SEC-ENGLISH-Gefahrenhinweise-V1.00-20210701

Hazard Warnings

Hazard warnings in this manual indicate potential harm to the user or the product. For the person interacting with the product, the level of risk includes consequences ranging from slight, up to lethal injuries. As for the product, disobeying the warnings may cause damage to the equipment and/or void the warranty. Therefore, said warnings are made apparent to instruct and warn the user, which precautions have to be made prior to performing any actions described in this manual. The user must read and be familiar with the manual, before performing any tasks as described in this manual.

Hazard warnings in this manual are presented in these three forms:

WARNING: These warning notices refer to personal safety. Failure to obey these notices could result in personal injury or death.

CAUTION: General precautions must be made. Failure to obey these notices could result in personal injury and/or equipment damage.

NOTE: Directs the user's attention to essential information.

SEC-DS-ENGLISH-PROFINET-V1.02-2023.08.01

Profinet Additional Board for SMARTCON Control

1 General

A fieldbus interface for the Profinet bus system is available for SCHIEBEL actuators in the ACTUSMART and SMARTCON series. Profinet is an IEEE 802 Ethernet-based fieldbus system.
This interface is a hardware option and should already be known when ordering the actuator.

2 Topology

Since two ports are executed on the additional board for the Profinet, the following network topologies can be implemented:

- Line structure
- Tree structure
- Star structure
- Ring structure (if supported by the master)
- Mixed forms

Example:

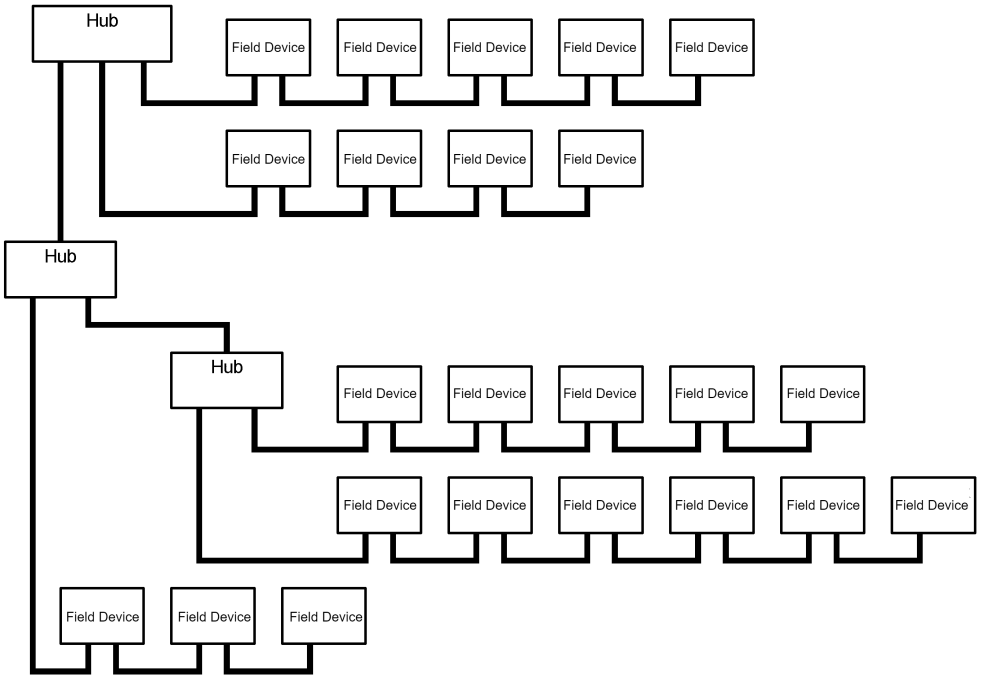

Figure 1: *Topology*

3 Technical Data

Feature	Value
Maximum number of total cyclic input data	1440 bytes (including IOPS and IOCS)
Maximum number of total cyclic output data	1440 bytes (including IOPS and IOCS)
Topology recognition	LLDP, SNMP V1, Physical Device Record Objects
Minimum cycle time (MinDeviceInterval)	1ms
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3, MAUType 16
Minimum RDHT (SystemRedundancy only)	200 ms

4 Limitations

- RT over UDP not supported.
- Multicast communication not supported.
- Only one device instance is supported.
- DHCP is not supported.
- Little endian byte order not supported.
- System Redundancy (SR-AR) and Dynamic Reconfiguration (formerly known as Configuration-in-Run, CiR) are not supported.
- The usage of PROFINET CombinedObjectContainer.
- SharedInput is not supported.
- MRPD is not supported.
- DFP and other HighPerformance-profile related features are not supported.
- FiberOptic Ethernet Physics are not supported. Neither Profinet specific “POF” nor real optical fiber is supported. Only copper-based Ethernet 100BASETXFD (MAUType 16) is supported.
- Configuration with iniBatch configuration file (inibatch.nxd) is not supported.

5 Connection

Depending on the order there are the following connections possible:

- standard design: M12 connectors
- explosion proof design: terminals

5.1 Standard design

The connection of the ACTUSMART and SMARTCON control to the Profinet fieldbus at the field level is done via 4-pin, D-coded, M12 connectors, to meet the required high degree of protection (see IEC 61076-2-101). The female side is on the device, and the male side on the cable side.
Two equivalent M12 connectors, which are internally wired to a hub, are located on the ACUSMART and SMARTCON control unit with Profinet. With this, a line structure can be implemented. Which connection is used is irrelevant for the function.

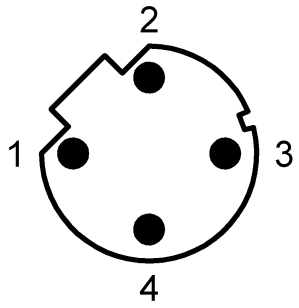

Figure 2: *Pin assignment on device side (female side)*

Pin	Function
1	Tx+
2	Rx+
3	Tx-
4	Rx-

The devices are connected via crossover cables, i.e.:

Tx+	to	Rx+
Tx-	to	Rx-
Rx+	to	Tx+
Rx-	to	Tx-

The cable types recommended are standard patch cables (twisted pair, S/UTP, AWG26, Cat5e).
The cable shield has to be connected to the actuator housing over the connector housing.
It is important to ensure that there are no potential differences between the individual devices in the Profinet network so that no transient currents flow over the cable shield.

5.2 Explosion proof design

For explosion proof actuators and control units, the connection to the fieldbus is realized through screw terminals. As shown in figure 3, an additional frame is provided to enable proper wiring. There are in total four M20x1,5 threaded holes, which lead directly to shielding connection clamps, to allow proper earthing of the fieldbus cables.

NOTE: The shield must be connected to the shielding connection clamp (windowcut) - see Figure 3 and 4.

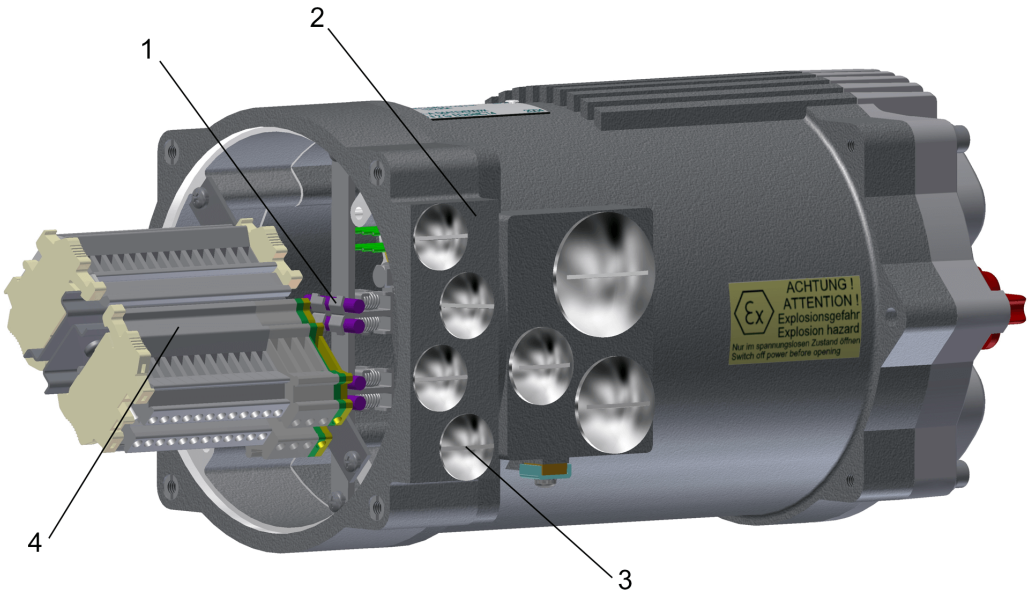

Figure 3: *1. . . shielding connection clamp, 2. . . additional frame, 3. . . metallic cable glands (closed with blind screw connections at delivery) 4 xM20x1,5, 4. . . terminal strip*

The devices are connected via crossover cables, i.e.:

Tx+	to	Rx+
Tx-	to	Rx-
Rx+	to	Tx+
Rx-	to	Tx-

The cable types recommended are standard patch cables (twisted pair, S/UTP, AWG26, Cat5e).
The cable shield has to be connected to the actuator housing over the shielding connection clamp.
It is important to ensure that there are no potential differences between the individual devices in the Profinet network so that no transient currents flow over the cable shield.

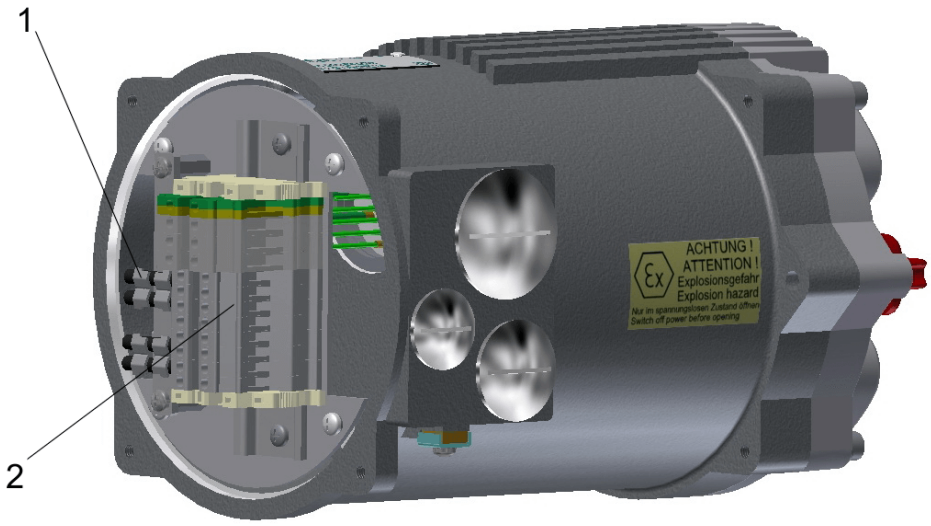

Figure 4: *1. . . shielding connection clamp, 2. . . terminal strip*

An additional frame with 4xM20 holes is possible on special request.

6 Exchange Cycling Data

PROFINET IO uses the concept of a cyclic process data image. Each PROFINET IO network Controller or Device has an image of input and output data. Each image is updated via communication partner images using periodic Ethernet frames. These frames are sent at intervals configured by the engineering tool. The frames contain the I/O data and the data status associated with it. Moreover, each frame contains a “global” frame data status field which can be used e.g. to mark the whole frame as invalid. PROFINET IO organizes the cyclic data in a Provider Consumer model, i.e. an I/O data consumer exists for every I/O data provider. Both indicate their current state to each other in several frames. These states are:

- the IO Provider State (IOPS)
- the IO Consumer State (IOCS)

The IOPS indicates whether the associated data is valid (good) or invalid (bad). For instance, a faulty submodule in a device will mark its input data as good or bad by setting the IOPS. To indicate whether the data has been handled, the consumer returns the IOCS to the provider. For instance, a Digital Analog Converter submodule can use this status to indicate to the controller an output value that is outside the range. With PROFINET IO, each submodule has its IO data and IO data states, i.e. the IO data plus two IO data states are exchanged for every submodule used by the IO-Controller. Regarding the Ethernet frame structure, the provider data state is located directly behind the IO data and contains information on whether the IO data is good and may be evaluated or not. The consumer state is sent in the opposite direction in an other frame and contains information on whether the IO data can be handled by the consumer.

7 Settings

The following additional parameters become visible in the control unit for the ACTUSMART or the SMARTCON actuator with the Profinet option enabled.

	menu item	sub menu item	poss. setting	notes / comments
P15.1	Profinet	Bus	0: Not Activated	Profinet disabled
			1: Activated	Profinet enabled
P15.2	Profinet	IP Adress	0 to 255	Valid IP address.
P15.3	Profinet	Net Mask	0 to 255	Valid net mask.
P15.4	Profinet	Gateway	0 to 255	Valid gateway.
P15.5	Profinet	Swap Bytes	0	Off
			1	Swap In/Off
			2	Swap In
			3	Swap Out
P15.6	Profinet	Watchdog Time	0.0 – 10.0s {0.0s}	Monitoring of the toggle bit transmitted from the master (bit 7 in the command). With a bus watchdog time set, this bit has to toggle within that time; otherwise there is a bus watchdog fault. At 0.0 s the watchdog function is disabled, in which case toggling of the toggle bit may be omitted.
P15.7	Profinet	Setpoint Source	{0}:	The set point is specified via the Profinet (only relevant when the positioner is enabled).
			1: Analog	The set point is specified by the analogue signal (only relevant when the positioner is enabled).
			2: Bus/analog	With an error-free bus, the set point is specified via the Profinet. With a bus error, the analogue value is switched to (only relevant when the positioner is enabled).
P15.8	Profinet	Status 2	{0}	Standard assignment for Status 2
			1 - 2	Reserved for future use.
P15.9	Profinet	Status 3	{0}	Standard assignment for Status 3 (current event)
			1 - 2	Reserved for future use.
P15.10	Profinet	Status 4	{0}	Standard assignment for Status 4 (current event)
			1 - 2	Reserved for future use.
P15.11	Profinet	Bus Monitor	0: Ignore	.
			1: Stop	.
			2: Open	.
			3: Close	.
			4: Emergency Position	.
			5: Emergency Open	.
			6: Emergency Close	.
			7: Last valid value	.
			8: Failsafe	.

NOTE: After changing parameters P15.1 . . . P15.3, the protocol stack for the Profinet is restarted to apply the

change.

NOTE: To allow the actuator to be unambiguously identified in the network, the MAC address is displayed in the bottom most line of Status Area S5!

8 Description of Input and Output Data

General information: Depending on the master, it is possible that the low byte (bits 0 . . . 7) and the high byte (bits 8 . . . 15) have to be swapped in the registry values. This swapping can be done by the control unit with parameter P15.5.
The transmission mode (big endian/little endian) always has to be adjusted such that the analog values are transmitted correctly. Only then can the binary data be swapped.

8.1 Position assignment for the input data (data from master to slave)

The position values can be written with functions 6 (06_{Hex} : Write single position): and 16 (10hex : Write multiple positions).
The position values can be read back with function 3 (03_{Hex} : Read holding position).

NOTE: Depending on the master, the position numbers are assigned with an offset! For example, position 0 in the master has the address 1_{Dec} or 40001_{Dec} !

8.1.1 Set point

Position number: 0_{Hex}
Data format: 16-bit, the lower 10 bits (0 . . . 1023) are used.
The other bits are reserved for future use and have to be set to zero!

Structure:

Value	Function:
0 (0_{Hex})	0 %
512 (200_{Hex})	50%
1023 ($3ff_{Hex}$)	100%

8.1.2 Command

Position number: 1_{Hex}
Data format: 16-bit (bit field)

Structure:

Bit no.:	Function:	Description:	
		Bit = 0	Bit = 1
0	OPEN	-	OPEN command in REMOTE mode
1	CLOSE	-	CLOSE command in REMOTE mode
2	STOP	-	STOP command in REMOTE mode
3	NOT-AUF	-	EMERGENCY OPEN command in LOCAL & REMOTE modes
4	NOT-ZU	-	EMERGENCY CLOSE command in LOCAL & REMOTE modes
5	BLOCK	-	BLOCK drive in LOCAL & REMOTE modes. The drive is not operable either via the selector switch locally nor via commands by REMOTE nor Profinet.
6	POSITIONER OFF	-	Deactivate the positioner in REMOTE mode.
7	WATCHDOG	Toggle bit for bus watchdog. Bit has to toggle before the specified time-out or a bus watchdog error will be detected.	
8	OPEN-SH	-	Latched Open in mode Remote. Release with command Stop
9	CLOSE-SH	-	Latched Close in mode Remote. Release with command Stop.
10	LOCKING- OPEN	-	Locks Open (in modes Remote & Local). Actuator carries out a latched Open command with highest priority. It can only be released with command Lock Off, power-off or mode Off.
11	LOCKING- CLOSE	-	Locks Close (in modes Remote & Local). Actuator carries out a latched Close command with highest priority. It can only be released with command Lock Off, power-off or mode Off.
12	LOCKING OFF	-	Releases the lock.
13	BLOCK LOCAL	-	Block the actuator in mode Local. Actuator cannot be moved with selection switch.
14	FAILSAFE	-	Trigger the failsafe unit (if available).
15	OVERRIDE	-	Binary inputs are not processed

8.1.3 Command 2

Position number: 2_{Hex}
Data format: 16-bit (bit field)

Structure:

Bit no.:	Function:	Description:	
		Bit = 0	Bit = 1
0	Bus Bit 1	-	The binary outputs can be assigned to the bus bits. The assignment can be done arbitrarily, including the assignment of a single bit to multiple outputs.
1	Bus Bit 2	-	
2	Bus Bit 3	-	
3	Bus Bit 4	-	
4	Bus Bit 5	-	
5	Bus Bit 6	-	
6	Bus Bit 7	-	
7	Bus Bit 8	-	
8	Intermediate Position	-	Move to intermediate position (bits 9, 10, 11 and 13). See table below for bit pattern.
9	Intermediate Position Bit 9	-	
10	Intermediate Position Bit 10	-	
11	Intermediate Position Bit 11	-	
12	PVST Start	-	Start PVST.
13	Intermediate Position Bit 13	-	See table below for bit pattern.
14	reserviert	-	
15	reserviert	-	

The table below shows the bit pattern for the intermediate positions:

Bit 13	Bit 11	Bit 10	Bit 9	Command
0	0	0	0	Position 1
0	0	0	1	Position 2
0	0	1	0	Position 3
0	0	1	1	Position 4
0	1	0	0	Position 5
0	1	0	1	Position 6
0	1	1	0	Position 7
0	1	1	1	Position 8
1	0	0	1	Position 9
1	0	1	0	Position 10
1	0	1	1	Position 11
1	1	0	0	Position 12
1	1	0	1	Position 13
1	1	1	0	Position 14
1	1	1	1	Position 15

8.1.4 Set point - revolution speed

Position number: 3_{Hex}
Data format: 16-bit, the lower 8 bits are used.
The other bits are reserved for future use and have to be set to zero!

Structure:

Bit	Value	Description:
0...6	0...100	Value corresponds to 0%...100%
7	0, 1	Sets the direction to OPEN

8.2 Extended Registers - Commands

Position number: 8_{Hex}
Data format: 16-bit

By means of the extended registers, it is possible to execute further commands or to read out various information. For this purpose, the desired register number is entered in position no. 9_{Hex} (see chapter 8.2.1), and if applicalbe, in position no. 10_{Hex} (see chapter 8.2.2) the value is entered (see document *SCHIEBEL Extended Bus Registers*).

Structure:

Bit	Value	Description:
0	0, 1	Execute Bit to execute data transfer; Operation has to be set (see 8.2.1 and 8.2.2).
14	0, 1	Write operation bit
15	0, 1	Read operation bit

NOTE: The other bits are reserved for future use and have to be set to zero

8.2.1 Extended Register - Register Number

Position number: 9_{Hex}
Data format: 16-bit

The register to be read or written is written in this position number upon execution of an extended control command (see document *SCHIEBEL Extended Bus Registers*).

Structure:

Bit	Value	Description:
0...15	0...65535	Corresponds to requested extended register.

8.2.2 Extended Register - Register Value

Position number: 10_{Hex}
Data format: 16-bit

If applicable, the value to be written to the given register number in position no. 9_{Hex} is written in this position no.

Structure:

Bit	Value	Description:
0...15	0...65535	Value to be written in given register no. in position no. 9_{Hex}

8.3 Modules for the output data (slave to master)

The position values can be read with function 4 (04_{Hex} : Read input position).

NOTE: Depending on the master, the position numbers are assigned with an offset! For example, position 0 in the master has the address 1_{Dec} or 40001_{Dec} !

8.3.1 Actual Position

Position number: 0_{Hex}
Data format: 16-bit, the lower 10 bits (0 . . . 1023) are used.
The other bits are reserved for future use and have to be hidden!

Structure:

Value	Function:	Description:
0 (0_{Hex})	0%	
512 (200_{Hex})	50%	
1023 ($3ff_{Hex}$)	100%	

8.3.2 Status

Position number: 1_{Hex}
Data format:16-bit (bit field)

Structure:

Bit no.:	Function:	Description:	
		Bit = 0	Bit = 1
0	READY	-	Actuator is ready
1	END POSITION OPEN	-	End position OPEN reached (taking into account the type of de-activation (torque- or travel-dependent))
2	END POSITION CLOSED	-	End position CLOSED reached (taking into account the type of de-activation (torque- or travel-dependent))
3	TRAVEL OPEN	-	Travel end position OPEN reached (no allowance for the type of de-activation (only straightforward travel information))
4	TRAVEL CLOSED	-	Travel end position CLOSED reached (no allowance for the type of de-activation (only straightforward travel information))
5	TORQUE OPEN	-	Cut-out torque in OPEN direction has been exceeded.
6	TORQUE CLOSED	-	Cut-out torque in CLOSE direction has been exceeded.
7	MOTOR TEMP.	-	Motor temperature sensor has responded (overtemp.)
8	OPERATION OPEN	-	The drive is operating by motor OPEN
9	OPERATION CLOSED	-	The drive is operating by motor CLOSED
10	LOCAL	-	Selector switch in position LOCAL
11	REMOTE	-	Selector switch in position REMOTE
12	LOCKING OPEN	-	Locking OPEN is active. OPEN command is queued with the highest priority and will not be jettisoned even in the end position (see command for bits 10 and 12)
13	LOCKING CLOSED	-	Locking CLOSED is active. CLOSE command is queued with the highest priority and will not be jettisoned even in the end position (see command for bits 11 and 12)
14	LIVEBIT 1	Livebit 1 toggles every second	
15	LIVEBIT 2	Livebit 2 is the copy from the watchdog toggle bit (see command bit 7)	

8.3.3 Actual torque

Position number: 2_{Hex}
Data format: 16-bit, only the lower 8 bits are used.
The other bits are reserved for future use and have to be hidden!

Bit	Value	Description:
0...6	0...100	Corresponds to 0%...100%
7	0, 1	Is set, if the direction is OPEN

8.3.4 Actual speed

(only for ACTUSMART)
Position number: 3_{Hex}
Data format: 16-bit, only the lower 8 bits are used.
The other bits are reserved for future use and have to be hidden!

Structure:

Bit	Value	Description:
0...6	0...100	Corresponds to 0%...100%
7	0, 1	Is set, if the direction is OPEN

8.3.5 Ext. actual value

(only with PID controller option!!!)
Registry number: 4_{Hex}
Data format: 16-bit, the lower 10 bits (0 ... 1023) are used.
The other bits are reserved for future use and have to be hidden!

8.3.6 Status 2

Position number: 5_{Hex}
Data format: 16-bit (bit field)

Structure:

Bit no.:	Function:	Description:	
		Bit = 0	Bit 0 = 1
0	Dig. output 1	-	Corresponding binary output is set.
1	Dig. output 2	-	
2	Dig. output 3	-	
3	Dig. output 4	-	
4	Dig. output 5	-	
5	Dig. output 6	-	
6	Dig. output 7	-	
7	Dig. output 8	-	
8	Dig. input 1	-	Corresponding Binary input is set
9	Dig. input 2	-	
10	Dig. input 3	-	
11	Dig. input 4	-	
12	Dig. input 5	-	
13	PHASE SEQUENCE	-	Phase sequence error: Error in supply voltage the (incorrect phase sequence, phase loss, total loss, asymmetry)
14	FC ERROR	-	FC error: error in the power supply unit and/or the frequency converter (if there is one)
15	FAILSAFE ERROR	-	Failsafe unit not ready (if there is one)

Parameter P15.9 can be used to set alternative output functions for status 2.

8.3.7 Status 3

Position Number: 6_{Hex}
Data format: 16-bit, error number

Error number:	Meaning:
3	Motor temperature warning (only for ACTUSMART)
4	Motor temperature cut-out
5	Phase sequence error or phase loss
9	Error in the power supply or the frequency converter
11	Error in the failsafe unit (provided there is one)
17	Fault position sensor
22	Fault torque sensor (provided there is one)

Parameter P15.10 can be used to set alternative output functions for status 3.

8.3.8 Status 4

Position Number: 7_{Hex}
Data format: 16-bit
The other bits are reserved for future use and have to be hidden!

Structure:
Bits 0. . . 1 show the channel activity.

Bit 1	Bit 0	Description
0	0	Bus channel A active.
0	1	Bus channel B active.
1	0	Bus channel A and B active. Main channel for input is A.
1	1	Bus channel A and B active. Main channel for input is B.

Bits 2. . . 7 are reserved for future use.
Bits 8. . . 9 show the PVST Status.

Bit 9	Bit 8	Description
0	0	PVST functionality not activated or not available.
0	1	PVST Active: A PVST is currently active..
1	0	PVST OK: The last PVST was successful.
1	1	PVST Error: The last PVST was not successful.

Bits 10. . . 15 are reserved for future use.

Parameter P15.11 can be used to set alternative output functions for status 4.

8.4 Extended Message Status

Position Number: 8_{Hex}
Data format: 16-bit

In this position no., the status of a read or write command as described in chapter 8.2 is shown acc. to the table below.

Structure:

Bit	Message	Description
0	Idle	New extended transaction can start
1	Pending	Extended transaction is executing
2	Done	Extended transaction is done, result is ready
3	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-
14	Error	Transaction Error, reset = clear EXEC control bit
15	Busy	Transaction Busy, wait till Done or Error bit is set

8.4.1 Extended Message Status - Current Register

Position Number: 9_{Hex}
Data format: 16-bit

This position no. shows the current extended register number, which is currently being accessed to acc. chapter 8.2.

Structure:

Bit	Value	Description:
0...15	0...65535	Currently accessed extended register no.

8.4.2 Extended Message Status - Current Register Value

Position Number: 10_{Hex}
Data format: 16-bit

Ths position no. shows the current value of the currently accessed extended register (see chapter 8.4.1).

Structure:

Bit	Value	Description:
0...15	0...65535	Actual value in currently accessed register given in position no. 9_{Hex}.