IB ST 24 BAI 8/EF

**INTERBUS-ST analog input module, 8 inputs,
0 - 5 V, 0 - 10 V, 0 - 25 V, 0 - 50 V, 0 - 20 mA, 4 - 20 mA,
0 - 40 mA, 0 - 60 mA**

Data sheet
105598_en_01

1 Description

The module is designed for use within an ST station.

It is used to acquire analog voltage and current signals.

Features

- 8 analog inputs for the connection of either voltage or current signals
- Connection of sensors in 2-wire technology

This module replaces the modules which have been discontinued and are listed under “ordering data”.

Use the DIP switch to configure the functions which the module should apply.

This data sheet is only valid in association with the IBS SYS PRO INST UM user manual.

Make sure you always use the latest documentation. It can be downloaded from the product at phoenixcontact.net/products.

2 Table of contents

3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
INTERBUS-ST analog input module, 8 inputs, 0 - 5 V, 0 - 10 V, 0 - 25 V, 0 - 50 V, 0 - 20 mA, 4 - 20 mA, 0 - 40 mA, 0 - 60 mA, IP20 protection, consisting of: terminal part with screw connection and module electronics	IB ST 24 BAI 8/EF	2700842	1
INTERBUS-ST analog input module, 8 inputs, 0 - 5 V, 0 - 10 V, 0 - 25 V, 0 - 50 V, 0 - 20 mA, 4 - 20 mA, 0 - 40 mA, 0 - 60 mA, degree of protection IP20, comprising: Module electronics only	IB STME 24 BAI 8/EF	2701956	1
INTERBUS-ST analog input module, 8 inputs, 0 - 5 V, 0 - 10 V 0 - 25 V, 0 - 50 V, 0 - 20 mA, 4 - 20 mA, 0 - 40 mA, 0 - 60 mA, degree of protection IP20, comprising: Terminal part with spring-cage connection and module electronics	IB ST ZF 24 BAI 8/EF	2701957	1

Accessories	Type	Order No.	Pcs. / Pkt.
Insertion bridges, divisible, isolated comb spine, color blue, 84-pos. (Bridges)	EB 84 IB ST BU	2836269	5
Insertion bridges, divisible, isolated comb spine, color red, 84-pos. (Bridges)	EB 84 IB ST RD	2836272	5
Replacement fuse, for INTERBUS-ST modules (Fuse)	IBS TR5 0,2AT	2753452	5
Replacement fuse, for INTERBUS-ST modules (Fuse)	IBS TR5 0,4AT	2753478	5

Module replaced	Type	Order No.	Function	DIP switch
INTERBUS-ST analog input module, 8 inputs, 0 to 20 mA, 4 to 20 mA, 0 to 40 mA, 0 to 60 mA, IP20 protection, consisting of: terminal part with screw connection and module electronics	IB ST 24 BAI 8/I	2721028	I	OFF/OFF
INTERBUS-ST analog input module, 8 inputs, 0 to 10 V, 0 to 5 V, 0 to 25 V, 0 to 50 V, IP20 protection, consisting of: Terminal part with spring-cage connection and module electronics	IB ST ZF 24 BAI 8/I	2721235	I	OFF/OFF
Replacement module electronics for IB ST (ZF) 24 BAI 8/I	IB STME 24 BAI 8/I	2721206	I	OFF/OFF
INTERBUS-ST analog input module, 8 inputs, 0 to 10 V, 0 to 5 V, 0 to 25 V, 0 to 50 V, IP20 protection, consisting of: Terminal part with screw connection and module electronics	IB ST 24 BAI 8/U	2721015	U	ON/ON
INTERBUS-ST analog input module, 8 inputs, 0 to 10 V, 0 to 5 V, 0 to 25 V, 0 to 50 V, IP20 protection, consisting of: Terminal part with spring-cage connection and module electronics	IB ST ZF 24 BAI 8/U	2721222	U	ON/ON
Replacement module electronics for IB ST (ZF) 24 BAI 8/U	IB STME 24 BAI 8/U	2721219	U	ON/ON

Documentation	Type	Order No.	Pcs. / Pkt.
User manual, English, Configuring and installing INTERBUS	IBS SYS PRO INST UM E	-	-

4 Technical data

Dimensions (nominal sizes in mm)	
Width	118 mm
Height	116 mm
Depth	117 mm

General data	
Weight	600 g
Operating mode	Process data mode with 4 words
Ambient temperature (operation)	-25 °C ... 55 °C
Ambient temperature (storage/transport)	-25 °C ... 70 °C
Permissible humidity (operation)	10 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	10 % ... 95 % (non-condensing)
Air pressure (operation)	80 kPa ... 106 kPa (up to 2000 m above sea level)
Air pressure (storage/transport)	80 kPa ... 106 kPa (up to 2000 m above sea level)
Degree of protection	IP20
Protection class	III, IEC 61140, EN 61140, VDE 0140-1
Processor monitoring	Watchdog circuit

Connection data	
Designation	Termination block
Connection method (IB ST 24 BAI 8/EF)	Screw connection
Connection method (IB ST ZF 24 BAI 8/EF)	Spring-cage connection
Conductor cross section solid / stranded	0.2 mm² ... 2.5 mm² / 0.2 mm² ... 2.5 mm²
Conductor cross section [AWG]	24 ... 12

Interface ST local bus	
Connection method	ST local bus connector
Number	2
Transmission speed	500 kBit/s
Transmission physics	Copper

Communications power	
Supply voltage	9 V DC (from the ST local bus)
Current consumption	typ. 54 mA, max. 80 mA
Power consumption	typ. 0.5 W

Periphery supply voltage	
Designation	U_S
Supply voltage	24 V DC
Nominal supply voltage range	19.5 V DC ... 30.2 V DC (including all tolerances, including ripple)
Current consumption	typ. 45 mA (I_b = 0 mA (I_b = total current for supplying passive sensors for all channels)) typ. 120 mA (I_b = 100 mA (I_b = total current for supplying passive sensors for all channels))
Power consumption	typ. 1.1 W (I_b = 0 mA (I_b = total current for supplying passive sensors for all channels)) typ. 2.9 W (I_b = 100 mA (I_b = total current for supplying passive sensors for all channels))
Protection against polarity reversal	Serial diode
Transient protection	Yes
Overload protection	F1 fuse in IBS TR5 0,4AT header

Passive sensor supply	
Designation	U_B (generated internally)
Supply voltage	15 V ±6 %
Current consumption	max. 100 mA (Total for all channels)
Load control	typ. 0.6 % (0 % ... 100 % Load)

Passive sensor supply	
Temperature coefficients	typ. 0.01 %/K (I_b = 100 mA (I_b = total current for supplying passive sensors for all channels))
Transient protection	Yes
Overload protection	F2 fuse in IBS TR5 0,2AT header

Total power consumption of the module	
Power consumption	typ. 1.6 W (Logic and I/O, I_b = 0 mA) typ. 3.4 W (Logic and I/O, I_b = 100 mA)

Analog inputs	
Number of inputs	max. 8 (Voltage or current)
Connection method	2, 3-conductor
A/D conversion time	max. 10 µs (per channel)
Measured value representation	8 bit straight binary (default) or 12 bit two's complement (can be parameterized)

Voltage inputs	
Number of inputs	8
Voltage input signal	0 V ... 10 V, 0 V ... 5 V, 0 V ... 25 V, 0 V ... 50 V
Input resistance of voltage input	150 kΩ
Open circuit response	decreasing
Resolution A/D	12 bit (4096 steps; 2.44 mV/quantization steps) 8 bit (256 steps; 39 mV/quantization steps)

Current inputs	
Number of inputs	8
Current input signal	4 mA ... 20 mA, 0 mA ... 20 mA, 0 mA ... 40 mA, 0 mA ... 60 mA (rms)
Input resistance current input	77 Ω
Open circuit response	decreasing
Resolution A/D	12 bit (4096 steps; 3.91 µA/quantization steps) 8 bit (256 steps; 62.7 µA/quantization steps)
Permissible common mode voltage for CMR	60 V

Programming Data	
ID code (hex)	7F
ID code (dec.)	127
Length code (hex)	4
Length code (dec.)	4
Input address area	8 Byte
Output address area	0 Byte
Parameter channel (PCP)	0 Byte
Register length (bus)	8 Byte

Error messages to the higher level control or computer system	
Failure of the internal I/O supply	I/O error message sent to the bus coupler
F1 fuse failure	I/O error message sent to the bus coupler
I/O supply failure	I/O error message sent to the bus coupler

Electrical isolation/isolation of the voltage areas	
Test section	**Test voltage**
Bus/Inputs	500 V AC, 50 Hz, 1 min
Supply voltage/inputs	500 V AC, 50 Hz, 1 min
Supply voltage/Ground conductor	500 V AC, 50 Hz, 1 min
I/O voltage/Ground conductor	500 V AC, 50 Hz, 1 min

Conformance with EMC Directive 2004/108/EC	
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 surge voltage (surge) EN 61000–4–5/IEC 61000–4–5	Criterion B; supply lines DC: ±0.5 kV/±0.5 kV (symmetrical/asymmetrical); ±1 kV to shielded I/O cables
Conducted interference EN 61000–4–6/IEC 61000–4–6	Criterion A; Test voltage 10 V
Noise emission test as per EN 61000-6-4	
EN 55011	Class A

Approvals
For the latest approvals, please visit phoenixcontact.net/products.

5 Additional tables

Tolerance and temperature response				
	Voltage inputs		Current inputs	
	Typ.	Max.	Typ.	Max.
Tolerance at 23°C	±0.30%	±0.50 %	±0.30%	±0.65 %
Drift	±15 ppm/K	±60 ppm/K	±45 ppm/K	±105 ppm/K
Total tolerance at -25°C ... +55°C	±0.35 %	±0.60 %	±0.42 %	±0.78 %

The tolerance values refer to the respectively configured measuring range final value.

No additional tolerances occur when influenced by electromagnetic interference. The module electronics function within the specified limits.

Cut-off frequencies of the analog voltage and current input filters		
Limit frequency	**Voltage inputs**	**Current inputs**
Limit frequency (3 dB)	3.4 kHz	980 Hz
Cut-off frequency (0.3 dB) for 12-bit accuracy of the A/D converter	290 Hz	81 Hz
Cut-off frequency (0.002 dB) for 8-bit accuracy of the A/D converter	74 Hz	21 Hz

Module response times (A/D conversion and process data update)		
Operating mode	**Process data update**	**Typical response time**
8 channel, 8 bit	per channel	350 µs
	For all channels	2.8 ms
4 channel, 12 bit	per channel	350 µs
	For four channels	1.4 ms

6 Internal circuit diagram

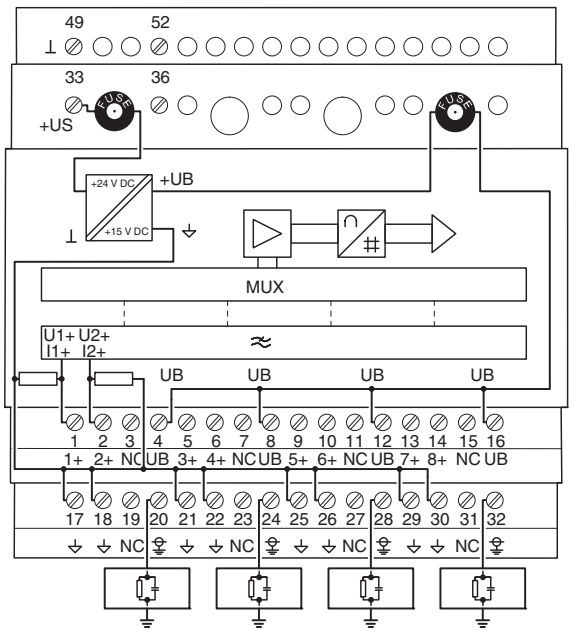

Figure 1 Internal wiring of the terminal points

Key:

	Power supply unit with electrical isolation
	Analog/digital converter
	Input amplifier
	Coupling network (internal)
	Filter
	Multiplexer

7 Electrical isolation

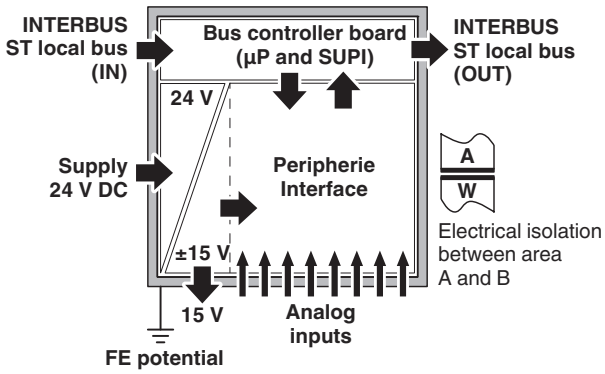

Figure 2 Electrical isolation of the individual function areas

8 Configuration via DIP switches

Use the DIP switches to set the function of the module.

Set the DIP switches before you connector the module electronics onto the terminal block base.

The configuration is transferred by applying the power supply for the bus logic. The communications power is fed to the bus terminal and then made available to the bus terminal for the entire ST station.

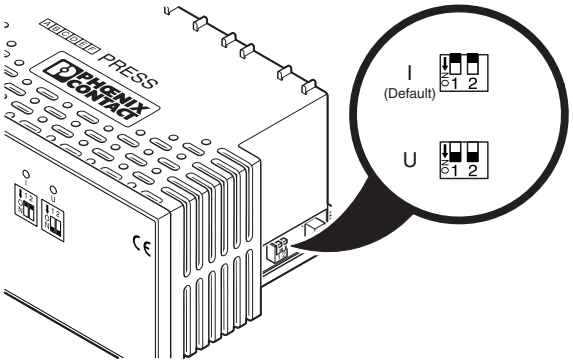

Figure 3 DIP switches

Switch		Function	
1	2		
OFF	OFF	I	0 mA ... 20 mA, 4 mA ... 20 mA, 0 mA ... 40 mA, 0 mA ... 60 mA
ON	ON	U	0 V ... 5 V, 0 V ... 10 V, 0 V ... 25 V, 0 V ... 50 V
ON	OFF	Reserved	
OFF	ON		

Default setting OFF / OFF

The corresponding LED indicates the current switch setting.

9 Terminal point assignment

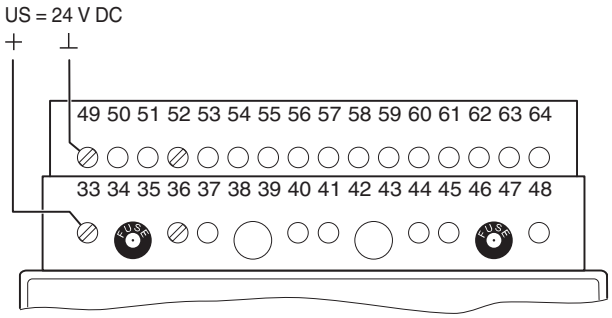

Figure 4 Connecting the supply voltage

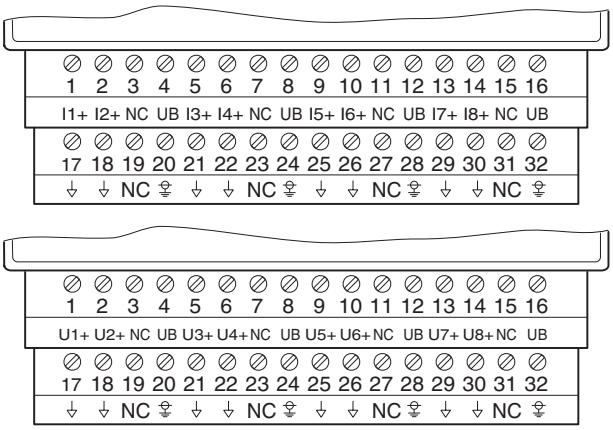

Figure 5 Terminal point assignment

Terminal point	Signal
U_S+	24 V I/O supply voltage
⊥	Supply voltage ground
U1+ ... U8+	Voltage inputs channel 1 ... 8
I1+ ... I8+	Current inputs channel 1 ... 8
UB	Sensor supply for passive sensors 15 V DC
▽	Analog ground
	Shield connection (for more than 10 m cable length)
NC	Not used
	These terminal points must not be wired.

10 Local status and diagnostic indicators

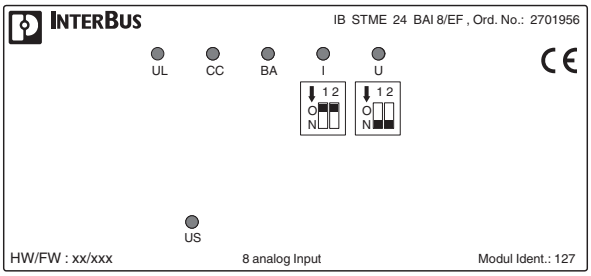

Figure 6 Local status and diagnostic indicators

Designation	Color	Meaning	
UL	Green	24 V supply for the module electronics	
CC	Green	Cable check	
BA	Green	Bus active	
I	Green	Mode:	I
U	Green	Mode:	U
US	Green	24 V I/O supply voltage	

11 Connection notes

Ground the DIN rail. The module is grounded by snapping it onto the DIN rail.

Always connect the analog sensors using shielded, twisted pair cables.

12 Connection examples

12.1 Connecting the supply voltage

Screw Connection

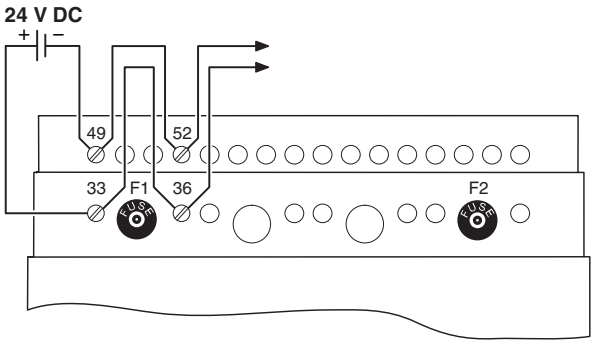

Figure 7 Connection of the supply voltage and potential routing

If you wish to connect more modules, an external jumper is required between terminal points 33 and 36 (U_S) as well as between 49 and 52 (ground).

Spring-cage connection

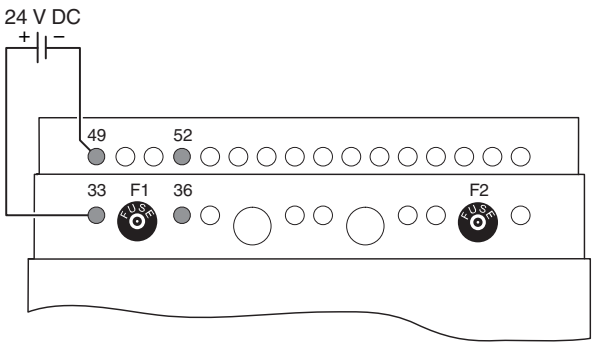

Figure 8 Connection of the supply voltage for the spring-cage version

12.2 Mode I

Connection of active analog sensors

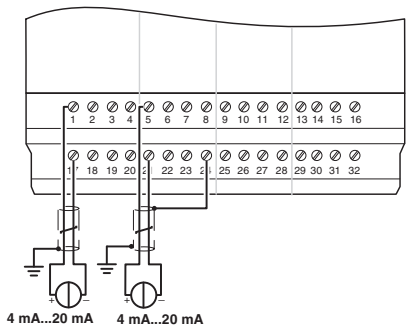

Figure 9 Connection of active analog sensors

K1	Channel 1	Active sensor with a cable length of **less** than 10 m (without module shield connection)
K3	Channel 3	Active sensor with a cable length of **more** than 10 m (with module shield connection)

NOTE: Electronics may be damaged when overloaded

Do not connect voltages above ±5 V to a current input. The module electronics will be damaged, as the maximum permissible current of ±100 mA will be exceeded.

Connection of a passive sensor

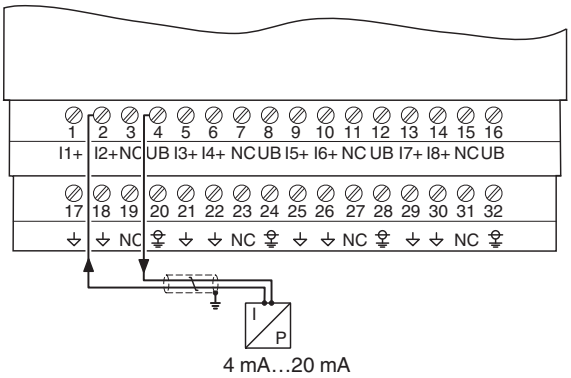

Figure 10 Connection of a passive sensor

Integration of a current input in a current measuring loop

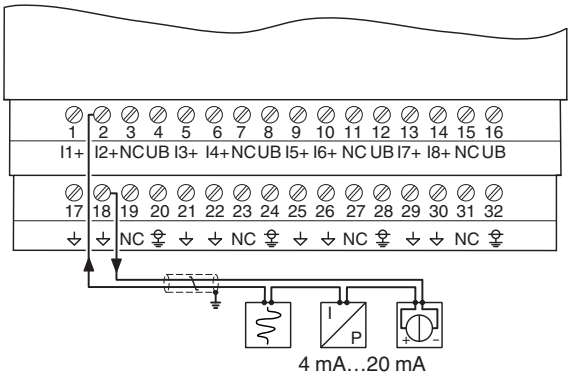

Figure 11 Integration of a current input in a current measuring loop

Supply

Writer

Pressure sensor

12.3 Mode U

Connection of active analog sensors

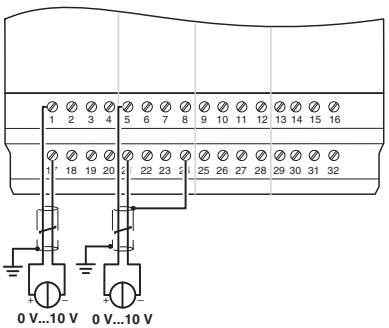

Figure 12 Connection of active analog sensors

K1 Channel 1 Active sensor with a cable length of **less** than 10 m (without module shield connection)

K3 Channel 3 Active sensor with a cable length of **more** than 10 m (with module shield connection)

Connection of potentiometers

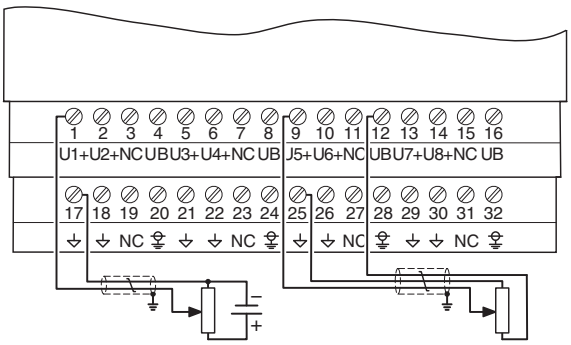

Figure 13 Connection of a passive and an active potentiometer

K1 Channel 1 Connection of an externally supplied 24 V potentiometer (active)

K5 Channel 5 Connection of a passive potentiometer with supply through the module electronics

Integration of analog shielding in a concept with central equipotential bonding

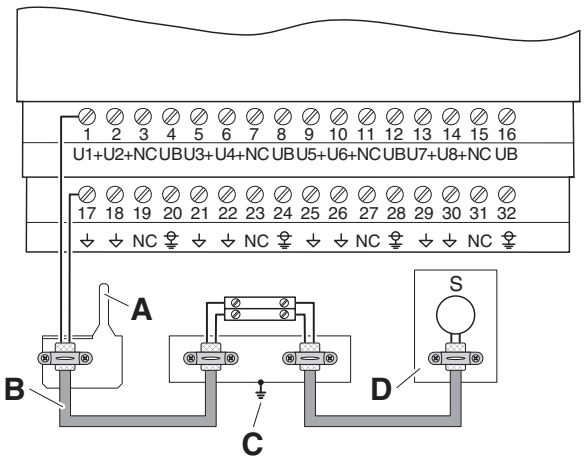

Figure 14 Shield connection with central equipotential bonding

A Connect the shield to the module using shield connection clamps 20, 24, 28, and 32.

The shield connection is optional for cable lengths up to 10 m.

For cable lengths greater than 10 m, you must connect the shield to the shield connection clamps.

B Use shielded, twisted pair cables.

C Connect the strain relief directly to PE potential.

The shield of the entire analog transmission path should be connected to PE potential at only one point.

In this example, this point is the jumpering level (C).

D Lead the sensor cable into the sensor, making sure to **maintain the cable insulation**.

When integrating the shielding of analog I/O cables in an equipotential bonding concept, make sure that direct connection to the PE potential is only established at one point (e.g., at the central grounding point of the jumpering level).

13 Process data

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

Set the operating mode using the first two process data output words.

Depending on the operating mode, the measured values of a channel are written to the input words in a different way.

In the 8 bit operating mode, all eight measured values are transmitted in one cycle.

In the 12 bit operating mode, the measured values from channel 1 to 4 are transmitted in the first cycle and the measured values from channels 5 to 8 are transmitted in the second cycle.

Before and after the start, all process data output words are set by default with the value 0000_{hex}.
As such, the operating mode is set by default for one process data update of all eight channels in one cycle.
The input currents (4 mA ... 20 mA, I mode) or the input voltages (0 V ... 10 V; U mode) are shown per channel with 8 bit binary.

13.1 Output words OUT1 to OUT4

Order of the process data words

Word	OUT1	OUT2	OUT3	OUT4
Assignment	Control word	Measuring range	Reserved	

OUT1: control word, setting the operating mode

Set the operating mode using the first process data output word, the control word.

Control word [hex]	Operating mode	Channels required	Input word
8100	8 bits (default)	2 x 8 bit analog value	
8101	12 bits with measuring range	Lower group: channel 1 ... 4	Analog value, group number, and measuring range
8102		Upper group: channel 5 ... 8	
8103	12 bits with channel number	Lower group: channel 1 ... 4	Analog value and channel number
8104		Upper group: channel 5 ... 8	

Observe the module response time after switching the operating mode or measuring range.

OUT2: setting the measuring range

Set the measuring range per channel using the second process data output word.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Measuring range for channel	8		7		6		5		4		3		2		1	

Adjustable measuring ranges

Bit combination	Measuring range		Notes
	I	U	
00	4 mA ... 20 mA	0 V ... 10 V	Default
01	0 mA ... 20 mA	0 V ... 5 V	can be parameterized
10	0 mA ... 40 mA	0 V ... 25 V	can be parameterized
11	0 mA ... 60 mA	0 V ... 50 V	can be parameterized

In the measuring range 0 mA to 60 mA, a peak value acquisition of 100 mA is also possible. The RMS value of 60 mA must however not be exceeded.

13.2 Input words IN1 to IN4

The assignment of the input words depends on the operating mode.

8 bit operating mode (control word 8100_{hex})

In the 8 bit operating mode, the values from the eight channels are transmitted to the INTERBUS ring in one cycle.

The measured values are shown in 8 bit straight binary format.

Word	IN1		IN2		IN3		IN4	
Channel	1	2	3	4	5	6	7	8

Process data word IN1 in the 8 bit operating mode

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Measured value (8 bit) channel 1								Measured value (8 bit) channel 2							

12 bit operating mode (control word 8101_{hex}, 8102_{hex}, 8103_{hex} or 8104_{hex})

The measured values from four channels are transmitted per cycle. In order to transmit the measured values from all eight channels, two cycles are required.

The measured values are represented in 12 bit two's complement.

Process data word	IN1	IN2	IN3	IN4
Channel in first transmission cycle	1	2	3	4
Channel in second transmission cycle	5	6	7	8

Process data word IN1 in the 12 bit operating mode with measuring range

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
V	Measured value (12 bit)												G	M	

V Sign bit
G Group
0 Lower group
1 Upper group
M Measuring range

Process data word IN1 in the 12 bit operating mode with channel number

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
V	Measured value (12 bit)												K		

V Sign bit
K Channel number

Channel number Bit 2 ... 0	Channel
000	1
001	2
010	3
011	4
100	5
101	6
110	7
111	8

This operating mode offers the advantage of being able to assign the analog value directly to the associated channel, while in the 12 bit operating mode with measuring range, it is necessary to calculate the channel number based on the input word address and group.

13.3 Assignment of the terminal points to IN process data

8 bit operating mode

(Word.bit) view	Word	x	
	Bit	15 ... 8	7 ... 0
Channel 1, 2	Channel	1	2
	Signal	1	2
	Analog ground	17	18
	Shielding	20	
	Sensor voltage	4	
Channel 3, 4	Channel	3	4
	Signal	5	6
	Analog ground	21	22
	Shielding	24	
	Sensor voltage	8	
Channel 5, 6	Channel	5	6
	Signal	9	10
	Analog ground	25	26
	Shielding	28	
	Sensor voltage	12	
Channel 7, 8	Channel	7	8
	Signal	13	14
	Analog ground	29	30
	Shielding	32	
	Sensor voltage	16	

12 bit operating mode

(Word.bit) view	Word	x		
	Bit	15	...	0
Channel 1	Signal	1		
	Analog ground	17		
	Shielding	20		
	Sensor voltage	4		
Channel 2	Signal	2		
	Analog ground	18		
	Shielding	20		
	Sensor voltage	4		
Channel 3	Signal	5		
	Analog ground	21		
	Shielding	24		
	Sensor voltage	8		
Channel 4	Signal	6		
	Analog ground	22		
	Shielding	24		
	Sensor voltage	8		
Channel 5	Signal	9		
	Analog ground	25		
	Shielding	28		
	Sensor voltage	12		
Channel 6	Signal	10		
	Analog ground	26		
	Shielding	28		
	Sensor voltage	12		
Channel 7	Signal	13		
	Analog ground	29		
	Shielding	32		
	Sensor voltage	16		
Channel 8	Signal	14		
	Analog ground	30		
	Shielding	32		
	Sensor voltage	16		

14 Conversion code tables

The following tables show the relationship between input signal and process data value.
One of the 12 bit operating modes can be applied, where the bits 0, 1, and 2 of process data are hidden (selected as 0).

Input signal	4 mA ... 20 mA	0 mA ... 20 mA	0 mA ... 40 mA	0 mA ... 60 mA (RMS) (0 mA ... 100 mA (peak))
	hex			
60 mA	7FF8	7FF8	7FF8	4CC8
50 mA	7FF8	7FF8	7FF8	4000
40 mA	7FF8	7FF8	7FF8	3330
20 mA	7FF8	7FF8	4000	1998
10 mA	3000	4000	2000	0CC8
5 mA	0800	2000	1000	0660
4 mA	0000	1998	0CC8	0518
2 mA	0000	0CC8	0668	0228
0 mA	0000	0000	0000	0000
1 QS	3.9 µA	4.88 µA	9.76 µA	24.4 µA

Input signal	0 V ... 10 V	0 V ... 5 V	0 V ... 25 V	0 V ... 50 V
	hex			
50 V	7FF8	7FF8	7FF8	7FF8
25 V	7FF8	7FF8	7FF8	4000
10 V	7FF8	7FF8	3330	1998
5 V	4000	7FF8	1998	0CC8
2.5 V	2000	4000	0CC8	0660
0 V	0000	0000	0000	0000
1 QS	2:44 mV	1.22 mV	6.1 mV	12.2 mV

15 Significant values

Abbreviations used in the following tables

QS	Quantization step(s)
ORS	Start of range
MRF	Measuring range final value
Bit 15	Most significant bit (MSB)
Bit 0	Least significant bit (LSB)
XX	Hexadecimal code of the measured value for the second channel in this input word
xxxxxxxx	Binary code of the measured value for the second channel in this input word

15.1 Mode I

Measured value tables

The measured values for the ranges 4 mA ... 20 mA and 0 mA ... 20 mA are represented in the tables A to D.

If you use the measuring ranges 0 mA to 40 mA or 0 mA to 60 mA, then you can also apply the tables B and D. In this case, multiply the analog input value with the factor 2 or 5 (see following table).

Operating mode	8 bits		12 bits	
Measuring range	Quantization	Table (* factor)	Quantization	Table (* factor)
4 mA ... 20 mA	62.5 µA	Table A	3.91 µA	Table C
0 mA ... 20 mA	78.1 µA	Table A	4.88 µA	Table D
0 mA ... 40 mA	156 µA	B * 2	9.77 µA	D * 2
0 mA ... 60 mA	391 µA	B * 5	24.4 µA	D * 5

Process data input word for the current inputs (example)

Table A, 8 bit operating mode				
Current input 4 mA ... 20 mA	Analog value [mA]	Process data input word		
		hex	bin	
			15 ... 8	7 ... 0
20 mA - 1 QS	19.9375	FFXX	11111111	xxxxxxxx
20 mA - 2 QS	19.8750	FEXX	11111110	xxxxxxxx
Middle	12.0000	80XX	10000000	xxxxxxxx
4 mA + 1 QS	4.0625	01XX	00000001	xxxxxxxx
ORS	4.0000	00XX	00000000	xxxxxxxx

Table B, 8 bit operating mode				
Current input 0 mA ... 20 mA	Analog value [mA]	Process data input word		
		hex	bin	
			15 ... 8	7 ... 0
20 mA - 1 QS	19.9219	FFXX	11111111	xxxxxxxx
20 mA - 2 QS	19.8438	FEXX	11111110	xxxxxxxx
Middle	10.0000	80XX	10000000	xxxxxxxx
1 QS	0.0781	01XX	00000001	xxxxxxxx
ORS	0.0000	00XX	00000000	xxxxxxxx

Table C, 12 bit operating mode with channel number				
Current input 4 mA ... 20 mA	Analog value [mA]	Process data input word		
		hex	bin	
			15 ... 8	7 ... 0
20 mA - 1 QS	19.9961	7FF8	01111111	11111000
20 mA - 2 QS	19.9922	7FF0	01111111	11110000
Middle	12.0000	4000	01000000	00000000
4 mA + 1 QS	4.0039	0008	00000000	00001000
ORS	4.0000	0000	00000000	00000000

Table D, 12 bit operating mode with channel number				
Current input 4 mA ... 20 mA	Analog value [mA]	Process data input word		
		hex	bin	
			15 ... 8	7 ... 0
20 mA - 1 QS	19.9951	7FF8	01111111	11111000
20 mA - 2 QS	19.9902	7FF0	01111111	11110000
Middle	10.0000	4000	01000000	00000000
1 QS	0.0049	0008	00000000	00001000
ORS	0.0000	0000	00000000	00000000

15.2 Mode U

Process data input word for the voltage inputs (example)

8 bit operating mode				
Voltage input 0 V ... 10 V	Analog value [V]	Process data input word		
		hex	Binary (two's complement)	
			15 ... 8	7 ... 0
10 V - 1 QS	9.961	FFXX	11111111	xxxxxxxx
10 V - 2 QS	9.922	FEXX	11111110	xxxxxxxx
Middle	5.0000	80XX	10000000	xxxxxxxx
1 QS	0.039	01XX	00000001	xxxxxxxx
Zero	0.0000	00XX	00000000	xxxxxxxx

12 bit operating mode with channel number				
Voltage input 0 V ... 10 V	Analog value [V]	Process data input word		
		hex	Binary (two's complement)	
			15 ... 8	7 ... 0
10 V - 1 QS	9.9976	7FF8	01111111	11111000
10 V - 2 QS	9.9951	7FF0	01111111	11110000
Middle	5.0000	4000	01000000	00000000
1 QS	0.00244	0008	00000000	00001000
Zero	0.0000	0000	00000000	00000000