

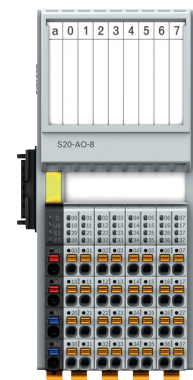
# S20 analog output module 8 outputs

**R911335984**  
Edition 04

## Data sheet S20-AO-8

8 analog outputs  
0 - 10 V,  $\pm 10$  V, 0 - 5 V,  $\pm 5$  V  
0 - 20 mA, 4 - 20 mA,  $\pm 20$  mA  
2-conductor technology

04 / 2022



## 1 Description

The module is designed for use within an S20 station. It is used to output analog voltage and current signals.

### Features

- 8 analog, bipolar output channels for the connection of either voltage or current signals
- Connection of actuators in 2-conductor technology
- Voltage ranges: 0 V ... 10 V,  $\pm 10$  V, 0 V ... 5 V,  $\pm 5$  V
- Current ranges: 0 mA ... 20 mA, 4 mA ... 20 mA,  $\pm 20$  mA
- Short-circuit-proof outputs
- Device rating plate stored



This data sheet is only valid in association with the application description for the S20 system, material number R911335988.



Make sure you always use the latest documentation.

It can be downloaded under [www.boschrexroth.com/electrics](http://www.boschrexroth.com/electrics).

<b>2</b>	<b>Table of contents</b>	
1	Description .....	1
2	Table of contents .....	2
3	Ordering data .....	3
4	Technical data .....	3
5	Derating .....	7
6	Tolerance data.....	7
7	Signal rise times .....	8
8	Internal circuit diagram .....	8
9	For your safety .....	9
	9.1 Intended use .....	9
	9.2 Qualification of users .....	9
	9.3 Electrical safety .....	9
10	Terminal point assignment.....	10
11	Connection example.....	10
12	Connection notes .....	10
13	Local diagnostic and status indicators .....	11
14	Process data.....	13
	14.1 OUT process data.....	13
	14.2 IN process data .....	13
15	Significant values.....	14
16	Parameter, diagnostics and information (PDI) .....	15
17	Standard objects .....	16
	17.1 Objects for identification (device rating plate).....	16
	17.10 Password (001Dhex: Password).....	21
	17.2 Miscellaneous standard objects .....	17
	17.3 Diagnostics state (0018hex: DiagState).....	18
	17.4 Handling diagnostic messages (0019hex: ResetDiag) .....	19
	17.5 Substitute value behavior during bus reset (PDOOUT) (0024hex: ResetCode) .....	19
	17.6 Input process data (0025hex: PDIN) .....	20
	17.7 Output process data (0026hex: PDOOUT) .....	20
	17.8 Request exclusive write access (0027hex: GetExRight) .....	20
	17.9 Substitute value for the OUT process data (002Fhex: PDOOUT_Subst) .....	21
18	Application objects .....	22
19	Writing the analog values over the PDI channel.....	23
20	Device descriptions .....	23

### 3 Ordering data

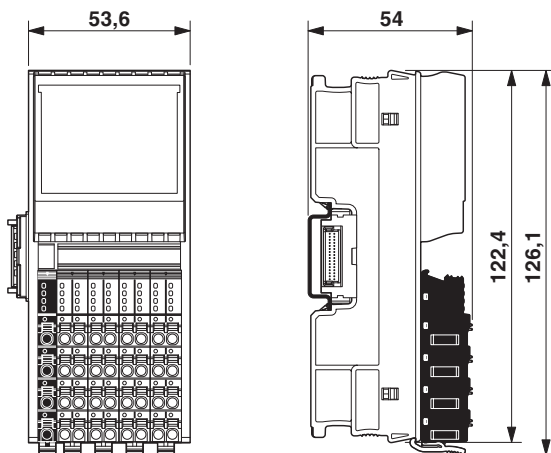
Description	Type	MNR	Pcs./Pkt.
S20 analog output module 8 outputs	S20-AO-8	R911172538	1
Accessories	Type	MNR	Pcs./Pkt.
S20 bus base module	S20-BS	R911172540	5
Connector set	S20-CNS-4L-O/D/UA/E1/E2	R911173864	1
S20 Shield set	S20-SHIELD-SET	R911173030	1
Shield connection clamps, for shield on busbars, for conductor diameters $\leq 5$ mm, contact resistance $< 1$ m $\Omega$	S20-SHIELD-SK5	R911173282	10
Shield connection clamps, for shield on busbars, for conductor diameters $\leq 14$ mm, contact resistance $< 1$ m $\Omega$	S20-SHIELD-SK14	R911173286	10
PEN conductor busbar, 3x10 mm, length: 1000 mm	S20-SHIELD-NLS	R911173283	1
Documentation	Type	MNR	Pcs./Pkt.
Application description S20: System and Installation	DOK-CONTRL-S20*SYS*INS-AP..-EN-P	R911335988	1
Application description S20: Error Messages	DOK-CONTRL-S20*DIAG*ER-AP..-EN-P	R911344826	1

#### Additional ordering data

For additional ordering data (accessories), please refer to the product catalog at [www.boschrexroth.com/electrics](http://www.boschrexroth.com/electrics).

### 4 Technical data

#### Dimensions (nominal sizes in mm)



Width	53.6 mm
Height	126.1 mm
Depth	54 mm
Note on dimensions	The depth is valid when a TH 35-7,5 DIN rail is used (according to EN 60715).

**General data**

Color	light grey RAL 7035
Weight	260 g (with connectors and bus base module)
Ambient temperature (operation)	-25 °C ... 60 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	III (IEC 61140, EN 61140, VDE 0140-1)
Overvoltage category	II (IEC 60664-1, EN 60664-1)
Degree of pollution	2 (IEC 60664-1, EN 60664-1)
Mounting type	DIN rail mounting
Mounting position	any (no temperature derating)

**Connection data: S20 connector**

Connection method	Push-in connection
Conductor cross section, rigid	0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section, flexible	0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section [AWG]	24 ... 16
Stripping length	8 mm



Observe the specifications for the conductor cross sections in the application description for the S20 system, material number R911335988.

**Interface: Local bus**

Number	2
Connection method	Bus base module
Transmission speed	100 Mbps

**Supply of the local bus ( $U_{Bus}$ )**

Supply voltage	5 V DC (via bus base module)
Current consumption	typ. 105 mA max. 130 mA
Power consumption	typ. 0.525 W max. 0.65 W

**Supply for analog modules (U<sub>A</sub>)**

Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	typ. 50 mA (internal current consumption, no load, 0 V output) typ. 110 mA (8 voltage channels, 10 V output) max. 235 mA (8 current channels, 20 mA output)
Power consumption	typ. 1.2 W (internal current consumption, no load, 0 V output) typ. 2.64 W (8 voltage channels, 10 V output) max. 5.64 W (8 current channels, 20 mA output)
Surge protection	electronic (35 V, 0.5 s)
Reverse polarity protection	up to index AB1: polarity protection diode starting at index AC1: parallel diode; with external 5 A fuse (for startup only)
Transient protection	Suppressor diode

**Power consumption**

Power consumption	typ. 1.725 W (to U <sub>Bus</sub> and U <sub>A</sub> ; power input; no load, output 0 V) max. 6.29 W (to U <sub>Bus</sub> and U <sub>A</sub> ; 8 current channels, output 20 mA)
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**Analog outputs**

Number of outputs	8
Connection method	Push-in connection
Connection technology	2-conductor, shielded, twisted pair
Current output signal	0 mA ... 20 mA, 4 mA ... 20 mA, -20 mA ... 20 mA
Voltage output signal	0 V ... 5 V, -5 V ... 5 V, 0 V ... 10 V, -10 V ... 10 V
D/A converter resolution	16 bit
D/A conversion time	5 μs
Representation of output values	16 bits (15 bits + sign)
Data formats	IB IL
Process data update	300 μs
Load/output load current output	to 500 Ω
Load/output load voltage output	> 2 kΩ
Precision	typ. 0.1 % (of output range final value)
Permissible cable length	max. 250 m (Reference cable type LiYCY (TP) n*2*0.5 mm <sup>2</sup> )
Short-circuit and overload protection	electronic
Transient protection	Suppressor diode

**Input and output address area**

Input address area	16 Byte
Output address area	16 Byte

**Configuration and parameter data in a PROFIBUS system**

Required parameter data	27 Byte
Required configuration data	7 Byte

**Electrical isolation/isolation of the voltage areas**

Test section	Test voltage
5 V supply of the local bus ( $U_{BUS}$ ) / 24 V supply (I/Os)	500 V AC, 50 Hz, 1 min.
5 V supply of the local bus ( $U_{BUS}$ )/analog outputs	500 V AC, 50 Hz, 1 min.
5 V supply of the local bus ( $U_{BUS}$ ) / functional ground	500 V AC, 50 Hz, 1 min.
24 V supply (I/O)/analog outputs	500 V AC, 50 Hz, 1 min.
24 V supply (I/O) / functional ground	500 V AC, 50 Hz, 1 min.
Analog outputs/functional ground	500 V AC, 50 Hz, 1 min.

**Mechanical tests**

Vibration resistance in acc. with EN 60068-2-6/ IEC 60068-2-6	5g
Shock in acc. with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock according to EN 60068-2-27/ IEC 60068-2-27	10g

**Conformance with EMC Directive 2014/30/EU****Immunity test in accordance with EN 61000-6-2/IEC 61000-6-2**

Electrostatic discharge (ESD) EN 61000-4-2/ IEC 61000-4-2	Criterion B, 6 kV contact discharge, 8 kV air discharge
Electromagnetic fields EN 61000-4-3/IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
Fast transients (burst) EN 61000-4-4/IEC 61000-4-4	Criterion B, 2 kV
Transient overvoltage (surge) EN 61000-4-5 /IEC 61000-4-5	up to index AB1: Criterion B, DC supply lines: $\pm 0.5$ kV/ $\pm 1.0$ kV (symmetrical/asymmetrical), $\pm 1.0$ kV to shielded I/O cables from index AC1: Criterion B, DC supply lines: $\pm 3.0$ kV/ $\pm 1.0$ kV (symmetrical/asymmetrical), $\pm 1.0$ kV to shielded I/O cables
Conducted interference EN 61000-4-6/IEC 61000-4-6	Criterion A, Test voltage 10 V
<b>Noise emission test according to EN 61000-6-3/ IEC 61000-6-3</b>	Class B

**Approvals**

For the latest approvals, please visit [www.boschrexroth.com/electrics](http://www.boschrexroth.com/electrics).

## 5 Derating

The values apply for a closed control cabinet and stagnant air.

For standard mounting position, e.g., wall mounting on horizontal DIN rail, no derating applies.

Other mounting positions are possible, however the maximum permitted temperature should be lowered by 5 Kelvin.

When operated outside the specified range, the outputs will be switched off to protect them (0 V/0 mA).

## 6 Tolerance data

Tolerances at $T_A = +25^\circ\text{C}$				
	Absolute tolerance		Relative tolerance	
	Typ.	Max.	Typ.	Max.
0 V ... 5 V, $\pm 5$ V, 0 V ... 10 V, $\pm 10$ V	$\pm 10$ mV	$\pm 30$ mV	$\pm 0.10$ %	$\pm 0.30$ %
0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20$ mA	$\pm 20$ $\mu\text{A}$	$\pm 60$ $\mu\text{A}$	$\pm 0.10$ %	$\pm 0.30$ %

Typical data contains offset error, gain error, and linearity error in the respective default setting.

All tolerances indicated as a percentage are related to the positive output range final value.

The data is valid for nominal operation ( $U_A = 24$  V in the default configuration).

Default configuration: IB IL format

Please also observe the values for temperature drift and the tolerances under influences of electromagnetic interferences.

The maximum tolerance values represent the worst case measurement inaccuracy. Besides maximum offset and gain drift, they also comprise longtime drift as well as the maximum tolerances of the test and calibration equipment.

Tolerance and temperature response at $T_A = -25^\circ\text{C} \dots +60^\circ\text{C}$		
	Drift	
	Typical	Maximum
0 V ... 5 V, $\pm 5$ V, 0 V ... 10 V, $\pm 10$ V	$\pm 25$ ppm/K	$\pm 70$ ppm/K
0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20$ mA	$\pm 25$ ppm/K	$\pm 70$ ppm/K

The drift values refer to the relevant output range final value.

The values refer to nominal operation with default settings.

### Additional tolerances influenced by electromagnetic interference

Electromagnetic fields	EN 61000-4-3/ IEC 61000-4-3	< 1 %
Fast transients (burst)	EN 61000-4-4/ IEC 61000-4-4	0 %
Conducted interference	EN 61000-4-6/ IEC 61000-4-6	0 %

All tolerances indicated as a percentage are related to the positive output range final value.

Additional tolerances may occur due to the influence of high-frequency electromagnetic interference caused by wireless transmission systems in the near vicinity. The values specified refer to nominal operation in the event of direct interference to components without additional shielding such as a steel cabinet, etc.

The above mentioned tolerances can be reduced by providing further shielding measures for the I/O module (e.g., use of a shielded control box/control cabinet, etc.).

## 7 Signal rise times

### Voltage step 0 V ... 10 V (typical values)

Load	Time for 0 % ... 99 %
$R_L = 2 \text{ k}\Omega$	90 $\mu\text{s}$
$R_L = 2 \text{ k}\Omega \parallel C_L = 10 \text{ nF}$	100 $\mu\text{s}$
$R_L = 2 \text{ k}\Omega \parallel C_L = 220 \text{ nF}$	250 $\mu\text{s}$
$R_L = 2 \text{ k}\Omega + L_L = 3 \text{ mH}$	90 $\mu\text{s}$

### Current step 0 mA ... 20 mA (typical values)

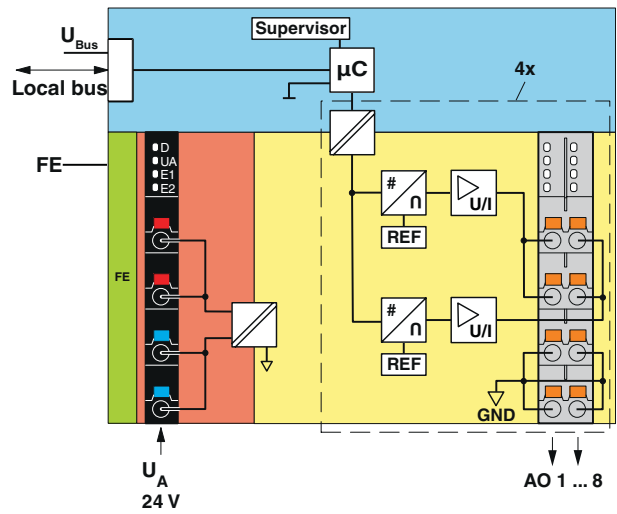
Load	Time for 0 % ... 99 %
$R_L = 500 \Omega$	350 $\mu\text{s}$
$R_L = 500 \Omega \parallel C_L = 10 \text{ nF}$	375 $\mu\text{s}$
$R_L = 500 \Omega \parallel C_L = 220 \text{ nF}$	950 $\mu\text{s}$
$R_L = 500 \Omega + L_L = 3 \text{ mH}$	600 $\mu\text{s}$

### Key to the tables

$R_L$	Ohmic load
$C_L$	Capacitive load
$L_L$	Inductive load
$\parallel$	Parallel connection
+	Serial connection

## 8 Internal circuit diagram

Fig. 1 Internal wiring of the terminal points



### Key:

	Hardware monitoring
	Microcontroller
	Electrical isolation for data or power supply
	Digital/analog converter
	Output level for current (I) or voltage (U)
	Reference voltage source
	Noiseless ground
	Analog I/O reference ground
	Logic reference ground
	Electrically isolated areas



## 9 For your safety

### 9.1 Intended use

Only use S20 modules in accordance with the information in this data sheet and in the application description for the S20 system, material number R911335988.

### 9.2 Qualification of users

The use of products described in this data sheet is oriented exclusively to electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

### 9.3 Electrical safety



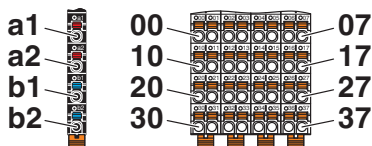
**WARNING: loss of electrical safety**

If used incorrectly, device safety may be impaired.

During installation, startup, and operation, observe the notes in this data sheet and the specifications in the application description for the S20 system, material number R911335988.

## 10 Terminal point assignment

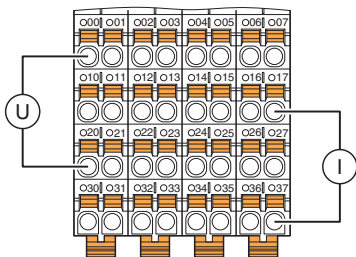
Fig. 2 Terminal point assignment



Terminal point	Color	Assignment	
<b>Supply voltage input</b>			
a1, a2	Red	24 V DC (U <sub>A</sub> )	Analog module feed-in (bridged internally)
b1, b2	Blue	GND	Reference potential of the supply voltage (bridged internally)
<b>Analog outputs</b>			
00 ... 07	Orange	U1 ... U8	Voltage connection for channels 1 ... 8
10 ... 17	Orange	I1 ... I8	Current connection for channels 1 ... 8
20 ... 27, 30 ... 37	Orange	GND	Reference potential for all channels

## 11 Connection example

Fig. 3 Connection for voltage and current output



## 12 Connection notes

**NOTE** Damage to the electronics/measuring error

Always connect the analog actuators using shielded twisted-pair cables.

Unshielded cables may lead to values outside the specified tolerance limits in environments subject to heavy noise.

Connect the cable shield to functional earth immediately after the cables enter the control cabinet.

If a closed control cabinet is not available, connect the shield to a shield bus.

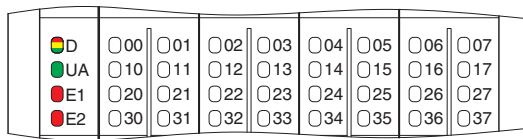
For the best possible connection directly in front of the module, use the S20 SHIELD-SET shield connection set (R911173030) in combination with the S20-SHIELD-NLS busbar (R911173283).



For more information on shielding, please refer to the application description for the S20 system, material number R911335988.

## 13 Local diagnostic and status indicators

Fig. 4 Local diagnostic and status indicators



Channel errors are errors that can be associated with a channel.

I/O errors are errors that affect the entire module.

Designation	Color	Meaning	State	Description
D	Red/ yellow/ green	Diagnostics of local bus communication		
		Run	Green on	The device is ready for operation, communication within the station is OK. All data is valid. An error has not occurred.
		Active	Flashing green	The device is ready to operate, communication within the station is OK. The data is <b>not</b> valid. The controller or higher-level network is not delivering valid data. There is no error on the module.
		Device application not active	Flashing green/yellow	The device is ready for operation, communication within the station is OK. Output data <b>cannot</b> be outputted and/or input data <b>cannot</b> be read. There is a fault on the periphery side of the module..
		Ready	Yellow on	The device is ready for operation but did not detect a valid cycle after power-up.
		Connected	Flashing yellow	The device is not (yet) part of the active configuration.
		Reset	Red on	The device is ready for operation but has lost the connection to the bus head.
		Not connected	Flashing red	The device is ready for operation but there is no connection to the previously existing device.
		Power down	Off	Device is in (power) reset.
UA	Green	U <sub>Analog</sub>	On	Supply for analog modules (U <sub>A</sub> ) present.
			Off	Supply for analog modules (U <sub>A</sub> ) not present.
E1	Red	Supply voltage error	On	Supply for analog modules (U <sub>A</sub> ) is faulty.
			Off	Supply for analog modules (U <sub>A</sub> ) is OK.
E2	Red	Error	On	I/O or channel error has occurred.
			Off	No error

## Error code and status of the E1 and E2 LEDs

Error	E1 LED	E2 LED
No error	off	off
Short-circuit	off	on
Wire break	off	on
Faulty supply voltage	on	on
Parameter table invalid	off	on
Device error	off	on
Flash format error	off	on



A short circuit or wire break is detected when the output value is >5% of the output range final value.

The module can only detect a short circuit or open circuit if a value is set.

## 14 Process data

The module uses eight words of IN and eight words of OUT process data.

Each channel is mapped to a word.

### 14.1 OUT process data

The output values are transmitted from the controller board or the computer to the module using process data output words.

#### Order of the process data words

OUT0	...	OUT7
Channel 1	...	Channel 8
AV	...	AV

AV Output value


#### Output value

The output values are mapped in IB&nbsp;IL format. In this format the output value is represented in bits 14 to 0. An additional bit (bit&nbsp;15) is available as a sign bit.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
V	Analog value														

V Sign bit

### 14.2 IN process data

 In the case of Sercos, the IN process data is hidden and therefore unavailable.

The following data is transmitted in the input process data:

- During normal error-free operation, the output value is mirrored in the input process data for each channel.
- If an error occurs, the diagnostic message is mirrored (in IB IL format) in the input process data for each channel. The diagnostics message is deleted as soon as the error is eliminated.


#### Order of the process data words

IN0	...	IN7
Channel 1	...	Channel 8
AW*/Diag	...	AW*/Diag

AW\*/Diag Mirrored output value or diagnostics messages (in IB IL format)

#### Diagnostic message (in IB IL format)

Code (hex)	Cause
8002	Wire break
8003	Short-circuit
8010	Parameter table invalid
8020	Faulty supply voltage
8040	Device faulty

 In the event of error, a currently existing error is mirrored in the process data on the corresponding channel.

## 15 Significant values

Output data		0 V ... 10 V	±10 V	0 V ... 5 V	±5 V	0 mA ... 20 mA	±20 mA	4 mA ... 20 mA
hex	dec	V	V	V	V	mA	mA	mA
7FFF ... 7F01		+10.837	+10.837	+5.419	+5.419	+21.6747	+21.6747	+21.3397
7F00	32512	+10.837	+10.837	+5.419	+5.419	+21.6747	+21.6747	+21.3397
7530	30000	+10.0	+10.0	+5.0	+5.0	+20.0	+20.0	+20.0
3A98	15000	+5.0	+5.0	+2.5	+2.5	+10.0	+10.0	+12.0
0001	1	+333.33 µV	+333.33 µV	+166.67 µV	+166.67 µV	+0.6667 µA	+0.6667 µA	+4.0005333
0000	0	0	0	0	0	0	0	+4.0
FFFF	-1	0	-333.33 µV	0	-166.67 µV	0	-0.6667 µA	+4.0
C568	-15000	0	-5.0	0	-2.5	0	-10.0	+4.0
8AD0	-30000	0	-10.0	0	-5.0	0	-20.0	+4.0
8100	-32512	0	-10.837	0	-5.419	0	-21.6747	+4.0
80FF ... 8000*		Hold last value	Hold last value	Hold last value	Hold last value	Hold last value	Hold last value	Hold last value
8001	Overrange	+10.837	+10.837	+5.419	+5.419	+21.6747	+21.6747	+21.3397
8080	Underrange	0	-10.837	0	-5.419	0	-21.6747	Hold last value

\* without 8001, 8080

## 16 Parameter, diagnostics and information (PDI)

Parameter and diagnostic data as well as other information is transmitted as objects via the PDI channel of the S20 station.

In IndraWorks, these parameters are displayed in the configurator.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

For an explanation of the data types, please refer to the application description for the S20 system, material number R911335988.

Abbreviation	Meaning
A	Number of elements
L	Length of the elements in bytes
R	Read
W	Write



Each visible string is terminated with a null terminator (00<sub>hex</sub>). The length of a visible-string-type element is therefore at least one byte larger than the number of user data items.

If the number of user data items plus null terminator is smaller than the specified length of the element, the visible string will be populated with a null character (00<sub>hex</sub>).



For detailed information on PDI objects, please refer to the application description for the S20 system, material number R911335988.

## 17 Standard objects

### 17.1 Objects for identification (device rating plate)

Index (hex)	Object name	Data type	A	L	Rights	Meaning	Contents
<b>Manufacturer</b>							
0001	VendorName	Visible String	1	17	R	Vendor name	Bosch Rexroth AG
0002	VendorID	Visible String	1	7	R	Vendor ID	006034
0012	VendorURL	Visible String	1	28	R	Vendor URL	http://www.boschrexroth.com
<b>Module - general</b>							
0004	DeviceFamily	Visible String	1	15	R	Device family	I/O analog OUT
0006	ProductFamily	Visible String	1	17	R	Product family	IndraControl S20
000E	CommProfile	Visible String	1	4	R	Communication profile	633
000F	DeviceProfile	Visible String	1	5	R	Device profile	0010
0011	ProfileVersion	Record of Visible Strings	2	11; 22	R	Profile version	2009-10-22; Basic - Profile V1.12
0017	Language	Record of Visible Strings	2	6; 8	R	Language	en-us; English
<b>Module - special</b>							
0005	Capabilities	Visible String	1	8	R	Capabilities	Energ_0
0007	ProductName	Visible String	1	9	R	Product name	S20-AO-8
0008	SerialNo	Visible String	1	16	R	Serial number	xx xx xx xx xx xx x (e. g., 7602012346BC125)
0009	ProductText	Visible String	1	17	R	Product text	8 analog outputs
000A	OrderNumber	Visible String	1	11	R	Item No.	R911172538
000B	HardwareVersion	Record of Visible Strings	2	11; 4	R	Hardware version	e.g., 2013-04-26; AA1
000C	FirmwareVersion	Record of Visible Strings	2	11; 6	R	Firmware version	e. g., 2010-06-21; V1.10
000D	PChVersion	Record of Visible Strings	2	11; 6	R	PDI version	2010-01-08; V1.00
0037	DeviceType	Octet string	1	8	R	Device type	00 10 00 10 00 00 00 A3 <sub>hex</sub>
003A	VersionCount	Array of UINT16	4	4 * 2	R	Version counter	e. g., 0007 0001 0001 0001 <sub>hex</sub>
<b>Use of the device</b>							
0014	Location	Visible String	1	58	R/W	Location	Can be completed by the user.
0015	EquipmentIdent	Visible String	1	58	R/W	Equipment identifier	Can be completed by the user.
0016	ApplDeviceAddr	UINT16	1	2	R/W	Application-specific device address	Can be completed by the user.



## 17.2 Miscellaneous standard objects

Index (hex)	Object name	Data type	A	L	Rights	Meaning/contents	
<b>Diagnostics objects</b>							
0018	DiagState	Record	6	2; 1; 1; 2; 1; 14	R	Diagnostic state	*
0019	ResetDiag	UINT8	1	1	R/W	Handling diagnostic messages	*
<b>Objects for process data management</b>							
0024	ResetCode	Array of UINT16	8	8 * 2	R/W	Substitute value behavior during bus reset (PDOOUT)	*
0025	PDIN	Octet string	1	16	R	Input process data	*
0026	PDOOUT	Octet string	1	16	R/W	Output process data	*
0027	GetExRight	UINT8	1	1	R/W	Get exclusive process data write rights	*
002F	PDOOUT_Subst	Array of UINT16	8	8 * 2	R/W	Substitute value for the OUT process data	*
<b>Objects for device management</b>							
001D	Password	Octet string	1	9	W	Password	*

The objects identified with \* in the last column are described in more detail in the following sections.

The description of the other objects is to be found in the application description for the S20 system, material number R911335988.

### 17.3 Diagnostics state (0018<sub>hex</sub>: DiagState)

This object is used for a structured message of an error.

0018 <sub>hex</sub> : Diagnostics state (read)				
Subindex	Data type	Length in bytes	Meaning	Contents
0	Record	21	Diagnostic state	Complete diagnostics information
1	UINT16	2	Error number	0 ... 65535 <sub>dec</sub>
2	UINT8	1	Priority	00 <sub>hex</sub>   No error
				01 <sub>hex</sub>   Error
				02 <sub>hex</sub>   Warning
				81 <sub>hex</sub>   Error removed
				82 <sub>hex</sub>   Warning eliminated
3	UINT8	1	Channel/group/module	00 <sub>hex</sub>   No error
				01 <sub>hex</sub>   Channel 1
				:   :
				08 <sub>hex</sub>   Channel 8
				FF <sub>hex</sub>   Entire device
4	UINT16	2	Error code	See table below
5	UINT8	1	More follows	00 <sub>hex</sub>
6	Visible String	14	Text	See table below



The message with priority 81<sub>hex</sub> or 82<sub>hex</sub> is a one-off, internal message to the bus coupler. The bus coupler transfers this error message to the error mechanisms of the higher-level system.

#### Error and status of the local diagnostics and status indicators

Subindex	2	3	4	6	LED			
	Priority	Channel/ group/ module	Error code	Text	D	UA	E1	E2
Error	hex	hex	hex					
No error	00	00	0000	Status OK	⦿	●	○	○
Short-circuit	01	01 ... 08	2130	Short-circuit	⦿	●	○	●
Faulty supply voltage	01	FF	5160	Supply fail	⦿	○	●	●
Device error	01	FF	6301	CS FLASH	⦿	●	○	●
Flash format error	01	FF	6302	FO FLASH	⦿	●	○	●
Parameter table invalid	01	FF	6320	Invalid para	⦿	●	○	●
Wire break	01	01 ... 08	7710	Open circuit	⦿	●	○	●

- Off
- On
- ⦿ Green on
- ⦿ Flashing green/yellow

#### 17.4 Handling diagnostic messages (0019<sub>hex</sub>: ResetDiag)

You can use this object to specify how the module should handle diagnostic messages.

0019 <sub>hex</sub> : Handling diagnostic messages (read, write)				
Subindex	Data type	Length in bytes	Code (hex)	Meaning/contents
0	UINT8	1	00	Permit all diagnostic messages
			02	Delete and acknowledge all diagnostic messages that are still pending
			06	Delete and acknowledge all diagnostic messages and do not permit new diagnostic messages
			Other	Reserved

#### 17.5 Substitute value behavior during bus reset (PDOOUT) (0024<sub>hex</sub>: ResetCode)

With this object, you parameterize the behavior of the module in the event that process data is missing.

0024 <sub>hex</sub> : substitute value behavior during bus reset (PDOOUT) (read, write)			
Subindex	Data type	Length in bytes	Meaning/contents
0	Array	8 * 2	Substitute value behavior during bus reset (PDOOUT)

Element	Data type	Length in bytes	Meaning	Contents	Default value
1	UINT16	2	Substitute value behavior channel 1	0000 ... 0003 <sub>hex</sub>	0002 <sub>hex</sub>
:	:	:	:	:	:
8	UINT16	2	Substitute value behavior channel 8	0000 ... 0003 <sub>hex</sub>	0002 <sub>hex</sub>

**Value range:**

Code (hex)	Behavior
0000	Output of zero value (0 V / 0 mA / 4 mA) at output
0001	Output of final value (10 V / 5 V / 20 mA) at output
0002	Hold last value
0003	Substitute value (PDOOUT): Copy the substitute value from the "Substitute value for the output process data" object (002F <sub>hex</sub> )

#### Behavior of the outputs when the supply voltage fails

U <sub>A</sub>	U <sub>Bus</sub>	Behavior of the outputs
Available	Available	Nominal operation or see object 0024 <sub>hex</sub>
Missing	Available	Outputs to 0 V/0 mA
Available	Missing	Hold the last values (as with object 0024 <sub>hex</sub> , code 0002)



If there is a requirement that a reset of the output value to 0 V or 0 mA is always expected, the output cable can be interrupted by a relay controlled by the application.

#### Special features

- You can only access this object via subindex 0, i. e., you access the entire object.
- Write access with 2 bytes is permissible. In this case, the parameterized value applies to all channels.
- In the case of valid parameters, the object is stored permanently.

## 17.6 Input process data (0025<sub>hex</sub>: PDIN)



In the case of Sercos, the IN process data is hidden and therefore unavailable.

You can read the IN process data of the module with this object.

The structure corresponds to the representation in the "Process data" section.

0025 <sub>hex</sub> : IN process data (read)			
Subindex	Data type	Length in bytes	Meaning
0	Octet string	16	Input process data

## 17.7 Output process data (0026<sub>hex</sub>: PDOOUT)

You can read or write the OUT process data of the module with this object.

The structure corresponds to the representation in the "Process data" section.

0026 <sub>hex</sub> : OUT process data (read, write)			
Subindex	Data type	Length in bytes	Meaning
0	Octet string	16	Output process data

There are 2 bytes available for each channel, starting with channel 1.



Observe the notes in the section "Writing the analog values via the PDI channel".

## 17.8 Request exclusive write access (0027<sub>hex</sub>: GetExRight)

This object allows you to determine which channel (process data channel or PDI channel) gets the rights for writing the outputs.

0027 <sub>hex</sub> : Request exclusive write access (read, write)				
Subindex	Data type	Length in bytes	Meaning/contents	
0	Simple variable	1	00 <sub>hex</sub>	Rights for writing output data over the PD channel (process data channel)
			01 <sub>hex</sub>	Rights for writing output data via the PDI channel

All other values are invalid and will be acknowledged with an error.



### Please note the following for your process:

The parameterization in object 0027<sub>hex</sub> "Rights for writing the output data via the PDI channel" overwrites the OUT process data transmitted via the process data channel with the values from object 0026<sub>hex</sub> PDOOUT.

From now, the OUT process data can only be changed using the PDI object. Changes on the process data channel will have no effect.

If the value from the process data channel is to be used again, write access must be changed to "Rights for writing the output data via the PD channel (process data channel)" via the GetExRight object.

After a power reset, the values transmitted via the process data channel are always valid.

### 17.9 Substitute value for the OUT process data (002F<sub>hex</sub>: PDOUT\_Subst)

This object is used to parameterize the substitute values that are to be output at the analog outputs in the event that process data is missing. The condition is that option 0003 is selected in the "Substitute value behavior when process data is missing" object (0024<sub>hex</sub>).

In the case of valid parameters, the parameterization is stored in the module permanently.

After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

002F <sub>hex</sub> : Substitute value for the OUT process data (read, write)			
Subindex	Data type	Length in bytes	Meaning/contents
0	Array of UINT16	8 * 2	Replace output process data

There are 2 bytes available for each channel, starting with channel 1.

The values are used in the parameterized format.

#### Example:

Channel 1: 1 V, Channel 2: 2 V ... Channel 8: 8 V, IB IL format

```
0B B8 17 70 23 28 2E E0 3A 98 46 50 52 08 5D C0
```

#### Special features

- You can only access this object via subindex 0, i. e., you access the entire object.
- In the case of valid parameters, the object is stored permanently.
- The parameterized values are compared with the selected output range. If the substitute value does not correspond to the output range, an error message is issued.

### 17.10 Password (001D<sub>hex</sub>: Password)

By entering the "Superuser" password you permit writing to the "Exclusiv right received" object. These rights are required to transmit process data over the PDI channel.

001D <sub>hex</sub> : Password (Write)			
Subindex	Data type	Length in bytes	Meaning/contents
0	Simple variable	9	Password

## 18 Application objects

Index (hex)	Object name	Data type	A	L	Rights	Meaning/contents
0080	ParaTable	Array of UINT16	10	10 * 2	R/W	Parameter table

### Parameter table (0080<sub>hex</sub>: ParaTable)

Parameterize the module using this object.

In the case of valid parameters, the parameterization is stored in the module permanently.

After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

0080 <sub>hex</sub> : Parameter table (read, write)				
Subindex	Data type	Length in bytes	Meaning/contents	Default value
0	Array of UINT16	10 * 2	Read/write all elements	See subindices
1	UINT16	2	Parameterization of channel 1	0000 <sub>hex</sub>
:	UINT16	2	:	0000 <sub>hex</sub>
8	UINT16	2	Parameterization of channel 8	0000 <sub>hex</sub>
9	UINT16	2	Data format	0000 <sub>hex</sub>
10	UINT16	2	Reserved	0000 <sub>hex</sub>

### Parameterization of channel 1 ... channel 8

#### Parameterization word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	Output range		

#### Output range

Output range	Code (bin)	Code (hex)
0 V ... 10 V (default)	0000	0
±10 V	0001	1
0 V ... 5 V	0010	2
±5 V	0011	3
0 mA ... 20 mA	0100	4
±20 mA	0101	5
4 mA ... 20 mA	0110	6
Channel inactive	1111	F
Other	Reserved	

#### Data format

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	Data format		0	0	0	0	0	0	0	0

Data format	Code (bin)	Code (hex)
IB IL (default)	00	0
Other	Reserved	



Set all unused bits to 0.

## 19 Writing the analog values over the PDI channel

PDI = Parameters, Diagnostics and Information

The exclusive right must be changed first, if the analog values are not to be output via the process data, but via the PDI channel. To do this, proceed as follows.

- Write the ASCII string "Superuser" to the "Password" (001D<sub>hex</sub>) object.
- Write the value 01<sub>hex</sub> to the "Request exclusive write access" object (0027<sub>hex</sub>).

You may now write to the "Output process data" (0026<sub>hex</sub>) object.

## 20 Device descriptions

The device is described in the device description files. These files are available for download at [www.boschrexroth.com/electrics](http://www.boschrexroth.com/electrics) in the download area of the bus coupler used.

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S20\*AO\*8\*\*\*-DA04-EN-P

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