rexroth
A Bosch Company

IndraControl
S20 special function module
2 incremental encoder inputs

R911345592
Edition 03

Data sheet S20-INC-2

2 incremental encoder inputs
300 kHz
32 bits

02 / 2021

1 Description

The module is designed for use within an IndraControl S20 station.

It is used for the bus-synchronous evaluation of the position of the incremental encoder sensors.

Features

- 2 incremental encoder inputs
- 10 digital inputs (IN1 ... IN6, Ref1, Ref2, L1, L2)
- 2 digital outputs
- Acquisition of digital signals from symmetrical and asymmetrical incremental encoders
- Evaluating linear or rotary axes
- Device type label stored

Due to the requirement for bus synchronicity, the S20-INC-2 module can be operated locally on the XM controller or decentrally on the S20-S3-BK+.

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

Make sure you always use the latest documentation.

It can be downloaded under www.boschrexroth.com/electrics.

2 Table of contents

3 Ordering data

Description	Type	MNR	Pcs./Pkt.
IndraControl S20 special function module 2 incremental encoder inputs	S20-INC-2	R911173559	1

Accessories	Type	MNR	Pcs./Pkt.
IndraControl S20 bus base module	S20-BS	R911172540	5
IndraControl shield set	S20-SHIELD-SET	R911173030	1
Shield connection clamps, for shield on busbars, for conductor diameters ≤ 5 mm, contact resistance < 1 mΩ	S20-SHIELD-SK5	R911173282	10
Shield connection clamps, for shield on busbars, for conductor diameters ≤ 14 mm, contact resistance < 1 mΩ	S20-SHIELD-SK14	R911173286	10
PEN conductor busbar, 3x10 mm, length: 1000 mm	S20-SHIELD-NLS	R911173283	1

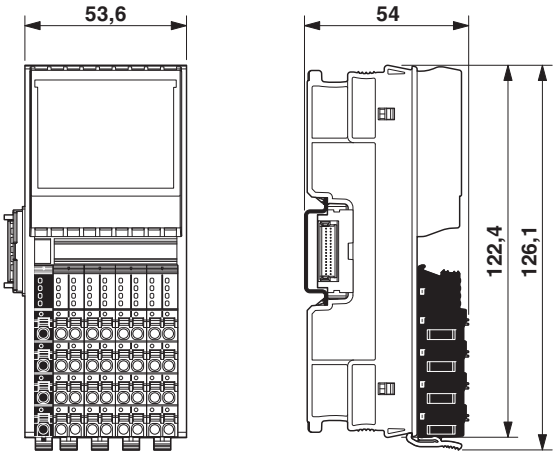
Documentation	Type	MNR	Pcs./Pkt.
Application description IndraControl S20: System and Installation	DOK-CONTRL-S20*SYS*INS-AP..-EN-P	R911335988	1
Application description S20-INC-2 IndraControl S20 function module	DOK-CONTRL-S20*INC*2**-AP..-DE-P	R911345595	1
Application description IndraControl S20: Error 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.

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	205 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, rigid / flexible	0.2 mm^2 ... 1.5 mm^2 / 0.2 mm^2 ... 1.5 mm^2
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 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	typ. 100 mA max. 120 mA
Power consumption	typ. 0.5 W max. 0.6 W

Supply voltage input U_I	
Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC including all tolerances, including ripple
Current consumption	typ. 50.5 mA (Own current consumption; without wiring of the terminal points) max. 2.5 A (dependent on the encoder or sensor type used and the load on the digital output.)
Power consumption	typ. 1.2 W max. 60 W (of which 1.6 W internal losses)
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.

Incremental encoder inputs	
Number of inputs	2 (A1, /A1, B1, /B1, Z1, /Z1; A2, /A2, B2, /B2, Z2, /Z2)
Connection method	Push-in connection
Encoder signals	Symmetrical and asymmetrical encoders
Cable length	30 m

Encoder types	
Symmetrical incremental encoders	
Number	max. 2 (A, /A, B, /B, (Z, /Z))
Type of connection of signals	Push-in connection
Signal voltage level	Differential signal (signal – inverted signal) ±0.5 V, minimum; ±6 V, maximum
Input frequency	max. 300 kHz
Encoder supply voltage	5 V DC
Common mode voltage range signal - ground	-10 V ... 13.2 V
Asymmetrical incremental encoder	
Number	max. 2 (A, B, (Z))
Type of connection of signals	Push-in connection
Signal voltage level	Low ≤ 2.5 V, high ≥ 3.5 V (up to 27 V, maximum)
Input frequency	max. 300 kHz

Encoder supply	
5 V encoder supply	
Number	2 (U_{E1}, U_{E2})
Nominal output voltage	5 V DC
Voltage range	5 V DC ... 5.5 V DC
Current carrying capacity	max. 250 mA
Short-circuit protection	electronic
24 V encoder supply	
Number	2 (U_{S1}, U_{S2})
Nominal output voltage	24 V DC
Voltage range	19.2 V DC ... 30 V DC
Current carrying capacity	typ. 500 mA
Short-circuit protection	electronic

Digital inputs	
Number of inputs	10 (IN1 ... IN6, Ref1, Ref2, L1, L2)
Connection method	Push-in connection
Connection technology	1-conductor (optional 2, 3-conductor)
Description of the input	EN 61131-2, type 3
Nominal input voltage	24 V DC
Nominal input current	2.5 mA (per channel)
Max. sensor current per channel	500 mA
Input voltage range "0" signal	-3 V DC ... 5 V DC
Input voltage range "1" signal	11 V DC ... 30 V DC
Permissible conductor length to the sensor	30 m
Short-circuit protection	Electronic per channel
Overload protection	Electronic per channel

Digital outputs	
Number of outputs	2 (Out1, Out2)
Connection method	Push-in connection
Connection technology	1-conductor
Nominal output voltage	24 V DC
Maximum output current per channel	500 mA
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)
Short-circuit protection, overload protection of the outputs	yes

Error messages to the higher level control or computer system	
Short-circuit or overload of the digital outputs	Yes
Fault at symmetrical incremental encoder	Yes

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 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

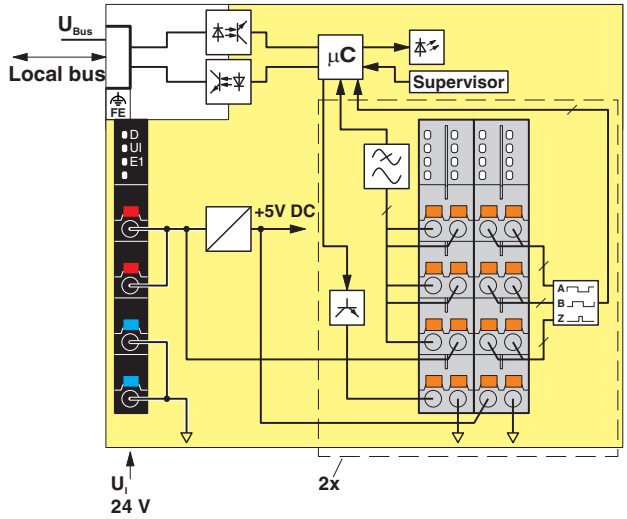
Conformance with EMC Directive 2014/30/EU	
Noise immunity test in accordance with EN 61000-6-2	
Electrostatic discharge (ESD) EN 61000-4-2/ IEC 61000-4-2	Criterion B, 6 kV contact discharge, 8 kV air discharge
Electromagnetic fields EN 61000-4-3/IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
Fast 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, DC supply lines: ±0.5 kV/±0.5 kV (symmetrical/ asymmetrical)
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	
Radio interference properties EN 55022	Class B

Approvals

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

5 Internal circuit diagram

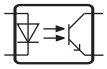
Fig. 1 Internal wiring of the terminal points



Key:

Microcontroller

Hardware monitoring



Electrical isolation
(optocoupler or isolator)

Power supply unit

Transistor

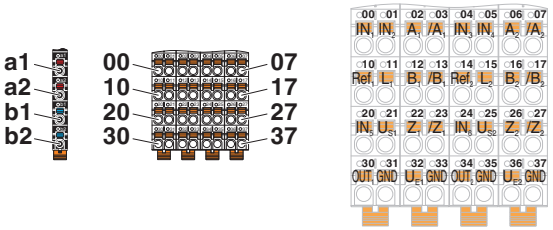
Low pass filter

LED

Electrically isolated areas

6 Terminal point assignment

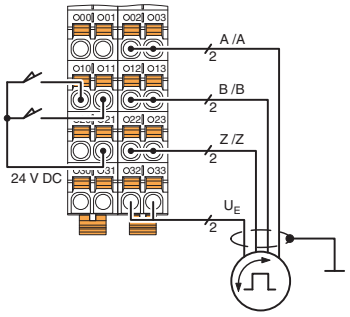
Fig. 2 Terminal point assignment



Terminal point	Color	Assignment	
Supply voltage input			
a1, a2	Red	24 V DC (U_I)	Feed-in sensor/encoder supply (bridged internally)
b1, b2	Blue	GND	Reference potential of the supply voltage (bridged internally)
Connector 2 (incremental encoder 1) / connector 4 (incremental encoder 2)			
00/04	Orange	IN1/IN3	Digital inputs
10/14	Orange	Ref1/ Ref2	Reference 1/2, home position switch input for incremental encoder 1/2
20/24	Orange	IN5/IN6	Digital inputs
30/34	Orange	Out1/ Out2	Digital outputs
01/05	Orange	IN2/IN4	Digital inputs
11/15	Orange	L1/L2	Latch input for incremental encoder 1/2
21/25	Orange	U_{S1}/ U_{S2}	+24 V DC sensor voltage, to supply the counter sensor, can also be used to supply the incremental encoder
31/35	Orange	GND	Reference potential of the I/O supply
Connector 3 (incremental encoder 1) / connector 5 (incremental encoder 2)			
02/06	Orange	A1/A2	Track A, incremental encoder 1/2
12/16	Orange	B1/B2	Track B, incremental encoder 1/2
22/26	Orange	Z1/Z2	Track Z, incremental encoder 1/2
32/36	Orange	U_{E1}/ U_{E2}	+5 V DC encoder supply for incremental encoder 1/2
03/07	Orange	/A1 / / A2	Track A inverted, incremental encoder 1/2
13/17	Orange	/B1 / / B2	Track B inverted, incremental encoder 1/2
23/27	Orange	/Z1 / /Z2	Track Z inverted, incremental encoder 1/2
33/37	Orange	GND	Reference potential of the I/O supply

7 Connection example

Fig. 3 Quadrature encoder with 5 V supply



The example shows typical wiring with a symmetrical 5 V encoder and the two latch and reference input signals.

Use a shielded cable and connect it to ground potential when you connect the quadrature encoder.

Unused terminal points can be used as an option.

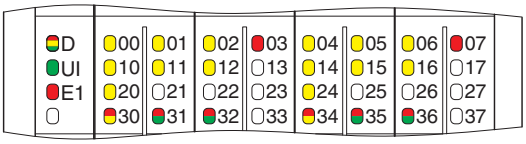
8 Connection note

If a symmetrical encoder without Z signal is used, input Z must be jumpered to 0 V (GND) and input /Z to +5 V.

If an asymmetrical encoder without Z signal is used, input Z must be jumpered to 0 V (GND) and input /Z remains open.

9 Local status and diagnostic indicators

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 to operate, communication within the station is OK. The data is **not** valid. The controller or superordinate network is not delivering valid data. 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 **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	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.
UI	Green	U_{Input}	On	Sensor/encoder supply present
			Off	Sensor/encoder supply not present
E1	Red	I/O error	On	I/O error present.
			Off	No I/O error.

Designation	Color	Meaning	State	Description
Connector 2 (incremental encoder 1)/connector 4 (incremental encoder 2)				
00/04	Yellow	Status of input 1/3	On	Input is set.
			Off	Input is not set.
10/14	Yellow	Status of reference switch input 1/2 (Ref1/Ref2, reference 1/2)	On	Input is set.
			Off	Input is not set.
20/24	Yellow	Status of input 5/6	On	Input is set.
			Off	Input is not set.
30/34	Red/ yellow	Status of output 1/2	Yellow on	Output is set.
			Red on	Short-circuit/overload of the output.
			Off	Output is not set.
01/05	Yellow	Status of input 2/4	On	Input is set.
			Off	Input is not set.
11/15	Yellow	Status of latch input 1/2 (L1/L2, latch 1/2)	On	Input is set.
			Off	Input is not set.
31/35	Red/ green	Status of sensor supply 1/2 (U_{S1}/U_{S2})	Green on	Sensor supply is OK.
			Red on	Short circuit/overload of the sensor supply.
			Off	Sensor supply not present.
Connector 3 (incremental encoder 1) / connector 5 (incremental encoder 2)				
02/06	Yellow	Positive direction of rotation (UP)	On	Module counting upwards.
			OFF and 12/16 OFF	Standstill or the corresponding INC channel is not parameterized.
12/16	Yellow	Negative direction of rotation (DN)	On	Module counting downwards.
			OFF and 02/06 OFF	Standstill or the corresponding INC channel is not parameterized.
32/36	Red/ green	Status of the 5 V sensor supply (U_{E1}/ U_{E2})	Green on	Encoder supply is OK.
			Red on	Short-circuit/overload of the encoder supply.
			Off	Encoder supply not present.
03/07	Red	Encoder error	On	An encoder error has occurred.
			Off	No encoder error has occurred.

10 Process data

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

You can control the application via the OUT process data (e.g., reference encoder, set outputs).

Input process data contains general states of the module, states of the channels, and the corresponding counter and latch values.

Please refer to the application description for the module for the assignment of the process data words, material number R911345595.

11 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.

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

For comprehensive information on all the objects created on the module, please refer to the application description for the module, material number R911345595.

12 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*INC*2**-DA03-EN-P

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