S20 digital output module 16 outputs

R911339279
Edition 02

Data sheet S20-DO-16/1

16 digital outputs 500 mA
24 V DC
1-conductor technology

10 / 2022

1 Description

The module is designed for use within an S20 station. It is used to output digital signals.
The outputs are protected against short circuit and overload.

Features

- 16 digital outputs
- 24 V DC, 500 mA
- Connection of actuators in 1-conductor technology
- Minimum update time of < 100 µs
- Device rating plate stored

Valid from index AD1.

The deviating behavior of the modules with an earlier index is documented in the corresponding points.

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.

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3 Ordering data

Description	Type	MNR	Pcs./Pkt.
S20 digital output module 16 outputs	S20-DO-16/1	R911172542	1

Accessories	Type	MNR	Pcs./Pkt.
S20 bus base module, narrow	S20-BS-S	R911173203	5

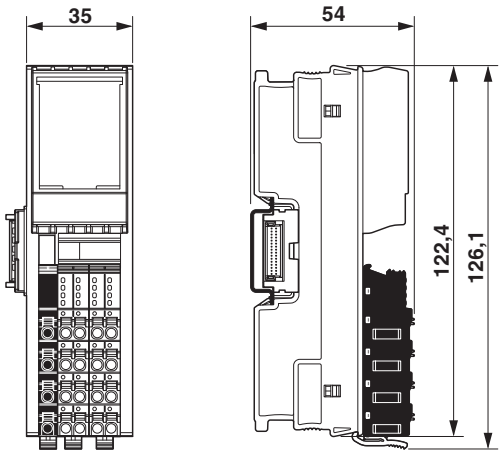
Documentation	Type	MNR	Pcs./Pkt.
Application description S20: System and Installation	DOK-CONTRL- S20*SYS*INS-AP..-EN-P	R911335988	1
Application description S20: Error Messages	DOK-CONTRL- S20*DIAG*ER-AP..-EN-P	R911344826	1

Additional ordering data

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

4 Technical data

Dimensions (nominal sizes in mm)



Width	35 mm
Height	126.1 mm
Depth	54 mm
Note on dimensions	The depth applies when a TH 35-7.5 DIN rail is used (in accordance with EN 60715).

General data	
Color	light grey RAL 7035
Weight	134 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 mm² ... 1.5 mm²
Conductor cross section, flexible	0.2 mm² ... 1.5 mm²
Conductor cross section [AWG]	24 ... 16
Stripping length	8 mm
Note	Observe the specifications for the conductor cross sections in the application description for the S20 system, material number R911335988.

Interface: Local bus	
Number of interfaces	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	max. 120 mA (up to index AC1) max. 60 mA (from index AD1)
Power consumption	max. 600 mW (up to index AC1) max. 300 mW (from index AD1)

Supply for digital output modules (U_O)	
Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	min. 14 mA (without actuators) max. 8 A (provide external protection)
Power consumption	typ. 320 mW (without actuators) max. 240 W (of which 560 mW with internal losses)
Surge protection	electronic (35 V, 0.5 s)
Reverse polarity protection	parallel diode; with external 5 A fuse (only for commissioning)

Supply for digital output modules (U_O)	
Protection	max. 8 A (polarity reversal protection up to 5 A)

NOTICE **Damage to the electronics**

Provide external protection for the module to ensure reverse polarity protection. If you use a fuse, the power supply unit must be capable of supplying four times the nominal current of the fuse. This ensures that the fuse trips reliably in the event of a fault.

When using the module for the first time, protect it with a 5 A fuse. When all modules in the system are correctly connected, the 5 A fuse can be replaced with an 8 A fuse. After that, you can load the module up to 8 A.

Loads over 8 A are not permitted.

Digital outputs	
Number of outputs	16
Connection method	Push-in connection
Connection technology	1-conductor
Nominal output voltage	24 V DC
Output current per channel	max. 500 mA
Output current of the device	max. 8 A (provide external protection)
Nominal load, ohmic	max. 12 W (48 Ω, with nominal voltage)
Nominal load, inductive	max. 12 VA (1.2 H, 48 Ω, with nominal voltage)
Nominal load, lamp	max. 12 W (at nominal voltage)
Load min.	10 kΩ
Energy consumption	see diagram
Limitation of the voltage induced on circuit interruption	-25.8 V ... -15 V
Output voltage when switched off	max. 1 V
Output current when switched off	max. 300 µA
Signal delay	max. 100 µs (when switched on) max. 100 µs (when switched off, with at least 50 mA load current)
Switching frequency	max. 10000 per second (with at least 50 mA load current) max. 1 per second (with inductive load) max. 16 per second (with nominal lamp load)
Behavior with overload	Shutdown with automatic restart
Behavior with inductive overload	Output can be destroyed
Reverse voltage resistance to short pulses	limited protection up to 0.5 A for 1 s

NOTICE **Damage to the electronics**

If there is a faulty external voltage (reverse voltage) at one of the outputs, the output may be destroyed. This may cause unintentional setting of further outputs.

Overcurrent shut-down	as of 0.7 A
Output current with ground connection interrupt when switched off	< 1 mA
Process data update	< 100 µs
Short-circuit protection, overload protection of the outputs	electronic

Input and output address area	
Input address area	0 Byte
Output address area	2 Byte

Configuration and parameter data in a PROFIBUS system	
Required parameter data	1 Byte
Required configuration data	6 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}) / functional ground	500 V AC, 50 Hz, 1 min.
24 V supply (I/O) / functional ground	500 V AC, 50 Hz, 1 min.

Mechanical tests	
Vibration resistance in accordance with EN 60068-2-6/IEC 60068-2-6	5g
Shock in accordance with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock in accordance with 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	Criterion B, DC supply lines: ±0.5 kV/±1.0 kV (symmetrical/ asymmetrical)
Conducted interference EN 61000-4-6/IEC 61000-4-6	Criterion A, Test voltage 10 V
Noise emission test in accordance with EN 61000-6-3/IEC 61000-6-3	Class B

Approvals

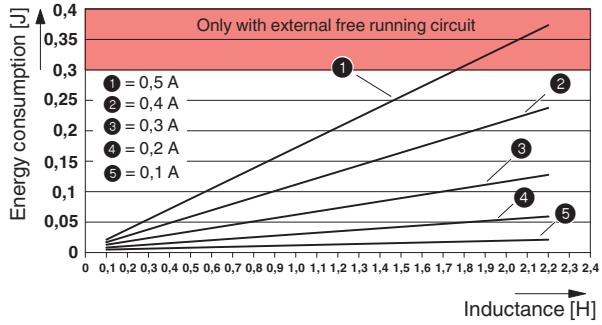
For the current approvals, please visit www.boschrexroth.com/electrics.

5 Maximum outputs power consumption when inductive loads are switched off

NOTICE **Damage to the electronics**

Restrict freewheeling voltage to a maximum of -17 V when using an external freewheeling circuit! The external freewheeling circuit does not function in the case of higher negative voltages.

Fig. 1 Maximum outputs power consumption when inductive loads are switched off

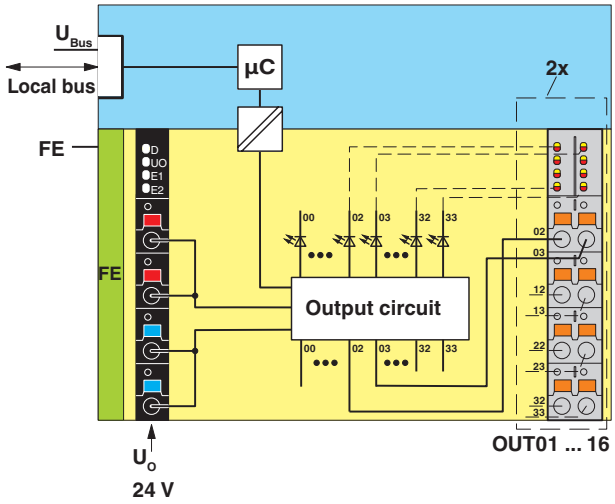


The specifications in the diagram refer to a maximum switching frequency of 1 Hz.

The diagram shows the maximum power that can be fed back for every switch-off operation in the respective output groups (outputs 1 to 4, 5 to 8, 9 to 12, 13 to 16) when an inductive load is switched off without an external freewheel.
The current data refers to the ohmic DC voltage component of the inductive load.

6 Internal circuit diagram

Fig. 2 Internal wiring of the terminal points



Key:

Local bus	Local bus
FE	Functional ground
µC	Microcontroller
	Electrical isolation
Output circuit	Output configuration
	LED
	Electrically isolated areas

7 For your safety

7.1 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.

7.2 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.

7.3 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.

7.4 Installation

Only install the S20 modules in a control cabinet or junction box.

The enclosure must meet the requirements regarding the protection against spread of fire according to the following standards:

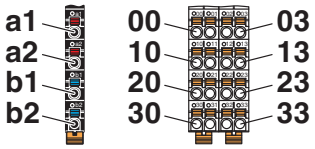
- EN 61010-1/IEC 61010-1
- UL 61010-1 (for applications with UL approval)

8 UL note

- Use copper conductors only.

9 Terminal point assignment

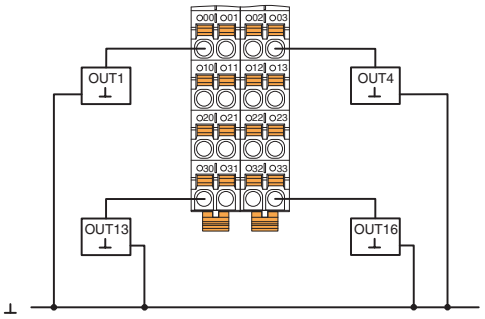
Fig. 3 Terminal point assignment



Terminal point	Color	Assignment	
Supply voltage input			
a1, a2	Red	24 V DC (U_O)	Supply for digital output modules (bridged internally)
b1, b2	Blue	GND	Reference potential of the supply voltage (bridged internally)
Digital outputs			
00 ... 03	Orange	OUT01 ... OUT04	Digital outputs 1 ... 4
10 ... 13	Orange	OUT05 ... OUT08	Digital outputs 5 ... 8
20 ... 23	Orange	OUT09 ... OUT12	Digital outputs 9 ... 12
30 ... 33	Orange	OUT13 ... OUT16	Digital outputs 13 ... 16

10 Connection example

Fig. 4 Connection in 1-conductor technology

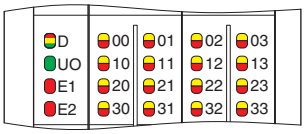


Make sure that the GND of the actuators and the GND for U_O have the same potential!

11 Local diagnostic and status indicators

From index AD1

Fig. 5 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 **not** 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 **cannot** be outputted and/or input data **cannot** 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.
U_O	Green	U_{Output}	On	Supply for digital output modules present.
			Off	Supply for digital output modules is not present.
E1	Red	I/O error	On	I/O error present.
			Off	No I/O error.
E2	Red	Channel error	On	Channel error present.
			Off	Channel error not present.
00 ... 03, 10 ... 13, 20 ... 23, 30 ... 33	Red/ yellow	Diagnostics/status of the output	Red on	Short-circuit/overload of the output.
			Yellow on	Output is set.
			Off	No error, output is not set.

Deviating behavior up to index AC1

The LED E2 is not present.

Designation	Color	Meaning	State	Description
E1	Red	I/O error	On	Breakdown or overload/short-circuit of an output.
			Off	No I/O error.

12 Process data

The process data is mapped in Motorola format (Big Endian).

OUT process data

Byte	0							
Bit	7	6	5	4	3	2	1	0
Signal	OUT 08	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01
Terminal point	13	12	11	10	03	02	01	00

Byte	1							
Bit	7	6	5	4	3	2	1	0
Signal	OUT 16	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09
Terminal point	33	32	31	30	23	22	21	20

13 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_{hex}). 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_{hex}).

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

14 Standard objects

14.1 Objects for identification (device rating plate)

From index AD1

Index (hex)	Object name	Data type	A	L	Rights	Meaning	Contents
Manufacturer							
0001	VendorName	Visible String	1	32	R	Vendor name	Bosch Rexroth AG
0002	VendorID	Visible String	1	7	R	Vendor ID	006034
0012	VendorURL	Visible String	1	58	R	Vendor URL	http://www.boschrexroth.com
Module - general							
0004	DeviceFamily	Visible String	1	16	R	Device family	I/O digital OUT
0006	ProductFamily	Visible String	1	32	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; 21	R	Profile version	2011-12-07; Basic - Profile V2.0
0017	Language	Record of Visible Strings	2	6; 8	R	Language	en-us; English
Module - special							
0005	Capabilities	Visible String	1	8	R	Capabilities	Nothing
0007	ProductName	Visible String	1	32	R	Product name	S20-DO-16/1
0008	SerialNo	Visible String	1	22	R	Serial number	xx xx xx xx xx xx xx x (e. g., 7602012346BC125)
0009	ProductText	Visible String	1	58	R	Product text	16 digital outputs
000A	OrderNumber	Visible String	1	32	R	Item No.	R911172542
000B	HardwareVersion	Record of Visible Strings	2	11; 11	R	Hardware version	e.g., 2020-04-26; AA1
000C	FirmwareVersion	Record of Visible Strings	2	11; 11	R	Firmware version	e.g., 2017-12-31; 1.00
000D	PChVersion	Record of Visible Strings	2	11; 6	R	PDI version	e. g., 2010-06-21; V1.00
0037	DeviceType	Octet string	1	8	R	Device type	00 40 00 02 00 00 00 $D7_{hex}$
003A	VersionCount	Array of UINT16	4	4 * 2	R	Version counter	e.g., 0007 0001 0001 0001_{hex}
Use of the device							
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.

Deviating behavior up to index AC1

Index (hex)	Object name	Data type	A	L	Rights	Meaning	Contents
Manufacturer							
0001	VendorName	Visible String	1	17	R	Vendor name	Bosch Rexroth AG
0012	VendorURL	Visible String	1	28	R	Vendor URL	http://www.boschrexroth.com
Module - general							
0006	ProductFamily	Visible String	1	17	R	Product family	IndraControl S20
0011	ProfileVersion	Record of Visible Strings	2	11; 20	R	Profile version	2011-12-07; Basis - Profil V2.0
003A	VersionCount	UINT16	4	4 * 2	R	Version counter	e.g., 0007 0001 0000 0000_{hex}
Module - special							
0007	ProductName	Visible String	1	12	R	Product name	S20-DO-16/1
0008	SerialNo	Visible String	1	16	R	Serial number	xx xx xx xx xx xx xx x (e. g., 7602012346BC125)
0009	ProductText	Visible String	1	19	R	Product text	16 digital outputs
000A	OrderNumber	Visible String	1	11	R	Item No.	R911172542
000B	HardwareVersion	Record of Visible Strings	2	11; 4	R	Hardware version	e.g., 2020-04-26; AA1
000C	FirmwareVersion	Record of Visible Strings	2	11; 3	R	Firmware version	0000-00-00; --

14.2 Miscellaneous standard objects

Index (hex)	Object name	Data type	A	L	Rights	Meaning/contents	
Diagnostics objects							
0018	DiagState	Record	6	58	R	Diagnostic state	*
Objects for process data management							
0026	PDOUT	Octet string	1	2	R	OUT process data The structure corresponds to the representation in the “Process data” section.	

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.

14.3 Diagnostics state (0018_{hex}: DiagState)

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

From index AD1

0018_{hex}: Diagnostics state (read)					
Subindex	**Data type**	**Length in bytes**	**Meaning**	**Contents**	
0	Record	58	Diagnostic state	Complete diagnostics information	
1	UINT16	2	Error number	0 ... 65535_{dec}	
2	UINT8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	UINT8	1	Channel/group/module	00_{hex}	No error
				01_{hex}	Channel 1 (OUT01)
				...	...
				10_{hex}	Channel 16 (OUT16)
				FF_{hex}	Entire device
4	UINT16	2	Error code	See table below	
5	UINT8	1	More follows	00_{hex}	
6	Visible String	51	Text	See table below	

The message with priority 81_{hex} or 82_{hex} 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.

After the error has been eliminated, it is automatically reset.

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**	**U_O**	**E1**	**E2**	**xx**
No error	00	00	0000	Status OK	◐	●	○	○	○
Short-circuit/overload of an output	02	##	2344	Overload / short circuit DO##, terminal point $$	◐	●	○	◑	◑
Failure of the supply for digital output modules (U_O) (Actuator supply not present)	01	FF	3422	Missing I/O supply UO, terminal point a1/a2, b1/b2	☼	○	◑	○	○

##	Channel number	xx LED	Diagnostics of the output
$$	Terminal point number	xx	00 ... 03, 10 ... 13, 20 ... 23, 30 ... 33
○	Off	◐	Green on
●	On	◑	Red on
		☼	Flashing green/yellow

"Actuator supply not present" is then signaled using object 0018_{hex} and LED E1 if you have configured a setting stipulating that the error should be sent to the controller (see object $FF8F_{hex}$).

Deviating behavior up to index AC1

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

Error and status of the local diagnostics and status indicators

Subindex	**2**	**3**	**4**				
Error	**Priority**	**Channel/group/module**	**Error code**	**LED**			
	hex	**hex**	**hex**	**D**	**U_O**	**E1**	**xx**
No error	00	00	0000	◐	●	○	○
Short-circuit/overload of an output	02	00	2344	◐	●	◑	◑
Failure of the supply for digital output modules (U_O) (Actuator supply not present)	01	FF	3422	◐ or ☼	○	○	○

xx LED	Diagnostics of the output		
xx	00 ... 03, 10 ... 13, 20 ... 23, 30 ... 33		
○	Off	◐	Green on
●	On	◑	Red on
		☼	Flashing green/yellow

The behavior of LED D during an "Actuator supply not present" error depends on whether you have switched error reporting via the $FF8F_{hex}$ object on or off.

Parameterization in $FF8F_{hex}$	**D LED**
Do not report error to the controller	◐
Report error to the controller	☼

15 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
FF8D	PD Output Substitute Configuration	UINT8	1	1	R/W	Substitute value behavior
FF8F	DiagOut	UINT8	1	1	R/W	Message “Actuator supply not present”

15.1 Substitute value behavior ($FF8D_{hex}$: PD Output Substitute Configuration)

With this object, you parameterize the behavior of the module so that an application reset can be detected if necessary.

$FF8D_{hex}$: Substitute value behavior (read, write)				
Subindex	**Data type**	**Length in bytes**	**Contents**	
0	UINT8	1	00_{hex} (Default)	Set outputs to 0
			01_{hex}	Hold last value

15.2 Message “Actuator supply not present” ($FF8F_{hex}$: DiagOut)

With this object, you parameterize whether the “Actuator supply missing” error is reported to the controller or not.

$FF8F_{hex}$: Message “Actuator supply not present” (Read, write)				
Subindex	**Data type**	**Length in bytes**	**Contents**	
0	UINT8	1	00_{hex} (Default)	Do not report error to the controller
			01_{hex}	Report error to the controller

From index AD1

If you parameterize the module so that the error is not reported to the controller, the corresponding indicator in LED E1 (red on) is suppressed. The behavior of the LED D is not affected.

Deviating behavior up to index AC1

If you parameterize the module so that the error is not reported to the controller, the corresponding indicator in LED D (flashing green/yellow) is suppressed and the LED lights up green.

16 Device descriptions

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

DOK-CONTRL-
S20*DO*16*1-DA02-EN-P

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