

# S20 digital input module 16 fast inputs

**R911342770**  
Edition 03

## Data sheet S20-DI-16/1-HS

16 digital inputs  
24 V DC  
1-conductor technology  
High speed

10 / 2022



## 1 Description

The module is designed for use within an S20 station. It is used to acquire digital signals.

### Features

- 16 digital inputs in accordance with EN 61131-2 type 1 and type 3
- 24 V DC, 2.4 mA
- Connection of sensors in 1-conductor technology
- Minimum update time of  $< 5 \mu\text{s}$ , bus synchronous
- Device rating plate stored

### Valid from index AB1.



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](http://www.boschrexroth.com/electrics).

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### 3 Ordering data

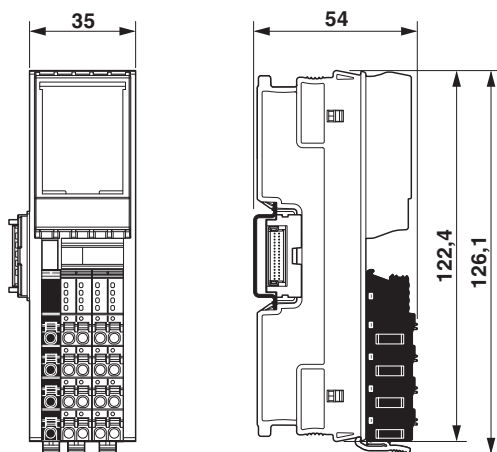
Description	Type	MNR	Pcs./Pkt.
S20 digital input module 16 fast inputs	S20-DI-16/1-HS	R911173344	1
Accessories	Type	MNR	Pcs./Pkt.
S20 bus base module, narrow	S20-BS-S	R911173203	5
Documentation	Type	MNR	Pcs./Pkt.
Application description S20: System and Installation	DOK-CONTRL- S20*SYS*INS-AP..-EN-P	R911335988	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](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 applies when a TH 35-7.5 DIN rail is used (in accordance with EN 60715).

#### General data

Color	light grey RAL 7035
Weight	133 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)

**General data**

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
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<sub>Bus</sub>)**

Supply voltage	5 V DC (via bus base module)
Current consumption	max. 120 mA (Index AA1) max. 60 mA (from index AB1)
Power consumption	max. 600 mW (Index AA1) max. 300 mW (from index AB1)

**Supply for digital input modules (U<sub>I</sub>)**

Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	max. 30 mA
Power consumption	typ. 480 mW max. 720 mW
Surge protection	electronic (35 V, 0.5 s)
Reverse polarity protection	parallel diode; with external 5 A fuse (only for commissioning)
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.

**Digital inputs**

Number of inputs	16
Connection method	Push-in connection
Connection technology	1-conductor
Description of the input	EN 61131-2 types 1 and 3
Nominal input voltage	24 V DC
Nominal input current	2.3 mA
Current flow	linear until nominal current is reached, then constantly approximately 2.3 mA
Input voltage range "0" signal	-3 V DC ... 8.4 V DC
Input voltage range "1" signal	9.4 V ... 30 V DC
Input filter time	< 5 $\mu$ s
Process data update	< 5 $\mu$ s (bus-synchronous)
Polarity reversal protection of the inputs	parallel diode (30 V, 5 s)



The minimum update time of the module can only be fully utilized if the station is configured accordingly, as the runtime of the local bus depends on the number of connected S20 modules (see also application description for the S20 system, material number R91 1335988).

**Input and output address area**

Input address area	2 Byte
Output address area	0 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: $\pm 0.5$ kV/ $\pm 1.0$ 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**

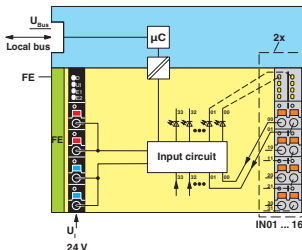
Class B

## Approvals






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

## 5 Internal circuit diagram

Fig. 1 Internal wiring of the terminal points



Key:

Local bus	Local bus
FE	Functional ground
	Microcontroller
	Electrical isolation
	Input circuit
	LED
	Electrically isolated areas

## 6 For your safety

### 6.1 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.

### 6.2 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.

### 6.3 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.

### 6.4 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:

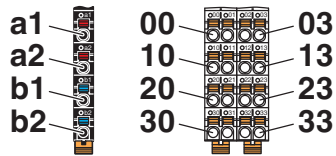
- EN 61010-1/IEC 61010-1
- UL 61010-1 (for applications with UL approval)

## 7 UL note

- Use copper conductors only.

### 8 Terminal point assignment

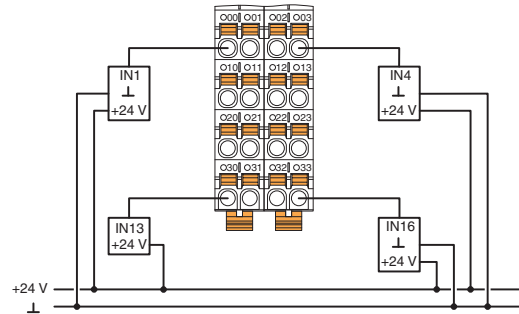
Fig. 2 Terminal point assignment



Terminal point	Color	Assignment	
<b>Supply voltage input</b>			
a1, a2	Red	24 V DC (U <sub>I</sub> )	Supply for digital input modules (bridged internally)
b1, b2	Blue	GND	Reference potential of the supply voltage (bridged internally)
<b>Digital inputs</b>			
00 ... 03	Orange	IN01 ... IN04	Digital inputs 1 ... 4
10 ... 13	Orange	IN05 ... IN08	Digital inputs 5 ... 8
20 ... 23	Orange	IN09 ... IN12	Digital inputs 9 ... 12
30 ... 33	Orange	IN13 ... IN16	Digital inputs 13 ... 16

### 9 Connection example

Fig. 3 Example of a connection of sensors when using external busbars

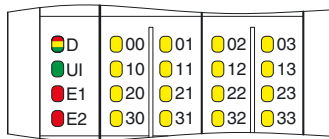


Ensure that GND of the sensors and GND for U<sub>I</sub> have the same potential.

## 10 Local diagnostic and status indicators

### From index AB1

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	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.		
UI	Green	U <sub>Input</sub>	On	Supply for digital input modules (U <sub>I</sub> ) is present.
			Off	Supply for digital input modules (U <sub>I</sub> ) is not present.
E1	Red	Supply voltage error	On	Feed-in for digital input modules (U <sub>I</sub> ) is faulty.
			Off	Feed-in for digital input modules (U <sub>I</sub> ) is OK.
E2	Red	Internal device error	On	There is an internal device error.
			Off	There is no internal device error.
00 ... 03, 10 ... 13, 20 ... 23, 30 ... 33	Yellow	Status of the inputs	On	Input is set.
			Off	Input is not set.

### Deviating behavior for index AA1

The LEDs E1 and E2 are not present.

## 11 Process data

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

### IN process data

Byte	0							
Bit	7	6	5	4	3	2	1	0
Signal	IN08	IN07	IN06	IN05	IN04	IN03	IN02	IN01
Terminal point	13	12	11	10	03	02	01	00

Byte	1							
Bit	7	6	5	4	3	2	1	0
Signal	IN16	IN15	IN14	IN13	IN12	IN11	IN10	IN09
Terminal point	33	32	31	30	23	22	21	20

## 12 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.

## 13 Standard objects

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

From index AB1

Index (hex)	Object name	Data type	A	L	Rights	Meaning	Contents
<b>Manufacturer</b>							
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
<b>Module - general</b>							
0004	DeviceFamily	Visible String	1	16	R	Device family	I/O digital IN
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
<b>Module - special</b>							
0005	Capabilities	Visible String	1	8	R	Capabilities	Syncl_0
0007	ProductName	Visible String	1	32	R	Product name	S20-DI-16/1-HS
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 input channels
000A	OrderNumber	Visible String	1	32	R	Item No.	R911173344
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 80 00 02 00 00 00 DB <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	AppIDeviceAddr	UINT16	1	2	R/W	Application-specific device address	Can be completed by the user.

## Deviating behavior for index AA1

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
0012	VendorURL	Visible String	1	28	R	Vendor URL	http://www.boschrexroth.com
<b>Module - general</b>							
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	Array of UINT16	4	4 * 2	R	Version counter	e.g., 0007 0001 0000 0000 <sub>hex</sub>
<b>Module - special</b>							
0007	ProductName	Visible String	1	15	R	Product name	S20-DI-16/1-HS
0008	SerialNo	Visible String	1	16	R	Serial number	xx xx xx xx xx xx x (e. g., 7602012346BC125)
0009	ProductText	Visible String	1	26	R	Product text	16 digital input channels
000A	OrderNumber	Visible String	1	11	R	Item No.	R911173344
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; --

## 13.2 Miscellaneous standard objects

Index (hex)	Object name	Data type	A	L	Rights	Meaning/contents
<b>Diagnostics objects</b>						
0018	DiagState	Record	6	58	R	Diagnostic state *
<b>Objects for process data management</b>						
0025	PDIN	Octet string	1	2	R	Input 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.


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

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

#### From index AB1

0018 <sub>hex</sub> : 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 <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
				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	51	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.

 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	LED			
Error	Pri- ority	Chan- nel/ group/ module	Error code	Text	D	UI	E1	E2
	hex	hex	hex					
No error	00	00	0000	Status OK	●	●	○	○
Failure of the supply for digital input modules (U <sub>I</sub> )	01	FF	3412	Missing I/O supply UI, terminal point a1/a2, b1/b2	⚡	○	●	○

○ Off  
● On

● Green on  
⚡ Flashing green/yellow

#### Deviating behavior for index AA1

The LEDs E1 and E2 are not present.

The error codes are identical to those in index AB1.

Error text is not specified.

## 14 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.

DOK-CONTRL-  
S20\*DI161HS-DA03-EN-P

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