

# IndraControl S20 analog output module 4 outputs

**R911342762**  
Edition 02

## Data sheet S20-AO-4

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

08 / 2019



## 1 Description

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

### Features

- 4 analog output channels for the connection of either voltage or current signals
- Bipolar voltage outputs, unipolar current outputs
- Connection of actuators in 2-wire 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
- Bus-synchronous value output when all four channels are activated
- Short-circuit-proof outputs
- No derating in all ranges
- Short signal rise times
- Driving of high loads
- Device rating plate stored



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



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

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### 3 Ordering data

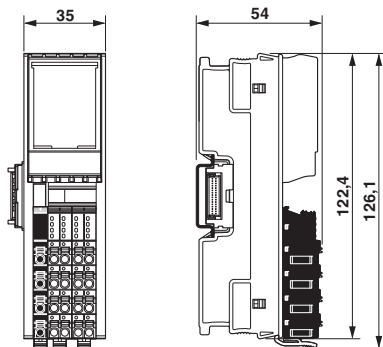
Description	Type	MNR	Pcs./Pkt.
IndraControl S20 analog output module 4 outputs	S20-AO-4	R911173248	1
Accessories	Type	MNR	Pcs./Pkt.
IndraControl S20 bus base module, narrow	S20-BS-S	R911173203	5
IndraControl shield set	S20-SHIELD-SET	R911173030	1
Shield connection clamps, for shield on busbars, for conductor 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 IndraControl S20: System and Installation	DOK-CONTRL-S20*SYS*INS-AP..-EN-P	R911335988	1
Application description IndraControl 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	35 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	145 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
Mounting position	any (no temperature derating)

**Connection data: S20 connector**

Connection method	Push-in connection
Conductor cross section solid / stranded	0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup> / 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 IndraControl 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<sub>Bus</sub>)**

Supply voltage	5 V DC (via bus base module)
Current consumption	typ. 120 mA max. 150 mA

**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	min. 40 mA (internal current consumption, no load, 0 V output) typ. 60 mA (4 voltage channels, 10 V output) max. 85 mA (4 voltage channels, 10 V output) max. 110 mA (4 current channels, 20 mA output, 500 Ω load) max. 125 mA (4 current channels, 24 mA output, 500 Ω load)
Power consumption	typ. 1.44 W (at U <sub>A</sub> ) max. 3 W (at U <sub>A</sub> )
Surge protection of the supply voltage	electronic (35 V, 0.5 s)
Polarity reversal protection of the supply voltage	Polarity protection diode
Transient protection	Suppressor diode

**Power consumption**

Power consumption	typ. 2.04 W (at U <sub>Bus</sub> and U <sub>A</sub> ) max. 3.75 W (at U <sub>Bus</sub> and U <sub>A</sub> )
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**Analog outputs**

Number of outputs	4
Connection method	Push-in connection
Connection technology	2-wire, shielded, twisted pair
Current output signal	0 mA ... 20 mA, 4 mA ... 20 mA
Voltage output signal	0 V ... 5 V, -5 V ... 5 V, 0 V ... 10 V, -10 V ... 10 V
D/A resolution	16 bit
Representation of output values	16 bits (15 bits + sign)
Data formats	IB IL
Process data update	140 µs
Load/output load current output	≤ 500 Ω
Load/output load voltage output	≥ 1 kΩ
Precision	typ. 0.1 % (of output range final value)
Short-circuit and overload protection	electronic
Transient protection	Suppressor diode

**Input and output address area**

Input address area	8 Byte
Output address area	8 Byte

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

Required parameter data	14 Byte
Required configuration data	7 Byte

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

Test section	Test voltage
5 V communications power (logic), 24 V supply (I/O)	500 V AC, 50 Hz, 1 min.
5 V supply (logic)/analog outputs	500 V AC, 50 Hz, 1 min.
5 V supply (logic)/functional earth 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 earth ground	500 V AC, 50 Hz, 1 min.
Analog outputs/functional earth 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****Noise immunity test in accordance with EN 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	Criterion B, supply lines DC: ±0.5 kV/±0.5 kV (symmetrical/ asymmetrical), ±1 kV to shielded I/O cables
Conducted interference EN 61000-4-6/IEC 61000-4-6	Criterion A; Test voltage 10 V

**Noise emission test according to EN 61000-6-3**

Class B

## Approvals

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

## 5 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	$\pm 20$ $\mu\text{A}$	$\pm 60$ $\mu\text{A}$	$\pm 0.10\%$	$\pm 0.30\%$

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	$\pm 25$ 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	< 0.1 %
Fast transients (burst)	EN 61000-4-4/ IEC 61000-4-4	< 0.1 %
Conducted interference	EN 61000-4-6/ IEC 61000-4-6	< 0.1 %

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.).

## 6 Signal rise times

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

Load	Time for 0 % ... 99 %
$R_L = 1 \text{ k}\Omega$	30 $\mu\text{s}$
$R_L = 1 \text{ k}\Omega \parallel C_L = 10 \text{ nF}$	30 $\mu\text{s}$
$R_L = 1 \text{ k}\Omega \parallel C_L = 220 \text{ nF}$	215 $\mu\text{s}$
$R_L = 1 \text{ k}\Omega + L_L = 3 \text{ mH}$	35 $\mu\text{s}$

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

Load	Time for 0 % ... 99 %
$R_L = 500 \Omega$	125 $\mu\text{s}$
$R_L = 500 \Omega \parallel C_L = 10 \text{ nF}$	130 $\mu\text{s}$
$R_L = 500 \Omega \parallel C_L = 220 \text{ nF}$	300 $\mu\text{s}$
$R_L = 500 \Omega + L_L = 2 \text{ mH}$	1 ms

### Key to the tables

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

7 Internal circuit diagram

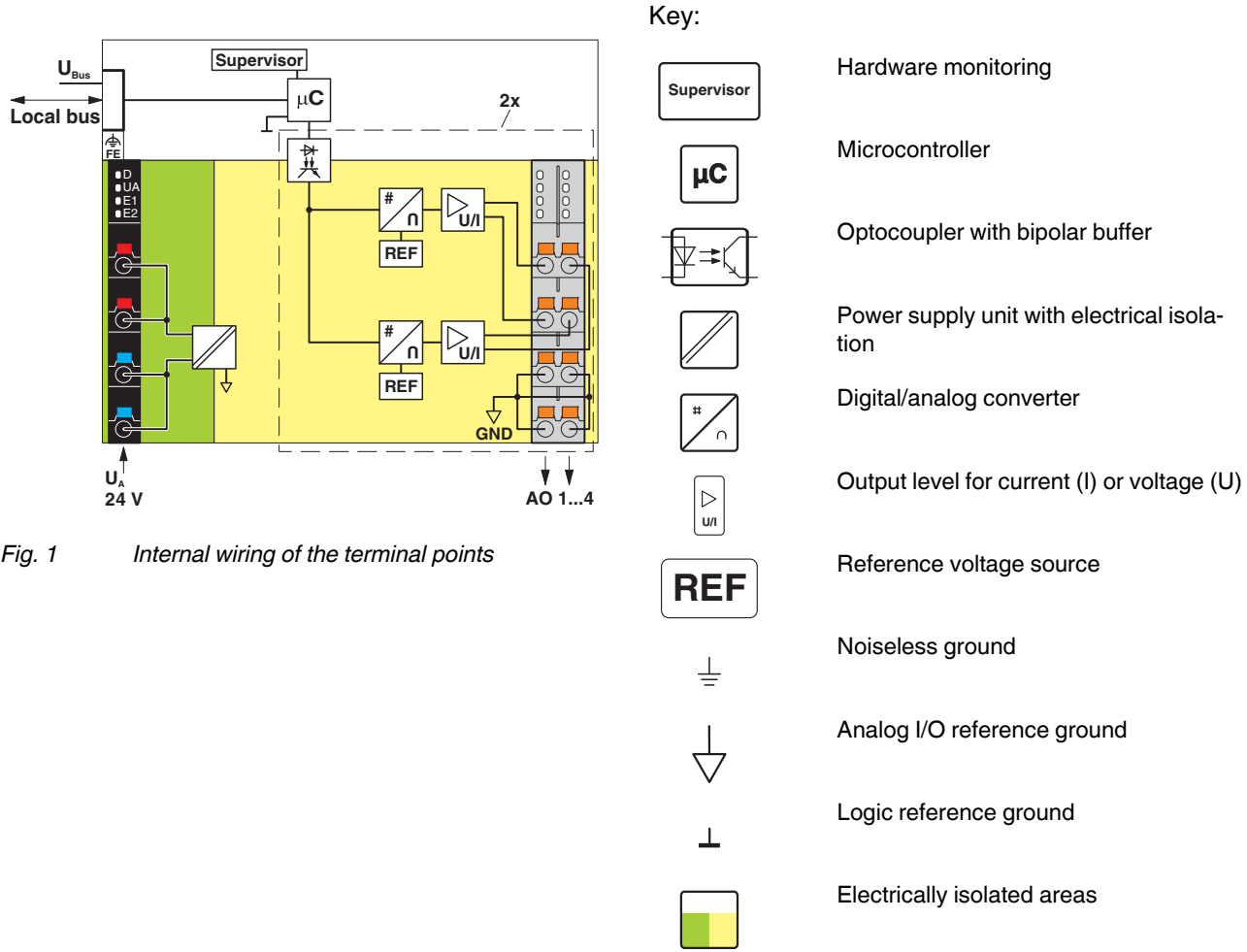


Fig. 1 Internal wiring of the terminal points



8 Terminal point assignment

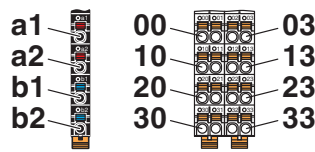


Fig. 2 Terminal point assignment

Terminal point	Color	Assignment	
Supply voltage input			
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)
Analog outputs			
00 ... 03	Orange	U1 ... U4	Voltage connection for channel 1 ... 4
10 ... 13	Orange	I1 ... I4	Current connection for channel 1 ... 4
20 ... 23, 30 ... 33	Orange	GND	Reference potential for all channels

9 Connection example

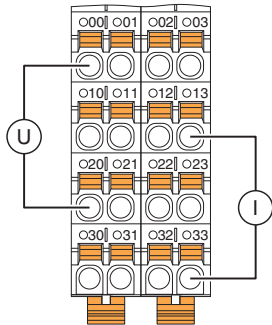


Fig. 3 Connection for voltage and current output

10 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 IndraControl 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 IndraControl S20 system, material number R911335988.

## 11 Local diagnostic and status indicators



Channel errors are errors that can be associated with a channel.  
Periphery errors are errors that affect the entire module.

Fig. 4 Local diagnostic and status indicators

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	Green flashing	The device is ready for operation, communication within the station is OK. The data is <b>not</b> valid. No valid data provided by the controller/higher-level network. There is no error on the module.
		Device application not active	Green/yellow flashing	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	Yellow flashing	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	Red flashing	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
Open circuit	off	on
Faulty supply voltage	on	on
Parameter table invalid	off	on
Device error	off	on
Flash format error	off	on



Short or open circuits are detected with an output value of > 5% of the output range final value.

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

## 12 Process data

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

Each channel is mapped to a word.

### 12.1 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	...	OUT3
Channel 1	...	Channel 4
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

### 12.2 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	...	IN3
Channel 1	...	Channel 4
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	Open circuit
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.

### 13 Significant values

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

\* without 8001, 8080

## 14 Parameter, diagnostics and information (PDI)

Parameter and diagnostic data as well as other information is transmitted as objects via the PDI channel of the IndraControl 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 IndraControl 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 IndraControl S20 system, material number R911335988.

## 15 Standard objects

### 15.1 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; 20	R	Profile version	2011-12-07; Basis - Profil V2.0
0017	Language	Record of Visible Strings	2	6; 8	R	Language	en-us; English
<b>Module - special</b>							
0005	Capabilities	Array of Visible Strings	2	8; 8	R	Capabilities	Energ_0; SyncO_0
0007	ProductName	Visible String	1	9	R	Product name	S20-AO-4
0008	SerialNo	Visible String	1	16	R	Serial number	xx xx xx xx xx xx x (e. g., 7602012346BC125)
0009	ProductText	Visible String	1	25	R	Product text	4 analog output channels
000A	OrderNumber	Visible String	1	11	R	Order No.	R911173248
000B	HardwareVersion	Record of Visible Strings	2	11; 3	R	Hardware version	e. g., 2010-06-21; 01
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 08 00 00 00 A7 <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	59	R/W	Location	Can be completed by the user.
0015	EquipmentIdent	Visible String	1	59	R/W	Equipment identifier	Can be completed by the user.
0016	ApplDeviceAddr	UINT16	1	2	R/W	Application device address	Can be completed by the user.

## 15.2 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	Reset diagnostic messages	*
<b>Objects for process data management</b>							
0024	ResetCode	Array of UINT16	4	4 * 2	R/W	Substitute value behavior during bus reset (PDOOUT)	*
0025	PDIN	Octet string	1	8	R	Input process data	*
0026	PDOOUT	Octet string	1	8	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	*
0029	ParamSetWrite-Control	UINT8	1	1	R/W	Parameter set write control	*
002A	ConflictDictionary	Record	N	12	R	Conflict dictionary	*
002D	ResetParam	UINT8	1	1	R/W	Reset parameterization	*
002E	Checksum	UINT32	1	4	R	Checksum	*

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 IndraControl S20 system, material number R911335988.

### 15.3 Diagnostics objects

#### 15.3.1 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
				:	:
				04 <sub>hex</sub>	Channel 4
				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				
Error	Priority	Channel/ group/ module	Error code	Text	LED			
	hex	hex	hex		D	UA	E1	E2
No error	00	00	0000	Status OK	●	●	○	○
Short-circuit	01	01 ... 04	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	●	●	○	●
Open circuit	01	01 ... 04	7710	Open circuit	●	●	○	●

Key:

○ Off  
● On

● Green on  
✱ Green/yellow flashing



15.3.2    **Reset diagnostic messages (0019<sub>hex</sub>: ResetDiag)**

You can delete the diagnostics memory and acknowledge the diagnostic messages with this object.

0019 <sub>hex</sub> : Reset 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, reset the error counter, and do not permit new diagnostic messages
			Other	Reserved

## 15.4 Objects for process data management

### 15.4.1 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.

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

0024 <sub>hex</sub> : substitute value behavior during bus reset (PDOOUT) (read, write)			
Subindex	Data type	Length in bytes	Meaning/contents
0	Array	4 * 2	Substitute value behavior during bus reset (PDOOUT)

Element	Data type	Length in bytes	Meaning	Contents	Default value
1	UINT16	2	Replacement value behavior channel 1	0000 ... 0003 <sub>hex</sub>	0002 <sub>hex</sub>
:	:	:	:	:	:
4	UINT16	2	Replacement value behavior channel 4	0000 ... 0003 <sub>hex</sub>	0002 <sub>hex</sub>

#### Value range:

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

#### 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	Outputs to 0 V/0 mA



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.
- In the case of valid parameters, the object is stored permanently.
- After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

#### 15.4.2 IN 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	8	Input process data

#### 15.4.3 OUT 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	8	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".

#### 15.4.4 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.

#### 15.4.5 Substitute value for the OUT process data (002F<sub>hex</sub>: PDOOUT\_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	4 * 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 4: 4 V, IB IL format

0B B8 17 70 23 28 2E E0

#### 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.

### 15.5 Objects for device management

Objects 0029<sub>hex</sub>, 002A<sub>hex</sub>, 002D<sub>hex</sub>, and 002E<sub>hex</sub> are available as of revision level AB1.

#### 15.5.1 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

### 15.5.2 Parameter record write control (0029<sub>hex</sub>: ParamSetWriteControl)

This object is used to control block parameterization.

0029 <sub>hex</sub> : Parameter record write control (read/write)				
Subindex	Data type	Length in bytes	Meaning/contents	
0	UINT8	1	00 <sub>hex</sub>	Termination of block parameterization
			01 <sub>hex</sub>	Initiation of block parameterization

Block parameterization serves to enable the joint transfer of interdependent parameters.

If you attempt to parameterize dependent parameters individually, this may result in the error message "Dependency of other parameter not taken into consideration". Block parameterization should be used in this case.

The plausibility check for the parameterization data is disabled during block parameterization, the data is only stored temporarily. However, the data length and subindex are checked.

The plausibility check is only performed when block parameterization is terminated with data item 00<sub>hex</sub>. If the check was completed with no errors, the temporarily stored parameterization data is applied and stored in the Flash memory.

If errors were detected in the temporarily stored parameterization data, the service is acknowledged negatively.

The exact cause of the error can be read in object 002A<sub>hex</sub>. The error codes are indicated by object 0080<sub>hex</sub>.

Not all startup objects have to be written.

The following actions are carried out when the parameter contents are modified:

#### Write control changes from 00<sub>hex</sub> to 01<sub>hex</sub>: initiation of block parameterization

- Block parameterization is initiated
- Conflict dictionary is reset

#### Write control changes from 01<sub>hex</sub> to 00<sub>hex</sub>: termination of block parameterization

- Block parameterization is terminated
- Individual parameterization is active
- Parameterization is checked for compatibility

Parameters are compatible:

- The parameter contents are accepted.
- Write access to the write control parameter is acknowledged positively.

Parameters are not compatible:

- The old contents of all the parameters required for block parameterization remain in effect.
- The conflict dictionary is updated.
- Write access to the write control parameter is acknowledged negatively.

Error code in the event of negative acknowledgment:

Code (hex)	Additional Code (hex)	Meaning	Corrective
0800 or 0801	0040	Dependent values were not taken into consideration.	Check the parameterization.

To use block parameterization without tools, proceed in the following sequence:

- Initiate block parameterization by writing the value 01<sub>hex</sub> to object 0029<sub>hex</sub>.
- Write the parameter table (ParaTable) to object 0080<sub>hex</sub>.
- Write the substitute value behavior when process data is missing (ResetCode) to object 0024<sub>hex</sub>.
- Write the substitute value for the OUT process data in the event of an error (PDOOUT\_Subst) to object 002F<sub>hex</sub>.
- Terminate block parameterization by writing the value 00<sub>hex</sub> to object 0029<sub>hex</sub>.

### 15.5.3 Conflict dictionary (002A<sub>hex</sub>: ConflictDictionary)

This object contains the indices and error messages (additional code) for the parameters involved in the conflict.

002A <sub>hex</sub> : Conflict dictionary (read)			
Subindex	Data type	Length in bytes	Meaning
0		12	Conflict dictionary

Meaning	Length in bytes	Example	
Subslot	1	00	No subslot
Index	2	00 2F	PDOUT_Subst
Subindex	1	02	Substitute value for OUT02
Parameter number	1	01	
Error code and class	1	80	
Additional error code	2	02 40	Substitute value for OUT02 outside the limit values

### Reset parameterization (002D<sub>hex</sub>: ResetParam)

This object is used to reset the module to the default settings.

To reset the module value 01<sub>hex</sub> must be transferred during write access. Any other values are not permissible and will be acknowledged with an error.

Then the default settings of the channels are loaded and all the user-set parameters are reset.

### Checksum (002E<sub>hex</sub>: Checksum)

The data of the startup objects is verified with this checksum. The checksum only changes if an object relevant for startup has been changed. The checksum is therefore suitable for comparing the parameterization.

16 Application objects

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

Index (hex)	Object name	Data type	A	L	Rights	Meaning/contents
0080	ParaTable	Array of UINT16	6	6 * 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	6 * 2	Read/write all elements	See subindices
1	UINT16	2	Parameterization of channel 1	0000 <sub>hex</sub>
:	UINT16	2	:	0000 <sub>hex</sub>
4	UINT16	2	Parameterization of channel 4	0000 <sub>hex</sub>
5	UINT16	2	Data format	0000 <sub>hex</sub>
6	UINT16	2	Reserved	0000 <sub>hex</sub>

Parameterization channel 1 ... channel 4

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				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
Reserved	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.

## 17 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.

## 18 Bus-synchronous operation

When all four channels are activated, the module operates synchronously to the local bus.

With each latch-out signal of the local bus, all channels are converted and output at a defined time. The MinimalCycleTime is 168 µs. If the latch-out signal were to arrive in shorter intervals than this time, an output would be omitted and the module would wait for the next latch-out signal.



### Please note that:

**Due to the optimization of the firmware at revision status AB1, the sync time point has changed slightly.**

- Modules with index AA1: synchronization with the analog output value when 90% of the output level is reached.
- Modules with index AB1: synchronization at the start of the signal change

## 19 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.