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.

⚠ **WARNING**

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

⚠ **CAUTION**

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

PROFIBUS Additional Board for SMARTCON Control System

1 General Information

A fieldbus interface is available for SCHIEBEL actuators in the ACTUSMART and SMARTCON series for the standardised bus system PROFIBUS-DP.
This interface is a hardware option and should already be known when ordering the actuator.
Retrofitting is possible, but should only be performed by a skilled SCHIEBEL technician or by specially trained personnel.

PROFIBUS-DP defines the technical and functional characteristics of a serial fieldbus system, with which a set of distributed, digital automation devices can be networked with one another. PROFIBUS-DP distinguishes between master and slave devices and is designed to exchange data at the field level.
This is where central control devices, such as PLCs and PCs, communicate with distributed field devices via a fast serial connection.
Data exchange with these decentralised devices is carried out cyclically. The communication functions necessary to do this are defined by the PROFIBUS-DP basic functions according to EN 50 170.

Master devices control the data traffic on the bus. A master can send messages without an external request. In the PROFIBUS protocol, masters are also called active participants.
Slave devices such as SMARTCON actuators are peripheral devices. Typical slave devices are input/output devices, valves, actuators and transmitters. They are not given active bus access authorisation, i.e. they are only allowed to acknowledge received messages, or, at the request of a master, transmit messages to it. Slaves are also called passive participants.

The master cyclically reads the input information from the slaves and cyclically writes the output information to the slaves. In addition to this cyclic data transmission of the process image, PROFIBUS-DP also offers powerful functions for diagnostics and commissioning purposes. Monitoring functions on the master and slave sides monitor the data traffic.

The **transmission technology** is based on an RS-485 connection via a shielded twisted-pair cable.

SCHIEBEL actuators in the ACTUSMART and SMARTCON series support baud rates up to 1.5 Mbit/s.

Only cables in accordance with standard DIN 19245 and/or EN 50170-2, cable type A, may be used for PROFIBUS-DP cabling.
Depending on the transmission speed, the following segment lengths are permitted:

Transmission Speed	Segment Length
9.6 / 19.2 / 93.75kBd	1200m
187.5kBd	1000m
500kBd	400m
1.5MBd	200m

A maximum of 32 PROFIBUS devices can be connected in one segment. If more devices are to be connected to a PROFIBUS line, then multiple segments have to be connected by repeaters.
The bus cable has to be installed at a distance of at least 20 cm from other cables and should be installed in a separate, conductive and earthed cable tray.
It is important to ensure that there are no potential differences between the individual devices on the PROFIBUS.

2   Connection

Depending on the order, there are the following connection options:

- Standard design: via terminal board

- Explosion-proof design: via terminals

2.1   Standard design

PROFIBUS cables connect via the input/output board in the terminal compartment for the customer's plug connector for the actuator. The PROFIBUS connection is thus, like the other electrical connections, plug-connectable both for power and signals. When the connecting plug is unplugged, the connection within the line for the PROFIBUS is maintained, i.e., the connecting plug can be unplugged during operation without interrupting the communication to other bus subscribers. IMPORTANT: The PROFIBUS has to be terminated at the end of the line. This active bus termination can be made on the input/output board. The supply for the terminating resistors, however, is carried out from the actuator, i.e., with the plug connector unplugged, the bus termination is not supplied. To avoid such problems, we recommend terminating the bus separately with an active bus termination.

If the PROFIBUS is a single-channel design, the PROFIBUS cables connect on Channel I, and with a dual-channel design (option: redundant), Channel I and Channel II are used.

2.1.1   Terminal board (provided by customer)

The terminal board is located in the terminal compartment for the customer's plug connector beneath the top cover.
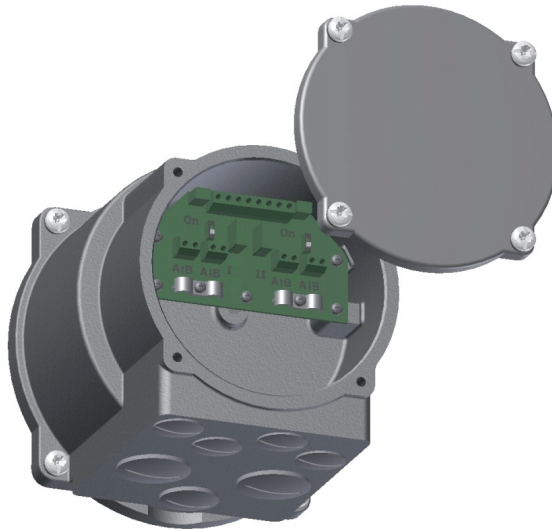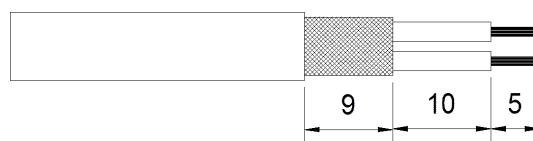

Figure 1: *Terminal board*

2.1.2   Connecting the PROFIBUS cables

Recommended cable assembly

Before connecting the bus cable, it has to be assembled as follows:

The terminals on the terminal board are designed for a max. cross-section of up to 1.5 mm^2. The shield outside diameter has to be in the range of 5. . . 8 mm.

Customer connection within the line

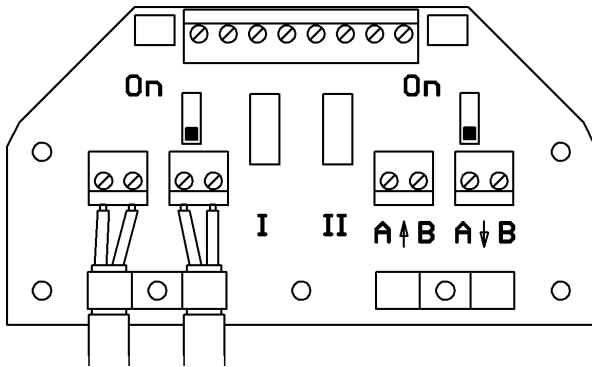There are other PROFIBUS subscribers before and after the slave. Connection for the cables:
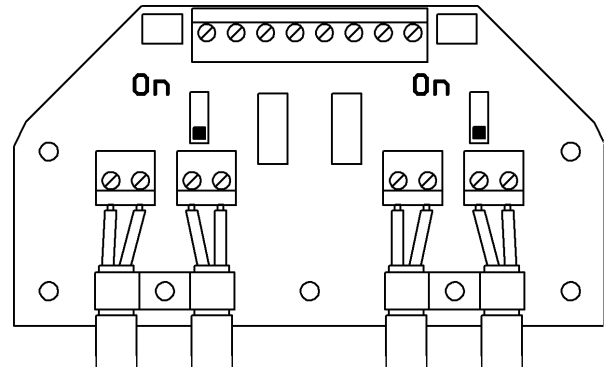

Figure 2: *Single channel*

Figure 3: *Dual channel*

Customer connection at the end of the line, bus termination

There are no further PROFIBUS subscribers before or after the slave.
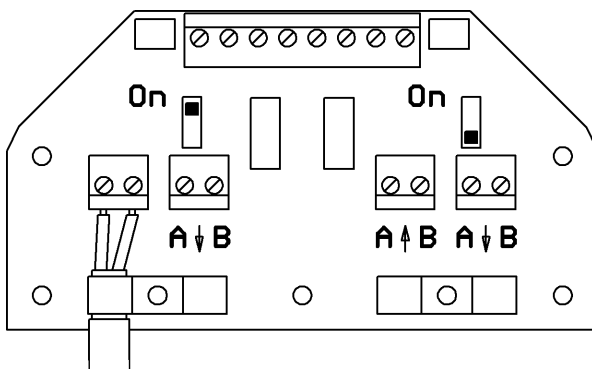Connection for the cables:

Figure 4: *Single channel*
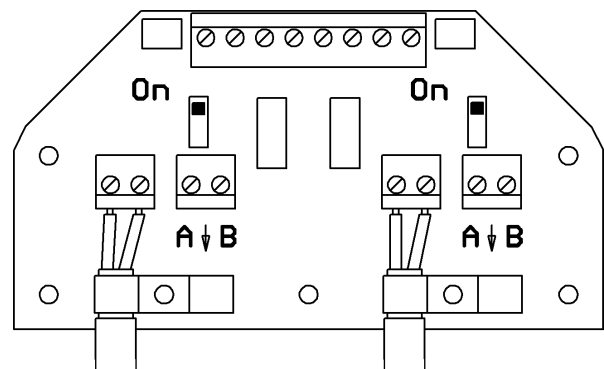
Figure 5: *Dual channel*

Bus termination:
The bus has to be terminated on both ends of the PROFIBUS line. This termination can be made via the built-in terminating resistors, which are actively supplied by the actuator. The terminating resistors are enabled when the switch on the terminal board is switched to "ON".

2.2 Explosion-proof design

Generally, no bus termination is provided in the SMARTCON in the explosion-proof design, i.e., the bus has to be implemented on both ends on the system side.
As an option, however, the bus connection can also be implemented in SMARTCON. This has to be specified when ordering.
In such case, the bus connection can be enabled by bridging the terminals:
A to AT and B to BT (single channal version) or
A1 to A1T, B1 to B1T, A2 to A2T and B2 to B2T (dual channal version).

WARNING: The shield has to be put on the clamping brackets (cross-section) - see Figure 6 or Figure 7

⚠️ **WARNING**

2.2.1 Design with additional binary I/Os

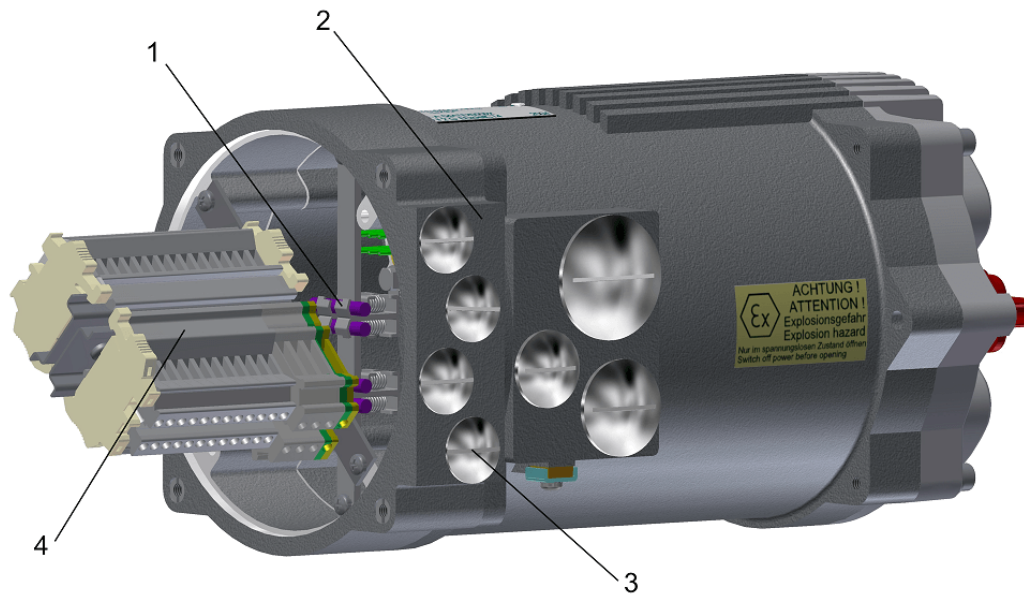**Figure 6:** *1. . . shielding connection clamp, 2. . . additional frame, 3. . . metallic cable glands (closed with blind screw connections at delivery) 4 xM20x1,5, 4. . . terminal strip*

2.2.2 Design without additional binary I/Os

Figure 7: *1. . . shielding connection clamp, 2. . . terminal strip*

As an option, 4xM20 drilled holes can be provided for additional cable entries.

3   Commissioning

When commissioning a PROFIBUS-DP network, the devices on the PROFIBUS-DP have to be parameterised and configured with the project configuration software of the control system used (PROFIBUS configurator).
In this step, each subscriber connected to the PROFIBUS also has to be given a unique address.
The project configuration software first reads in the GSD file (**G**eräte**S**tamm**D**aten [DeviceMasterData]) of the various actuators. The GSD file contains information about the device's properties needed by the master. The current GSD file can be downloaded at http://actuators.schiebel.com.
After that, the user can configure and parameterise each device on the PROFIBUS-DP.
This information is stored in the control system (DP master) and sent to the actuators (DP slaves) each time communication starts up.
The following additional parameters become visible in the control unit for the ACTUSMART and the SMART-CON actuator with the PROFIBUS option enabled.

	Menu Item	Subitem	Options	Explanation/Comments
P15.1	PROFIBUS	BUS	0: disabled	PROFIBUS disabled
			1: allow paramet.	Parameterisation by the master is allowed
			{2}: ignore paramet.	Parameterisation by the master is ignored. Only parameters set in the actuator control system are effective (recommended setting)
			3: deny paramet.	Parameterisation by the master is not allowed
P15.2	PROFIBUS	Address Channel A	0 bis 125	Setting of the bus address for the first, primary channel
P15.3	PROFIBUS	Address Channel B	0 bis 125	Setting the bus address of the second, secondary channel (only with the option "PROFIBUS redundant")
P15.4	PROFIBUS	Watchdogtime	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 error. At 0.0 s the watchdog function is disabled, in which case toggling of the toggle bit may be omitted
P15.5	PROFIBUS	Setpoint Source	{0}: Standard	The set point is specified via PROFIBUS (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 a fault-free bus, the set point is specified via the PROFIBUS. With a bus error, the analogue value is switched to (only relevant when the positioner is enabled)
P15.6	PROFIBUS	Status 2	{0}	Standard assignment for Status 2
			1 - 2	Reserved for future use
P15.7	PROFIBUS	Status 3	{0}	Standard assignment for Status 3 (current event)
			1 - 2	Reserved for future use
P15.8	PROFIBUS	Status 4	{0}	Standard assignment for Status 4
			1 - 2	Reserved for future use
P15.10	PROFIBUS	Bus Timeout	0,0…60,0 sec	Sets the delay time a bus fault is signalled by the actuator after an actual bus fault occurs.
			0: Ignore	Bus fault or watchdog timeout is ignored.
			1: Stop	The actuator stops in case of a bus fault or watchdog timeout.
			2: Open	The actuator moves to the open position in case of a bus fault or watchdog timeout.

Continuation of the Table

	Menu Item	Subitem	Options	Explanation/Comments
P15.11[1]	PROFIBUS	Bus Monitor	3: Close	The actuator moves to the closed position in case of a bus fault or watchdog timeout.
			4: Emergency Position	The actuator moves to the emergency position (see parameter P8.5) in case of a bus fault or watchdog timeout.
			5: Emergency Open	The actuator moves to the open position with a superimposed run command in case of a bus fault or watchdog timeout.
			6: Emergency Close	The actuator moves to the closed position with a superimposed run command in case of a bus fault or watchdog timeout.
			7: Last Valid Value	The actuator moves to the last valid value set by the setpoint register (see chapter **??** on page **??**) in case of a bus fault or watchdog timeout
			8: Failsafe	The actuator moves to the failsafe position in case of a bus fault or watchdog timeout (only for failsafe actuators).

CAUTION: After changing an address, the control unit has to be briefly switched off and back on again in order to apply the change.

⚠ **CAUTION**

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[1] FW1515 or higher

4   Description of the Input and Output Data

General information: Depending on the master, it is possible that the low byte (bit 0...7) and the high byte (bit 8...15) might have to be swapped. The transmission mode (big endian/little endian) always has to be adjusted such that the analogue values are transmitted correctly. Only then can the binary data be swapped.

4.1   Modules for the input data (data from master to slave)

4.1.1   Command

Module number: 23_{Hex}
ID-byte: 60_{Hex} (1 word AA / consistency 1 word)
Data format: 16 bit (bit field)

Structure:

Bitno.:	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	EMERGENCY-OPEN	-	EMERGENCY-OPEN command in REMOTE & LOCAL modes.
4	EMERGENCY-CLOSE	-	EMERGENCY-CLOSE command in REMOTE & LOCAL modes.
5	BLOCK	-	BLOCK actuator in LOCAL & REMOTE modes The actuator is not operable either via the selector switch locally nor via commands by REMOTE nor PROFIBUS.
6	POSITIONER OFF	-	Deactivating the positioner in REMOTE mode.
7	WATCHDOG	Toggle bit from the master for bus watchdog monitoring With bus watchdog time set, the bit has to toggle within this time; otherwise there is a bus error.	
8	OPEN SH	-	OPEN command with self-retention in REMOTE mode, jettison with STOP
9	CLOSE SH	-	CLOSE command with self-retention in REMOTE mode, jettison with STOP
10	LOCK-OPEN	-	Trigger locking OPEN (in LOCAL and REMOTE modes) The actuator runs OPEN with highest priority, the command continues to queue internally even after reaching the OPEN end position. Jettison only with LOCKING OFF, supply off or OFF mode.
11	LOCK-CLOSE	-	Trigger locking CLOSED (in LOCAL and REMOTE modes) The actuator runs CLOSED with highest priority, the command continues to queue internally even after reaching the CLOSED end position. Jettison only with LOCKING OFF, supply off or OFF mode.
12	LOCK-OFF	-	Jettison locking
13	BLOCK LOCAL	-	BLOCK actuator in LOCAL mode The actuator is not operable via the selector switch locally.
14	FAILSAFE	-	Trigger the failsafe unit (provided there is one).
15	OVERRIDE	-	Binary inputs are not processed.

4.1.2 Setpoint

Module number: 22_{Hex}
ID-byte: 60_{Hex} (1 word AA / consistency 1 word)
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:	Descritpion:
0 (0_{Hex})	0 %	
512 (200_{Hex})	50%	
1023 ($3ff_{Hex}$)	100%	

4.1.3 Command 2

Module number: 24_{Hex}
ID-byte: 60_{Hex} (1 word AA / consistency 1 word)
Data format: 16 bit (bit field)

Structure:

Bitno.:	Function:	Description:	
		Bit = 0	Bit = 1
0	Bus Bit 1	-	The binary outputs can be assigned to the bus bits.
1	Bus Bit 2	-	The assignment can be done however wished,
2	Bus Bit 3	-	i.e. multiple outputs can also be assigned to the same bit.
3	Bus Bit 4	-	(Available from firmware 1.323)
4	Bus Bit 5	-	
5	Bus Bit 6	-	
6	Bus Bit 7	-	
7	Bus Bit 8	-	
8	Intermediate position	-	Intermediate position, defined by Bit9, Bit10 and Bit11
9	Definition intermediate position	-	Bit-setting for intermediate position see table 2, page 10.
10	Definition intermediate position	-	Bit-setting for intermediate position see table 2, page 10.
11	Definition intermediate position	-	Bit-setting for intermediate position see table 2, page 10.
12	PVST-Start	-	start PVST
13	reserved	-	
14	reserved	-	
15	reserved	-	

Bit11	Bit10	Bit9	Function
0	0	0	move to intermediate position: Position 1
0	0	1	move to intermediate position: Position 2
0	1	0	move to intermediate position: Position 3
0	1	1	move to intermediate position: Position 4
1	0	0	move to intermediate position: Position 5
1	0	1	move to intermediate position: Position 6
1	1	0	move to intermediate position: Position 7
1	1	1	move to intermediate position: Position 8

Table 2: *Bit-setting for intermediate position (Bit8)*

4.1.4 Set-point speed

Only for ACTUSMART!

Module number: 25_{Hex}
ID-byte: 60_{Hex} (1 word AA / consistency 1 word)
Data format: 16-bit, only the lower 8 bits are used (bit 7: direction OPEN; bit 6...0: 0...100 corresponding to 0...100%)
The other bits are reserved for future use and have to be set to zero!

4.2 Modules for the output data (slave to master)

4.2.1 Actual value

Module number: 12_{Hex}
ID-byte: 50_{Hex} (1 word AA / consistency 1 word)
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%	

4.2.2 Status

Module number: 13Hex
ID-byte: 50Hex (1 word AA / consistency 1 word)
Data format: 16-bit (bit field)

Structure:

Bitno.:	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 command termination (torque- or travel-dependent))
2	END POSITION CLOSE	-	End position CLOSED reached (taking into account the type of command termination (torque- or travel-dependent))
3	TRAVEL OPEN	-	Travel end position OPEN reached (not taking into account the type of command termination (only straightforward travel information))
4	TRAVEL CLOSE	-	Travel end position CLOSED reached (not taking into account the type of command termination (only straightforward travel information))
5	TORQUE OPEN	-	Cut-out torque in OPEN direction has been exceeded
6	TORQUE CLOSE	-	Cut-out torque in CLOSE direction has been exceeded
7	MOTORTEMP.	-	Motor temperature sensor has responded (overtemp.)
8	OPENING	-	The actuator is operating by motor OPEN
9	CLOSING	-	The actuator is operating by motor CLOSED
10	LOCAL	-	Selector switch in position LOCAL
11	REMOTE	-	Selector switch in position REMOTE
12	LOCK 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	LOCK CLOSE	-	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)	

4.2.3 Actual torque

Module number: 14$_{Hex}$
ID-byte: 50$_{Hex}$ (1 word AA / consistency 1 word)
Data format: 16-bit, only the lower 8 bits are used (bit 7: direction OPEN; bit 6...0: 0...100 corresponding to 0...100%)
The other bits are reserved for future use and have to be hidden!

4.2.4 Actual speed

Only for ACTUSMART!

Module numbe: 15$_{Hex}$
ID-byte: 50$_{Hex}$ (1 word AA / consistency 1 word)
Data format: 16-bit, only the lower 8 bits are used (bit 7: direction OPEN; bit 6...0: 0...100 corresponding to 0...100%)
The other bits are reserved for future use and have to be hidden!

4.2.5 Ext. actual value

Only with PID controller option!

Module number: 16_{Hex}
ID-byte: 50_{Hex} (1 word AA / consistency 1 word)
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!

4.2.6 Status 2

Module number: 17_{Hex}
ID-byte: 50_{Hex} (1 word AA / consistency 1 word)
Datenformat: 16 bit (bit field)

Structure:

Bitno.:	Function:	Description	
		Bit = 0	Bit = 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 (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 P15.6 can be used to set alternative output functions for Status 2.

4.2.7 Status 3

Module number: 18_{Hex}
ID-byte: 50_{Hex} (1 word AA / consistency 1 word)
Data format: 16-bit, error number

Error Code:	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, displacement potentiometer
22	Fault, torque potentiometer

Parameter P15.7 can be used to set alternative output functions for Status 3.

4.2.8   Status 4

Module number: 19_{Hex}
ID-byte: 50_{Hex} (1 word AA / consistency 1 word)
Data format: 16-bit (bit field)
Reserved for future use

Structure:

Bitno.:	Function:	Description		
		Bit1	Bit0	Signal
		0	0	Bus: Channel A active.
0 and 1	Channel activity	0	1	Bus: Channel B active.
		1	0	Bus: Channel A and B active, main channel for inputs is channel A.
		1	1	Bus: Channel A and B active, main channel for inputs is channel B.
2	reserved			
3	reserved			
4	reserved			
5	reserved			
6	reserved			
7	reserved			
		Bit9	Bit8	Signal
		0	0	PVST functionality not activated or no PVST realised yet.
8 and 9	PVST Status	0	1	PVST active: There is a PVST active currently.
		1	0	PVST OK: The last PVST was successful.
		1	1	PVST Error: The last PVST was not successful.
10	reserved			
11	reserved			
12	reserved			
13	reserved			
14	reserved			
15	reserved			

Parameter P15.8 can be used to set alternative output functions for Status 4.

4.3   Bi-directional data (master to slave and slave to master)

4.3.1   Parameter channel in/out

Not currently supported!

Module number: 30_{Hex}
ID-byte: $F1_{Hex}$ (2 word AE / AA / complete consistency)
Data format: 32-bit, parameter number, parameter value