analog signals which have a channel error:

3.6 mA = Analog signal = 21 mA

The above NAMUR limits are set as fixed defaults for limit monitoring. If you want to set other limits, you have to set the inputsCH_F_ON = TRUE and set corresponding new limits in mA at the input parameters CH_F_HL and CH_F_LL. If the lower or upper active limit is exceeded, QBAD = TRUE is set at a life zero analog signal.

Note

The selectable limits must lie below the upper limit of the overrange or above the lower limit of the underrange of the module. Values outside the NAMUR range are also possible in as far as the module does not limit the measured values automatically to these.

Normal value

Only if PA_ON = FALSE: The non-linearized value is adjusted according to ist physical size by the inputs VLRANGE, VHRANGE and MODE (see also OMODE_xx). The interconnectability of the settings of VLRANGE and VHRANGE with other block connections are determined by the outputs OVLRANGE and OVHRANGE. The conversion algorithm depends on a linearized input signal. If VLRANGE = 0 and VHRANGE = 100 you get a percentage value. If VHRANGE = VLRANGE is set, you get the the input signal of the analog input module (e.g. mA) according to the MODE setting. If the non-linearized value is already a physical value, please set VLRANGE = 0 and VHRANGE = 1. The Quality Code is set to QUALITY = 16#80.

Note

In the measuring mode "Thermocouples external or internal comparison", the physiacl size is adjusted to +/- 80 mV in the modules of S7 300. You have to determine the temperature with reference to the conversion tables concerned.

The physical equivalence in mV is delivered by the module as non-linearized value, please set VHRANGE and VLRANGE +/- 80 mV here.

Simulation

With the input parameter SIM_ON = TRUE, the value of the input SIM_V is given with Quality Code QUALITY = 16#60. In simulation operation too, a valid operating mode has to be set in Low Word of the input MODE. Otherwise QBAD = 1 is output. If there is a higher-level error, QBAD = FALSE is set. Simulation has highest priority. If the block is in the simulation status, QSIM = TRUE is set.

Substitute value

With the input parameter SUBS_ON = TRUE, the value of the input SUBS_V is output as value, as long as the non-linearized value is invalid. The Quality Code is set as QUALITY = 16#48 and QBAD = 1.

Hold last value

With input parameter SUBS_ON = FALSE, the last valid output value (V_LAST) is output, if the non-linearized value is invalid. For V_DELTA > 0, the following applies:

ABS (V - V_LAST) > V_DELTA: V = V_LAST1
(second last valid output value)

ABS (V - V_LAST) ≤ V_DELTA: V = V_LAST
(last valid output value)

The Quality Code is set as QUALITY = 16#44 and QBAD = 1.

Accept value delay

Only if PA_ON = FALSE: After restart or if the Quality Code is changed from "BAD" to "GOOD", the Quality Code and value are not updated until the CNT_LIM cycles have passed. If CNT_LIM = 0 (Default setting), this function is switched off. During the accept value delay, the Quality Code = 16#00 and QBAD = 1. The last value remains during the accept value delay.

Value limiting

If PA_ON = TRUE, you can limit very low or very high process values from the (part) process image.

If the switch LIMIT_ON = TRUE, the process values (V) are limited:

- To V_HL, if V > V_HL.
- To LL_V, if V < V_LL.

Error handling

No plausibility checks are carried out with reference to the input parameters. In case of invalid operating mode in the low word of the MODE input it is assumed that the non-linearized value is invalid.

Start-up characteristics

Does not exist.

Time response

Does not exist.

Message characteristics

The block does not have message characteristics.

Operator control and monitoring

The block does not have a faceplate (display block).

2.16.1 Connections of CH_U_AI

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
CH_F_HL	Overrange of the Input Value (mA)	REAL	0	I/O
CH_F_LL	Underrange of the Input Value (mA)	REAL	0	I/O
CH_F_ON	1 = Activate Limit-value Monitoring	BOOL	0	I/O
CNT_LIM	Counter limit	INT	0	I/O
CNT_RES	Counter	INT	0	I/O
PA_ON	1 = Use PA field device in process image	BOOL	0	I/O
LAST_BAD	Last invalid process value	BOOL	0	I/O

Connection (parameter)	Meaning	Data type	Initial	I/O
LIMIT_ON	1 = Limit value control PA field device process value	BOOL	0	I/O
LL_V	Process value, if V < V_LL	REAL	0	I/O
MODE	Value status and operating mode	DWORD	0	I/O
OUT	Input value process image	REAL	0	I/O
OVHRANGE	High limit of the process value (copy)	REAL	0	O
OVLRANGE	Low limit of the process value (copy)	REAL	0	O
PQC	1 = Use value status in process image	BOOL	0	I/O
QBAD	1 = Process value invalid	BOOL	0	O
QC	Value status of the input process value	BYTE	0	I/O
QCHF_HL	1=Input value high limit failure	BOOL	0	O
QCHF_LL	1=Input value low limit failure	BOOL	0	O
QSIM	1 = Simulation activ	BOOL	0	O
QSUBS	1 = Substitute value switching-in active	BOOL	0	O
QUALITY	Value status of the process value	BYTE	0	O
SIM_ON	1 = Activate simulation	BOOL	0	I/O
SIM_V	Simulation value	REAL	0	I/O
STATUS	Status process value	BYTE	0	O
SUBS_ON	1 = Enable substitute value switching-in	BOOL	0	I/O
SUBS_V	Substitute value	REAL	0	I/O
V	Process value	REAL	0	O
VALUE	Input value	WORD	0	I/O
VHRANGE	Upper limit of the process value	REAL	100	I/O
VLRANGE	Lower limit of the process value	REAL	0	I/O
V_DELTA	Difference (V - V_LAST) Process value	REAL	0	I/O
V_HL	Upper limit value	REAL	0	I/O
V_LAST	Last valid process value	REAL	0	I/O
V_LAST1	Second-last valid process value	REAL	0	I/O
V_LL	Lower limit value	REAL	0	I/O

2.17 CH_U_AO: Analog value output (Universal)

Object name (Type + Number)

FC 284

Area of application

The block is used for signal processing of a analog input value from S7-300/400 SM analog output modules or a PA field device (PA-Profile 3.0 Analog Output only output of REAL value (e.g. SP) with Quality Code).

Calling OBs

The calling OB is the watchdog interrupt OB3x into which the block is installed (for example OB 32)and the restart OB100

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The input PA_ON is configured in accordance with the I/O devices used (S7 signal modules (=0) or PA field devices (=1)).
- The symbol for the Quality Code of the analog output channel is interconnected to the input QC_SP (at PA devices).
- The MODE input is interconnected to the corresponding output OMODE_xx of the MOD block (or of the PADP block).
- The CH_U_AO block is installed after the MOD/PADP block which is assigned to it in the OB100.

Note

If you do not use the CFC function "Generate Module Driver", you have to ensure that the CH_U_AO block is installed after the MOD-/PADP block assigned to it in the OB100.

Function and Operating principle

The block processes all the channel-specific signal functions or the REAL value with Quality Code cyclically.

The CH_U_AO block uses the switch position (input PA_ON) to differentiate between an analog non-linearized value and a REAL value with Quality Code of a PA field device (see Addressing).

- PA_ON = TRUE

The REAL value (SP) with Quality Code (ST_SP) of a PA field device is written in the (part) process image.

- PA_ON = FALSE

The block writes the process value as analog non-linearized value in a (part) process image. The MODE input determines in which form the non-linearized value is to be created. If the high byte of the MODE input = 0 (value status), the non-linearized value continues to be written into the (part) process image - however, a quality code "invalid value" is set.

The quality code can have the following states:

State	Quality Code
Valid value	16#80
Upper value limited	16#56
Lower value limited	16#55
Simulation	16#60
Invalid value	16#00

Addressing

The symbol generated by HW Config in the symbol table for the analog output channel has to be interconnected to the VALUE output .

At PA field devices (PA_ON = TRUE), the symbol for the REAL value with O_SP output is interconnected with the symbol of the Quality Code with the QC_SP output . The CFC function “Generate Module Driver” interconnects the symbol for Quality Code automatically with the QC_SP output.

Normal value

Only if PA_ON = FALSE: The parameters ULRANGE and UHRANGE map the process value U onto the non-linearized value VALUE (quantification stages) of the analog output module depending on the MODE. For example in the mode 4..20mA (16#0203) the non-linearized value for 4mA is output for U = ULRANGE and the non-linearized value for 20mA is output for U = UHRANGE.

PHYS_LIM is used to set the limitation of the VALUE non-linearized value. In the default setting (PHYS_LIM = 0) the VALUE output value is limited to the normalizing limits of the module. In accordance with the above example the block calculates the non-linearized value for 20 mA for U > UHRANGE and the non-

linearized value for 4mA for U < ULRANGE Accordingly the quality codes 16#56 (upper value limited) and 16#55 (lower value limited) are applied at the QUALITY output instead of the 16#80 (valid value).

In order to output analog values outside the normalization values up to the physical limits of the module, you have to set PHYS_LIM = 1. The output values are not limited until, in the above example, the module limits are exceeded by specifying U = 200 (36mA) or U = -50 (-4mA) at ULRANGE = 0 and UHRANGE = 100. The output values are then limited to the physical limits specified in the data sheets of the modules and the corresponding quality codes are output.

The outputs QCHF_HL and QCHF_LL also provide information on whether the output values have been limited.

Simulation

If the input parameter SIM_ON = TRUE, the value of SIM_U is output with Quality Code (QUALITY) = 16#60. A valid mode must also be set in simulation mode in the low word of the input MODE. Otherwise QBAD = 1 is output. Simulation has the highest priority. If there is a higher-level fault, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set.

I/O fault

If the high byte of the input MODE = 0 (value status), the quality code QUALITY = 16#00 is set. The current non-linearized value is always written into the (part) process image.

Value limiting

(PA_ON = TRUE) you can limit very low or very high process values which lead to an error (QBAD = TRUE) before entry in the (part) process image.

If the switch LIMIT_ON = TRUE, the process values (V) are limited:

- To V_HL, if V > V_HL.
- To LL_V, if V < V_LL.

Error handling

No plausibility checks are carried out with reference to the input parameters. In case of an invalid operating mode in the low word of the MODE input the digitized output value is set to 0 and QUALITY = 16#00 is output.

Start-up characteristics

The MOD blocks set the LSB in Byte 2 of their outputs OMODE_xx in the OB100. If the block recognizes this code, it acknowledges it and then reacts as follows:

If START_ON is not set, the process value U is processed and is transferred to the process image. Otherwise the non-linearized value corresponding to the START_U process value is written to the process image.

At PA field devices (PA_ON = TRUE), the current REAL value with Quality Code is written to the process image.

Time response

Does not exist.

Message characteristics

The block does not have message characteristics.

Operator control and monitoring

The block does not have a faceplate.

2.17.1 Connections of CH_U_AO

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
LIMIT_ON	1 = Limit value control process value	BOOL	0	I/O
LL_V	Process value, if U < V_LL	REAL	0	I/O
MODE	Value status and operating mode	DWORD	0	I/O
PA_ON	1 = PA field device, 0 = Signal module	BOOL	0	I/O
O_SP	Process image Setpoint	REAL	0	O
PHYS_LIM	1 = Enable physical module limit values	BOOL	0	I/O
QBAD	1 = Invalid output value	BOOL	0	O
QCHF_HL	1 = Overdriven process value	BOOL	0	O
QCHF_LL	1 = Underdriven process value	BOOL	0	O
QC_SP	Process image Quality Code Setpoint	BYTE	0	O
QSIM	1 = Simulation active	BOOL	0	O
QUALITY	Value status of the output value	BYTE	0	O
SIM_ON	1 = Activate simulation	BOOL	0	I/O
SIM_U	Simulation value	REAL	0	I/O
START_ON	1 = Substitute value switching-in at start-up	BOOL	0	I/O
START_U	Substitute value at start-up	REAL	0	I/O

Connection (parameter)	Meaning	Data type	Initial	I/O
ST_SP	Status Setpoint	BYTE	0	I/O
U	Process value	REAL	0	I/O
UHRANGE	Upper limit of the process value	REAL	100	I/O
ULRANGE	Lower limit of the process value	REAL	0	I/O
VALUE	Output value	WORD	0	O
V_HL	Upper limit value	REAL	0	I/O
V_LL	Lower limit value	REAL	0	I/O

2.18 CH_U_DI: Digital value input (Universal)

Object name (Type + Number)

FC 285

Area of application

The block is used for signal processing of a digital input value from S7-300/400 SM digital input modules or a PA field device (PA-Profile 3.0 Discrete Input).

Calling OBs

The calling OB is the watchdog interrupt OB3x into which the block is installed (for example OB 32).

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The input PA_ON is configured in accordance with the I/O devices used (S7 signal modules (=0) or PA field devices (=1)).
- The symbol for the Quality Code of the analog output channel is interconnected to the input QC (at PA devices).
- The MODE input is interconnected to the corresponding output OMODE_xx of the MOD block (or of the PADP block).

Function and Operating principle

The block processes all the channel-specific signal functions or a process value with Quality Code of a PA field device cyclically.

The block uses the switch position (input PA_ON) to differentiate between a digital value with or without Quality Code of the data type BOOL or a digital value with Quality Code of the data type BYTE of a PA field device (see Addressing).

- PA_ON = TRUE

The block cyclically reads in the (part) process image the process value (OUT_D) with status byte (STATUS, see Adressing) of the PROFIBUS PA field device (structure an accordance with the Discrete Input of the PA profiles). The status byte contains information on the measured value and the state of the PROFIBUS PA field device.The process value is displayed in the Q output as below:

Q = FALSE, if process value = 0

Q = TRUE, if process value <> 0 If the high byte of the MODE input parameter = 16#40 (value status = higher-level error), the process value and Quality Code are treated as in PA_ON = FALSE.

The quality code QUALITY for the process value is determined from the status of the input MODE and the output STATUS. PA MODE recognizes a higher level error e.g. DP/PA Link failure via the input MODE If the high byte of the input MODE = 16#80, the values in the (part) process image are valid. If the high byte of the input MODE = 16#40 (value status = higher-level error), the digital value will be handled as invalid. The Quality Code (QUALITY) is set to 16#44 or 16#48. The same is true for a STATUS with status "BAD". Otherwise STATUS and QUALITY are identical.

- PA_ON = FALSE

The block reads a digital value of the data type BOOL from the (part) process image. If the high byte of the MODE input parameter = 16#40 (value status = higher-level error), the digital value is treated as invalid. If the input parameter PQC = TRUE, the value status of the digital value is read in the (part) process image.

The quality code can have the following states:

State	**Quality Code**
Valid value	16#80
Simulation	16#60
Last valid value	16#44
Substitute value	16#48
Invalid value	16#00

Addressing

The symbol generated with HW Config (symbol table) for the digital input channel has to be interconnected to the VALUE input. If the value status of the digital input channel is also in the (part) process image, you have to interconnect the corresponding symbol with the input VALUE_QC and set the input PQC = TRUE.

In the case of PA field devices (PA_ON = TRUE), the symbol generated with HW Config (symbol table) for the digital input channel has to be interconnected to the I_OUT_D input. The CFC function "Generate Module Driver" interconnects the symbol for the Quality Code of the digital input channel automatically to the input QC.

Normal value

The digital value of the (part) process image is output to the output Q with Quality Code QUALITY = 16#80.

Simulation

If the input parameter SIM_ON = TRUE, the value of the input SIM_I (PA_ON = FALSE) or SIM_OUT (PA_ON = TRUE) is output to the output Q with Quality Code QUALITY = 16#60. Simulation has the highest priority. If there is a higher-level fault, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set.

Substitution value

If the input parameter SUBS_ON = TRUE, the value of the input SUBS_I is output to the output Q with Quality Code QUALITY = 16#48 and QBAD = 1, in as far as the digital value of the (part) process image is invalid.

Hold last value

If the input parameter SUBS_ON = FALSE, the last valid output value is output if the non-linearized value is invalid. The Quality Code is set to QUALITY = 16#44 and QBAD = 1.

- Last valid output value corresponds to Q_LAST.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

Do not exist.

Time response

Does not exist.

Message characteristics

The block does not have message characteristics.

Operator control and monitoring

The block does not have a faceplate (display block).

2.18.1 Connections of CH_U_DI

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
I_OUT_D	Input value of the process image	BYTE	0	I/O
MODE	Value status and operating mode	DWORD	0	I/O
OUT_D	Process value	BYTE	0	O
PA_ON	1 = PA field device	BOOL	0	I/O
PQC	1 = Use value status in the process image	BOOL	0	I/O
Q	Process value	BOOL	0	O
Q_LAST	Last valid process value	BOOL	0	I/O
QBAD	1 = Invalid process value	BOOL	0	I/O
QC	Value status in the process image (Symbol)	BYTE	0	I/O
QSIM	1 = Simulation active	BOOL	0	O
QSUBS	1 = Substitute value switching-in active	BOOL	0	O
QUALITY	Value status of the process value	BYTE	0	O
SIM_I	Simulation value	BOOL	0	I/O
SIM_ON	1 = Activate simulation	BOOL	0	I/O
SIM_OUT	Simulation Value	BYTE	0	I/O
STATUS	Status process value	BYTE	0	O
SUBS_I	Substitute value	BOOL	0	I/O
SUBS_ON	1 = Enable substitute value switching-in	BOOL	0	I/O
SUBS_OUT	Substitution Value	BYTE	0	I/O
V_LAST	Last valid process value	BYTE	0	I/O
VALUE	Input value	BOOL	0	I/O
VALUE_QC	Value status in the process image	BOOL	0	I/O

2.19 CH_U_DO Digital value output (Universal)

Object name (Type + Number)

FC 286

Area of application

The block is used for signal processing of a digital output value from S7-300/400 SM digital output modules or a PA field device (PA-Profile 3.0 Discrete Input only SP or RCAS_IN).

Calling OBs

The calling OB is the watchdog interrupt OB3x into which the block is installed (for example OB 32) and the restart OB100.

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The input PA_ON is configured in accordance with the I/O devices used (S7 signal modules (=0) or PA field devices (=1)).
- The symbol for the Quality Code of the analog output channel is interconnected to the input QC (at PA devices).
- The MODE input is interconnected to the corresponding output OMODE_xx of the MOD block (or of the PADP block).
- The CH_U_DO block is installed after the MOD/PADP block assigned to it in the OB100.

Note

If you do not use the CFC function "Generate Module Driver", you have to ensure that the CH_U_DO block is installed after the MOD-/PADP block assigned to it in the OB100.

Function and Operating principle

The block processes all the channel-specific signal functions or a process value with Quality Code of a PA field device cyclically.

The block uses the switch position (input PA_ON) to differentiate between a digital output value without Quality Code of the data type BOOL and a digital output value with Quality Code of the data type BYTE of a PA field device (see Addressing).

- PA_ON = TRUE

The block writes the process value with Quality Code (structure of the process value corresponds to the Digital Output of the PA Profile, 1 Byte (SP) with 1 Byte (ST_SP) Quality Code) in a (part) process image. The Quality Code contains information on the state of the process value. The coding of the Quality Code is described in the PROFIBUS PA 3.0 "General Requirements".

If the high byte of the MODE input = 16#40 (value status = higher-level error), the process value with Quality Code continues to be written into the (part) process image - however, a quality code "invalid value" is set at the block output QUALITY.

- PA_ON = FALSE

The block writes a digital value in a (part) process image. If the high byte of the MODE input = 0 (value status), the digital value continues to be written into the (part) process image - however, a quality code "invalid value" is set.

The quality code can have the following states:

State	Quality Code
Valid value	16#80
Simulation	16#60
Invalid value	16#00

Addressing

The symbol generated with HW Config (symbol table) for the digital output channel has to be interconnected to the VALUE input.

In the case of PA field devices (PA_ON = TRUE), the symbol generated with HW Config (symbol table) for the process value with Quality Code has to be interconnected to the output variable O_SP. The CFC function "Generate Module Driver" interconnects the symbol for the Quality Code of the analog output channel automatically to the output QC_SP.

Normal value

The digital value is written to the (part) process image and Quality Code (QUALITY) = 16#80 is set.

Simulation

If the input parameter SIM_ON = TRUE, the value of the input SIM_I (PA_ON = FALSE) or SIM_OUT (PA_ON = TRUE) is written to the (part) process image and the Quality Code QUALITY = 16#60 is set. Simulation has the highest priority. If there is a higher-level fault, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set.

I/O fault

If the high byte of the input parameter MODE = 0 (value status), the quality code QUALITY = 16#00 is set. The current non-linearized value is always written into the (part) process image.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

The MOD blocks set the LSB in Byte 2 of their outputs OMODE_xx in the OB100. If the block recognizes this code, it acknowledges it and then reacts as follows:

If START_ON is not set, the process value U is processed and is transferred to the process image. Otherwise the non-linearized value corresponding to the START_U process value is written to the process image.

At PA field devices (PA_ON = TRUE), the current BYTE value with Quality Code is entered in the process image.

Time response

Does not exist.

Message characteristics

The block does not have message characteristics.

Operator control and monitoring

The block does not have a faceplate (display block).

2.19.1 Connections of CH_U_DO

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
I	Process value	BOOL	**0**	I/O
MODE	Value status and operating mode	DWORD	0	I/O
O_SP	Process Image Setpoint	BYTE	0	O
PA_ON	1 = PA field device	BOOL	0	I/O
QBAD	1 = Invalid output value	BOOL	0	O
QC_SP	Process Image Quality Code Setpoint	BYTE	0	O
QSIM	1 = Simulation active	BOOL	0	O
QUALITY	Value status of the output value	BYTE	0	O
SIM_I	Simulation value	BOOL	0	I/O
SIM_ON	1 = Activate simulation	BOOL	0	I/O
SIM_SP	Simulation Setpoint	BYTE	0	I/O
SP	Setpoint	BYTE	0	I/O
ST_SP	Status Setpoint	BYTE	0	I/O
START_I	Substitute value at start-up	BOOL	0	I/O
START_ON	1 = Substitute vale switching-in at start-up	BOOL	0	I/O
VALUE	Output value	BOOL	0	O

3 PROFIBUS PA blocks

3.1 PA_AI: Analog value input PROFIBUS PA

3.1.1 PA_AI: Analog Input PROFIBUS PA

Object name (Type + Number)

FB 101

Area of Application

The block processes (cyclic operation) the PA Profile "Transmitter" of a PA field device in accordance with PROFIBUS PA 3.0 Class A and B or a main or secondary variable of a HART analog input module.

Calling OBs

The calling OB is the watchdog interrupt OB3x, in which you install the block (for example OB32) and OB1.

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The installation of block in OB1.
- The symbol for the Quality Code of the analog input channel is interconnected to the input QC.
- The MODE input is interconnected to the corresponding output OMODE_xx of the PADP_L0x block.

Function and Operating principle

The block cyclically reads the process value with status byte (STATUS) of the PROFIBUS PA field device (structure in accordance with the Analog Input of the PA profiles) from the (part) process image. The process value exists as a physical value. The status byte contains information on the measured value and the state of the PROFIBUS PA field device.

In order to improve the interconnectability further important detailed information in addition to the status byte as Boolean (BOOL) values is supplied at the output interface. They correspond to the bit combinations specified in the PROFIBUS PA 3.0 "General Requirements". Device-specific control system messages are generated via ALARM_8P on the basis of the status of the status byte.

The quality code (QUALITY) is determined by the status of the input MODE and the output STATUS and used as a process value.

The block recognizes a higher-level error (for example failure of DP/PA-Link) via the MODE input . If the High Byte of the input MODE = 16#80, the values in the (part) process image are valid. If the high byte of the MODE input = 16#40 (value status = higher-level error), the analog value is handled as invalid. The Quality Code (QUALITY) is set to 16#44 or 16#48. The same is also true for a STATUS with "BAD" status. Otherwise STATUS and QUALITY are identical.

In case of a higher-level error no messages are generated.

The operating mode in the Low Word of the MODE input is not taken into consideration.

Addressing

The symbol generated with HW Config in the symbol table for the analog input channel has to be interconnected to the VALUE input. The symbol for the Quality Code of the analog input channel interconnects the CFC function "Generate Module Driver" with the input parameter QC for you.

Simulation

If the input parameter SIM_ON = TRUE, the value of the input parameter SIM_V is output with Quality Code (QUALITY =) 16#60. Simulation has the highest priority. If there is a higher-level error, QBAD = FALSE is set. If the block is in the simulation state, QSIM = TRUE is set. If there is no higher-level error and the PA field device displays a Quality Code “BAD”, either the substitute value SUBS_V (SUBS_ON= TRUE) or the last value is output.

Substitution value

If the input parameter SUBS_ON = TRUE, the value of the input SUBS_V is output as the value, in as far as the values are invalid. The Quality Code is set to (QUALITY =) 16#48 and QBAD = 1.

Hold last value

If the input parameter SUBS_ON = FALSE, the last valid output parameter is output if the values are invalid. The Quality Code is set to (QUALITY =) 16#44 and QBAD = 1.

Value limiting

You can limit very low or very high process values from the (part) process image.

If the switch LIMIT_ON = TRUE, the process values (V) are limited:

- To V_HL, if V > V_HL.
- To LL_V, if V < V_LL.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

Input MODE = 16#xx01xxxx: Initializing ALARM_8P.

Time response

Does not exist.

Message characteristics

As long as there is no higher-level error, the block signals the current state of the Quality Code (status byte) when there is a change. The messages are event messages which do not have to be acknowledged and are only stored in the chronic list of the OS. If the QBAD and QUNCERT outputs are interconnected to the CSF input (external error) of the technological block, this block generates a control system message if a malfunction arises.

The DELAY input (default setting 2 seconds) is used to delay an event message when there is a change in the Quality Code. With DELAY you can specify the period in seconds which the block waits when there is a change in the Quality Code after a higher-level error (DP Master system failure, DP/PA-Link failure, device failure or I/O access error), (MODE = 16#40xxxxxx) has gone, until it emits the message. Messaging can be de-activated by using EN_MSG = FALSE.

Operator control and monitoring

Does not exist.

3.1.2 Connections of PA_AI

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
DELAY	Alarm Delay (s)	INT	2	I
EN_MSG	1=Enable Alarm	BOOL	1	I
EV_ID	Event ID	DWORD	0	I
LIMIT_ON	1=Limit on Input Value	BOOL	0	I
LL_V	High Limit Input Value. Set Value if V < V_LL	REAL	0	I
MSG_STAT	Message Failure of Alarm_8P	WORD	0	O
MODE	Value status and operating mode	DWORD	0	O
QA_1	1 = Alarm/Warning 1	BOOL	0	O
QA_2	1 = Alarm/Warning 2	BOOL	0	O
QBAD	1 = Collected event QBAD_X	BOOL	0	O
QBAD_0	1 = Non-specific	BOOL	0	O
QBAD_1	1 = Configuration error	BOOL	0	O
QBAD_2	1 = Not connected	BOOL	0	O
QBAD_3	1 = Device failure	BOOL	0	O
QBAD_4	1 = Sensor failure	BOOL	0	O
QBAD_5	1 = No communication (last usable value)	BOOL	0	O
QBAD_6	1 = No communication (no usable value)	BOOL	0	O
QBAD_7	1 = Out of service	BOOL	0	O
QBAD_HL	1 = High limit upper physical range of sensor has been reached	BOOL	0	O
QBAD_LL	1 = Low limit lower physical range of sensor has been reached	BOOL	0	O
QC	Process Image Input Value Quality Code	BYTE	0	I
QCASCAD0	1 = OK (cascade)	BOOL	0	O
QCASCAD1	1 = Initialization acknowledged	BOOL	0	O
QCASCAD2	1 = Initialization request	BOOL	0	O
QCASCAD3	1 = Not requested	BOOL	0	O
QCASCAD4	1 = Reserved	BOOL	0	O
QCASCAD5	1 = Do not select	BOOL	0	O
QCASCAD6	1 = Local override	BOOL	0	O
QCASCAD7	1 = Reserved	BOOL	0	O
QCASCAD8	1 = Initiate fail safe	BOOL	0	O
QCONST	1 = Constant	BOOL	0	O
QERR	1 = Error output (inverted value of ENO)	BOOL	1	O
QOUT_HHL	1 = Active critical alarm, high limit of OUT has been exceeded	BOOL	0	O
QOUT_HL	1 = Active advisory alarm, high limit of OUT has been exceeded	BOOL	0	O
QOUT_LL	1 = Active advisory alarm, low limit of OUT has been exceeded	BOOL	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
QOUT_LLL	1 = Active critical alarm, low limit of OUT has been exceeded	BOOL	0	O
QNONCAS0	1 = OK (non-cascade)	BOOL	0	O
QNONCAS1	1 = Update event	BOOL	0	O
QNONCAS2	1 = Active advisory alarm (priority <8)	BOOL	0	O
QNONCAS3	1 = Active critical alarm (priority >8)	BOOL	0	O
QNONCAS4	1 = Unacknowledged update event	BOOL	0	O
QNONCAS1	1 = Active block alarm	BOOL	0	O
QNONCAS2	1 = Active advisory alarm (priority <8)	BOOL	0	O
QNONCAS3	1 = Active critical alarm (priority >8)	BOOL	0	O
QNONCAS4	1 = Unacknowledged block alarm	BOOL	0	O
QNONCAS5	1 = Unacknowledged advisory alarm	BOOL	0	O
QNONCAS6	1 = Unacknowledged critical alarm	BOOL	0	O
QNONCAS7	1 = Initial fail safe	BOOL	0	O
QNONCAS8	1 = Maintenance required	BOOL	0	O
QSIM	1 = Simulation Active	BOOL	0	O
QSUBS	1 = Failure Substitution Active	BOOL	0	O
QUALITY	Value status of the process value	BYTE	0	O
QUNCERT	1 = Collected event QUNCERTx	BOOL	0	O
QUNCERT0	1 = Non-specific	BOOL	0	O
QUNCERT1	1 = Last usable value	BOOL	0	O
QUNCERT2	1 = Substitute set	BOOL	0	O
QUNCERT3	1 = Initial value	BOOL	0	O
QUNCERT4	1 = Sensor conversion not accurate	BOOL	0	O
QUNCERT5	1 = Engineering unit violation (unit not in the valid set)	BOOL	0	O
QUNCERT6	1 = Sub-normal	BOOL	0	O
QUNCERT7	1 = Configuration error	BOOL	0	O
QUNCERT8	1 = Sensor calibration	BOOL	0	O
QUNCERT9	1 = Simulated value	BOOL	0	O
SIM_ON	1 = Activate Simulation	BOOL	0	I
SIM_V	Simulation Value	REAL	0	I
STATUS	Process value status	BYTE	0	O
SUBS_ON	1 = Enable Failure Substitution	BOOL	0	I
SUBS_V	Substitution Value	REAL	0	I
V	Process value	REAL	0	O
VALUE	Process Image Input Value	REAL	0	I
V_HL	High Limit Input Value	REAL	0	I
V_LL	Low Limit Input Value	REAL	0	I

3.1.3 Message texts and auxiliary process values of PA_AI

Assignment of message texts and classes to the block parameters of PA_AI

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID	1	QBAD	Device error	S
	2	QUNCERT	Uncertain value	S
	3	QNONCAS1	Update event	S
	4	QNONCAS7	Initiate fail safe	S
	5	QNONCAS8	Maintenance required	M
	6	QOUT_LLL	Lower alarm	AL
	7	QOUT_HHL	Upper alarm	AH
	8			No message

The block has no auxiliary process values. If QBAD = TRUE because of a higher-level error, no message is created.

3.2 PA_AO: Analog value output PROFIBUS PA

3.2.1 PA_AO: Analog Output PROFIBUS PA

Object name (Type + Number)

FB 103

Area of Application

The block processes (cyclic operation) the PA Profile "Actuator" of a PA field device in accordance with PROFIBUS PA 3.0 Class A and B.

Calling OBs

The calling OB is the watchdog interrupt OB3x, in which you install the block (for example OB32) and OB1 and the restart OB100.

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The installation of block in OB1 and in OB100.
- The symbol for the Quality Code of the analog output channel O_SP is interconnected to the output QC_SP and other selected options.
- The MODE input is interconnected to the corresponding output OMODE_xx of the PADP_L0x block.

Function and Operating principle

The block reads the user data from the (part) process image and writes them into the (part) process image depending on the selection (with HW Config or SIMATIC PDM) of the user data configuration of the PA-Profile "Analog Output" in accordance with PROFIBUS PA 3.0.

The coding of the set user data configuration of the PROFIBUS PA 3.0 Profile "Analog Output" is contained in the Low Word of the input variable MODE. This specifies which variables are to be read and written in the (part) process image.

The block cyclically writes the setpoint (SP) with Quality Code (configuration of the setpoints and process values in accordance with the Analog Output of the PA profiles, REAL with 1 byte Quality Code) into the (part) process image. The PA-Profile contains the setpoint and other analog values as a physical unit. The Quality Code contains the information on the state of the setpoint. The coding of the Quality Code is described in the PROFIBUS PA 3.0 "General Requirements". Optionally the reference variable (RCAS_IN) with Quality Code can be transferred in the same cycle into the (part) process image.

The data of the PROFIBUS PA field device, as well as the process variable (READBACK) and the discrete position feedback (POS_D) are read cyclically from the (part) process image. Optionally you can additionally read the active reference variable (RCAS_OUT) and the detailed device information (CHECKBACK). The device information is available at the block output in bit-granular form. The data are read from the (part) process image. In order to improve the interconnectability important detailed information is offered from the status bytes read (READBACK) as Boolean (BOOL) values at the output interface. They correspond to the bit combinations specified in the PROFIBUS PA 3.0 "General Requirements".

If there is a higher-level error, the data continue to be written into the (part) process image and no data are read from the (part) process image. As long as the higher-level error exists, the last values are retained with QBAD = TRUE.

Note

Zero is assigned as the initial value to the status byte of the setpoint (ST_SP) and the reference variable (ST_RCAS_IN). The setpoint or the reference variable only becomes active in the PROFIBUS PA field device if you set the corresponding Quality Code to 16#80.

Addressing

You have to interconnect one of the symbols configured with HW Config (for example SP) for the analog output channel (PROFIBUS PA 3.0 Profile "Analog Output") with the corresponding connection:

Connection	Data type
I_READBACK	REAL
I_RCAS_OUT	REAL
I_POS_D	BYTE
O_SP	REAL
O_RCAS_IN	REAL

In CFC the "Generate Module Driver" function is used to automatically interconnect the symbol for the corresponding Quality Code (if it exists) of the connection and the remaining configured symbols of the analog output channel (with Quality Code).

Simulation

If the input parameter SIM_ON = TRUE, the value of the input SIM_SP (and the options SIM_RCAS_IN) is output with Quality Code (QUALITY) = 16#60. A valid mode must also be set in the simulation mode in the Low Word of the MODE input. Otherwise QBAD = 1 is output. Simulation has the highest priority. If there is a higher-level error, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set.

Value limiting

You can limit very low or very high process values which lead to an error (QBAD = TRUE) before entry in the (part) process image.

All the process values (V) (both input and output values) are limited at the switch LIMIT_ON = TRUE:

- To V_HL, if V > V_HL.
- To LL_V, if V < V_LL.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

Input MODE = 16#xx01xxxx: Initializing ALARM_8P.

Time response

Does not exist.

Message characteristics

As long as there is no higher-level error, the block signals the state of the Quality Code (status byte) of READBACK and the state of CHECKBACK when there is a change. If the options READBACK or CHECKBACK are not activated, no messages are output.

The messages are event messages which do not have to be acknowledged and are only stored in the chronic list of the OS. If the QBAD, QCB and QUNCERT outputs are interconnected to the CSF input (external error) of the technological block, this block generates a control system message if a malfunction arises.

The DELAY input (default setting 2 seconds) is used to delay an event message when there is a change in the Quality Code or change in the CHECKBACK state (only rising edge). With DELAY you can specify the period in seconds which the block waits after a higher-level error (DP Master system failure, DP/PA-Link failure, device failure or I/O access error), (MODE = 16#40xxxxxx) has gone, until it emits the message. Messaging can be de-activated by using EN_MSG = FALSE.

Operator control and monitoring via OS

The block does not have a faceplate.

3.2.2 Connections of PA_AO

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
CHECK_0	Checkback Field Device	BYTE	0	I
CHECK_1	Checkback Field Device	BYTE	0	I
CHECK_2	Checkback Field Device	BYTE	0	I
DELAY	Alarm Delay (s)	INT	2	I
EN_MSG	1=Enable Alarm	BOOL	1	I
EV_ID	Event ID	DWORD	0	I
I_POS_D	The current position of the valve (discrete) (symbol)	BYTE	0	I
I_RCAS_OUT	Function Block setpoint	REAL	0	I
I_READBACK	The actual position of the final control element within the travel span (between OPEN and CLOSE position) in PV units. (symbol)	REAL	0	I
LIMIT_ON	1=Limit on Input Value	BOOL	0	I
LL_V	High Limit Input Value. Set Value if V < V_LL	REAL		I
MODE	MODE Input parameter	BYTE	0	I/O
MSG_STAT	Message Failure	WORD	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
O_RCAS_IN	Target setpoint provided by a supervisory host to the analog control or output block (symbol)	REAL	0	O
O_SP	Setpoint (symbol)	REAL	0	O
POS_D	The current position of the valve (discrete). The coding of the POS bytes is as follows: 0 = Not initialized 1 = Closed 2 = Opened 3 = Intermediate	BYTE	0	O
QA_1	1 = Alarm/Warning 1	BOOL	0	O
QA_2	1 = Alarm/Warning 2	BOOL	0	O
QBAD	1 = Collected event QBAD_X	BOOL	0	O
QBAD_0	1 = Non-specific	BOOL	0	O
QBAD_1	1 = Configuration error	BOOL	0	O
QBAD_2	1 = Not connected	BOOL	0	O
QBAD_3	1 = Device failure	BOOL	0	O
QBAD_4	1 = Sensor failure	BOOL	0	O
QBAD_5	1 = No communication (last usable value)	BOOL	0	O
QBAD_6	1 = No communication (no usable value)	BOOL	0	O
QBAD_7	1 = Out of service	BOOL	0	O
QCASCAD0	1 = OK (cascade)	BOOL	0	O
QCASCAD1	1 = Initialization acknowledged	BOOL	0	O
QCASCAD2	1 = Initialization request	BOOL	0	O
QCASCAD3	1 = Not requested	BOOL	0	O
QCASCAD4	1 = Reserved	BOOL	0	O
QCASCAD5	1 = Do not select	BOOL	0	O
QCASCAD6	1 = Local override	BOOL	0	O
QCASCAD7	1 = Reserved	BOOL	0	O
QCASCAD8	1 = Initiate fail safe	BOOL	0	O
QCB	1 = CHECKBACK (1 or more bits true)	BOOL	0	O
QCB_0	1 = Field device in fail-safe position active	BOOL	0	O
QCB_1	1 = Request for local operation	BOOL	0	O
QCB_2	1 = Field device under local control, LOCKED OUT switch is in gear.	BOOL	0	O
QCB_3	1 = Emergency override active	BOOL	0	O
QCB_4	1 = Actual position feedback different from expected position	BOOL	0	O
QCB_5	1 = Indicates that the torque limit in OPEN direction is exceeded	BOOL	0	O
QCB_6	1 = Indicates that the torque limit in CLOSE direction is exceeded	BOOL	0	O
QCB_7	1 = Indicates status of travel monitoring equipment. If YES, travel time for actuator has exceeded	BOOL	0	O
QCB_8	1 = Actuator is moving towards open direction	BOOL	0	O
QCB_9	1 = Actuator is moving towards close direction	BOOL	0	O
QCB_10	1 = The alert generated by any change to the static data (Function and Transducer Block)	BOOL	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
QCB_11	1 = Simulation of process values is enabled	BOOL	0	O
QCB_12	Not used	BOOL	0	O
QCB_13	1 = Internal control loop disturbed	BOOL	0	O
QCB_14	1 = Positioner inactive (OUT status = BAD)	BOOL	0	O
QCB_15	1 = Device under self test	BOOL	0	O
QCB_15	1 = Device under self test (MODE = out of service)	BOOL	0	O
QCB_16	1 = Indicates that total valve travel limit is exceeded	BOOL	0	O
QCB_17	1 = Indicates that an additional input (i.e. for diagnostics) is activated	BOOL	0	O
QCONST	1 = Constant	BOOL	0	O
QC_POS_D	Quality Code POS	BYTE	0	I
QC_RCAS_IN	Quality Code RCAS_IN (symbol)	BYTE	0	O
QC_RCAS_OUT	Quality Code Function Block Setpoint	BYTE	0	I
QC_READBACK	Quality Code Function Block Setpoint (symbol)	BYTE	0	I
QC_SP	Quality Code Setpoint (symbol)	BYTE	0	O
QERR	1 = Error output (inverted value of ENO)	BOOL	1	O
QNONCAS0	1 = OK (non-cascade)	BOOL	0	O
QNONCAS1	1 = Update event	BOOL	0	O
QNONCAS2	1 = Active advisory alarm (priority <8)	BOOL	0	O
QNONCAS3	1 = Active critical alarm (priority >8)	BOOL	0	O
QNONCAS4	1 = Unacknowledged update event	BOOL	0	O
QNONCAS5	1 = Unacknowledged advisory alarm	BOOL	0	O
QNONCAS6	1 = Unacknowledged critical alarm	BOOL	0	O
QNONCAS7	1 = Initial fail safe	BOOL	0	O
QNONCAS8	1 = Maintenance required	BOOL	0	O
QSIM	1=Simulation Active	BOOL	0	O
QUNCERT	1 = Collected event QUNCERTx	BOOL	0	O
QUNCERT0	1 = Non-specific	BOOL	0	O
QUNCERT1	1 = Last usable value	BOOL	0	O
QUNCERT2	1 = Substitute set	BOOL	0	O
QUNCERT3	1 = Initial value	BOOL	0	O
QUNCERT4	1 = Sensor conversion not accurate	BOOL	0	O
QUNCERT5	1 = Engineering unit violation (unit not in the valid set)	BOOL	0	O
QUNCERT6	1 = Sub-normal	BOOL	0	O
QUNCERT7	1 = Configuration error	BOOL	0	O
QUNCERT8	1 = Sensor calibration	BOOL	0	O
QUNCERT9	1 = Simulated value	BOOL	0	O
RCAS_IN	Target setpoint provided by a supervisory host to the analog control or output block	REAL	0	I
RCAS_OUT	Function Block setpoint	REAL	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
READBACK	The actual position of the final control element within the travel span (between OPEN and CLOSE position) in PV units.	REAL	0	O
SIM_ON	1 = Active Simulation	BOOL	0	I
SIM_SP	Simulation Setpoint	REAL	0	I
SIM_RCAS_IN	Simulation RCAS_IN	REAL	0	I
SP	Setpoint	REAL	0	I
ST_POS_D	Status POS	BYTE	0	O
ST_READBACK	Function Block setpoint status	BYTE	0	O
ST_RCAS_IN	RCAS_IN status	BYTE	0	I
ST_RCAS_OUT	Function Block setpoint status	BYTE	0	O
ST_SP	Status setpoint	BYTE	0	I
V_HL	High Limit Input Value	REAL	0	I
V_LL	Low Limit Input Value	REAL	0	I

3.2.3 Message texts and auxiliary process values of PA_AO

Assignment of message texts and classes to the block parameters of PA_AO

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID	1	QBAD	Device failure	S
	2	QUNCERT	Uncertain value	S
	3	QNONCAS1	Update event	S
	4	QNONCAS7	Initiate fail safe	S
	5	QNONCAS8	Maintenance required	M
	6	QCB_0	Field device in fail safe active	S
	7	QCB_3 or QCB_11	Emergency override active /Simulation enabled	S
	8	QCB_4 or QCB_7 or QCB_16	Discrepancy in direction	S

The block has no auxiliary process value. If QBAD = TRUE because of a higher-level error, no message is created.

3.3 PA_DI: Digital value input PROFIBUS PA

3.3.1 PA_DI: Discrete Input PROFIBUS PA

Object name (Type + Number)

FB 104

Area of Application

The block is used to cyclically input digital values (Discrete Input) via a PROFIBUS PA field device Class A and B.

Calling OBs

The calling OB is the watchdog interrupt OB3x, in which you install the block (for example OB32) and OB1.

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The installation of block in OB1.
- The symbol for the Quality Code of the digital input channel is interconnected to the input QC.
- The MODE input Setting_PA_MODE is interconnected to the corresponding output OMODE_xx of the PADP_L0x block.

Function and Operating Principle

The block cyclically reads the process value (OUT_D) with status byte (STATUS) of the PROFIBUS PA field device (structure an accordance with the Discrete Input of the PA profiles) from the (part) process image. The status byte contains information on the measured value and the state of the PROFIBUS PA field device. The process value and status bytes (total of 2 bytes) are read directly and coherently as a WORD. Further important detailed information is supplied as Boolean (BOOL) values at the output interface in addition to the status byte in order to improve the interconnectability. They correspond to the bit combinations specified in the PROFIBUS PA 3.0 "General Requirements". Device-specific process control system messages are generated via ALARM_8P from the status of the status bytes.

The quality code QUALITY for the process value is determined from the status of the input MODE and the output STATUS. PA MODE recognizes a higher level error e.g. DP/PA Link failure via the input MODE If the high byte of the input MODE = 16#80, the values in the (part) process image are valid. If the high byte of the input MODE = 16#40 (value status = higher-level error), the digital value will be handled as invalid. The Quality Code (QUALITY) is set to 16#44 or 16#48. The same is true for a STATUS with status "BAD". Otherwise STATUS and QUALITY are identical.

Addressing

The symbol generated with HW Config in the symbol table for the digital input channel has to be interconnected to the I_OUT_D input. The CFC function "Generate Module Driver" interconnects the symbol for the Quality Code of the digital input channel to the input parameter QC.

Simulation

If the input parameter SIM_ON = TRUE, the value of the input SIM_I is output with Quality Code (QUALITY =) 16#60. Simulation has the highest priority. If there is a higher-level error, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set. If there is no higher-level error and the PA field device displaysa Quality Code “BAD”, either the substitute value SUBS_I (SUBS_ON= TRUE) or the last value is outpit.

Substitution value

If the input parameter SUBS_ON = TRUE, the value of the input SUBS_I is output as the value, in as far as the values are invalid. The Quality Code is set to (QUALITY =) 16#48 and QBAD = 1.

Hold last value

If the input parameter SUBS_ON = FALSE, the last valid output parameter is output if the values are invalid. The Quality Code is set to (QUALITY =) 16#44 and QBAD = 1.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

Input MODE = 16#xx01xxxx: Initializing ALARM_8P.

Time response

Does not exist.

Message characteristics

As long as there is no higher-level error, the block signals the current state of the Quality Code (status byte) when there is a change. The messages are event messages which do not have to be acknowledged and are only stored in the chronic list of the OS. If the QBAD and QUNCERT outputs are interconnected to the CSF input (external error) of the technological block, this block generates a control system message if a malfunction arises.

The DELAY input (default setting 2 seconds) is used to delay an event message when there is a change in the Quality Code. With DELAY you can specify the period in seconds which the block waits when there is a change in the Quality Code after a higher-level error (DP Master system failure, DP/PA-Link failure, device failure or I/O access error), (MODE = 16#40xxxxxx) has gone, until it emits the message. Messaging can be de-activated by using EN_MSG = FALSE.

Operator control and monitoring

The block does not have a faceplate.

3.3.2 Connections of PA_DI

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
DELAY	Alarm Delay (s)	INT	2	I
EN_MSG	1=Enable Alarm	BOOL	1	I
EV_ID	Event ID	DWORD	0	I
I_OUT_D	Process Image Process Value	BYTE	0	I
MODE	MODE Input parameter	DWORD	0	I/O
MSG_STAT	Message Failure	WORD	0	O
OUT_D	Process value	BYTE	0	O
QA_1	1 = Alarm/Warning 1	BOOL	0	O
QA_2	1 = Alarm/Warning 2	BOOL	0	O
QBAD	1 = Collected event QBAD_X	BOOL	0	O
QBAD_0	1 = Non-specific	BOOL	0	O
QBAD_1	1 = Configuration error	BOOL	0	O
QBAD_2	1 = Not connected	BOOL	0	O
QBAD_3	1 = Device failure	BOOL	0	O
QBAD_4	1 = Sensor failure	BOOL	0	O
QBAD_5	1 = No communication (last usable value)	BOOL	0	O
QBAD_6	1 = No communication (no usable value)	BOOL	0	O
QBAD_7	1 = Out of service	BOOL	0	O
QC	Process Image Value Quality Code	BYTE	0	I
QCONST	1 = Constant	BOOL	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
QERR	1 = Error output (inverted value of ENO)	BOOL	1	O
QSIM	1=Simulation Active	BOOL	0	O
QSUBS	1=Failure Substitution Active	BOOL	0	O
QUALITY	Value status of the process value	BYTE	0	O
QUNCERT	1 = Collected event QUNCERTx	BOOL	0	O
QUNCERT0	1 = Non-specific	BOOL	0	O
QUNCERT1	1 = Last usable value	BOOL	0	O
QUNCERT2	1 = Substitute set	BOOL	0	O
QUNCERT3	1 = Initial value	BOOL	0	O
QUNCERT4	1 = Sensor conversion not accurate	BOOL	0	O
QUNCERT5	1 = Engineering unit violation (unit not in the valid set)	BOOL	0	O
QUNCERT6	1 = Sub-normal	BOOL	0	O
QUNCERT7	1 = Configuration error	BOOL	0	O
QUNCERT8	1 = Sensor calibration	BOOL	0	O
QUNCERT9	1 = Simulated value	BOOL	0	O
Q0	Process Value Bit 0	BOOL	0	O
Q1	Process Value Bit 1	BOOL	0	O
Q2	Process Value Bit 2	BOOL	0	O
Q3	Process Value Bit 3	BOOL	0	O
Q4	Process Value Bit 4	BOOL	0	O
Q5	Process Value Bit 5	BOOL	0	O
Q6	Process Value Bit 6	BOOL	0	O
Q7	Process Value Bit 7	BOOL	0	O
SIM_I	Simulation Value	BYTE	0	I
SIM_ON	1 = Activate Simulation	BOOL	0	I
STATUS	Process Value Status	BYTE	0	O
SUBS_I	Substitute Value	BYTE	0	I
SUBS_ON	1 = Enable failure substitution	BOOL	0	I

3.3.3 Message texts and auxiliary process values of PA_DI

Assignment of message texts and classes to the block parameters of PA_DI

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID	1	QBAD	Device failure	S
	2	QUNCERT	Uncertain value	S
	3	QNONCAS1	Update event	S
	4	QNONCAS7	Initiate fail safe	S
	5	QNONCAS8	Maintenance required	M
	6			No message
	7			No message
	8	-	-	No message

The block has no auxiliary process value. If QBAD = TRUE because of a higher-level error, no message is created.

3.4 PA_DO: Digital value output PROFIBUS PA

3.4.1 PA_DO: Discrete Output PROFIBUS PA

Object name (Type + Number)

FB 105

Area of Application

The block is used to cyclically output digital values (SP or RCAS_IN, max. of 8) via a PROFIBUS PA field device Class A and B.

Calling OBs

The calling OB is the watchdog interrupt OB3x, in which you install the block (for example OB32) and OB1 and the restart OB100.

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The installation of block in OB1 and OB100.
- The symbol for the Quality Code of the digital output channel O_SP is interconnected to the output QC_SP and other selected options.
- The MODE input Setting_PA_MODE is interconnected to the corresponding output OMODE_xx of the PADP_L0x block.

Function and Operating principle

The block reads the user data from the (part) process image and writes them into the (part) process image depending on the selection (with HW Config or SIMATIC PDM) of the user data configuration of the PA-Profile "Digital Output" in accordance with PROFIBUS PA 3.0.

The coding of the set user data configuration of the PROFIBUS PA 3.0 Profile "Discrete Output" is contained in the Low Word of the input variable MODE. This specifies which variables are to be read and written in the (part) process image.

The block cyclically writes the setpoint (SP) with Quality Code (configuration of the setpoints and process values in accordance with the Digital Output of the PA Profiles, 1 byte with 1 byte Quality Code) into the (part) process image. The Quality Code contains the information on the state of the setpoint. The coding of the Quality Code is described in the PROFIBUS PA 3.0 "General Requirements". Optionally the setpoint in the state RCAS (Remote Cascade) (RCAS_IN) with Quality Code can be transferred in the same cycle into the (part) process image.

Optionally, the data are read cyclically from the PROFIBUS PA field such as the state of the valve (READBACK), the process value of the valve setting in the state RCAS (RCAS_OUT) and the detailed device information (CHECKBACK) from the (part) process image. The device information is available at the block output in bit-granular form.

In order to improve the interconnectability important detailed information is offered from the status bytes read as Boolean (BOOL) values at the output interface. They correspond to the bit combinations specified in the PROFIBUS PA "General Requirements". If READBACK and RCAS_OUT exist simultaneously, the detailed information is derived from the READBACK status byte.

If there is a higher-level error, the data continue to be written into the (part) process image and no data are read from the (part) process image. As long as the higher-level error exists, the last values are retained with QBAD = TRUE.

Note

"Zero" is assigned as the initial value to the status byte of the setpoint (ST_SP) and the reference variable (ST_RCAS_IN). The setpoint or the reference variable only becomes active in the PROFIBUS PA field device if you set the corresponding status byte to 16#80.

Addressing

You have to interconnect one of the symbols configured with HW Config (for example SP) for the digital output channel (PROFIBUS PA 3.0 Profile "Analog Output") with the corresponding connection:

Connection	Data type
I_READBACK	BYTE
I_RCAS_OUT	BYTE
O_SP	BYTE
O_RCAS_IN	BYTE

In CFC the "Generate Module Driver" function is used to automatically interconnect the symbol for the corresponding Quality Code (if it exists) of the connection and the remaining configured symbols of the digital output channel (with Quality Code).

Simulation

If the input parameter SIM_ON = TRUE, the value of the input SIM_SP (and the option SIM_RCAS_IN) is output with Quality Code (QUALITY) = 16#60. A valid mode must also be set in the simulation mode in the Low Word of the MODE input. Otherwise QBAD = 1 is output. Simulation has the highest priority. If there is a higher-level error, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

Input MODE = 16#xx01xxxx: Initializing ALARM_8P.

Time response

Does not exist.

Message characteristics

As long as there is no higher-level error, the block signals the state of the Quality Code (status byte) of READBACK and the state of CHECKBACK when there is a change. If the options READBACK or CHECKBACK are not activated, no messages are output.

The messages are event messages which do not have to be acknowledged and are only stored in the chronic list of the OS. If the QBAD, QCB and QUNCERT outputs are interconnected to the CSF input (external error) of the technological block, this block generates a control system message if a malfunction arises.

The DELAY input (default setting 2 seconds) is used to delay an event message when there is a change in the Quality Code or change in the CHECKBACK state (only rising edge). With DELAY you can specify the period in seconds which the block waits after a higher-level error (DP Master system failure, DP/PA-Link failure, device failure or I/O access error), (MODE = 16#40xxxxxx) has gone, until it emits the message. Messaging can be de-activated by using EN_MSG = FALSE.

Operator control and monitoring

The block does not have a faceplate.

3.4.2 Connections of PA_DO

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
CHECK_0	Checkback Field Device	BYTE	0	I
CHECK_1	Checkback Field Device	BYTE	0	I
CHECK_2	Checkback Field Device	BYTE	0	I
DELAY	Alarm Delay (s)	INT	2	I
EN_MSG	1=Enable Alarm	BOOL	1	I
EV_ID	Event ID	DWORD	0	I
I_RCAS_OUT	Function Block setpoint	BYTE	0	I
I_READBACK	Process value (READBACK) (symbol)	BYTE	0	I
MODE	MODE Input parameter	BYTE	0	I/O
MSG_STAT	Message Failure	WORD	0	O
O_RCAS_IN	Process image target setpoint provided by a supervisory host to the analog control or output block (symbol)	BYTE	0	O
O_SP	Setpoint (symbol)	BYTE	0	OI
QA_1	1 = Alarm/Warning 1	BOOL	0	O
QA_2	1 = Alarm/Warning 2	BOOL	0	O
QBAD	1 = Collected event QBAD_X	BOOL	0	O
QBAD_0	1 = Non-specific	BOOL	0	O
QBAD_1	1 = Configuration error	BOOL	0	O
QBAD_2	1 = Not connected	BOOL	0	O
QBAD_3	1 = Device failure	BOOL	0	O
QBAD_4	1 = Sensor failure	BOOL	0	O
QBAD_5	1 = No communication (last usable value)	BOOL	0	O
QBAD_6	1 = No communication (no usable value)	BOOL	0	O
QBAD_7	1 = Out of service	BOOL	0	O
QCONST	1 = Constant	BOOL	0	O
QCB_0	1 = Field device in fail-safe position active	BOOL	0	O
QCB_1	1 = Request for local operation at device	BOOL	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
QCB_2	1 = Field device under local control	BOOL	0	O
QCB_3	1 = Emergency override active	BOOL	0	O
QCB_4	1 = The actuator left the final position it had already reached	BOOL	0	O
QCB_5	1 = Indicates a lead break of the valve connection	BOOL	0	O
QCB_6	1 = Indicates a short circuit of the valve connection	BOOL	0	O
QCB_7	Not used	BOOL	0	O
QCB_8	1 = Actuator is moving towards open direction	BOOL	0	O
QCB_9	1 = Actuator is moving towards close direction	BOOL	0	O
QCB_10	1 = The alert generated by any change to the static data of FB and TB	BOOL	0	O
QCB_11	1 = Simulation of process values is enabled	BOOL	0	O
QCB_12	Not used	BOOL	0	O
QCB_13	1 = Internal control loop disturbed	BOOL	0	O
QCB_14	1 = Valve inactive (status OUT_D bad)	BOOL	0	O
QCB_15	1 = Device under self test	BOOL	0	O
QCB_16	1 = Indicates that total valve travel limit is exceeded	BOOL	0	O
QCB_17	1 = Limit for break time of change from OPEN to CLOSE exceeded	BOOL	0	O
QCB_18	1 = Limit for break time of change from CLOSE to OPEN exceeded	BOOL	0	O
QCB_19	1 = Error occurred in the internal cycle test	BOOL	0	O
QCB_20	1 = Limit for time between change from OPEN to CLOSE exceeded	BOOL	0	O
QCB_21	1 = Limit for time between change from CLOSE to OPEN exceeded	BOOL	0	O
QCB_22	1 = Valve blocked mechanically	BOOL	0	O
QC_RCAS_IN	Quality Code Target Setpoint (symbol)	BYTE	0	O
QC_RCAS_OUT	Quality Code FB Setpoint (symbol)	BYTE	0	I
QC_READBACK	Quality Code Function Block Setpoint (symbol)	BYTE	0	I
QC_SP	Quality Code Setpoint (symbol)	BYTE	0	O
QERR	1 = Error output (inverted value of ENO)	BOOL	1	O
QSIM	1=Simulation Active	BOOL	0	O
QSUBS	1=Failure Substitution Active	BOOL	0	O
QUNCERT	1 = Collected event QUNCERTx	BOOL	0	O
QUNCERT0	1 = Non-specific	BOOL	0	O
QUNCERT1	1 = Last usable value	BOOL	0	O
QUNCERT2	1 = Substitute set	BOOL	0	O
QUNCERT3	1 = Initial value	BOOL	0	O
QUNCERT4	1 = Sensor conversion not accurate	BOOL	0	O
QUNCERT5	1 = Engineering unit violation (unit not in the valid set)	BOOL	0	O
QUNCERT6	1 = Sub-normal	BOOL	0	O
QUNCERT7	1 = Configuration error	BOOL	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
QUNCERT8	1 = Sensor calibration	BOOL	0	O
QUNCERT9	1 = Simulated value	BOOL	0	O
RCAS_IN	Target setpoint	BYTE	0	I
RCAS_OUT	Function Block setpoint	BYTE	0	O
READBACK	Process Value (READBACK)	BYTE	0	O
SIM_ON	1 = Activate simulation	BOOL	0	I
SIM_RCAS_IN	Simulation target setpoint	BYTE	0	I
SIM_SP	Simulation Value	BYTE	0	I
SP	Setpoint	REAL	0	I
ST_READBACK	Function Block setpoint status	BYTE	0	O
ST_RCAS_IN	RCAS_IN status	BYTE	0	I
ST_RCAS_OUT	Function Block setpoint status	BYTE	0	O
ST_SP	Setpoint status	BYTE	0	I
V_HL	High Limit Input Value	REAL	0	I
V_LL	Low Limit Input Value	REAL	0	I

3.4.3 Message texts and auxiliary process values of PA_DO

Assignment of message texts and classes to the block parameters of PA_DO

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID	1	QBAD	Device failure	S
	2	QUNCERT	Uncertain value	S
	3	QNONCAS1	Update event	S
	4	QNONCAS7	Initiate fail safe	S
	5	QNONCAS8	Maintenance required	M
	6	QCB_0	Field device in fail safe active	S
	7	QCB_3 or QCB_11	Emergency override active /Simulation anabled	S
	8	QCB_17or QCB_18 or QCB_20 or QCB_21	Break/Transit time OPEN / CLOSE	S

The block has no auxiliary process value. If QBAD = TRUE because of a higher-level error, no message is created.

3.5 PADP_L0x: Monitoring of DP/PA slaves

3.5.1 PADP_L00: Monitoring of DP/PA slaves with up to 7 slots

Object name (Type + Number)

FB 109

Area of Application

The block monitors DP/PA field devices which are operated as a DP-V0 or DP-V1 slave behind a DP/PA Y-Link which is operated as a DP-V0 slave. The PA field devices have to fulfill the PROFIBUS PA V3.0 Profile. For DP field devices individual blocks have to be available for their diagnostic and signal processing.

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB82	Diagnostic interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The PADP_L00 block is installed in the run sequence behind the DPAY_V0 block
- Configuration of
  - The MODE_xx input (mode of slot xx of a field device).
  - The PADP_ADR input (DP/PA Slave address behind DP/PA-Link or Y-Link).

- Interconnection of
  - The inputs to the inputs of the DPAY_V0
  - The OUT structure CPU_DIAG of the OB_BEGIN and RAC_DIAG of the DPAY_V0 block with the INOUT structures of the same name of the PADP_L00 block.

Function and Operating Principle

The block acyclically analyzes all the events which concern a DP or PA field device and its slots. Depending on the slot it forms the respective DP_MODE or PA_MODE and value status for the DP or PA signal processing blocks. The permissible PA_MODE is already defined for the PA signal processing blocks. In the case of DP field devices the DP_MODE has to be defined individually for the DP field device blocks. The events are signaled with ALARM_8P. The signaling function can be switched off.

The block is enabled for running by the higher-level DPAY_V0 block. The event to be evaluated is entered in the start information (CPU_DIAG) of the OB_BEGIN block.

In diagnostic cases the data are already evaluated by the LINK block (DPAY_V0). The diagnostic information which concern the PA field device are saved in the structure DPA_M. The structure consists of two DWORD (S_01 for Module 1 to 16 and S_02 for Module 17 to 32) and one BOOL (S_ERR = DP/PA field device faulty) variables. Two bits of the DWORD are assigned per slot of the DP/PA field device, whereby Bit 0 and Bit 1 belong to Slot 1 of the DP/PA field device, etc. The slots 1 to 7 are evaluated. They are defined as follows:

State Bit 0	State Bit 1	Meaning
0	0	Module x OK (valid user data)
0	1	Module x fault (invalid user data)
1	0	Incorrect Module x (invalid user data)
1	1	No Module x (invalid user data)

An input (MODE_xx) exists for every slot (module) of the DP/PA field device. In the case of PA field devices the configurations carried out with HW Config of the PA field device slots (modules) are communicated.

In the case of DP field devices the user has to carry out its codings at the MODE input himself.

MODE_xx is read into the low word of the output OMODE_xx. This is only carried out during the start-up/initial start or if ACC_MODE = TRUE. The current value status of the slot is entered in the highest-value byte. If good, OMODE_xx = 16#80xxxxxx is set. The following events lead to a value status "Invalid value" due to higher-level error (OMODE_xx = 16#40xxxxxx):

• CPU redundancy loss (OB72)	(if not switched, output parameter QRACKF = TRUE)
• I/O access error (OB70)	(if not switched, output parameter QRACKF = TRUE)
• Rack failure (OB86)	(output parameter QRACKF = TRUE)
• Diagnostic interrupt concerning a complete field device (OB82)	(output parameter QMODF = TRUE, if DPA_M.S_ERR = TRUE)
• Diagnostic interrupt slot xx concerning a field device (OB82):	(output parameter OMODE_xx = Module-(slot-)error specific DPA_M)

The above events are evaluated by the DPAY_V0 block.

In the case of a diagnostic interrupt the block signals to the WinCC field-device-specifically by means of the ALARM_8P. A difference is made between a field device and its slots, whereby a message number is assigned to each slot.

Redundancy

The redundancy evaluation of the DP Master systems at an H system is carried out in the higher-level DPAY_V0 block.

MODE Setting for PA-Profiles

PA_MODE

Note

If you change the configuration of the MODE_xx inputs during operation, the change does not become active until the input ACC_MODE = 1 has been set at the outputs.

OMODE structure

Refer to OMODE

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

After a restart or an initial start the system checks whether the PA field device is available under the logical base address. A restart (OB100) is signaled via the LSB in Byte 2 of the outputs OMODE_xx.

Time response

Does not exist.

Message characteristics

The block signals field device faults by means of ALARM_8P and creates the following messages in the OBs listed below:

OB No.	Starting event	Message
OB1	Cyclic processing	Repeat updating ALARM_8P outputs / messages, if necessary
OB82	Diagnostic interrupt	Device fault coming/going Device module xx fault coming/going Device module xx incorrect coming/going Device module xx missing coming/going
OB100	Restart	Initializing ALARM_8P

Operator control and monitoring

The block does not have a faceplate (display block).

Note

In "Connection of PADP L0x" the variables are identified (with a "+" in the column OCM) which are transferred from this instance block to the OS when the option "Operator C and M capability for diagnostic blocks" in the "Generate Module Driver" settings is selected. Default: option is not set.

3.5.2 Message texts and auxiliary process values of PADP_L00

Assignment of message texts and classes to the block parameters of PADP_L00

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID	1	QMODF	Device @1%d@/@2%d@/@3%d@: Failure	S
	2	-	Device @1%d@/@2%d@/@3%d@: Module 00 @4W%t#PADP_L00_TXT@	S
	...		...	
	8	-	Device @1%d@/@2%d@/@3%d@: Module 06 @10W%t#PADP_L00_TXT@	S

The message texts and their text numbers in the text library PADP_L00_TXT are listed in the Text Library for DP-/PA-Slaves after a PA-/Y-LINK DP V0

Assignment of the auxiliary process values for the block parameters of PA_TOT

Message block ALARM_8P	Value	Block parameter	Meaning
EV_ID	1	SUBN_ID	DP master system ID (byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 2-8) from PADP_L00_TXT

If the PA field device is connected behind a DP/PA-Link V0 which is not connected and SUBN1_ID = 16#FF, SUBN2_ID is entered as the auxiliary process value.

3.5.3 PADP_L01: Monitoring of DP/PA slaves with up to 16 slots

Object name (Type + Number)

FB 110

Area of Application

The block monitors DP/PA field devices which are operated as a DP-V0 or DP-V1 slave behind a DP/PA Y-Link which is operated as a DP-V0 slave. The PA field devices have to fulfill the PROFIBUS PA V3.0 Profile. For DP field devices individual blocks have to be available for their diagnostic and signal processing.

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB82	Diagnostic interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The PADP_L01 block is installed in the run sequence behind the DPAY_V0 block
- Configuration of
  - The MODE_xx input (mode of slot xx of a field device).
  - The PADP_ADR input (DP/PA Slave address behind DP/PA-Link or Y-Link).
- Interconnection of
  - The inputs to the inputs of the DPAY_V0
  - The OUT structure CPU_DIAG of the OB_BEGIN and RAC_DIAG of the DPAY_V0 block with the INOUT structures of the same name of the PADP_L01 block.

Function and Operating Principle

The block acyclically analyzes all the events which concern a DP or PA field device and its slots. Depending on the slot it forms the respective DP_MODE or PA_MODE and value status for the DP or PA signal processing blocks. The permissible PA_MODE is already defined for the PA signal processing blocks. In the case of DP field devices the DP_MODE has to be defined individually for the

DP field device blocks. The events are signaled with ALARM_8P. The signaling function can be switched off.

The block is enabled for running by the higher-level DPAY_V0 block. The event to be evaluated is entered in the start information (CPU_DIAG) of the OB_BEGIN block.

In diagnostic cases the data are already evaluated by the LINK block (DPAY_V0). The diagnostic information which concern the PA field device are saved in the structure DPA_M. The structure consists of two DWORD (S_01 for Module 1 to 16 and S_02 for Module 17 to 32) and one BOOL (S_ERR = DP/PA field device faulty) variables. Two bits of the DWORD are assigned per slot of the DP/PA field device, whereby Bit 0 and Bit 1 belong to Slot 1 of the DP/PA field device, etc. The slots 1 to 16 are evaluated. They are defined as follows:

State Bit 0	**State Bit 1**	**Meaning**
0	0	Module x OK (valid user data)
0	1	Module x fault (invalid user data)
1	0	Incorrect Module x (invalid user data)
1	1	No Module x (invalid user data)

An input (MODE_xx) exists for every slot (module) of the DP/PA field device. In the case of PA field devices the configurations carried out with HW Config of the PA field device slots (modules) are communicated.

In the case of DP field devices the user has to carry out its codings at the MODE input himself.

MODE_xx is read into the low word of the outputOMODE_xx. This is only carried out during the start-up/initial start or if ACC_MODE = TRUE. The current value status of the slot is entered in the highest-value byte. If good, OMODE_xx = 16#80xxxxxx is set. The following events lead to a value status "Invalid value" due to higher-level error (OMODE_xx = 16#40xxxxxx):

• CPU redundancy loss (OB72)	(if not switched, output parameter QRACKF = TRUE)
• I/O access error (OB70)	(if not switched, output parameter QRACKF = TRUE)
• Rack failure (OB86)	(output parameter QRACKF = TRUE)
• Diagnostic interrupt concerning a complete field device (OB82)	(output parameter QMODF = TRUE, if DPA_M.S_ERR = TRUE)
• Diagnostic interrupt slot xx concerning a field device (OB82):	(output parameter OMODE_xx = Module-(slot-)error specific DPA_M)

The above events are evaluated by the DPAY_V0 block.

In the case of a diagnostic interrupt the block signals to the WinCC field-device-specifically by means of the ALARM_8P. A difference is made between a field device and its slots, whereby a message number is assigned to each slot.

Redundancy

The redundancy evaluation of the DP Master systems at an H system is carried out in the higher-level DPAY_V0 block.

MODE Setting for PA-Profiles

PA_MODE

Note

If you change the configuration of the MODE_xx inputs during operation, the change does not become active until the input ACC_MODE = 1 has been set at the outputs.

OMODE structure

Refer to OMODE

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

After a restart or an initial start the system checks whether the PA field device is available under the logical base address. A restart (OB100) is signaled via the LSB in Byte 2 of the outputs OMODE_xx.

Time response

Does not exist.

Message characteristics

The block signals field device faults by means of ALARM_8P and creates the following messages in the OBs listed below:

OB No.	Starting event	Message
OB1	Cyclic processing	Repeat updating ALARM_8P outputs / messages, if necessary
OB82	Diagnostic interrupt	Device fault coming/going Device module xx fault coming/going Device module xx incorrect coming/going Device module xx missing coming/going
OB100	Restart	Initializing ALARM_8P

Operator control and monitoring

The block does not have a faceplate (display block).

Note

In "Connection of PADP L0x" the variables are identified (with a "+" in the column OCM) which are transferred from this instance block to the OS when the option "Operator C and M capability for diagnostic blocks" in the "Generate Module Driver" settings is selected. Default: option is not set.

3.5.4 Message texts and auxiliary process values of PADP_L01

Assignment of message texts and classes to the block parameters of PADP_L01

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID1	1	QMODF	Device @1%d@/@2%d@/@3%d@: Failure	S
	2	-	Device @1%d@/@2%d@/@3%d@: Module 00 @4W%t#PADP_L01_TXT@	S
	...		...	
	8	-	Device @1%d@/@2%d@/@3%d@: Module 06 @10W%t#PADP_L01_TXT@	S
EV_ID2	1	-	Device @1%d@/@2%d@/@3%d@: Module 07 @4W%t#PADP_L01_TXT@	S
	...		...	
	8	-	Device @1%d@/@2%d@/@3%d@: Module 14 @10W%t#PADP_L01_TXT@	S
EV_ID3	1	-	Device @1%d@/@2%d@/@3%d@: Module 15 @5W%t#PADP_L01_TXT@	S
	2		-	-
	...		...	
	8	-	-	-

The message texts and their text numbers in the text library PADP_L01_TXT are listed in the Text Library for DP-/PA-Slaves after a PA-/Y-LINK DP V0

Assignment of the auxiliary process values for the block parameters of PADP_L01

Message block ALARM_8P	Value	Block parameter	Meaning
EV_ID1	1	SUBN_ID	DP master system ID (byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 2-8) from PADP_L01_TXT
EV_ID2	1	SUBN_ID	DP Master system ID(byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 1-8) from PADP_L01_TXT
EV_ID3	1	SUBN_ID	DP master system ID (byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 1) from PADP_L01_TXT

If the PA field device is connected behind a DP/PA-Link V0 which is not connected and SUBN1_ID = 16#FF, SUBN2_ID is entered as the auxiliary process value.

3.5.5 PADP_L02: Monitoring of DP/PA slaves with up to 32 slots

Object name (Type + Number)

FB 111

Area of Application

The block monitors DP/PA field devices which are operated as a DP-V0 or DP-V1 slave behind a DP/PA Y-Link which is operated as a DP-V0 slave. The PA field devices have to fulfill the PROFIBUS PA V3.0 Profile. For DP field devices individual blocks have to be available for their diagnostic and signal processing.

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB82	Diagnostic interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The PADP_L02 block is installed in the run sequence behind the DPAY_V0 block
- Configuration of
  - The MODE_xx input (mode of slot xx of a field device).
  - The PADP_ADR input (DP/PA Slave address behind DP/PA-Link or Y-Link).
- Interconnection of
  - The inputs to the inputs of the DPAY_V0
  - The OUT structure CPU_DIAG of the OB_BEGIN and RAC_DIAG of the DPAY_V0 block with the INOUT structures of the same name of the PADP_L02 block.

Function and Operating principle

The block acyclically analyzes all the events which concern a DP or PA field device and its slots. Depending on the slot it forms the respective DP_MODE or PA_MODE and value status for the DP or PA signal processing blocks. The permissible PA_MODE is already defined for the PA signal processing blocks. In the case of DP field devices the DP_MODE has to be defined individually for the DP field device blocks. The events are signaled with ALARM_8P. The signaling function can be switched off.

The block is enabled for running by the higher-level DPAY_V0 block. The event to be evaluated is entered in the start information (CPU_DIAG) of the OB_BEGIN block.

In diagnostic cases the data are already evaluated by the LINK block (DPAY_V0). The diagnostic information which concern the PA field device are saved in the structure DPA_M. The structure consists of two DWORD (S_01 for Module 1 to 16

and S_02 for Module 17 to 32) and one BOOL (S_ERR = DP/PA field device faulty) variables. Two bits of the DWORD are assigned per slot of the DP/PA field device, whereby Bit 0 and Bit 1 belong to Slot 1 of the DP/PA field device, etc. The slots 1 to 32 are evaluated. They are defined as follows:

State Bit 0	State Bit 1	Meaning
0	0	Module x OK (valid user data)
0	1	Module x fault (invalid user data)
1	0	Incorrect Module x (invalid user data)
1	1	No Module x (invalid user data)

An input (MODE_xx) exists for every slot (module) of the DP/PA field device. In the case of PA field devices the configurations carried out with HW Config of the PA field device slots (modules) are communicated.

In the case of DP field devices the user has to carry out its codings at the MODE input himself.

MODE_xx is read into the low word of the output OMODE_xx. This is only carried out during the start-up/initial start or if ACC_MODE = TRUE. The current value status of the slot is entered in the highest-value byte. If good, OMODE_xx = 16#80xxxxxx is set. The following events lead to a value status "Invalid value" due to higher-level error (OMODE_xx = 16#40xxxxxx):

• CPU redundancy loss (OB72)	(if not switched, output parameter QRACKF = TRUE)
• I/O access error (OB70)	(if not switched, output parameter QRACKF = TRUE)
• Rack failure (OB86)	(output parameter QRACKF = TRUE)
• Diagnostic interrupt concerning a complete field device (OB82)	(output parameter QMODF = TRUE, if DPA_M.S_ERR = TRUE)
• Diagnostic interrupt slot xx concerning a field device (OB82):	(output parameter OMODE_xx = Module-(slot-)error specific DPA_M)

The above events are evaluated by the DPAY_V0 block.

In the case of a diagnostic interrupt the block signals to the WinCC field-device-specifically by means of the ALARM_8P. A difference is made between a field device and its slots, whereby a message number is assigned to each slot.

Redundancy

The redundancy evaluation of the DP Master systems at an H system is carried out in the higher-level DPAY_V0 block.

MODE Setting for PA-Profiles

PA_MODE

Note

If you change the configuration of the MODE_xx inputs during operation, the change does not become active until the input ACC_MODE = 1 has been set at the outputs.

OMODE structure

Refer to OMODE

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

After a restart or an initial start the system checks whether the PA field device is available under the logical base address. A restart (OB100) is signaled via the LSB in Byte 2 of the outputs OMODE_xx.

Time response

Does not exist.

Message characteristics

The block signals field device faults by means of ALARM_8P and creates the following messages in the OBs listed below:

OB No.	Starting event	Message
OB1	Cyclic processing	Repeat updating ALARM_8P outputs / messages, if necessary
OB82	Diagnostic interrupt	Device fault coming/going Device module xx fault coming/going Device module xx incorrect coming/going Device module xx missing coming/going
OB100	Restart	Initializing ALARM_8P

Operator control and monitoring

The block does not have a faceplate (display block).

Note

In "Connection of PADP L0x" the variables are identified (with a "+" in the column OCM) which are transferred from this instance block to the OS when the option "Operator C and M capability for diagnostic blocks" in the "Generate Module Driver" settings is selected. Default: option is not set.

3.5.6 Message texts and auxiliary process values of PADP_L02

Assignment of message texts and classes to the block parameters of PADP_L02

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID1	1	QMODF	Device @1%d@/@2%d@/@3%d@: Failure	S
	2	-	Device @1%d@/@2%d@/@3%d@: Module 07 @4W%t#PADP_L02_TXT@	S
	3	-	Device @1%d@/@2%d@/@3%d@: Module 15@5W%t#PADP_L02_TXT@	S
	4	-	Device @1%d@/@2%d@/@3%d@: Module 23@5W%t#PADP_L02_TXT@	S
	5	-	Device @1%d@/@2%d@/@3%d@: Module 31 @5W%t#PADP_L02_TXT@	S
EV_ID2	1	-	Device @1%d@/@2%d@/@3%d@: Module 00 @4W%t#PADP_L02_TXT@	S
	7	-	Device @1%d@/@2%d@/@3%d@: Module 06 @10W%t#PADP_L02_TXT@	S
EV_ID3	1	-	Device @1%d@/@2%d@/@3%d@: Module 08 @4W%t#PADP_L02_TXT@	S
	...		...	
	7	-	Device @1%d@/@2%d@/@3%d@: Module 14 @10W%t#PADP_L02_TXT@	S
EV_ID4	1	-	Device @1%d@/@2%d@/@3%d@: Module 16 @4W%t#PADP_L02_TXT@	S
	...		...	

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
	7	-	Device @1%d@/@2%d@/@3%d@: Module 22 @10W%t#PADP_L02_TXT@	S
EV_ID5	1	-	Device @1%d@/@2%d@/@3%d@: Module 24 @4W%t#PADP_L02_TXT@	S
	...		...	
	7	-	Device @1%d@/@2%d@/@3%d@: Module 30 @10W%t#PADP_L02_TXT@	S

The message texts and their text numbers in the text library PADP_L02_TXT are listed in the Text Library for DP-/PA-Slaves after a PA-/Y-LINK DP V0

Assignment of the auxiliary process values for the block parameters of PADO_L02

Message block ALARM_8P	Value	Block parameter	Meaning
EV_ID1	1	SUBN_ID	DP master system ID (byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 2-8) from PADP_L02_TXT
EV_ID2	1	SUBN_ID	DP Master system ID(byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 1-8) from PADP_L02_TXT
EV_ID3	1	SUBN_ID	DP master system ID (byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 1-8) from PADP_L02_TXT
EV_ID4	1	SUBN_ID	DP master system ID (byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 1-8) from PADP_L02_TXT
EV_ID5	1	SUBN_ID	DP master system ID (byte)
	2	RACK_NO	Rack / Station number (byte)
	3	PADP_ADR	DP/PA device address (byte)
	4	-	Text number (Message 1) from PADP_L02_TXT

If the PA field device is connected behind a DP/PA-Link V0 which is not connected and SUBN1_ID = 16#FF, SUBN2_ID is entered as the auxiliary process value.

3.5.7 Connections of PADP_L0x

The connections of the blocks PADP_L00, PADP_L01 and PADP_L02 are identical with the exception of the number of MODE_xx and OMODE_xx. The number of slots to be monitored determines the number of the respective input and outputs.

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O	OC&M
ACC_MODE	1=Accept New Mode Settings	BOOL	0	I/O	
CPU_DIAG	CPU diagnostics	STRUCT		I/O	
DPA_M	Status Modules of DP/PA Slave	STRUCT		I	
EN_MSG	1=Enable Alarm	BOOL	1	I	
EV_ID	Event ID	DWORD	0	I	
MODE_xx	Mode Channel (xx = 00 – 06 / 00 – 15 / 00 – 31)	WORD	0	I	
MSG_ACK	Message Acknowledged	WORD	0	O	
MSGSTAT	Message Failure	WORD	0	O	
OMODE_xx	Mode Channel (xx = 00 – 06 / 00 – 15 / 00 – 31)	DWORD	0	O	+
PADP_ADR	Address DP/PA field device	BYTE	0	I	
QERR	1=Program Error	BOOL	1	O	
QMODF	1=Module Withdrawn / Out of Order	BOOL	0	O	+
QRACKF	1=Rack/Station failure	BOOL	0	O	
RAC_DIAG	1=DPV1 mode	STRUCT		I/O	

3.6 DPAY_V0: Monitoring of DP/PA-Link and Y-Link as V0 slave

3.6.1 DPAY_V0: Monitoring of DP/PA-Link and Y-Link as V0 slave

Object name (Type + Number)

FB 108

Area of Application

The block monitors the state of a DP/PA- or Y-Link as a V0 slave (IM157) and signals the corresponding error events.

The DP/PA-Link is a PA master for the subordinate PA field devices and a slave at the DP bus. The Y-Link is a DP master for the subordinate DP field devices and a slave at the higher-level DP bus.

Calling OBs

The block has to be installed in the following OBs in the run sequence (is carried out automatically in CFC):

OB1	Cyclic program
OB70	I/O redundancy error
OB72	CPU redundancy error
OB82	Diagnostic interrupt
OB85	Program execution error
OB86	Rack failure
OB100	Restart (warm start)

If the CFC function "**Generate Module Driver**" is used, the block is installed in the run sequence behind the SUBNET block and before the PADP_L0x block and

- Configured
  - RACK_NO (Rack/Station number)
  - DADDR (Diagnostic address of the DP/PA-Link or Y-Link)
  - DPPA_xx (Slave xx address, 1st module (slot) address of the slave xx in the link, number of slots of the slave xx)
- Interconnection of
  - The OUT structures CPU_DIAG of the OB_BEGIN block and SUB_DIAG of the SUBNET block with the INOUT structures of the same name of the DPAY_V0.
  - In case of PA or DP field devices, PADP_L0x

Function and Operating Principle

The DPAY_V0 block generates a process control system fault message for the OS in case of redundancy losses and link failures. In addition it indicates faults within the link (SUBN1ERR, SUBN2ERR) and the preferred channel (SUBN1ACT, SUBN2ACT) when the links are activated at the output bar. The output structure RAC_DIAG contains the geographic address of the link as well as the group error information RACK_ERR. If RACK_ERR = 1, the corresponding link is not available.

The block requires an interfacing to the PROFIBUS DP. This can be integrated either in the CPU or be effected as an external DP interface (CP). The conversion of PROFIBUS DP to PROFIBUS PA is carried out by means of a SIMATIC DP/PA-Link.

All the field devices of a link are only addressed via the DP address of the IM157 at the higher-level DP bus.

The AS addresses the field devices via the link, meaning indirectly. The topological structure of the PA bus is mapped in the flat structure of the slave interface. A maximum of 64 field devices can be operated behind a link. Any number of virtual slots (maximum of 223) of the link can be assigned per field device. In order to assign the diagnostic data to the field devices, the block has an input structure (DPPA_xx) of 3 bytes per field device with the following meaning:

1. Byte (SLAV_NO) = User number (address) of the field device at the PA or DP Master system of the LINK

2. Byte (SLOT_NO) = 1st module address of the field device in the LINK

3. Byte (SLAV_SL) = Number of slots of the field device

The CFC function "Generate Module Driver" imports these data from HW Config.

The start information is read from the I/O structure CPU_DIAG. It has to be interconnected to the structure CPU_DIAG of the OB_BEGIN block (is implemented with the CFC function "Generate Module Driver" for you).

The block generates a corresponding message (see Message behavior) on the basis of the start information of the calling OBs if the current instance is affected.

The block determines the currently active preferred channel (SUBN1ACT, SUBN2ACT) in the case of redundant PROFIBUS DP interfaces by evaluating the error events and, if required, the diagnostic address ADDR of the link.

The diagnostic data (OB82) are read with SFC 13 (DPNRM_DG, Diagnostic data consistent). The reading process can take several cycles (OB1). In rare cases it is therefore possible that the triggering diagnostic event cannot be recognized.

The diagnostic user data contain information on the state of the link and the connected field devices. The state of the link is displayed in the structure **DPPA_ST**.

The state of a field device is entered in the structure DPA_M_xx.
A field device can have a maximum of 32 slots (module). Depending on the number of slots of a field device three block types are available:

- PADP_L00 (field device with a maximum of 7 slots)
- PADP_L01 (field device with a maximum of 16 slots)
- PADP_L02 (field device with a maximum of 32 slots)

The structure DPA_M_xx is interconnected to the structure DPA_M and the output EN_Mx with EN of one of the PADP_Lxx blocks (is carried out for you by the CFC function "Generate Module Driver").

The structure DPA_M_xx consists of two DWORD (S_01 for Module 1 to 16 and S_02 for Module 17 to 32) and one BOOL (S_ERR = DP/PA field device faulty). Two bits of the DWORD are assigned per slot of the DP/PA field device, whereby

Bit 0 and Bit 1 belong to Slot 1 (Module 1) of the DP/PA field device, etc. They are defined as follows:

State Bit 0	State Bit 1	Meaning
0	0	Module x OK (valid user data)
0	1	Module x fault (invalid user data)
1	0	Incorrect Module x (invalid user data)
1	1	No Module x (invalid user data)

If the diagnostic interrupt applies for the complete DP/PA field device, DPA_M_xx.S_ERR = TRUE is set.

If you want to change the inputs of the SUBNET block SUBN1_ID (connection to CPU 0) and SUBN2_ID (connection to CPU 1) online without using the CFC function "Generate Module Driver", you have to set the input ACC_ID = TRUE at the corresponding block. This checks the link states and updates the output values.

Redundancy

The block supports the redundancy of the DP Master systems at an H system (only distributed I/O devices). To this purpose the inputs of the SUBNET block SUBN1_ID (connection to CPU 0) and SUBN2_ID (connection to CPU 1) are to be configured with the numbers of the redundant DP Master systems. If there is no redundancy of the DP Master systems, the remaining input must have the value 16#FF (default) assigned.

Error handling

Error handling of the block is limited to the error information of ALARM_8P.

Refer to Error information of the MSG_STAT output parameter

Start-up characteristics

The block initializes the messages of ALARM_8P. A check whether the link is available is carried out. In the case of H systems the preferred channel of the links is determined.

Overload behavior

The block counts the OB86 (no DP Master system failure, see SUBNET block) and OB82 calls. Both counters are reset in the OB1. If more than two OB86s or more than two OB82 events occur successively before the cycle checkpoint (OB1) is reached, these are rejected and either the message "Failure OB86 DP Master:x Rack:y" or the message "Failure OB82 DP Master:x Rack:y Slot: z" is emitted. If an OB86 is rejected, the DP/PA-Link / Y-Link is registered as failed. If an OB82 is rejected, the corresponding DP Slave is registered as failed.

Time response

Does not exist

Message characteristics

After it has been called up by OB70, OB72, OB85 or OB86, the block analyses the state of the CPU, DP Master and link assigned to it. If necessary, it generates the corresponding messages for redundancy loss and failure of the link by emitting an ALARM_8P.

The block generally only signals events whose cause lies within the link monitored by it. Redundancy losses and link failures which result from the failure of a DP Master or of a CPU, are initially neither signaled nor indicated at the outputs SUBN1ERR and SUBN2ERR.

The DELAY input allows a signal delay, which can be configured, for an outgoing higher-order error. If, for example, the block recognizes an outgoing error in a DP master connected to it, it initially assumes that there is a faulty assigned DP slave in the link monitored by it and sets the corresponding output SUBNxERR. The error is not canceled until the DP slave returns (in this case: OB86, OB70). The blocks suppress the potential slave failure for DELAY seconds in order not to trigger a wave of messages from the DP slaves which are not synchronized yet after the master returns. An error message is not output to the OS unless a DP slave does not report its return before this period expires.

You should not set the value of DELAY too high. Otherwise DP slaves which were removed during the master failure or which are defective will be reported back to the OS after the master returns with a correspondingly high delay period.

The block generates the following messages in the OBs listed below:

OB No.	Starting event	Message
OB1	Cyclic processing	Repeat updating ALARM_8P outputs / messages, if necessary
OB70	Redundancy loss	Link redundancy loss/return
OB85	I/O access error	Link failure going
OB86	Rack monitoring	Link failure coming/going
OB100	Restart	Initializing ALARM_8P

Operator control and monitoring

The block does not have a faceplate.

Note

In "Connection of DPAY V0" the variables are identified (with a "+" in the column OCM) which are transferred from this instance block to the OS when the option "Operator C and M capability for diagnostic blocks" in the "Generate Module Driver" settings is selected. Default: option is not set.

3.6.2 Connections of DPAY_V0

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O	OC& M
ACC_ID	1=Accept New ID Settings	BOOL	0	I/O	
CPU_DIAG	CPU diagnostics	STRUCT		I/O	
DADDR	Diagnostic Address of DP-Slave	INT	0	I	
DELAY	Alarm Delay (s)	INT	15	I	
DPA_M_xx	Status Modules of DP/PA Slave (xx = 00 – 63)	STRUCT		O	
DPPA_ST	DP/PA-/Y-Link Status	STRUCT		O	
DPPA_xx	Information of DP/PA-Slave (xx = 00 - 63)	STRUCT		I	
EN_MSG	1=Enable Alarm	BOOL	1	I	
EN_Mxx	1=Enable module (xx = 00 - 63)	BOOL	0	O	
EV_ID	Event ID	DWORD	0	I	
MSG_STAT	Message Failure	WORD	0	O	
RAC_DIAG	Rack diagnostic	BOOL	0	O	
RACK_NO	Rack/Station Number	WORD	0	I	
SUB_DIAG	OB_Start Information	STRUCT		I/O	
SUBN_TYP	1=External DP interface	BOOL	0	I	
SUBN1_ID	ID of Primary Subnet	BYTE	255	I	
SUBN1ACT	1 = Slave 1 Active	BOOL	0	O	+
SUBN1ERR	1 = Subnet Failure of Primary Subnet	BOOL	0	O	+
SUBN2_ID	ID of Redundant Subnet	BYTE	255	I	
SUBN2ACT	1 = Slave 2 Active	BOOL	0	O	+
SUBN2ERR	1 = Subnet Failure of Primary Subnet	BOOL	0	O	+

3.6.3 Message texts and auxiliary process values of DPAY_V0

Assignment of message text and message class

Message No.	Default message text	Message class
1	DP-Link @1%d@/ @3%d@: Redundancy loss	S
2	DP-Link @2%d@/ @3%d@: Redundancy loss	S
3	DP-Link @1%d@/ @3%d@: Failure	S
4	DP-Link @2%d@/ @3%d@: Failure	S
5	-	-
6	-	-
7	-	-
8	-	-

Assignment of the auxiliary values

Value	Block parameter
1	Primary DP Master system ID (SUBN1_ID)
2	Redundant DP Master system ID (SUBN2_ID)
3	Rack/Station number (RACK_NO)

3.7 PA_TOT: Totalizer PROFIBUS PA

Object name (Type + Number)

FB 102

Area of Application

The block processes the cyclic parameters of the PA Profile "Totalizer" of a PA field device in accordance with PROFIBUS PA 3.0 Class A and B.

Calling OBs

The calling OB is the watchdog interrupt OB3x, in which you install the block (for example OB32) and OB1 and the restart OB100.

Use in the CFC

If the CFC function "**Generate Module Driver**" is used, the following steps are carried out automatically:

- The installation of block in OB1 and OB100.
- The symbol for the Quality Code of the analog input channel is interconnected to the input QC and other selected options.
- The MODE input is interconnected to the corresponding output OMODE_xx of the PADP_L0x block.

Function and Operating principle

The block cyclically reads the process value (TOTAL) with status byte (Quality Code) of the PROFIBUS PA field device (structure in accordance with the Totalizer of the PA profiles) from the (part) process image. The process value exists as a physical value. The status byte contains information on the measured value and the state of the PROFIBUS PA field device or HART device.

In order to improve the interconnectability further important detailed information in addition to the status byte as Boolean (BOOL) values is supplied at the output interface. They correspond to the bit combinations specified in the PROFIBUS PA 3.0 "General Requirements". Device-specific control system messages are generated via ALARM_8P on the basis of the status of the status byte.

The quality code QUALITY for the process value is determined from the status of the input MODE and the output STATUS. PA MODE recognizes a higher level error e.g. DP/PA Link failure via the input MODE The block recognizes a higher-level error (for example failure of DP/PA-Link) via the MODE input MODE. If the

High Byte of the input MODE = 16#80, the values in the (part) process image are valid. If the High Byte of the MODE input = 16#40 (value status = higher-level error), the analog value is handled as invalid. The Quality Code (QUALITY) is set to 16#44 or 16#48. The same is true for a STATUS with status "BAD". Otherwise STATUS and QUALITY are identical.

In case of a higher-level error no messages are generated

Optionally the input variables SET_TOT and MODE_TOT can be written to the (part) process image.

Addressing

The symbol generated with HW Config in the symbol table for the analog input channel has to be interconnected to the TOTAL input . The symbol for the Quality Code of the analog input channel interconnects the CFC function "Generate Module Driver" with the input QC and, as far as they exist, the outputsO_SET_TOT and O_MODE_TOT for you.

Simulation

If the input parameter SIM_ON = TRUE, the value of the input SIM_V is output with Quality Code (QUALITY =) 16#60. Simulation has the highest priority. If there is a higher-level error, QBAD = FALSE is set. If the block is in simulation state, QSIM = TRUE is set. If there is no higher-level error and the PA field device displays a Quality Code “BAD”, either the substitute value SUBS_V (SUBS_ON= TRUE) or the last value is output.

Substitution value

If the input parameter SUBS_ON = TRUE, the value of the input parameter SUBS_V is output as the value, in as far as the values are invalid. The Quality Code is set to (QUALITY =) 16#48 and QBAD = 1.

Hold last value

If the input parameter SUBS_ON = FALSE, the last valid output parameter is output if the values are invalid. The Quality Code is set to (QUALITY =) 16#44 and QBAD = 1.

Value limiting

You can limit very low or very high process values from the (part) process image.

If the switch LIMIT_ON = TRUE, the process values (V) are limited:

- To V_HL, if V > V_HL.
- To LL_V, if V < V_LL.

Error handling

No plausibility checks are carried out with reference to the input parameters.

Start-up characteristics

Input MODE = 16#xx01xxxx: Initializing ALARM_8P.

Time response

Does not exist.

Message characteristics

As long as there is no higher-level error, the block signals the current state of the Quality Code (status byte) when there is a change. The messages are event messages which do not have to be acknowledged and are only stored in the chronic list of the OS. If the QBAD and QUNCERT outputs are interconnected to the CSF input (external error) of the technological block, this block generates a control system message if a malfunction arises.

The DELAY input (default setting 2 seconds) is used to delay an event message when there is a change in the Quality Code. With DELAY you can specify the period in seconds which the block waits when there is a change in the Quality Code after a higher-level error (DP Master system failure, DP/PA-Link failure, device failure or I/O access error), (MODE = 16#40xxxxxx) has gone, until it emits the message. Messaging can be de-activated by using EN_MSG = FALSE.

Operator control and monitoring

The block does not have a faceplate.

3.7.1 Connections of PA_TOT

The state of delivery of the block display in the CFC is marked in the "Connection" column: Connection name **bold** = Connection displayed, normal = Not displayed.

Connection (parameter)	Meaning	Data type	Initial	I/O
DELAY	Alarm Delay (s)	INT	2	I
EN_MSG	1=Enable Alarm	BOOL	1	I
EV_ID	Event ID	DWORD	0	I
LIMIT_ON	1=Limit on Input Value	BOOL	0	I
LL_V	High Limit Input Value. Set Value if V < V_LL	REAL	0	I
MODE	MODE Input parameter	DWORD	0	I/O
MODE_TOT	Mode Totalizer 0=Balanced, 1=pos_only, 2=neg_only, 3=hold	BYTE	0	I
MSG_STAT	Message Failure	WORD	0	O
O_SET_TOT	Totalize Algorithm	BYTE	0	O
O_MODE_TOT	Totalizer Mode	BYTE	0	O
QA_1	1 = Alarm/Warning 1	BOOL	0	O
QA_2	1 = Alarm/Warning 2	BOOL	0	O
QBAD	1 = Collected event QBAD_X	BOOL	0	O
QBAD_0	1 = Non-specific	BOOL	0	O
QBAD_1	1 = Configuration error	BOOL	0	O
QBAD_2	1 = Not connected	BOOL	0	O
QBAD_3	1 = Device failure	BOOL	0	O
QBAD_4	1 = Sensor failure	BOOL	0	O
QBAD_5	1 = No communication (last usable value)	BOOL	0	O
QBAD_6	1 = No communication (no usable value)	BOOL	0	O
QBAD_7	1 = Out of service	BOOL	0	O
QBAD_HL	1 = High limit upper physical range of sensor has been reached	BOOL	0	O
QBAD_LL	1 = Low limit lower physical range of sensor has been reached	BOOL	0	O
QC	Input Process Value Quality Code	BYTE	O	I
QCASCAD0	1 = OK (cascade)	BOOL	0	O
QCASCAD1	1 = Initialization acknowledged	BOOL	0	O
QCASCAD2	1 = Initialization request	BOOL	0	O
QCASCAD3	1 = Not requested	BOOL	0	O
QCASCAD4	1 = Reserved	BOOL	0	O
QCASCAD5	1 = Do not select	BOOL	0	O
QCASCAD6	1 = Local override	BOOL	0	O
QCASCAD7	1 = Reserved	BOOL	0	O
QCASCAD8	1 = Initiate fail safe	BOOL	0	O
QCONST	1 = Constant	BOOL	0	O
QERR	1 = Error output (inverted value of ENO)	BOOL	1	O
QOUT_HHL	1 = Active critical alarm, high limit of OUT has been exceeded	BOOL	0	O

Connection (parameter)	Meaning	Data type	Initial	I/O
QOUT_HL	1 = Active advisory alarm, high limit of OUT has been exceeded	BOOL	0	O
QOUT_LL	1 = Active advisory alarm, low limit of OUT has been exceeded	BOOL	0	O
QOUT_LLL	1 = Active critical alarm, low limit of OUT has been exceeded	BOOL	0	O
QNONCAS0	1 = OK (non-cascade)	BOOL	0	O
QNONCAS1	1 = Update event	BOOL	0	O
QNONCAS2	1 = Active advisory alarm (priority <8)	BOOL	0	O
QNONCAS3	1 = Active critical alarm (priority >8)	BOOL	0	O
QNONCAS4	1 = Unacknowledged update event	BOOL	0	O
QNONCAS5	1 = Unacknowledged advisory alarm	BOOL	0	O
QNONCAS6	1 = Unacknowledged critical alarm	BOOL	0	O
QNONCAS7	1 = Initial fail safe	BOOL	0	O
QNONCAS8	1 = Maintenance required	BOOL	0	O
QSIM	1 = Simulation Active	BOOL	0	O
QSUBS	1 = Failure Substitution Active	BOOL	0	O
QUALITY	Value status of the process value	BYTE	0	O
QUNCERT	1 = Collected event QUNCERTx	BOOL	0	O
QUNCERT0	1 = Non-specific	BOOL	0	O
QUNCERT1	1 = Last usable value	BOOL	0	O
QUNCERT2	1 = Substitute set	BOOL	0	O
QUNCERT3	1 = Initial value	BOOL	0	O
QUNCERT4	1 = Sensor conversion not accurate	BOOL	0	O
QUNCERT5	1 = Engineering unit violation (unit not in the valid set)	BOOL	0	O
QUNCERT6	1 = Sub-normal	BOOL	0	O
QUNCERT7	1 = Configuration error	BOOL	0	O
QUNCERT8	1 = Sensor calibration	BOOL	0	O
QUNCERT9	1 = Simulated value	BOOL	0	O
SET_TOT	Algorithm 0=Totalize, 1=Reset assign 0, 2=preset assign PRESET_TOT	BYTE	0	I
SIM_ON	1 = Activate Simulation	BOOL	0	I
SIM_V	Simulation Value	REAL	0	I
STATUS	Process Value Status	BYTE	0	O
SUBS_ON	1 = Enable Failure Substitution	BOOL	0	I
SUBS_V	Substitution Value	REAL	0	I
TOTAL	Input Value	REAL	0	I
V	Process Value	REAL	0	O
V_HL	High Limit Input Value	REAL	0	I
V_LL	Low Limit Input Value	REAL	0	I

3.7.2 Message texts and auxiliary process values of PA_TOT

Assignment of message texts and classes to the block parameters of PA_TOT

Message block ALARM_8P	Message number	Block parameter	Default message text	Message class
EV_ID	1	QBAD	Device failure	**S**
	2	QUNCERT	Uncertain value	**S**
	3	QNONCAS1	Update event	**S**
	4	QNONCAS7	Initiate fail safe	**S**
	5	QNONCAS8	Maintenance required	**M**
	6	QOUT_LLL	Lower alarm	**AL**
	7	QOUT_HHL	Upper alarm	**AH**
	8			**No message**

A Appendix

A.1 Addressing

If you do not use the CFC function "Generate Module Driver", you have to set the logical basic address of the module created with HW Config at the input LADDR. If the input SUBN_TYP = FALSE, the RACK of the module is connected to an integrated DP interface (distributed I/O device interface) of the CPU module by means of a line. Otherwise set SUBN_TYP = TRUE.

The following points are generally to be observed for all the SM and PA modules:

- In the case of pure input modules, that is modules which write data exclusively into the input range of the CPU process image the basic address can be taken directly from HW Config.,
  for example: the module SM331 AI 8x12Bit 331-7KF01-0AB0:

Address input range HW Config	Address output range HW Config	LADDR (decimal / hex)
512	-	512 / 16#0200

- In the case of pure output modules, that is modules which read data exclusively from the output range of the CPU process image, the MSB (most significant bit) has to be set in the basic address from HW Config.;
  for example the module SM332 AO 4x12Bit 332-5HD01-0AB0:

Address input range HW Config	Address output range HW Config	LADDR (decimal / hex)
-	512	-32256 / 16#8200

A.2 Error information of the MSG_STAT output parameter

The messages can be de-activated via the input EN_MSG = FALSE (output parameter MSG_STAT(_x) remains unchanged).

The ALARM8_P(_x) block is called in the acyclic OBs and OB1 if message suppression has not been suppressed Error information of the ALARM_8P(_x) (messages cannot be emitted) is displayed in the output parameter MSG_STAT(_x).

The error information of the output parameter MSG_STAT and of the acknowledgment word MSG_ACK(_x) of ALARM8_8P is described in the on-line help for SSFB35 (ALARM_8P).

A.3 MODE settings for Signal Modules

Measuring range coding of the analog input module

Depending on the coding of the measuring range of the analog input modules, the parameter MODE_xx (measuring range coding) corresponding to the channel must be specified in accordance with the table. When thermoelements are used (due to the various combinations of the measuring type (Coding A) with the measuring range (Coding B)) this is to be calculated in accordance with the following formula and the result then entered as an INTEGER value at the MODE input:
MODE = 256 ∗ Coding A + Coding B
Please note that in the table Codings **A** and **B** are binary encoded and that the result is shown as the **MODE** parameter as a hexadecimal number.

Measuring type	**Coding (A)**	**Measuring range**	**Coding (B)**	**MODE (256∗A+B)**
Voltage	2#0001	± 25 mV	2#1010	16#010A
		± 50 mV	2#1011	16#010B
		± 80 mV	2#0001	16#0101
		± 250 mV	2#0010	16#0102
		± 500 mV	2#0011	16#0103
		± 1 V	2#0100	16#0104
		± 2.5 V	2#0101	16#0105
		± 5 V	2#0110	16#0106
		1 to 5 V	2#0111	16#0107
		± 10 V	2#1001	16#0109
		± 100 V	2#1100	16#010C
4-wire measuring transducer	2#0010	± 3.2 mA	2#0000	16#0200
		± 5 mA	2#0101	16#0205
		± 10 mA	2#0001	16#0201
		0 to 20 mA	2#0010	16#0202
		4 to 20 mA	2#0011	16#0203
		± 20 mA	2#0100	16#0204

Measuring type	Coding (A)	Measuring range	Coding (B)	MODE (256*A+B)
HART interface	2#0111	4 to 20 mA	2#1100	16#070C
2-wire measuring transducer	2#0011	4 to 20 mA	2#0011	16#0303
Resistor 4-wire connection	2#0100	48 Ω	2#0000	16#0400
		150 Ω	2#0010	16#0402
		300 Ω	2#0100	16#0404
		600 Ω	2#0110	16#0406
		6000 Ω	2#1000	16#0408
Resistor 3-wire connection	2#0101	48 Ω	2#0000	16#0500
		150 Ω	2#0010	16#0502
		300 Ω	2#0100	16#0504
		600 Ω	2#0110	16#0506
		6000 Ω	2#1000	16#0508
Resistor 2-wire connection	2#0110	48 Ω	2#0000	16#0600
		150 Ω	2#0010	16#0602
		300 Ω	2#0100	16#0604
		600 Ω	2#0110	16#0606
		6000 Ω	2#1000	16#0608
Thermal resistor + linearization 4-wire connection	2#1000	Pt 100 climate range	2#0000	16#0800
		Pt 200 climate range	2#0111	16#0807
		Pt 500 climate range	2#1000	16#0808
		Pt 1000 climate range	2#1001	16#0809
		Ni 100 climate range	2#0001	16#0801
		Ni 1000 climate range	2#1010	16#080A
		Pt 100 standard range	2#0010	16#0802
		Pt 200 standard range	2#0011	16#0803
		Pt 500 standard range	2#0100	16#0804
		Pt 1000 standard range	2#0101	16#0805
		Ni 100 standard range	2#1011	16#080B
		Ni 1000 standard range	2#0110	16#0806
		Ni 120 standard range	2#1100	16#080C
		Ni 120 climate range	2#1101	16#080D
		Cu10 climate range	2#1110	16#080E
		Cu10 standard range	2#1111	16#080F
		Ni 200 standard range	2#10000	16#0810
		Ni 200 climate range	2#10001	16#0811
		Ni 500 standard range	2#10010	16#0812
		Ni 500 climate range	2#10011	16#0813
Thermal resistor + linearization 3-wire connection	2#1001	Pt 100 climate range	2#0000	16#0900
		Pt 200 climate range	2#0111	16#0907
		Pt 500 climate range	2#1000	16#0908

Measuring type	Coding (A)	Measuring range	Coding (B)	MODE (256∗A+B)
		Pt 1000 climate range	2#1001	16#0909
		Ni 100 climate range	2#0001	16#0901
		Ni 1000 climate range	2#1010	16#090A
		Pt 100 standard range	2#0010	16#0902
		Pt 200 standard range	2#0011	16#0903
		Pt 500 standard range	2#0100	16#0904
		Pt 1000 standard range	2#0101	16#0905
		Ni 100 standard range	2#1011	16#090B
		Ni 1000 standard range	2#0110	16#0906
		Ni 120 standard range	2#1100	16#090C
		Ni 120 climate range	2#1101	16#090D
		Cu10 climate range	2#1110	16#090E
		Cu10 standard range	2#1111	16#090F
		Ni 200 standard range	2#10000	16#0910
		Ni 200 climate range	2#10001	16#0911
		Ni 500 standard range	2#10010	16#0912
		Ni 500 climate range	2#10011	16#0913
Thermal resistor + linearization 2-wire connection	2#1100	Pt 100 climate range	2#0000	16#0C00
		Pt 200 climate range	2#0111	16#0C07
		Pt 500 climate range	2#1000	16#0C08
		Pt 1000 climate range	2#1001	16#0C09
		Ni 100 climate range	2#0001	16#0C01
		Ni 1000 climate range	2#1010	16#0C0A
		Pt 100 standard range	2#0010	16#0C02
		Pt 200 standard range	2#0011	16#0C03
		Pt 500 standard range	2#0100	16#0C04
		Pt 1000 standard range	2#0101	16#0C05
		Ni 100 standard range	2#1011	16#0C0B
		Ni 1000 standard range	2#0110	16#0C06
		Ni 120 standard range	2#1100	16#0C0C
		Ni 120 climate range	2#1101	16#0C0D
		Cu10 climate range	2#1110	16#0C0E
		Cu10 standard range	2#1111	16#0C0F
		Ni 200 standard range	2#10000	16#0C10
		Ni 200 climate range	2#10001	16#0C11
		Ni 500 standard range	2#10010	16#0C12
		Ni 500 climate range	2#10011	16#0C13

Measuring type	Coding (A)	Measuring range	Coding (B)	MODE (256*A+B)
Thermocouples internal comparison	2#1010	Type B [PtRh-PtRh]	2#0000	16#0A00
		Type N [NiCrSi-NiSi]	2#0001	16#0A01
		Type E [NiCr-CuNi]	2#0010	16#0A02
		Type R [PtRh-Pt]	2#0011	16#0A03
		Type S [PtRh-Pt]	2#0100	16#0A04
		Type J [Fe-CuNi IEC]	2#0101	16#0A05
		Type L [Fe-CuNi DIN]	2#0110	16#0A06
		Type T [Cu-CuNi IEC]	2#0111	16#0A07
		Type K [NiCr-Ni]	2#1000	16#0A08
		Type U [Cu-CuNi DIN]	2#1001	16#0A09
Thermocouples external comparison	2#1011	Type B [PtRh-PtRh]	2#0000	16#0B00
		Type N [NiCrSi-NiSi]	2#0001	16#0B01
		Type E [NiCr-CuNi]	2#0010	16#0B02
		Type R [PtRh-Pt]	2#0011	16#0B03
		Type S [PtRh-Pt]	2#0100	16#0B04
		Type J [Fe-CuNi IEC]	2#0101	16#0B05
		Type L [Fe-CuNi DIN]	2#0110	16#0B06
		Type T [Cu-CuNi IEC]	2#0111	16#0B07
		Type K [NiCr-Ni]	2#1000	16#0B08
		Type U [Cu-CuNi DIN]	2#1001	16#0B09
Thermocouples + linearization internal comparison	2#1101	Type B [PtRh-PtRh]	2#0000	16#0D00
		Type N [NiCrSi-NiSi]	2#0001	16#0D01
		Type E [NiCr-CuNi]	2#0010	16#0D02
		Type R [PtRh-Pt]	2#0011	16#0D03
		Type S [PtRh-Pt]	2#0100	16#0D04
		Type J [Fe-CuNi IEC]	2#0101	16#0D05
		Type L [Fe-CuNi DIN]	2#0110	16#0D06
		Type T [Cu-CuNi IEC]	2#0111	16#0D07
		Type K [NiCr-Ni]	2#1000	16#080D
		Type U [Cu-CuNi DIN]	2#1001	16#090D
Thermocouples + linearization external comparison	2#1110	Type B [PtRh-PtRh]	2#0000	16#0E00
		Type N [NiCrSi-NiSi]	2#0001	16#0E01
		Type E [NiCr-CuNi]	2#0010	16#0E02
		Type R [PtRh-Pt]	2#0011	16#0E03
		Type S [PtRh-Pt]	2#0100	16#0E04
		Type J [Fe-CuNi IEC]	2#0101	16#0E05
		Type L [Fe-CuNi DIN]	2#0110	16#0E06
		Type T [Cu-CuNi IEC]	2#0111	16#0E07
		Type K [NiCr-Ni]	2#1000	16#080E
		Type U [Cu-CuNi DIN]	2#1001	16#090E

Measuring range coding of the analog output modules

Depending on the coding of the measuring range of the analog output modules, the parameter MODE_xx (measuring range coding) corresponding to the channel must be specified in accordance with the table.

Measuring type	Measuring range	MODE
Voltage	1 to 5 V	16#0107
	0 to 10 V	16#0108
	± 10 V	16#0109
Current	0 to 20 mA	16#0202
	4 to 20 mA	16#0203
	± 20 mA	16#0204
HART interface	4 to 20 mA	16#070C

Measuring range coding of the digital input and digital output modules

There is neither a measuring type nor a measuring range for digital input and digital output modules:

MODE = 16#FFFF (at DI)
MODE = 16#FFFE (at DO)

OMODE structure

The outputs OMODE_xx of data type DWORD are structured as follows and have the following meaning:

Byte 3:	16#80: Value status "valid value" 16#20: Value status "valid value" 16#00: Value status "invalid value" 16#40: Value status "invalid value"	 (redundancy error) (channel error) (higher-level error)
Byte 2:	16#01: Restart (OB100) has been carried out	
Byte 1, 0 (Low Word):	MODE (see above)	

Example:
16#80010203 corresponds to value state "valid value", restart has been carried out, current 4 to 20mA

A.4 MODE settings for PA Devices

MODE_xx inputsare available for a maximum of 32 slots of a PA field device. Their initial value is zero (no reading/writing). Per Slot xx you have to set the selected combination of the options of the PROFIBUS PA 3.0 - Profile at the MODE_xx input:

Block	**Connection (parameter) (cyclic data) permitted combination and sequence**	**Input (I) / Output (O) (PLS view)**	**MODE 16#xxyy, O=xx I=yy**
Analog Input (PA_AI)	OUT	I	16#0001
Totalizer (PA_TOT)	TOTAL	I	16#000F
Totalizer (PA_TOT)	TOTAL SET_TOT	I O	16#070F
Totalizer (PA_TOT)	TOTAL SET_TOT MODE_TOT	I O O	16#080F
Analog Output (PA_AO)	SP	O	16#0100
Analog Output (PA_AO)	SP READBACK POS_D	O I I	16#0103
Analog Output (PA_AO)	SP CHECK_BACK	O I	16#0104
Analog Output (PA_AO)	SP READBACK POS_D CHECK_BACK	O I I I	16#0105
Analog Output (PA_AO)	RCAS_IN, RCAS_OUT	O I	16#0206
Analog Output (PA_AO)	RCAS_IN, RCAS_OUT, CHECK_BACK	O I I	16#0207
Analog Output (PA_AO)	SP RCAS_IN READBACK RCAS_OUT POS_D CHECK_BACK	O O I I I I	16#0308
Discrete Input (PA_DI)	OUT_D	I	16#0002
Discrete Output (PA_DO)	SP_D	O	16#0400
Discrete Output (PA_DO)	SP_D READBACK_D	O I	16#0409
Discrete Output (PA_DO)	SP_D CHECKBACK_D	O I	16#040A
Discrete Output (PA_DO)	SP_D READBACK_D CHECK_BACK_D	O I I	16#040B
Discrete Output (PA_DO)	RCAS_IN_D RCAS_OUT_D	O I	16#050C

Block	Connection (parameter) (cyclic data) permitted combination and sequence	Input (I) / Output (O) (PLS view)	MODE 16#xxyy, O=xx I=yy
Discrete Output (PA_DO)	RCAS_IN_D RCAS_OUT_D CHECK_BACK_D	O I I	16#0D05
Discrete Output (PA_DO)	SP_D RCAS_IN_D READBACK_D RCAS_OUT_D CHECK_BACK_D	O O I I I	16#0E06

A.5 Text Library for Signal Modules

The event class/event ID, their message texts and text IDs of the text libraries MOD_1_TXT / MOD_2_TXT / MOD_D1_TXT and MOD_D2_TXT are summarized in the following table:

Text ID.	Event class / ID	Message text	Remark
1	08/50, 08/60, 08/70, 08/80	Configuration error	
2	08/51, 08/61	Common mode error	
3	08/52, 08/62, 08/72, 08/82	P short circuit	
4	08/53, 08/63, 08/73, 08/83	M short circuit	
5	08/54, 08/64, 08/74, 08/84	Wire breakage	
6	08/55	Reference channel error	
7	08/56	Below measuring range	
8	08/57	Above measuring range	
9	08/66, 08/86	Load voltage missing	
10	08/71, 08/81	Mass error	
11	08/75	Sensor supply missing	
12	08/87	Over-temperature	
13	08/00	Module OK	
14	08/01	Internal error	
15	08/02	External error	
16	08/04	External auxiliary voltage missing	
17	08/05	Front connector missing	
18	08/06	No configuration	
19	08/07	False parameter in BG	
20	08/30	False/Missing user module	
21	08/31	Communication error	
22	08/32	Operating mode RUN/STOP	STOP: incoming, RUN: outgoing
23	08/33	Time-check operates	

Text ID.	Event class / ID	Message text	Remark
24	08/34	Failed BG-int. Supply voltage	
25	08/35	Battery 1 empty	
26	08/36	Standby supply fails	
27	08/41	Processor failure	
28	08/42	EPROM error	
29	08/43	RAM error	
30	08/44	ADU/DAU error	
31	08/45	Fuse blown	
32	08/46	Process interrupt lost	
33	03/61	withdrawn	EV_CLAS = 16#39
34	03/61	plugged	EV_CLAS = 16#38
35	03/63	false BG type plugged	EV_CLAS = 16#39
36	03/64	faulty BG plugged	EV_CLAS = 16#39
37	03/65	BG plugged (Param.error)	EV_CLAS = 16#39
38		Chatter error	
39		Changeover contact diagnostics	

A.6 Text Libraries for DP-/PA-Slaves after a PA-/Y-LINK DP V0

PADP_L00_TXT

PADP_L01_TXT

PADP_L02_TXT

Text ID.	Message text
1	Module error
2	False module
3	Module missing

A.7 Technical data

The column headings have the following meaning:

Block type name

The symbolic identifier in the symbol table of the library for the respective FB or FC. FC It must be unique within the project.

Object name

The object name consists of the block type (FB, FC) and the number.

Typical Execution Time

The time which the CPU needs to process the corresponding block program under normal circumstances (for example, for a driver this is the execution time in the watchdog interrupt organization block (OB3x) without message generation in the event of channel errors).

The table below shows the execution times of the blocks in a 417-4H CPU (6ES7 417-4HL01-0AB0). With other CPUs the run time depends on their performance.

Block Length in Load/Work Memory

Memory requirements of the program code, with each block type having unique requirements.

Length of the Instance Data in Load/Work Memory

Memory requirement of an instance DB.

Length of the Local Data

The local-data memory required in the OB when the block is called. This is limited CPU-specifically. When it is exceeded, a CPU STOP is caused. The local data requirements are checked in CFC when you compile/download and downloading is prevented if there is not enough local data memory.

Block Outputs Messages

Where “yes“ is indicated for a block, this means that the block outputs messages.

Block Type Name (Object Name)	Typical Execution Time CPU 417-4H [ms]	Block Length in Load/Work Memory [bytes]	Length of the Instance Data in Load /Work Memory [bytes]	Length of the Local Data [bytes]	Block Outputs Messages
CH_AI (FC 275)	0,080	5484 / 4724		28	
CH_AO (FC 276)	0,060	1696 / 1436		28	
CH_DI (FC 277)	0,035	418 / 314		4	
CH_DO (FC 278)	0,025	330 / 248		2	
CH_U_AI (FC 283)	0,065	5036 / 4340		30	
CH_U_AO (FC 284)	0,050	1472 / 1254		28	
CH_U_DI (FC 285)	0,024	658 / 512		4	
CH_U_DO (FC 286)	0,018	522 / 416		2	
IM_DRV (FB 90)	0,300	13090 / 10398	5938 / 4056	112	**yes**
MOD_1 (FB 91)	0,400	4584 / 3580	1080 / 326	60	**yes**
MOD_2 (FB 92)	0,600	4982 / 3912	1240 / 422	58	**yes**
MOD_D1 (FB 93)	0,400	12876 / 10960	1724 / 666	68	**yes**
MOD_D2 (FB 94)	0,600	13092 / 11052	2396 / 1070	70	**yes**
OB_BEGIN (FB 100)	0,500	20470 / 17092	6164 / 3632	208	**yes**
OB_END (FC 280)	0,010	514 / 86		4	
OB_DIAG (FC 281)	0,080	5148 / 4266		86	
DPAY_V0 (FB 108)	0,900	9986 / 7362	3568 / 1374	134	**yes**
PADP_L00 (FB 109)	0,220	3564 / 2728	888 / 254	40	**yes**
PADP_L01 (FB 110)	0,900	4704 / 3662	1394 / 570	40	**yes**
PADP_L02 (FB 111)	1,000	6330 / 5040	1992 / 944	40	**yes**
PA_AI (FB 101)	0,100	2046 / 1706	504 / 222	12	**yes**
PA_AO (FB 103)	0,140	3058 / 2592	636 / 272	18	**yes**
PA_DI (FB 104)	0,080	1782 / 1488	440 / 192	12	**yes**
PA_DO (FB 105)	0,120	2804 / 2392	552 / 218	18	**yes**
PA_TOT (FB 102)	0,100	2176 / 1814	520 / 226	18	**yes**
PO_UPDAT (FC 279)	-	324 / 252		10	
RACK (FB 107)	0,300	8366 / 7048	1108 / 236	100	**yes**
SUBNET (FB 106)	0,800	5374 / 4132	1146 / 214	106	**yes**

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