SCHIEBEL

DeviceNet operating manual

Contents

DeviceNet for SMARTCON control (Smart DeviceNet 1048)

Valid for firmware version 1.286, 17.11.2010

The DeviceNet is not explosion-proof!

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1 General

The DeviceNet® fieldbus is based on the CAN protocol and was originally developed by Rockwell Automation as an open fieldbus. Today, DeviceNet is the umbrella organization for ODVA (Open DeviceNet Vendors Association, Inc., http://www.odva.org). DeviceNet is defined in EN 50325-2 and in IEC 62026-3. DeviceNet is a simple and powerful fieldbus system for the lowest fieldbus level for the networking of sensors and actuators (slaves) with the associated controller.

1.1 Cable and topology

The DeviceNet network consists of a trunk line and drop lines which are connected to the trunk line in drop boxes. The master line usually contains the master and the power supply for the DeviceNet bus system. There must be a bus termination at both ends of the trunk line. For the trunk line the Thick cable is usually used, for the stub lines the Thin cable. The Thick cable as well as the Thin cable can be connected to the Smartcon control with DeviceNet option. For the flat cable also mentioned in the standard, the DeviceNet connection of the Smartcon control is not suitable.
Both DeviceNet cables consist of a total of 5 wires with the following function:

Color	Description	Function
red	V+	Power supply +24V
white	CAN H	Data line H
colorless	Drain	Shield/Screen
blue	CAN L	Data line L
black	V-	Power supply 0V

The Smartcon controller is galvanically isolated from the DeviceNet network via optocouplers. The 24V available in the DeviceNet cable are only needed for the network side parts of the DeviceNet interface (power consumption max 55mA), all other functions are powered by the Smartcon controller. Depending on the baud rate, the following max. permissible lengths:

Baud rate	Max. Length of the trunk line		Max. length of all drop lines together	Max. length of one drop line
	Thick cable	Thin cable		
125kBd	500m	100m	156m	6m
250kBd	250m	100m	78m	6m
500kBd	100m	100m	39m	6m

1.2 Installation

The option DeviceNet is a hardware option and should already be known when ordering the actuator.

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Subsequent installation is possible, but should only be carried out by a SCHIEBEL specialist fitter or specially trained personnel.
Only cables for the DeviceNet cabling may be used (Thick cable, thin cable).
Care must be taken to ensure that there are no potential differences between the individual devices in the DeviceNet network, so that no compensating currents occur via the cable shield.
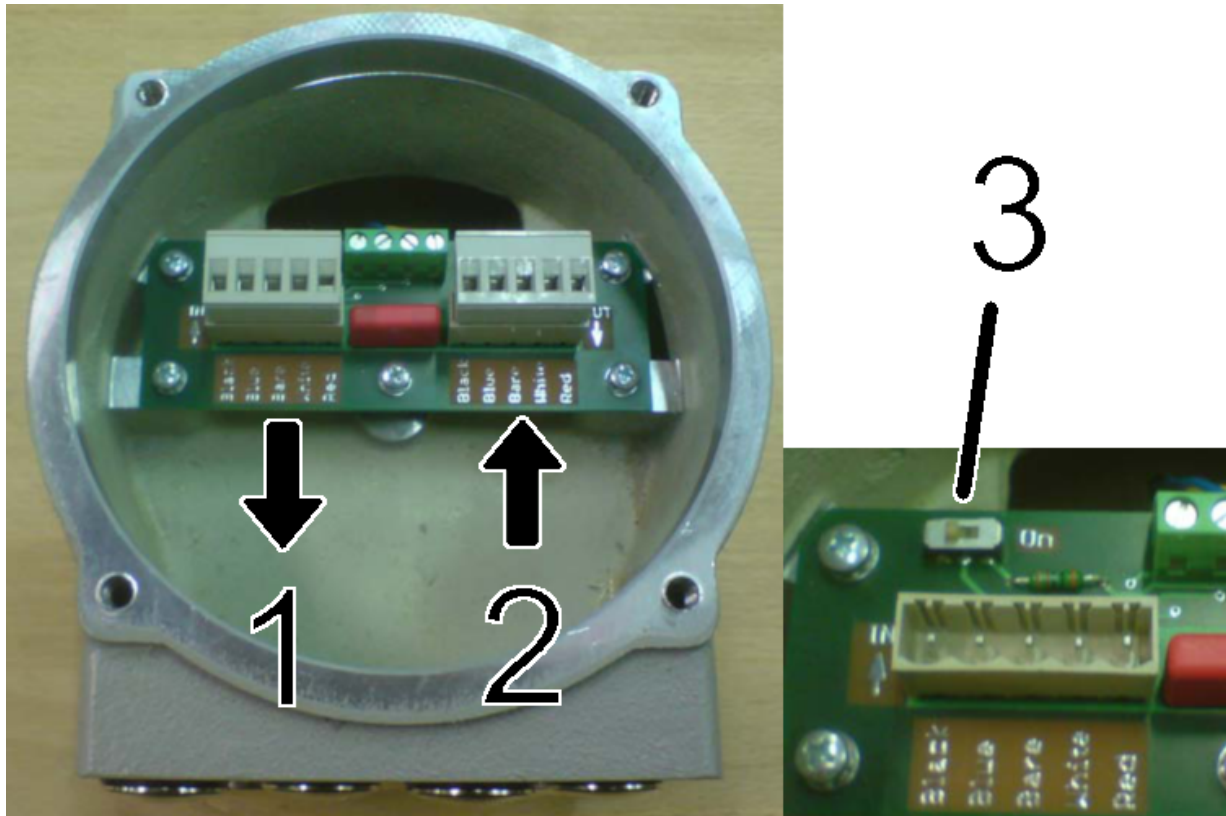
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Figure 1: 1 . . . DeviceNet cable to the previous DeviceNet device,
2 . . . DeviceNet cable to the next DeviceNet device,
3 . . . switch for the bus connection

1.3 Connection

The DeviceNet cables must be connected in the separate terminal compartment in the top of the connector (see figure 1). 4 pcs. M20x1.5mm holes are provided for the cable glands, which are sealed with metallic screw plugs as standard.

The DeviceNet network must be terminated at both ends with a bus terminator. If the terminator is to be activated in the Smartcon controller, the switch (see picture 1) must be set to "On".

1.4 DeviceNet Communication

With DeviceNet, all data and functions of a device are described with an object model.
In the DeviceNet network, the Smartcon controller is identified as follows (Identity Object 01_{hex}):

Information	Value	Description
Vendor ID	$005A_{hex}$	HMS Industrial Networks
Product Type	$000C_{hex}$	Communications Adapter
Product Code	$003D_{hex}$	Anybus-IC
Product Name	"Anybus-IC DEV"	

The input and output data for the Smartcon controller are exchanged with the master via assembly objects (04_{hex}). The length of this data can be configured (input data = process setpoints = consumed data | output data = process actual values = produced data).
The DeviceNet interface of the Smartcon controller is implemented as a Group 2 server and has explicit message server and client capabilities.
Furthermore, the process data Polled, Change Of State (COS) and Cyclic Connections are supported for the data exchange.

1.5 Commissioning

When commissioning a DeviceNet device, the participant address, the baud rate and the desired length of the input and output data must be set in the parameter menu.

1.5.1 Menu overview

	Menu entry	Subitem	poss. sett.	Explanations / Notes
P15.1	DeviceNet	DeviceNet	0: inaktiv	Disable DeviceNet
			1: 125kBd	Enable DeviceNet with Baud rate 125kBd
			2: 250kBd	Enable DeviceNet with Baud rate 250kBd
			3: 500kBd	Enable DeviceNet with Baud rate 500kBd
			4: AutoBd	Enable DeviceNet with Baud rate AutoBd
P15.2	DeviceNet	adress channel	0 - 63 {63}	Adress of the DeviceNet user
P15.4	DeviceNet	Input data	1 - 2 {2}	Number of data words exchanged via DeviceNet from master to slave (process setpoints = consumed data).
P15.5	DeviceNet	Output data	1 - 8 {2}	Number of data words exchanged via DeviceNet from slave to master (process actual values = produced data).
P15.6	DeviceNet	Watchdogtime	0.0 - 10.0s {0.0s}	Monitoring of the toggle bit sent by the master (bit 7 in the command). This bit must toggle within this time with set bus watchdog time, otherwise there is a bus watchdog error. The watchdog function is disabled at 0.0s.
P15.7	DeviceNet	Setpoint source	0: Default	The setpoint is specified via DeviceNet (only relevant if the positioner is activated).
			1: Analog	The setpoint is specified with the analogue signal (only relevant if the positioner is activated).
			2: Bus/analog	In the case of a fault-free bus, the setpoint is specified via DeviceNet; in the case of a bus error, it is switched to the analog value (only relevant if the positioner is activated).
P15.8	DeviceNet	Status 2	{0}	Standard assignment Status 2
			1 - 2	Reserved for future use.
P15.9	DeviceNet	Status 3	{0}	Standard assignment Status 3 (aktuelles Ereignis).
			1 - 2	Reserved for future use.
P15.10	DeviceNet	Status 4	{0}	Standard assignment Status 4
			1 - 2	Reserved for future use.

2 Description of the data in cyclic data exchange

General: Depending on the master, it may happen that the low byte (bit 0 ... 7) and the high byte (bit 8 ... 15) are to be swapped. Basically, the transmission type (Big Endian / Little Endian) must be set so that the analog values are transmitted correctly, only then can the binary data be exchanged.
The length of the input and output data must be set in the parameter menu.
The length of the input data (**consumed data**) is set with parameter P15.4. Depending on the set length, the following structure results:

Function of the input word	Set length	
	1	**2**
Word 1	Setpoint	
Word 2	-	Command

The length of the output data (**produced data**) is set with parameter P15.5. Depending on the set length, the following structure results:

Funktion of the output word	Set length							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Word 1	Actual value							
Word 2	-	Status						
Word 3	-	-	Actual torque					
Word 4	-	-	-	Actual speed				
Word 5	-	-	-	-	Ext. actual value			
Word 6	-	-	-	-	-	Status 2		
Word 7	-	-	-	-	-	-	Status 3	
Word 8	-	-	-	-	-	-	-	Status 4

2.1　Description of the input data (master to slave, consumed data)

2.1.1　Command:

Length: 2 Byte
Data format: 16bit

Construction:

Bitno.:	Function:	Description:	
		Bit = 0	**Bit = 1**
0	OPEN	-	OPEN-command in mode REMOTE
1	CLOSE	-	CLOSE-command in mode REMOTE
2	STOP	-	STOP-command in mode REMOTE
3	EMERGENCY OPEN	-	EMERGENCY OPEN command in mode LOCAL & REMOTE
4	EMERGENCY CLOSE	-	EMERGENCY CLOSE in mode LOCAL & REMOTE
5	BLOCK	-	BLOCK actuator in mode LOCAL & REMOTE Drive can not be operated either by the local selector switch or by commands via REMOTE or via the bus
6	CONTROLLER LOCK	-	CONTROLLER LOCK in mode REMOTE The intervention of the positioner is suppressed
7	WATCHDOG	Toggle bit of master for bus watchdog monitoring Bit must toggle within this time if the bus watchdog time is correct, otherwise there is a bus error.	
8	OPEN-SR	-	OPEN-command with self-retaining in mode REMOTE Dropping with STOP

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9	CLOSE-SR	-	CLOSE-command with self-retaining in mode REMOTE Dropping with STOP
10	LOCK-OPEN	-	Initiate LOCK-OPEN (in mode LOCAL & REMOTE) Actuator drives with highest priority into OPEN, command is still active after reaching the OPEN end position. Release only with LOCK-OFF, supply off or mode off.
11	LOCK-CLOSE	-	Initiate LOCK-CLOSE (in mode LOCAL & REMOTE) Actuator drives with highest priority into CLOSE, command is still active after reaching the CLOSE end position. Release only with LOCK-OFF, supply off or mode off.
12	LOCK-OFF	-	Cancel the LOCK
13	BLOCK LOCAL	-	BLOCK drive in mode LOCAL Drive can not be operated by the selector switch on site.
14	FAILSAFE	-	Triggering the failsafe unit (if available)
15	OVERRIDE	-	Binary inputs are not processed

2.1.2 Setpoint:

Length: 2 Byte
Data format: 16bit, the lower 10bit are unsed (0 ... 1023),
Remaining bits are reserved for future use and must be set to zero!

Construction:

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

2.2 Description of the output data (slave to master, produced data)

2.2.1 Actual value:

Length: 2 Byte
Data format: 16bit, the lower 10bit are unsed (0 ... 1023),
Remaining bits are reserved for future use and must be set to zero!

Construction:

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

2.2.2 Status:

Length: 2 Byte
Data format: 16bit, (Bit field)

Construction:

Bitno.:	Function:	Description:	
		Bit = 0	Bit = 1
0	READY	-	Actuator is ready

continued from previous page

1	END POSITION OPEN	-	End position OPEN reached (taking into account the type of taxation (torque or path-dependent))
2	END POSITION CLOSE	-	End position CLOSE reached (taking into account the type of taxation (torque or path-dependent))
3	TRAVEL OPEN	-	Travel OPEN reached (no consideration of the type of control (only pure way information))
4	TRAVEL CLOSE	-	Travel CLOSE reached (no consideration of the type of control (only pure way information))
5	TORQUE OPEN	-	Turn-off-torque in OPEN-Direction has been exceeded
6	TORQUE CLOSE	-	Turn-off-torque in CLOSE-Direction has been exceeded
7	MOTORTEMP.	-	Engine temperature sensor has responded (overtemp.)
8	DRIVE OPEN	-	Actuator is driving into the OPEN end position
9	DRIVE CLOSE	-	Actuator is driving into the CLOSE end position
10	LOCAL	-	Selector switch in position LOCAL
11	REMOTE	-	Selector switch in position REMOTE
12	LOCK OPEN	-	LOCK OPEN is enabled. Command OPEN is active with the highest priority and is not dropped even in the end position (see command bit 10 and 12)
13	LOCK CLOSE	-	LOCK CLOSE is enabled. Command CLOSE is active with the highest priority and is not dropped even in the end position (see command bit 11 and 12)
14	LIVEBIT 1	Livebit1 toggles every second	
15	LIVEBIT 2	Livebit2 is the copy of the watchdog toggle bit (see command bit 7)	

2.2.3 Actual torque:

Length: 2 Byte
Data format: 16bit, only the lower 8bit are used (bit 7: direction OPEN; bit 6 ... 0: 0 ... 100 corresponding to 0 ... 100%).
Remaining bits are reserved for future use and must be hidden!

2.2.4 Actual speed:

(only with ACTUSMART!!!)
Length: 2 Byte
Data format: 16bit, only the lower 8bit are used (bit 7: direction OPEN; bit 6 ... 0: 0 ... 100 corresponding to 0 ... 100%).
Remaining bits are reserved for future use and must be hidden!

2.2.5 Ext. actual value:

(only with option PID controller!!!)
Length: 2 Byte
Data format: 16bit, the lower 10bit (0 ... 1023) will be used.
Remaining bits are reserved for future use and must be hidden!

2.2.6 Status 2:

Length: 2 Byte
Data format: 16bit, (Bitfeld)

Construction:

Bitno.:	Function:	Description:	
		Bit = 0	Bit = 1

continued from previous page

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 SQUENCE	-	Phase sequence error: Supply voltage error (wrong phase sequence, phase failure, total failure, asymmetry)
14	FC ERROR	-	FC ERROR: Fault in the power supply unit and / or in the frequency converter (if present)
15	FAILSAFE ERROR	-	Failsafe-ERROR not ready (if present)

With parameter P15.6 alternative output functions for status 2 can be set.

2.2.7 Status 3:

Length: 2 Byte
Data format: 16bit, (Bit field) Error number

Error number:	Meaning:
3	Engine temperature warning (only for Actusmart)
4	Engine temperature shutdown
5	Phase sequence error or phase failure
9	Failure of the power supply or the frequency converter
11	Failure of the failsafe unit (if available)
17	Fault path potentiometer
22	Fault torque potentiometer

With parameter P15.7, alternative output functions for status 3 can be set.

2.2.8 Status 4:

Length: 2 Byte
Data format: 16bit, (Bit field)
Reserved for future use

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

Smart DeviceNet Module (Smart DeviceNet Module 1048)

Valid for firmware version 1.286, 17.11.2010

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1 Description of the modules in cyclic data exchange

General: Depending on the master, it may happen that the low byte (bit 0 ... 7) and the high byte (bit 8 ... 15) must be swapped. Basically, the transmission type (Big Endian / Little Endian) must be set so that the analog values are transmitted correctly, only then can the binary data be exchanged.

1.1 Modules for the input data (master to slave, consumed data):

1.1.1 Command:

Length: 2 Byte
Data format: 16bit

Construction:

Bitno.:	Function:	Description:	
		Bit = 0	Bit = 1
0	OPEN	-	OPEN-command in mode REMOTE
1	CLOSE	-	CLOSE-command in mode REMOTE
2	STOP	-	STOP-command in mode REMOTE
3	EMERGENCY OPEN	-	EMERGENCY OPEN command in mode LOCAL & REMOTE
4	EMERGENCY CLOSE	-	EMERGENCY CLOSE in mode LOCAL & REMOTE
5	BLOCK	-	BLOCK actuator in mode LOCAL & REMOTE Drive can not be operated either by the local selector switch or by commands via REMOTE or via the bus
6	CONTROLLER LOCK	-	CONTROLLER LOCK in mode REMOTE The intervention of the positioner is suppressed
7	WATCHDOG	Toggle bit of master for bus watchdog monitoring Bit must toggle within this time if the bus watchdog time is correct, otherwise there is a bus error.	
8	OPEN-SR	-	OPEN-command with self-retaining in mode REMOTE Dropping with STOP
9	CLOSE-SR	-	CLOSE-command with self-retaining in mode REMOTE Dropping with STOP
10	LOCK-OPEN	-	Initiate LOCK-OPEN (in mode LOCAL & REMOTE) Actuator drives with highest priority into OPEN, command is still active after reaching the OPEN end position. Release only with LOCK-OFF, supply off or mode off.
11	LOCK-CLOSE	-	Initiate LOCK-CLOSE (in mode LOCAL & REMOTE) Actuator drives with highest priority into CLOSE, command is still active after reaching the CLOSE end position. Release only with LOCK-OFF, supply off or mode off.

12	LOCK-OFF	-	Cancel the LOCK
13	BLOCK LOCAL	-	BLOCK drive in mode LOCAL Drive can not be operated by the selector switch on site.
14	FAILSAFE	-	Triggering the failsafe unit (if available)
15	OVERRIDE	-	Binary inputs are not processed

1.1.2 Setpoint:

Length: 2 Byte
Data format: 16bit, the lower 10bit (0 ... 1023) are used,
Remaining bits are reserved for future use and must be set to zero!

Construction:

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

1.2 Modules for the output data (slave to master, produced data):

1.2.1 Actual value:

Length: 2 Byte
Data format: 16bit, the lower 10bit (0 ... 1023) are used
Remaining bits are reserved for future use and must be hidden!

Construction:

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

1.2.2 Status:

Length: 2 Byte
Data format: 16bit, (Bit field)

Construction:

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 taxation (torque or path-dependent))
2	END POSITION CLOSE	-	End position CLOSE reached (taking into account the type of taxation (torque or path-dependent))
3	TRAVEL OPEN	-	Travel OPEN reached (no consideration of the type of control (only pure way information))
4	TRAVEL CLOSE	-	Travel CLOSE reached (no consideration of the type of control (only pure way information))
5	TORQUE OPEN	-	Turn-off-torque in OPEN-Direction has been exceeded
6	TORQUE CLOSE	-	Turn-off-torque in CLOSE-Direction has been exceeded
7	MOTORTEMP.	-	Engine temperature sensor has responded (overtemp.)

8	DRIVE OPEN	-	Actuator is driving into the OPEN end position
9	DRIVE CLOSE	-	Actuator is driving into the CLOSE end position
10	LOCAL	-	Selector switch in position LOCAL
11	REMOTE	-	Selector switch in position REMOTE
12	LOCK OPEN	-	LOCK OPEN is enabled. Command OPEN is active with the highest priority and is not dropped even in the end position (see command bit 10 and 12)
13	LOCK CLOSE	-	LOCK CLOSE is enabled. Command CLOSE is active with the highest priority and is not dropped even in the end position (see command bit 11 and 12)
14	LIVEBIT 1	Livebit1 toggles every second	
15	LIVEBIT 2	Livebit2 is the copy of the watchdog toggle bit (see command bit 7)	

1.2.3   Actual torque:

Length: 2 Byte
Data format: 16bit, only the lower 8 bits are used (bit 7: direction OPEN; bit 6 ... 0: 0 ... 100 corresponding to 0 ... 100%).
Remaining bits are reserved for future use and must be hidden!

1.2.4   Actual speed:

(only with ACTUSMART!!!)
Module number: 15_{Hex}
Identification byte: 50_{Hex} (1 Word AE / Consistency 1 Word)
Data format: 16bit, only the lower 8bit are used (bit 7: direction OPEN; bit 6 ... 0: 0 ... 100 corresponding to 0 ... 100%).
Remaining bits are reserved for future use and must be hidden!

1.2.5   Ext. actual value:

(only with option PID controller!!!)
Module number: 16_{Hex}
Identification byte: 50_{Hex} (1 Word AE / Consistency 1 Word)
Data format: 16bit, the lower 10bit (0 ... 1023) will be used.
Remaining bits are reserved for future use and must be hidden!

1.2.6   Status 2:

Length: 2 Byte
Data format: 16bit, (Bit field)

Construction:

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	-	

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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 SQUENCE	-	Phase sequence error: Supply voltage error (wrong phase sequence, phase failure, total failure, asymmetry)
14	FC ERROR	-	FC ERROR: Fault in the power supply unit and / or in the frequency converter (if present)
15	FAILSAFE ERROR	-	Failsafe-ERROR not ready (if present)

With parameter P15.6 alternative output functions for status 2 can be set.

1.2.7 Status 3:

Length: 2 Byte
Data format: 16bit, (Bit field) Error number

Error number:	Meaning:
3	Engine temperature warning (only for Actusmart)
4	Engine temperature shutdown
5	Phase sequence error or phase failure
9	Failure of the power supply or the frequency converter
11	Failure of the failsafe unit (if available)
17	Fault path potentiometer
22	Fault torque potentiometer

With parameter P15.7, alternative output functions for status 3 can be set.

1.2.8 Status 4:

Length: 2 Byte
Data format: 16bit, (Bit field)
Reserved for future use

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

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