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IndraControl S20 2-Axis Module

6 Analog Inputs, 2 Analog Outputs, 2 SSI Interfaces

Application Description
R911342260

Edition 03

Title IndraControl
S20 2-Axis Module
6 Analog Inputs, 2 Analog Outputs, 2 SSI Interfaces

Type of Documentation Application Description

Document Typecode DOK-CONTRL-S20AI6AO2SI-AP03-EN-P

Internal File Reference RS-e73f55e4a4ec9d0a0a6846a5004da9e7-3-en-US-6

Change Record

Edition	Release Date	Notes
Edition 01	2015-06	First edition
Edition 02	2015-08	Technical data supplemented
Edition 03	2021-02	Technical data corrected

Editorial Department Development Automation Systems Control Platform MaHo (MaKo/MePe)

Table of Contents

Page

Page

1 Using safety instructions

1.1 Structure of the safety instructions

The safety instructions are structured as follows:

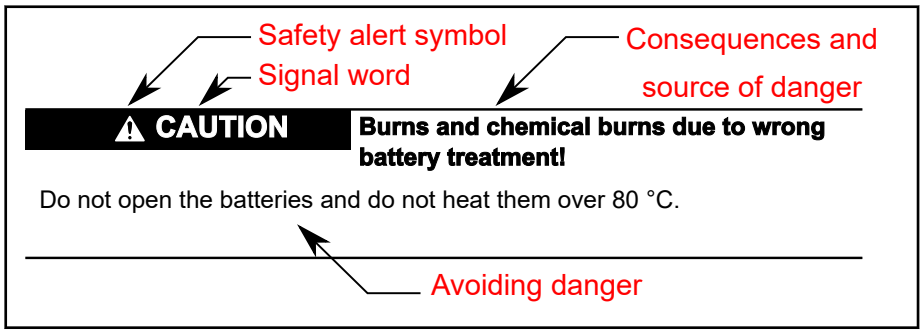

Fig. 1-1: Structure of the safety instructions

1.2 Explaining signal words and safety alert symbol

The safety instructions in this documentation contain specific signal words (danger, warning, caution, notice) and, if necessary, a safety alert symbol (according to ANSI Z535.6-2006).

The signal word draws attention to the safety instruction and indicates the risk potential.

The safety alert symbol (triangular safety reflector with exclamation marks), preceding the signal words Danger, Warning, Caution indicates hazards for persons.

⚠ DANGER

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

⚠ WARNING

In case of non-compliance with this safety instruction, death or serious injury **can** occur.

⚠ CAUTION

In case of non-compliance with this safety instruction, minor or moderate injury can occur.

NOTICE

In case of non-compliance with this safety instruction, material damage can occur.

1.3 Symbols used

Pointers are displayed as follows:

This is a note.

Tips are displayed as follows:

This is a tip.

1.4 Explaining the signal alert symbol on the device

If this symbol is on your device, you have to observe the documentation on the device. The respective documentation informs on the type of hazard as well as the steps required to avoid this hazard.

2 Functional description of the module

2.1 General information

For the technical data of the module including its terminal point assignment and meaning of the diagnostic and status displays, refer to the data sheet of the module, part number R911342258. For the data sheet, go to the media directory under **www.boschrexroth.com ▸ Products ▸ Electric Drives and Controls ▸ CAD and documentation ▸ Documentation**.

AI	"Analog Input"
AO	"Analog Output"

Tab. 2-1: Abbreviations

2.2 General functions

The module is intended to be used in an IndraControl S20 station. The module is intended to control two hydraulic axes.

The following inputs and outputs are available for each hydraulic axis:

- Three analog inputs
- One digital position detection via SSI inputs
- One analog output (control for proportional valves)

The analog inputs and outputs and the position inputs can be operated in different measuring and output ranges as well as encoder resolutions to adapt the sensors and valves used. For a detailed description of the possible settings, refer to the following chapters.

The module can be commissioned with the standard parameterization. In this case, all inputs and outputs are disabled.

There are two options to perform the parameterization:

1. Via an engineering tool, such as Bosch Rexroth IndraWorks
2. By writing the configuration register via the service channel

We recommend the engineering tool IndraWorks.

Observe the parameterization sequence when parameterizing via the service channel. The parameterization sequence is described in the following chapter: chapter 4.3.3 "Object Block_Param " on page 20. Irrespective of the parameterization method, all channels are stopped and parameterized again (even if the changes affected only one channel).

2.3 Analog inputs

2.3.1 Characteristics of analog inputs

- Six analog differential signal inputs (three per hydraulic axis)
- Connection of sensors in 2- and 3-wire technique possible
- Measuring value resolution of 16 bits (Inline format: 15 bits + sign)
- Three voltage measuring ranges: ±10 V, 0-10 V, 0.1-10 V
- Four current measuring ranges: ±10 mA, ±20 mA, 0-20 mA, 4-20 mA

- Wire break detection in the measuring ranges 4-20 mA and 0.1-10 V
- Average value generation can be set via the values 0, 4, 8, 16, 32, 64, 128, 256
- Output of substitute values in case of an error, e.g. when exceeding the set measuring range
- Inputs can be enabled and disabled individually
- Sensor or actuator supply 2 × 100 mA

2.3.2 Measuring ranges

Depending on the valve, it can be required that the measuring range of the individual inputs has to be adjusted to the output range of the respective sensor. The following measuring ranges can be configured via the object "Parameter for analog input (0080hex Subindex 01)", refer to chapter 4.3.6 "Object Parameter for analog input" on page 21.

Depending on the sensor, it can be required that the measuring range of the individual inputs has to be adjusted to the output range of the sensor. The following measuring ranges are possible:

Output data word		**0 V to 10 V U_{Input}**	**±10 V U_{Input}**	**0.1 V to 10 V U_{Input}**	**0 mA to 20 mA I_{Input}**	**4 mA to 20 mA I_{Input}**	**±10 mA I_{Input}**	**±20 mA I_{Input}**
Hex	dec	V	V	V	mA	mA	mA	mA
8001	Range exceeded	>+10.837	>+10.837	>+10.829	>+21.676	>+21.339	>+10.837	>+21.676
7F00	32512	10.837	10.837	10.829	21.676	21.339	10.837	21.676
7530	30000	10	10	10	20	20	10	20
3A98	15000	5	5	5.05	10	12	5	10
1	1	+0.0003333	+0.0003333	+0.1003333	+0.0006667	+4.0005333	+0.0003333	+0.0006667
0	0	0	0	+0.1...+0.06 V	0	+4...+3.2 mA	0	0
FFFF	-1	-	-0.0003333	-	-	-	-0.0003333	-0.0006667
C568	-15000	-	-5	-	-	-	-5	-10
8AD0	-30000	-	-10	-	-	-	-10	-20
8100	-32512	-	-10.837	-	-	-	-10.837	-21.676
8080	Range fallen below	-	<-10.837	-	-	-	<-10.837	<-21.676
8002	Wire break	-	-	<+0.06 V	-	<+3.2 mA	-	-

Tab. 2-2: Value ranges of the inputs

2.3.3 Sequence, detection and average value generation

Every 32 µs, new input values are read in at the analog inputs. Every 32 µs, the S20 2-axis module provides a new average value irrespective of the field bus used and irrespective of the number of values used for averaging. The latest n-1 values read in are saved and form a new average value together with the value currently read in. The value "n" specifies the number of values used for the average value. "n" can be set with the values 0, 4, 8, 16, 32, 64, 128, 256, refer to chapter 4.3.6 "Object Parameter for analog input" on page 21. If the average value generation is switched off, the currently read in value is provided.

2.3.4 Average value filtering

A filter (floating average value) can be used at the analog inputs to reduce noise effects. If the filter is switched on, the last n values (n = 4, 8, 16, 32, 64,

128, 256) are averaged. Using the average value filtering, a filter cycle time, resulting in approx. n × 32 µs according to an approximate filter cycle constant of 1 ÷ (2 × π × n × 32 µs), results.

2.3.5 Setting the average value filtering

The parameterization of the average value filtering orients at the cycle time of the superimposed bus and at the cycle time of the filtered value processing, e.g. within one PLC task. The filter time constant should be similar or higher than the value of the bus cycle time or the higher value of the PLC task cycle time.

Example:

Sercos cycle time = 1 ms, PLC task cycle time = 2 ms. In this case, use an average value filtering with n = 64 or 128. This results in a filter cycle time of approx. 2.5 or 4.1 ms.

- For 64 values: 64 × 32 µs = 2050 µs = 2.05 ms
- For 128 values: 128 × 32 µs = 4096 µs = 4.096 ms

2.3.6 Diagnostics of the analog inputs

Exceeding values

If the input signal exceeds the allowed maximum value of a measuring range, the substitute value 0x8001 is transferred for the respective channel and a diagnostic message is generated, refer to the fault code "8910" in chapter "Error messages" on page 16. The message provides information on the channel at which the value exceeded. If the affected input is within a current measuring range, the internal resistance is increased due to safety reasons. Thus, the input assignment is protected against destruction. If the input signal reaches a valid value again, the input returns to the normal operating state.

Falling below values

If the input signal falls below the allowed minimum value (negative maximum value) of a measuring range, the substitute value 0x8080 is transferred for the respective channel and a diagnostic message is generated, refer to the fault code "8920" in chapter "Error messages" on page 16. The message provides information on the channel at which the value exceeded. If the affected input is within a current measuring mode, the internal resistance is increased due to safety reasons. Thus, the input assignment is protected against destruction. If the input signal reaches a valid value again, the input returns to the normal operating state.

Wire break

A wire break can only be detected at the analog outputs in the measuring ranges 4-20 mA and 0.1-10 V. As a minimum value is expected in these value ranges, falling below this value is considered as wire break. In this case, the value 0x8002 is transferred for the respective channel and a diagnostic message is generated, refer to the fault code "7710" in chapter "Error messages" on page 16.

2.4 Analog outputs

2.4.1 Characteristics of analog outputs

- Four universal analog signal outputs for an optional output of voltage or current signals.

- Two voltage ranges: ±10 V, 0-10 V
- Four current ranges: ±10 mA, ±20 mA, 0-20 mA, 4-20 mA
- Connection in 2-wire technique possible
- Resolution 16 bits (Inline format: 15 bits + sign)
- Substitute value behavior can be set upon bus failure
- Short circuit and overload protection, self-healing
- Wire break detection in the output range 4-20 mA
- Outputs can be enabled and disabled individually

2.4.2 Output ranges

Depending on the valve, it can be required that the output range of the individual outputs has to be adjusted to the input range of the valve. The following output ranges can be configured via the object "Parameter for analog output (0080hex Subindex 00)", refer to chapter 4.3.5 "Object Parameter for analog output" on page 20.

Output data word		0 V to 0 V U_{Output}	±10 V U_{Output}	0 mA to 20 mA I_{Output}	4 mA to 20 mA I_{Output}	±10 mA I_{Output}	±20 mA I_{Output}
Hex	dec	V	V	mA	mA	mA	mA
8001	Range exceeded	10.837	10.837	21.676	21,3397	10.837	21.676
7FFF to 7F01	-	10.837	10.837	21.676	21,3397	10.837	21.676
7F00	32512	10.837	10.837	21.676	21,3397	10.837	21.676
7530	30000	10	10	20	20	10	20
3A98	15000	5	5	10	12	5	10
1	1	+0.0003333	+0.0003333	+0.0006667	4,000533	+0.0003333	+0.0006667
0	0	0	0	0	4	0	0
FFFF	-1	0	-0.0003333	0	4	-0.0003333	-0.0006667
C568	-15000	0	-5	0	4	-5	-10
8AD0	-30000	0	-10	0	4	-10	-20
8100	-32512	0	-10.837	0	4	-10.837	-21.676
80FF to 8000 without 8001, 8080,8002	-	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD
8080	Range exceeded	0	-10.837	0	HOLD	-10.837	-21.676
8002	Wire break	HOLD	HOLD	HOLD	0	HOLD	HOLD

Tab. 2-3: Value ranges of the outputs

2.4.3 Sequence and output times

The analog outputs refresh their output value when the module receives new process data differing from the previous one. If this is not the case, the values at the outputs are kept constant. The output delay, from the reception of new values until these are valid at the output, is max. 16 µs.

2.4.4 Diagnostics and substitute value behavior of the analog outputs

Internal communication

The controller in the S20 2-axis module monitors the communication to the output function block converting the process data into discrete analog values. If an error occurs when transferring a value internally, a diagnostic message

is generated and the last valid value remains, refer to the fault code "5230" in chapter "Error messages" on page 16. This error is an exception in the substitute value behavior of the analog outputs, as no other substitute value is possible and reasonable. For all other errors applies that the analog outputs respond according to the set substitute value behavior. The error message and the substitute value remain pending until a data package is present at the output function block again.

Overtemperature

The "Overtemperature" error refers only to the output driver. If the output driver becomes too warm due to overload for example, a diagnostic message is generated, refer to the fault code "4200" in chapter "Error messages" on page 16. The function block continues operating.

Short circuit

The error "Short circuit" can only be detected in the voltage ranges. Thus, the output current is monitored. If the "output current" exceeds 15 mA, an overload or a short circuit is assumed at the analog output. In this case, a diagnostic message is generated, refer to the fault code "2130" in chapter "Error messages" on page 16.

Wire break

The error "Wire break" can only be detected in the current ranges. If the module detects that the set current cannot flow, a diagnostic message is generated, refer to fault code "7710" in chapter "Error messages" on page 16.

Substitute value behavior

In case of an error, the substitute value behavior of the analog outputs can be set via the object "Parameter for analog output (0080hex Subindex 00)", refer to chapter 4.3.5 "Object Parameter for analog output" on page 20. It might result that the analog outputs output a substitute value in case of an error or that the latest valid output value is kept. The setting affects both outputs. A separate configuration is not possible.

2.5 SSI inputs

2.5.1 Characteristics of SSI inputs

- Two SSI inputs
- Reading in digital signals of position encoders between 8 and 31 bits per SSI input
- SSI transmission rate: Can be set in steps with the following values: 67.5 kHz, 100 kHz, 125 kHz, 200 kHz, 250 kHz, 300 kHz, 400 kHz, 500 kHz, 600 kHz, 700 kHz, 800 kHz, 900 kHz, 1 MHz, 2 MHz, 4 MHz
- Resolution 8-31 bits (can be configured)
- Different codings can be set (gray/binary)
- Parity bit (odd/even/non) and Error bit can be parameterized
- Sensor supply 24 V and 2 × 500 mA with short circuit and overload protection, self-healing
- Analysis of the waiting cycles (clock break, underclocking)
- Enabling or disabling SSI inputs
- Parameterizable substitute values in case of error (e.g. wire break)
- Parameterizable offset values

- Sercos-synchronous detection possible

2.5.2 Describing SSI functions

Reading position values

Reading in position values can be enabled or disabled individually for each channel via the object "Parameter for SSI input (0080hex Subindex 02)", refer to chapter 4.3.7 "Object Parameter for SSI input" on page 22.

If reading in is activated, the positions are read cyclically from the encoders via the SSI inputs. The intervals, in which the position values are read out, result from the data bits to be transferred together with the transmission rate of the encoder. For a more detailed explanation, refer to chapter 2.5.4 "SSI reading times" on page 10. Transmission takes place via two differential clock lines and two differential data lines. The current position is applied at the first edge of the clock and transferred with the following clocks to the S20 2-axis module. How fast data is transferred from the encoder to the S20 2-axis module depends on the parameterized clock frequency and the line length between encoder and module.

Offset for position value

An offset can be specified for the position value. This offset is then always added to the position value currently read out from the encoder. The offset value can be up to 32 bits. Parameterize the offset via the object "Parameter for SSI input (0080hex Subindex 02)", refer to chapter 4.3.7 "Object Parameter for SSI input" on page 22.

Gray or binary code

Encoders providing a coded absolute value in binary code as well as encoders providing the absolute value in grey code can be connected to the module. The value transferred via process data is always binary-coded. Conversion takes place in the module. Parameterize the code used by the encoder via the object "Parameter for SSI input (0080hex Subindex 02)", refer to chapter 4.3.7 "Object Parameter for SSI input" on page 22.

Waiting cycles

For some encoder types, it is required that - when reading in the position values after applying the data - it is waited for some clock cycles until the transmission starts. For this case, the corresponding number of waiting cycles can be set via the object "Parameter for SSI input (0080hex Subindex 02)", refer to chapter 4.3.7 "Object Parameter for SSI input" on page 22.

SSI clock frequency

The SSI clock frequency (or transmission rate) indicates the frequency used to exchange or transfer data to the SSI bus.

To adjust the reading-in procedure the best possible to the encoder used and to the external requirements, the SSI clock frequency can be set. The SSI clock frequency is also set via the object "Parameter for SSI input (0080hex Subindex 02)".

Resolution

Depending on the resolution of the encoder used, the number of bits to be read in can vary between 8 and 31 bits. The number of bits to be read in, can be set via the object "Parameter for SSI input (0080hex Subindex 02)". Only the set number of clock cycles is then output on the clock line of the SSI inputs upon each reading cycle.

2.5.3 Diagnostics of SSI inputs and encoder

Parity check

For an automatic parity check of the position value, parameterize the module accordingly. The modes ODD and EVEN are supported. Depending on the mode, 1 (EVEN) or 0 (ODD) results as parity bit when reading in an even number of ones. In the module, the received parity bit is compared to the calculated parity. If both values differ, a diagnostic message is generated which depends on the parameterization after one, two or three consecutive parity errors, "6320" in chapter "Error messages" on page 16. The NON option disables the parity check. Select the parity check mode with regard to the data sheet specifications of the encoder.

Encoder not connected, wire break or short circuit

Whether an encoder is connected correctly, a wire break is present or no encoder is connected, it is monitored directly before and after the data exchange using the data signal. Before exchanging data, the signal has to have a high level (idle state or inactive state) and it has to have a low level directly after exchanging data. If this is not the case, an error is present. The error is analyzed and a diagnostic message is generated, refer to the fault code "2360" in chapter "Error messages" on page 16. The error LED is orange.

Short-circuit or overcurrent at the 24 V supply of the encoder

The encoder voltage supply is 24 V and it is self-healingly protected against short circuit and overload with 2 × 250 mA. In case of an overload, this fuse blows and a diagnostic message is generated, refer to the fault code "5160" in chapter "Error messages" on page 16. If the reason for the overload is not present anymore, the diagnostic message is also canceled as soon as the 24 V are again applied at the output.

Substitute value behavior

In case of an error of the SSI channel, a substitute value behavior can be parameterized. In case of an error, the substitute value is transmitted as position value in the process input data. Parameterize the behavior and the substitute value via the object "SSI channel 1 and 2: Substitute Value Behavior" (0081hex), refer to the fault code "7710" in chapter 4.3.8 "Object SSI channel 1 and 2: Substitute Value Behavior" on page 23. The substitute value behavior as well as the parameterized substitute value are saved in the module and loaded again after a power-up. In addition to the substitute value, the lowest four bits are replaced in the process data by diagnostic bits and the corresponding diagnostic code is reported via the error mechanism of the bus system. The substitute value is loaded to the process data in case of all errors affecting the SSI channel. The diagnostic bits have the following meaning:

Bit 31 … bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Substitute value	0	0	0	0

Tab. 2-4: Meaning of the diagnostic bits

- Bit 3: Short-circuit or overload of the encoder supply
- Bit 2: Wire break or short circuit of the encoder line
- Bit 1: Data valid error
- Bit 0: Parity error
- 0: No error

- 1: Error

2.5.4 SSI reading times

The SSI reading time is the period from the detection of the position values of the encoder until the end of the transmission to the S20 2-axis module. The SSI reading time specifies the intervals to read in the new values. The SSI reading time depends on the encoder used and the selected transmission rate and can be calculated using the following formula: (1/transmission rate) × Number of bits to be transmitted.

Two examples for the minimum and the maximum reading time.

- Shortest reading period: Resolution 8 bits, SSI clock frequency 4 MHz ⇒ (1/4MHz) × 8 = 2µs
- Longest reading period: Resolution 31 bits, SSI clock frequency 67.5 kHz ⇒ (1/ 67.5kHz) + 32 = 474 µs.

The SSI reading time can be higher than the set Sercos cycle time. In this case, a current position value cannot be read in in each Sercos cycle.

3 Process data

3.1 General information

The module assigns ten words of output process data and ten words of input process data.

The following data is transferred in the output process data:

- Analog output values

The following data is transferred in the input process data:

- Currently read SSI position values
- Current analog input value

Data between the S20 master and the slave is exchanged in each S20 cycle. The S20 cycle is the data exchange cycle between the S20 salve and the S20 master (e.g. S20-S3-BK+).

3.2 Output process data

The output process data assigns a total of two words for the analog outputs.

MSB	LSB
Word 0	Word 1
Analog output value AO1	Analog output value AO2

Tab. 3-1: Structure of the output process data of the analog outputs

A Sercos-synchronous operation is not intended for the analog outputs. The S20 2-axis output module outputs the current output values at the analog outputs immediately after the reception. When operating at a Sercos III bus head, data always has to be transferred at a specified point in time in the Sercos cycle. Thus, a temporal relation between the Sercos cycle and the output of the analog output values results.

3.3 Input process data

A total of ten words consisting of six words for the analog inputs and four words for the Positioning inputs is assigned to the input process data.

MSB									LSB
Word 0	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7	Word 8	Word 9
Analog input value AI1 to AI6						SSI1 position value		SSI2 position value	
Axis 1			Axis 2			Axis 1		Axis 2	

Tab. 3-2: Structure of input process data

New values are continuously read in in the analog inputs. This does not depend on the parent system. A triple removable storage ensures that the latest data is always available for collection by the S20 master. However, for the Positioning inputs, the S20 master specifies the point of time of reading in data. As the reading and processing times are calculated at each new local bus initialization and transferred to the S20 master, it is known when the read data is ready for collection.

3.4 Sercos-synchronous mode

For the Sercos-synchronous operation, an S20 bus master supporting this functionality has to be used, e.g. S20-S3-BK+ (part no.) or an XM2x control (part no. R911173147 or R911173148).

If the Sercos-synchronous mode is set at the S20 bus master used, the SSI inputs of all S20 2-axis modules connected to this S20 bus master are detected and read in in each communication cycle at a defined synchronization point in time "tsync", refer to the description of the S20 bus master (e.g. R911342782).

It is also possible to use multiple S20 bus masters, which are operated in Sercos-synchronous mode, in one application. The SSI inputs of all S20 2-axis modules at the Sercos-synchronous S20 bus masters are read in at this synchronization defined point in time.

The synchronization point corresponds to the first edge at the SSI clock lines. At this point in time, the position value of the encoder is detected and subsequently transferred to the S20 2-axis module.

The Sercos-synchronous operation only runs without errors if the longest SSI reading time is lower at this Sercos master than the set Sercos cycle time. The SSI reading times depend on the encoder type used, refer to chapter 2.5.4 "SSI reading times" on page 10.

Meeting this criterion (longest SSI reading time has to be shorter than the set Sercos cycle time) is checked by the control upon field bus initialization. If this criterion is not met, the S20 bus master returns to the asynchronous mode and generates the fault code "B043", "Local bus is running asynchronously".

4 Parameters, diagnostics and information

4.1 General information

PDI = Parameters, diagnostics and information

Parameter and diagnostic data as well as status messages and other information are transferred via the PDI channel.

For information on the PDI, refer to the application description of the system IndraControl S20, part number R911335988.

The communication via the PDI channel is organized via objects. The created common standard objects and vendor-specific application objects are described in the following chapters.

Applies to all tables:

Data type	Meaning
Var	Simple variable: Individual, simple variable
Array	Sequence of simple variables of the same data type
Record	Sequence of simple variables of a different data type or of the same data type, but with a different length
Visible string	Byte string with only printable ASCII characters, terminated with 00_{hex}
Octet string	Byte string with any content
Unsigned 8	Unsigned value, only positive values 00_{hex} ... FF_{hex}
Unsigned 16	Unsigned value, only positive values 0000_{hex} ... $FFFF_{hex}$
Unsigned 32	Unsigned value, only positive values 0000 0000_{hex} ... FFFF $FFFF_{hex}$

Tab. 4-1: Explaining object codes and data types

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

Tab. 4-2: Abbreviations in table headers

4.2 Standard objects

4.2.1 Objects for identification (device type plate)

Object number (hex)	Object name	Object code	Data type	A	L	Rights	Meaning	Content
Vendor								
0001	VendorName	Var	Visible string	1	16	R	Vendor name	Bosch Rexroth AG
0002	VendorID	Var	Visible string	1	7	R	Vendor ID	006034

Object number (hex)	Object name	Object code	Data type	A	L	Rights	Meaning	Content
0003	VendorText	Var	Visible string	1	49	R	Notes on the vendor	Components and systems for industrial automation
0012	VendorURL	Var	Visible string	1	30	R	Vendor URL	boschrexroth.com
Module - General								
0004	DeviceFamily	Var	Visible string	1	20	R	Device family	I/O function module
0006	ProductFamily	Var	Visible string	1	33	R	Product family	IndraControl S20
000E	CommProfile	Var	Visible string	1	4	R	Communication profile	633
000F	DeviceProfile	Var	Visible string	1	5	R	Device profile	0010
0011	Profile-Version	Record	Visible string	2	33	R	Version name of device profile	2009-10-22; Basic - Profile V1.12
003A	VersionCount	Array	Unsigned 16	4	2	R	Version counter	0007 0001 0000 0005
Module - Special								
0007	ProductName	Var	Visible string	1	19	R	Product name	S20-AO2-AI6-SSI2
0008	Serial-Number	Var	Visible string	1	11	R	Serial number	xx xx xx xx xx xx xx x (e.g. 7260201123456BC)
0009	ProductText	Var	Visible string	1	47	R	Product text:	6 analog inputs, 4 analog outputs, 2 absolute encoders (SSI)
000A	Order-Number	Var	Visible string	1	8	R	Part number	R911173120
000B	HardwareVersion	Record	Visible string	2	14	R	Hardware version	E.g. 2014-07-02; AA0
000C	FirmwareVersion	Record	Visible string	2	17	R	Firmware version	E.g. 2014-07-02, FW version V1.01
000D	PCH Version	Record	Visible string	2	17	R	Parameter channel version	E.g. 2010-01-08; V1.00
0037	DeviceType	Array	Octet string	1	8	R	Module identification	08 30 10 14 00 00 00 F3
Device use								
0014	Location	Var	Visible string	1	59	R/W	Mounting location	Can be filled in by the user.
0015	EquipmentIdent	Var	Visible string	1	59	R/W	Equipment ID	Can be filled in by the user.
0016	Appl-DeviceAddr	Var	Unsigned 16	1	2	R/W	User-defined device number	Can be filled in by the user.

Tab. 4-3: Objects for identification

4.2.2 Object for multilingualism

Object number (hex)	Object name	Object code	Data type	A	L	Rights	Meaning	Content
0017	Language	Record	Visible string	2	6; 8	R	Language	en-us; English

Tab. 4-4: Object for multilingualism

4.2.3 Objects for diagnostics

Object for diagnostics

Index (hex)	Object name	Object code	Data type	A	L	Rights	Meaning and content
0018	DiagState	Record	-	6	22	R	Diagnostic state

Tab. 4-5: Object for diagnostics

Diagnostic state (0018hex: DiagState)

This object is used for the structured message of a fault.

This object can only be accessed via the subindex 0. Thus, the complete object can be read.

0018_{hex}: DiagState (Read)

Subindex (hex)	Data type	Length in bytes	Meaning	Content
0	Record	22	Diagnostic state	Complete diagnostic information
1	Unsigned 16	2	Fault number	0 ... 65535_{dec} Consecutive fault number since last reset or error memory reset
2	Unsigned 8	1	Priority	00_{hex} No fault
				01_{hex} Error still pending
				02_{hex} Warning still pending
				81_{hex} Recovered error
				82_{hex} Recovered warning

0018_{hex}: DiagState (Read)

3	Unsigned 8	1	Channel	00_{hex} No fault
				01_{hex} Fault, channel 1
				02_{hex} Fault, channel 2
				FF_{hex} Fault not assigned to specific channel
4	Unsigned 16	2	Fault code	See following table
5	Unsigned 8	1	More follows	00_{hex} (not supported)
6	Visible string	15	Text (14 characters)	See following table

Tab. 4-6: Diagnostic state

☞ The message with either priority 81hex or 82hex is a unique internal message to the bus coupler transferred from the bus coupler to the error mechanisms of the superimposed system.

Error messages

The following table lists all error messages that can be issued by the 2-axis module.

☞ Messages of priority 1 are errors due to which the function of the complete module cannot be ensured anymore. Messages of priority 2 are errors due to which the complete function of the module is still provided, but single channels might not be able to read in or output valid values.

Fault	Fault code (hex)	Text	Note	Priority (hex)	Channel (hex)
No fault	0000	–	Status OK	01	FF
Short-circuit or overload at 24 V supply	3124	24 V main undervoltage	24 V supply voltage disrupted	01	FF
Short-circuit or overload at 5 V supply	5113	+5 V supply low voltage	Internal 5 V supply voltage disrupted	01	FF
Short-circuit or overload at +15 V supply	5110	+15 V supply low voltage	Internal 15 V supply voltage disrupted	01	FF
Short-circuit or overload at -15 V supply	5110	-15 V supply low voltage	Internal -15 V supply voltage disrupted	01	FF

Fault	Fault code (hex)	Text	Note	Priority (hex)	Channel (hex)
Internal communication error	5230	–	If this error occurs without text message, the internal communication to the micro controller is interrupted	01	FF
Measuring value exceeded at input X	8910	Analog In noX measured value overrange	Measuring range exceeded at input no.X (X = 1 to 6)	02	For X= (1 to 3) channel = 01 For X= (4 to 6) channel 02
Wire break at analog input X	7710	Analog In noX wire break	Wire break at input no.X(X = 1 to 6)	02	For X= (1 to 3) channel = 01 For X= (4 to 6) channel = 02
Measuring value fallen below at input X	8920	Analog In noX measured value underrange	Measuring range fallen below at input no.X(X = 1 to 6)	02	For X= (1 to 3) channel = 01 For X= (4 to 6) channel = 02
Short-circuit or overload at 24 V supply for connected actuators	5160	Analog supply for axis X short or overcurrent	Short-circuit or overload at 24 V supply, channel X (X = 1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02
Short circuit at analog output, channelX	2130	Analog Out axis1 short circuit	Short circuit at analog output, channel X X = (1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02
Wire break at analog output, channelX	7710	Analog Out axis1 wire break	Wire break at analog output ,channel X X = (1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02
Overtemperature at analog output driver, channelX	4200	Analog Out axis1 overtemperature	Short circuit at analog output driver, channelX X = (1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02
Communication error at analog output driver, channelX	5230	Analog Out axis1 communication inside error	Communication error at analog output driver, channelX X = (1 or 2)	02	For X= 1 channel = 1 For X= 2 channel = 02
Wire break at “Positioning” input, channelX	2360	SSI axis1 wire break	Wire break at “Positioning” input, channelX X = (1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02
Short circuit at “Positioning” input, channelX	2137	SSI axis1 short circuit	Short circuit at “Positioning” input, channelX X = (1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02
Parity error at “Positioning” input, channelX	6320	SSI axis1 parity bit error	Parity error at “Positioning” input, channelX X = (1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02
Data at “Positioning” input, channelX, invalid	6320	SSI axis1 data valid bit error	Data at “Positioning” input, channelX, invalid X = (1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02

Fault	Fault code (hex)	Text	Note	Priority (hex)	Channel (hex)
Short-circuit or overcurrent at the 24 V supply for position encoder channelX	5160	SSI axis1 short or overcurrent	Short-circuit or overcurrent at 24 V supply for position encoder, channelX X = (1 or 2)	02	For X= 1 channel = 01 For X= 2 channel = 02
Undefined error	5160	Unknown error	Unknown error	02	FF

Tab. 4-7: Fault code and corresponding text for diagnostic messages with priority error

4.2.4 Objects for process data management

Overview

Object number (hex)	Object name	Object type	Data type	A	L	Rights	Assignment
25	PDIN	Record	Octet string	10	-	R	Input process data
26	PDOUT	Simple variable	Integer 16	10	-	R/W	Output process data

Tab. 4-8: Objects for process data management – Overview

Input process data (0025hex: PDIN)

Input process data of the module can be read using this object. The structure corresponds to the representation in chapter 3 "Process data" on page 11.

0025 (hex): PDIN(Read)

Subindex	Data type	Length in bytes	Meaning
0	Integer 16	2	Analog input value AI1
1	Integer 16	2	Analog input value AI2
2	Integer 16	2	Analog input value AI3
3	Integer 16	2	Analog input value AI4
4	Integer 16	2	Analog input value AI5
5	Integer 16	2	Analog input value AI6
6	Octet string	4	Position value of SSI channel 1
7	Octet string	4	Position value of SSI channel 2

Tab. 4-9: Structure of the object PDIN (0025hex)

Output process data (0026hex: PDOUT)

Output process data of the module can be written using this object. The structure corresponds to the representation in chapter 3 "Process data" on page 11.

0026 (hex): PDOUT(Read)

Subindex	Data type	Length in bytes	Meaning
0	Integer 16	2	Analog output value AO1

0026 (hex): PDOUT(Read)			
1	Integer 16	2	Analog output value AO2
3	Integer 16	16	Not assigned

Tab. 4-10: Structure of the object POUT (0026hex)

4.3 Application objects

4.3.1 Overview

Object number (hex)	Object name	Object type	Data type	A	L	Rights	Meaning
0024	Analog Output 1 and 2: Substitute Value Behavior	-	-	-	-	R/W	Analog output substitute value settings
0029	Block_Param	-	-	-	-	R/W	Object to control the block parameterization
002F	Analog Output 1 and 2: Substitute Values	-	-	-	-	R/W	Analog output substitute values
0080	Parameter for analog output	-	-	-	-	R/W	Setting for analog outputs
	Parameter for analog input						Settings for analog inputs
	Parameter for SSI input						Settings for SSI inputs
0081	SSI channels 1 and 2: Substitute Value Behavior	-	-	-	-	R/W	SSI substitute value settings
	SSI channels 1 and 2: SubstituteValues						SSI substitute values

Tab. 4-11: Objects for parameterization

4.3.2 Object "Analog Output 1 and 2: Substitute Value Behavior"

The object 0024_{hex} "Analog Output 1 and 2: Substitute Value Behavior" describes the behavior of the analog outputs in case of an error, e.g. when a local bus fails. The setting made always refers to both outputs. It cannot be set individually here.

Object number (hex)	Subindex (hex)	Object name	Length (bytes)	Bit	Meaning	Values	Default (hex)
0024	00	Analog Output 1 and 2: Substitute Value Behavior	2	0 to 15	Substitute value behavior AO1 and AO2	02 = Hold last value	03
						03 = Set output to substitute	

Tab. 4-12: Object to set the substitute value behavior or the analog outputs

4.3.3 Object "Block_Param"

The object "Block_Param" object no.. 0029_{hex} subindex 00_{hex} is used by the S20 2-axis module to detect the beginning and the end of the parameter transfer and thus the transition to the operating mode.

If the bit is set to 1, the S20 2-axis module cancels reading in into the inputs and outputting new output values. The S20 2-axis module then expects new parameter data. Parameter data can be changed in this state.

Resetting the bit signals the end of the parameter transfer to the S20 2-axis module. The module starts to directly apply the parameters, to configure the periphery accordingly and, if required, to determine new synchronization times for the synchronous operation.

Object number (hex)	Subindex (hex)	Object name	Length (bytes)	Bit	Meaning	Values (hex)	Default (hex)
0029	00	Block_Param	1	0 to 8	Block parameterization	00 = Writing parameter completed	00
						01 = Writing parameter active	

Tab. 4-13: Object to control the module parameterization

☞ If it is not switched from 1 to 0 after writing the parameters, the parameters from the application objects are also not applied.

4.3.4 Object "Analog Output 1 and 2: Substitute Values"

There are the following options for the substitute value behavior of the analog outputs:

- In the "Hold last Value" setting, the analog outputs output the last valid output value (freeze of the last value…). This is for example the case if the connection to the control is canceled.
- If "Set Output to Substitute" is set, the analog outputs output the value set in the object "$2F_{hex}$". This substitute value can be set individually for each channel.

Object number (hex)	Subindex (hex)	Object name	Length (bytes)	Bit	Meaning	Values	Default (hex)
002F	00	Analog Output 1 and 2: Substitute Values	4	0 to 15	Substitute value AO1	Valid values in Inline format for the value range set	00000000
				16 to 31	Substitute value AO2		

Tab. 4-14: Object for substitute values of analog outputs

4.3.5 Object "Parameter for analog output"

The object "Parameter for analog output" is used to set the analog outputs.

Object number (hex)	Subindex (hex)	Object name	Length (bytes)	Bit	Meaning	Values	Default (hex)
0080	00	Parameter for analog output	2	0 to 7	Output range AO1	00 = ±10 mA 01 = ±20 mA 02 = 0-20 mA 03 = 4-20 mA 04 = ±10 V 05 = 0-10 V 0F = Input disabled	04
				8 to 15	Output range AO2		

Tab. 4-15: Object to set the analog outputs

4.3.6 Object "Parameter for analog input"

The object "Parameter for analog input" is used to set the analog inputs.

Object number (hex)	Subindex (hex)	Object name	Length (bytes)	Bit	Meaning	Values	Default (hex)
0080	01	Parameter for analog input	12	0 to 7	Measuring range AI1	00 = ±10 mA	04
						01 = ±20 mA	
						02 = 0-20 mA	
						03 = 4-20 mA	
						04 = ±10 V	
						05 = 0-10 V	
						06 = 0.1-10 V	
						0F = Input disabled	
				8 to 15	Measuring range AI2	See measuring range AI1	04
				16 to 23	Measuring range AI3	See measuring range AI1	04
				24 to 31	Filter setting AI1	00 = No filtering	00
						01 = 4 values	
						02 = 8 values	
						03 = 16 values	
						04 = 32 values	
						05 = 64 values	
						06 = 125 values	
						07 = 256 values	
				32 to 39	Filter setting AI2	See filter setting AI1	00
				40 to 47	Filter setting AI3	See filter setting AI1	00
				48 to 55	Measuring range AI4	See measuring range AI1	04
				56 to 63	Measuring range AI5	See measuring range AI1	04
				64 to 71	Measuring range AI6	See measuring range AI1	04
				72 to 79	Filter setting AI4	See filter setting AI1	00
				80 to 87	Filter setting AI5	See filter setting AI1	00
				88 to 95	Filter setting AI6	See filter setting AI1	00

Tab. 4-16: Object to set the analog inputs

4.3.7 Object "Parameter for SSI input"

The object "Parameter for SSI input" is used to set the SSI inputs.

Object number (hex)	Subindex (hex)	Object name	Length (bytes)	Bit	Meaning	Values	Default (hex)
0080	02	Parameter for SSI input	14	0 to 7	SSI1 bin/gray	00 = Bin	01
						01 = Gray	
				8 to 15	SSI1 error bit	00 = Error bit off	00
						01 = Error bit on	
				16 to 23	SSI1 parity enable	00 = No parity	00
						01 = Odd	
						02 = Even	
				24 to 31	SSI1 clock frequency	00 = 67.5 kHz	0C
						01 = 100 kHz	
						02 = 125 kHz	
						03 = 200 kHz	
						04 = 250 kHz	
						05 = 300 kHz	
						06 = 400 kHz	
						07 = 500 kHz	
						08 = 600 kHz	
						09 = 700 kHz	
						0A = 800 kHz	
						0B = 900 kHz	
						0C = 1 MHz	
						0D = 2 MHz	
						0E = 4 MHz	
						>= 0F = Reserved	
				32 to 39	SSI1 resolution	Lengths between 8 and 31 possible	18 (= 24 bits)
				40 to 47	SSI1 waiting cycles	Value from 0 to dec 100 possible	00
				48 to 55	SSI1 enable	0 = SSI disable	00
						1 = SSI enable	
				56 to 63	SSI2 bin/gray	See SSI1	01
				64 to 71	SSI2 error bit	See SSI1	00
				72 to 79	SSI2 parity enable	See SSI1	00
				80 to 87	SSI2 clock frequency	See SSI1	0C
				88 to 95	SSI2 resolution	See SSI1	18 (= 24 bits)
				96 to 103	SSI2 waiting cycles	See SSI1	00
				104 to 111	SSI2 enable	See SSI1	00

Tab. 4-17: Object to set the SSI inputs

4.3.8 Object "SSI channel 1 and 2: Substitute Value Behavior"

The object "SSI channel 1 and 2" is used to set the SSI substitute value behavior.

Object number (hex)	Subindex (hex)	Object name	Length (bytes)	Bit	Meaning	Values	Default (hex)
0081	00	SSI channels 1 and 2: Substitute Value Behavior	02	0 to 7	Substitute value behavior SSI1	00 = Zero value 01 = Final value 02 = Hold last value 03 = Position substitute value	01
				8 to 15	Substitute value behavior SSI2	See SSI1	01

Tab. 4-18: Object for SSI substitute value settings

4.3.9 Object "SSI channel 1 and 2: SubstituteValues"

The object "SSI channel 1 and 2: SubstituteValues" is used to set the SSI substitute values.

Object number (hex)	Subindex (hex)	Object name	Length (bytes)	Bit	Meaning	Values	Default (hex)
0081	01	SSI channels 1 and 2: Substitute-Values	08	0 to 31	Substitute value SSI1	32 bit substitute value	00
				31 to 63	Substitute value SSI2	32 bit substitute value	00

Tab. 4-19: Object for SSI substitute values

5 Service and support

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Service Germany

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Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

Index

T

V

W

Notes

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