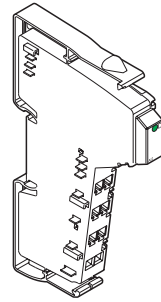# IB IL AI 2/SF

INTERBUS Inline Terminal With Two Analog Input Channels

Data Sheet 5564AC01   05/2001

5564A001

👉 This data sheet is intended to be used in conjunction with the "Configuring and Installing the INTERBUS Inline Product Range" user manual IB IL SYS PRO UM E.

Function

This terminal is used to measure analog voltage or current signals.

Features

– Two analog single-ended signal inputs for the connection of either voltage or current signals

– Connection of 2- and 3-wire sensors

– Three current measuring ranges:
  0 mA to 20 mA, ±20 mA, 4 mA to 20 mA

– Two voltage measuring ranges:
  0 V to 10 V, ±10 V

– Configuration of the independent channels through INTERBUS

– Measured values can be represented in four different formats

– Resolution independent of the representation format and the measuring range

– Process data update of both channels in 1.5 ms, maximum

– Diagnostic indicators
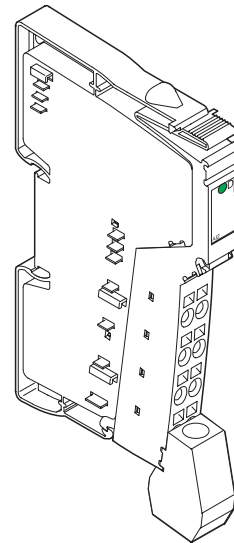
5564A010

Figure 1   IB IL AI 2/SF terminal with the connector plugged in

👉 Please note that the connector is not supplied with the terminal. Refer to the "Ordering Data" Table at the end of this data sheet to choose the appropriate connector for your application.

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Table of Contents

Local Diagnostic and Status Indicators

Des.	Color	Meaning
D	Green	Bus diagnostics

Terminal Assignment

Terminal Points	Signal	Assignment
1.1	**+U1**	Voltage input channel 1
2.1	**+U2**	Voltage input channel 2
1.2	**+I1**	Current input channel 1
2.2	**+I2**	Current input channel 2
1.3	**-1**	Return for channel 1 (common for current and voltage)
2.3	**-2**	Return for channel 2 (common for current and voltage)
1.4, 2.4	**Shield**	Shield connection

Figure 2   IB IL AI 2/SF terminal with an appropriate connector

Installation Instruction

High current flowing through the potential jumpers U_M and U_S raises the temperature of the potential jumpers and at the inside of the terminal. Note the following instruction to keep the current flowing through the potential jumpers of the analog terminals as low as possible:

All of the analog terminals need a separate main circuit!

If this is not possible in your application and if you use analog terminals in a main circuit together with other terminals, place the analog terminals behind all the other terminals at the end of the main circuit.

Internal Circuit Diagram

Key:

OPC	INTERBUS protocol chip
	Optocoupler
	DC/DC converter with electrical isolation
	Microprocessor with multiplexer and analog/digital converter
REF	Reference voltage
EEPROM	Electrically erasable programmable read-only memory
▷	Amplifier
	Coupling network
	Other symbols are explained in the IB IL SYS PRO UM E User Manual.
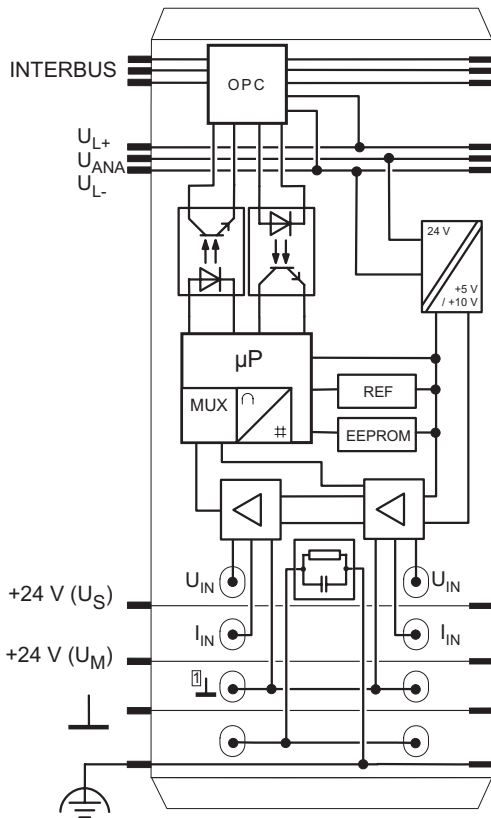
Figure 3   Internal wiring of the terminal points

Electrical Isolation
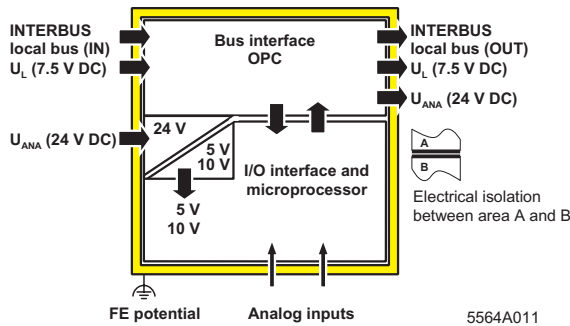
Figure 4   Electrical isolation of the function
areas

Connection

Do not connect voltages above ± 5 V to a current input. This damages the module electronics as the permissible maximum current of ±100 mA is exceeded.

Always connect sensors using shielded, twisted-pair cables.

Connect the shielding of the terminal above the shield connector clamp. With the clamp, the shield is connected with a high-resistance and capacitance to FE on the module side. Additional wiring is not necessary.

Connect the shielding of the sensor with PE potential.

Connection Examples

☞ Use a connector with shield connection when installing the sensor. Figure 5 and Figure 6 show the connection schematically (without shield connector).

Connection of Active Sensors

A

B

5564A004

Connection of Passive Sensors

IB IL 24 SEG/F

IB IL AI 2/SF

5564A005
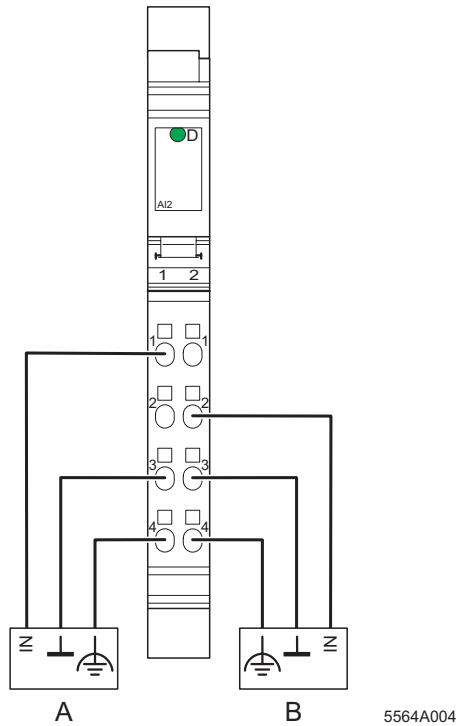
Figure 5   Connection of active sensors with 2-wire technology with shield connection

A   Active sensor with voltage output (channel 1)

B   Active sensor with current output (channel 2)
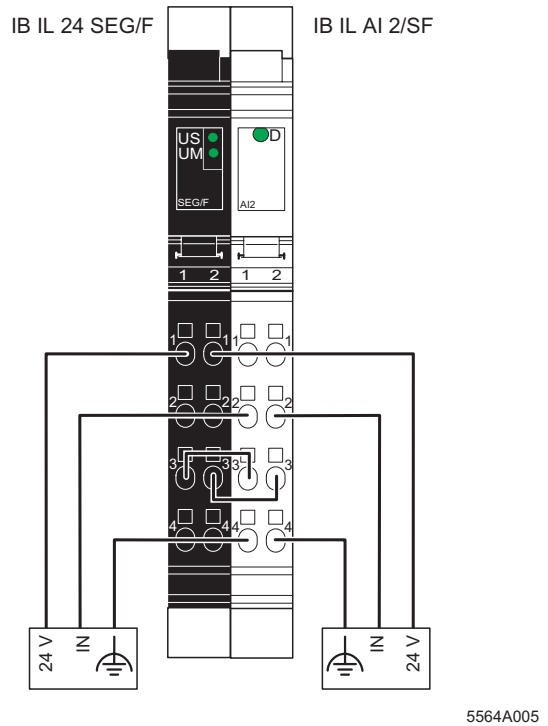
Figure 6   Connection of two passive sensors with 2-wire technology with shield connection

Figure 6 shows the passive sensor supply. The sensors are supplied through a preconnected segment terminal with a fuse. The sensors can also be supplied from an external power supply.

5564AC01

Connection for Battery Monitoring

⚠ Both reference inputs (minus inputs) of each IB IL AI 2/SF terminal are connected with each other. If signal sources are connected in series, wrong connections can lead to a short circuit of individual signal sources.
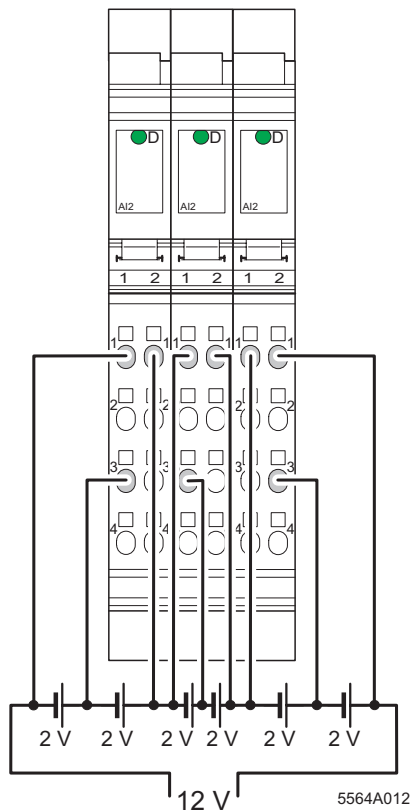
Because of the single-ended inputs, the following connections are necessary:

– Connect the reference input of a terminal between two voltage sources.

– Channel 1 measures with opposite polarity the first voltage source. The measured value must be adapted in the control system to the polarity.

Channel 2 measures with correct polarity the second voltage source.

Configure the terminal to bipolar (±10 V).

Figure 7   Connection for battery monitoring

Programming Data

ID code	$7F_{hex}$ (127_{dec})
Length code	02_{hex}
Input address area	4 bytes
Output address area	4 bytes
Parameter channel (PCP)	0 bytes
Register length (bus)	4 bytes

INTERBUS Process Data Words

Process Data Output Word for the Configuration of the Terminal (compare page 11)

INTERBUS reference	Word	Word x															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
"Byte-bit" view	Byte	Byte 0								Byte 1							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Channel 1	Assignment	1	0	0	0	0	0	Filter		0	0	Format		Measuring range			
Channel 2	Assignment	1	0	0	0	0	0	Filter		0	0	Format		Measuring range			

Assignment of the Terminal Points to the Process Data Input Words (compare page 12)

INTERBUS reference	Word	Word x															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
"Byte-bit" view	Byte	Byte 0								Byte 1							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Channel 1	Signal	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
		Terminal point 1.1: Voltage input Terminal point 1.2: Current input															
	Signal reference	Terminal point 1.3															
	Shield (FE)	Terminal point 1.4															
Channel 2	Signal	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
		Terminal point 2.1: Voltage input Terminal point 2.2: Current input															
	Signal reference	Terminal point 2.3															
	Shield	Terminal point 2.4															

INTERBUS OUT Process Data Output Words

With the two process data output words you can configure each channel of the terminal independently. The following configurations are possible:

– Selecting a measuring range according to the input signal

– Switching off averaging function

– Switchover of the formats of the measuring value representation

The configuration setting is not saved. It must be transmitted in each INTERBUS cycle.

After applying voltage (Power Up) to the Inline station, the message "Measured value invalid" (error code 8004_{hex}) appears in the process data input words. After 1 s (maximum) the preset configuration is accepted and the first measured value is available. If you change the configuration the corresponding channel is re-initialized. The message "Measured value invalid" (error code $E8004_{hex}$) appears in the process data input words for 100 ms (maximum).

Default:

Measuring range:	0 to 10 V
Averaging:	Switched on
Output format:	IL format

You cannot change the signal input type through the process data output words. Current or voltage measurement is selected by applying the measured signal to the current or voltage input.

In addition, select the corresponding measuring range through the process data output words.

Do not simultaneously apply current and voltage signals to an input channel as you will not receive valid measured values.
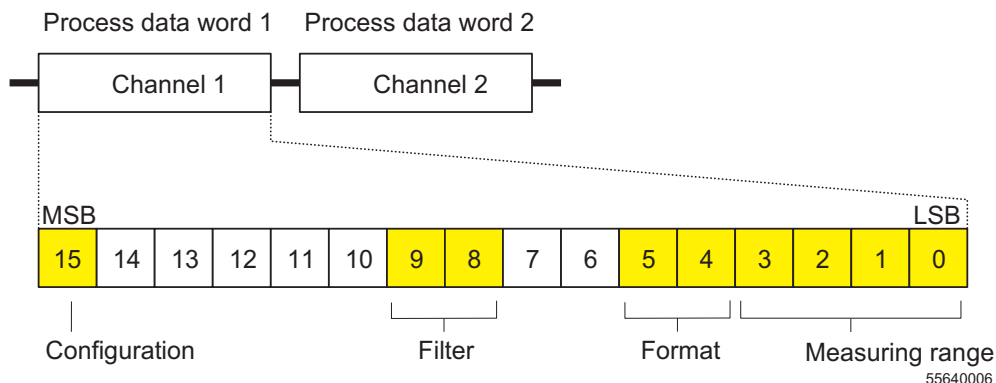
Figure 8   Process data output words

MSB   Most Significant Bit

One process data output word is available for the configuration of each channel.

You must set bit 15 of the corresponding output word to 1 to configure the terminal. If bit 15 = 0 the preset configuration is active.

Bit 9 and bit 8:

Code	Filter
00	**16-fold average (default)**
01	No filter
10, 11	Reserved

Bit 3 to bit 0:

Code	Measuring Range (Voltage)
0000	**0 V to 10 V (default)**
0001	±10 V
0010 to 0111	Reserved

☞   Set all reserved bits to 0.

LSB   Least Significant Bit

Bit 15:

Code	Configuration
0	**Default**
1	Configuration data

Bit 5 and bit 4:

Code	Format
00	**IB IL (15 bits) (default)**
01	IB ST (12 bits)
10	IB RT (15 bits)
11	Standardized representation

Code	Measuring Range (Current)
1000	0 mA to 20 mA
1001	±20 mA
1010	4 mA to 20 mA
1011 to 1111	Reserved

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INTERBUS IN Process Data Input Words

The measured values are transmitted, per channel, through the process data input words INTERBUS IN to the controller board or the computer.

Process data word 1   Process data word 2

| | Channel 1 | | Channel 2 | |

Format:

MSB															LSB	IL
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	RT
SB	AV															Standardized representation

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	ST
SB	AV												0/4	OC	OR	

5564A009
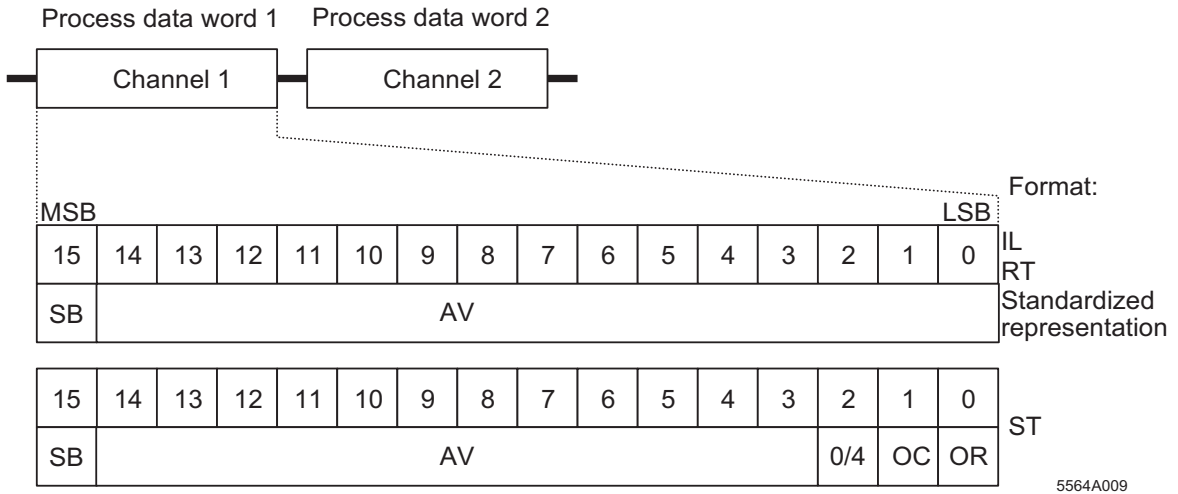
Figure 9   Sequence of the process data input words in the INTERBUS ring and representation of the bits of the first process data word in different formats

SB   Sign bit   OC   Open circuit

AV   Analog value   OR   Over range

0/4   Measuring range 4 to 20 mA

MSB   Most Significant Bit   LSB   Least Significant Bit

The process data formats "IB IL" and "Standardized representation" support extended diagnostics. The following error codes are possible:

Code (hex)	Error
8001	Over range
8002	Open circuit
8004	Measured value invalid/no valid measured value available
8010	Configuration invalid
8040	Terminal defective
8080	Under range

Formats for Representing the Measured Values

"IB IL" Format

The measured value is represented in bits 14 to 0. An additional bit (bit 15) is available as a sign bit.

This format supports extended diagnostics. Values > 8000_{hex} indicate an error. The error codes are listed on page 13.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SB	AV														

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Figure 10   Measured value representation in "IB IL" format (15 bits)

SB   Sign bit   AV   Analog value

This format is preset (default). To ensure that the terminal can be operated in previously used data formats, the measured value representation can be switched to different formats.

Significant Measured Values

☞ Some codes are used for diagnostic functions. Therefore, the resolution is not 15 bits but exactly 14.9886847 bits.

Measuring range 0 mA to 20 mA / 0 V to 10 V

Input Data Word (Two's Complement)		0 mA to 20 mA I_{Input}	0 V to 10 V U_{Input}
hex	dec	mA	V
8001	Over range	+21.6746	+10.837
7F00	32512	+21.6746	+10.837
7530	30000	+20.0	+10.0
0001	1	+0.66667 µA	+333.33 µV
0000	0	0	0
0000	0	< 0	< 0

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Measuring range -20 mA to +20 mA / -10 V to +10 V

Input Data Word (Two's Complement)		-20 mA to +20 mA I_{Input}	-10 V to +10 V U_{Input}
hex	dec	mA	V
8001	Over range	> +21.6746	> +10.837
7F00	32512	+21.6746	+10.837
7530	30000	+20.0	+10.0
0001	1	+0.66667 µA	+333.33 µV
0000	-1	0	0
FFFF	0	-0.66667 µA	-333.33 µV
8AD0	-30000	-20.0	-10.0
8100	-32000	-21.6746	-10.837
8080	Under range	<-21.6746	<-10.837

Measuring range 4 mA to 20 mA

Input Data Word (Two's Complement)		4 mA to 20 mA I_{Input}
hex	dec	mA
8001	Over range	> +21.339733
7F00	32512	+21.339733
7530	30000	+20.0
0001	1	+4.00053333
0000	0	+4.0 to 3.2
8002	Open circuit	<+3.2

"IB ST" Format

The measured value is represented in bits 14 to 3. The remaining 4 bits are: sign bit, measuring range, open circuit, and overrange.

This format corresponds to the data format used on INTERBUS ST modules.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SB	AV												0/4	OC	OR

55640007

Figure 11   Measured value representation in "IB ST" format (12 bits)

SB   Sign bit   OC   Open circuit

AV   Analog value   OR   Over range

0/4   Measuring range 4 to 20 mA

Significant Measured Values

Measuring range 0 mA to 20 mA / 0 V to 10 V

Input Data Word (Two's Complement)	0 mA to 20 mA I_{Input}	0 V to 10 V U_{Input}
hex	mA	V
7FF9	>21.5	>10.75
7FF8	20.0 to 21.5	10.00 to 10.75
7FF8	19.9951	9.9975
4000	10.0	5.0
0008	0.0048828	0.002441
0000	0	0

Measuring range -20 mA to +20 mA / -10 V to +10 V

Input Data Word (Two's Complement)	-20 mA to +20 mA I_{Input}	-10 V to +10 V U_{Input}
hex	mA	V
7FF9	>21.5	>10.75
7FF8	20.0 to 21.5	10.00 to 10.75
7FF8	19.9951	9.9975
0008	0.0048828	0.002441
0000	0	0
FFF8	-0.0048828	-0.002441
8000	-20.0 to -21.5	-10.00 to -10.75
8001	<-21.5	<-10.75

Measuring range 4 mA to 20 mA

Input Data Word (Two's Complement)	4 mA to 20 mA I_{Input}
hex	mA
7FFD	>21.5
7FFC	20.0 to 21.5
7FFC	19.9961
000C	4.003906
0004	3.2 to 4.0
0006	< 3.2

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"IB RT" Format

The measured value is represented in bits 14 to 0. An additional bit (bit 15) is available as a sign bit.

This format corresponds to the data format used on INTERBUS RT modules.

In this data format error codes or error bits are not defined. Open circuit is indicated through the positive final value $7FFF_{hex}$.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SB	AV														
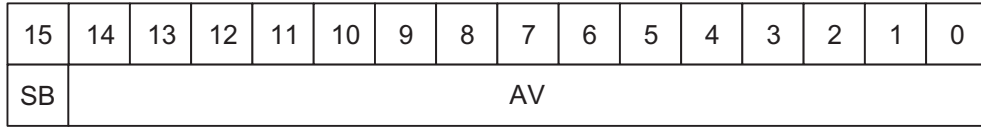
55641008

Figure 12   Measured value representation in "IB RT" format (15 bits)

SB   Sign bit   AV   Analog value

Significant Measured Values

Measuring range 0 mA to 20 mA / 0 V to 10 V

Input Data Word (Two's Complement)	0 mA to 20 mA I_{Input}	0 V to 10 V U_{Input}
hex	mA	V
7FFF	$\geq$ 19.999385	$\geq$ 9.999695
7FFE	19.9987745	9.999939
4000	10.0	5.0
0001	0.6105 µA	305.0 µV
0000	$\leq$ 0	$\leq$ 0

Measuring range -20 mA to +20 mA / -10 V to +10 V

Input Data Word (Two's Complement)	-20 mA to +20 mA I_{Input}	-10 V to +10 V U_{Input}
hex	mA	V
7FFF	≥ +19.999389	≥ +9.999939
7FF7	+19.998779	+9.99939
4000	+10.0	+5.0
0001	+0.61035 µA	+305.0 µV
0000	0	0
FFFF	-0.61035 µA	-305.0 µV
8001	-19.999389	-9.99939
8000	≤-20.0	≤-10.0

Measuring range 4 mA to 20 mA

Input Data Word (Two's Complement)	4 mA to 20 mA I_{Input}
hex	mA
7FFF	≥ 19.9995116
7FFE	19.9990232
4000	12.0
0001	0.4884 µA
0000	4.0
0000	3.2 to 4.0
7FFF	< 3.2

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"Standardized Representation" Format

The data is represented in bits 14 to 0. An additional bit (bit 15) is available as a sign bit.

In this format, data on the measuring range is standardized and represented in such a way that it indicates the corresponding value without conversion. In this format one bit has the value of 1 mV or 1 µA.

This format supports extended diagnostics. Values > 8000_{hex} indicate an error. The error codes are listed on page 13.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SB	AV														
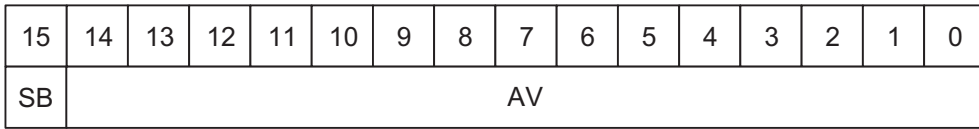
55641008

Figure 13   Measured value representation in "Standardized representation" format (15 bits)

SB   Sign bit   AV   Analog value

Significant Measured Values

Because of the representation standardization not all of the possible codes are used. In addition, some codes are used for diagnostic functions. Therefore, the resolution is not 15 bits but exactly 13.287713 bits.

Measuring range 0 V to 10 V

Input Data Word (Two's Complement)		0 V to 10 V U_Input
hex	dec	V
8001	Over range	> +10.837
2A55	10837	+10.837
2710	10000	+10.0
0001	1	+0.001
0000	0	≤ 0

Measuring range 0 mA to 20 mA

Input Data Word (Two's Complement)		0 mA to 20 mA I_Input
hex	dec	mA
8001	Over range	> +21.674
54AA	21674	+21.674
4E20	20000	+20.0
0001	1	+0.001
0000	0	≤ 0

Measuring range -10 V to +10 V

Input Data Word (Two's Complement)		-10 V to +10 V U_Input
hex	dec	V
8001	Over range	> +10.837
2A55	10837	+10.837
2710	10000	+10.0
0001	1	+0.001
0000	0	0
FFFF	-1	-0.001
D8F0	-10000	-10.0
D5A6	-10837	-10.837
8080	Under range	<-10.837

Measuring range -20 mA to +20 mA

Input Data Word (Two's Complement)		-20 mA to +20 mA I_Input
hex	dec	mA
8001	Over range	> +21.674
54AA	21674	+21.674
4E20	20000	+20.0
0001	1	+0.001
0000	0	0
FFFF	-1	-0.001
B1E0	-20000	-20.0
A656	-21674	-21.674
8080	Under range	<-21.674

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Measuring range 4 mA to 20 mA

Input Data Word (Two's Complement)		4 mA to 20 mA I_{Input}
hex	dec	mA
8001	Over range	> 21.339
43BB	17339	21.339
3E80	16000	20.0
0001	1	4.001
0000	0	4.0 to 3.2
8002	Open circuit	< 3.2

Example

Measured value representation in different data formats.

Measuring range: 0 mA to 20 mA

Measured value: 10 mA

Input data word

Format	HEX Value	DEC Value	Measured Value
IB IL	3A98	15 000	10 mA
IB ST	4000	16 384	10 mA
IB RT	4000	16 384	10 mA
Standardized representation	2710	10 000	10 mA

Technical Data

General	
Housing dimensions (width x height x depth)	12.2 mm x 120 mm x 71.5 mm (0.480 in. x 4.724 in. x 2.795 in.)
Weight	47 g (without connector)
Operating mode	Process data operation with 2 words
Connection type of the sensors	2- and 3-wire technology
Power supply of the sensors	With an external power supply or with an additional segment terminal with a fuse (IB IL 24 SEG/F)
Permissible temperature (operation)	-25°C to +55°C (-13°F to +131°F)
Permissible temperature (storage/transport)	-25°C to +85°C (-13°F to +185°F)
Permissible humidity (operation)	75% on average, 85% occasionally
☞ Ranging from -25°C to +55°C (-13°F to +131°F). Appropriate measures against increased humidity (> 85%) must be taken.	
Permissible humidity (storage/transport)	75% on average, 85% occasionally
☞ For a short period, slight condensation may appear on the housing if, for example, the terminal is brought into a closed room from a vehicle.	
Permissible air pressure (operation)	80 kPa to 106 kPa (up to 2000 m [6562 ft.] above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3000 m [9843 ft.] above sea level)
Degree of protection	IP 20 according to IEC 60529
Class of protection	Class 3 according to VDE 0106, IEC 60536

Deviations From Common Technical Data That Are Indicated in the IB IL SYS PRO UM E User Manual	
Noise Immunity Test According to EN 50082-2	
Electrostatic discharge (ESD) according to IEC 61000-4-2	Criterion B 6 kV contact discharge 6 kV air discharge

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Mechanical Demands	
Shock test according to IEC 60068-2-27	15g load for 11 ms, half sinusoidal wave, three shocks in each space direction and orientation 25g load for 6 ms, half sinusoidal wave, three shocks in each space direction and orientation

Interface	
INTERBUS interface	Data routing

Power Consumption	
Communications power U_L	7.5 V
Current consumption from U_L	Approximately 45 mA, typical
I/O supply voltage U_{ANA}	24 V DC
Current consumption of U_{ANA}	Approximately 12 mA, typical
Total power consumption	Approximately 625 mW, typical

Supply of the Module Electronics and I/O Through Bus Terminal/Power Terminal	
Connection method	Potential routing

Analog Inputs				
Number		2 analog single-ended inputs		
Signals/resolution in the process data word (quantization)				
Voltage	0 to 10 V	0 to 10.837 V 0 to 10.000 V 0 to 10.000 V 0 to 10.837 V	(Format IB IL) (Format IB ST) (Format IB RT) (Standardized repres.)	0.333 mV/LSB 2.441 mV/LSB 0.305 mV/LSB 1.000 mV/LSB
	±10 V	±10.837 V ±10.000 V ±10.000 V ±10.837 V	(Format IB IL) (Format IB ST) (Format IB RT) (Standardized repres.)	0.333 mV/LSB 2.441 mV/LSB 0.305 mV/LSB 1.000 mV/LSB
Current	0 to 20 mA	0 to 21.6746 mA 0 to 20.000 mA 0 to 20.000 mA 0 to 21.6746 mA	(Format IB IL) (Format IB ST) (Format IB RT) (Standardized repres.)	0.6666 µA/LSB 4.8828 µA/LSB 0.6105 µA/LSB 1.000 µA/LSB

Analog Inputs (continued)			
±20 mA	±21.6746 mA	(Format IB IL)	0.6666 µA/LSB
	±20.000 mA	(Format IB ST)	4.8828 µA/LSB
	±20.000 mA	(Format IB RT)	0.6105 µA/LSB
	±21.6746 mA	(Standardized repres.)	1.000 µA/LSB
4 mA to 20 mA	4 to 21.339 mA	(Format IB IL)	0.533 µA/LSB
	4 to 20.000 mA	(Format IB ST)	3.906 µA/LSB
	4 to 20.000 mA	(Format IB RT)	0.4884 µA/LSB
	4 to 21.339 mA	(Standardized repres.)	1.000 µA/LSB
Measuring value representation		In the formats	
		IB IL	(15 bits with sign bit)
		IB ST	(12 bits with sign bit)
		IB RT	(15 bits with sign bit)
		Standardized repres.	(15 bits with sign bit)
☞ For the measured value representation in the formats "IB IL" and "Standardized representation" observe the information on page 14 and page 20.			
Mean value generation		Over 16 measured values (can be switched off)	
Conversion time of the A/D converter		Approximately 120 µs	

Analog Input Stages	
Voltage inputs	
Input resistance	> 220 kΩ
Limit frequency (-3 dB) of the input filter	40 Hz
Process data update of both channels	< 1.5 ms
Behavior upon sensor failure	Goes to 0 V
Maximum permissible voltage between analog voltage inputs and analog reference potential	±32 V
Common mode rejection (CMR)	90 dB, minimum
Reference: Voltage input signal, valid for permissible DC common-mode voltage range	110 dB, typical
Permissible DC common-mode voltage for CMR	40 V between voltage input and FE

Analog Input Stages (continued)	
Current inputs	
Input resistance	50 Ω (shunt)
Limit frequency (-3 dB) of the input filter	40 Hz
Process data update of both channels	< 1.5 ms
Behavior upon sensor failure	Goes to 0 mA / 4 mA
Maximum permissible voltage between analog current inputs and analog reference potential	±5 V (corresponding with 100 mA across the sensor resistances)
Common mode rejection (CMR)	90 dB, minimum
Reference: Current input signal, valid for permissible DC common-mode voltage range	110 dB, typical
Permissible DC common-mode voltage for CMR	40 V between current input and FE
Permissible current, maximum	±100 mA

Tolerance and Temperature Response of the Voltage Inputs (The error indications refer to the measuring range final value of 10 V.)		
	Typical	**Maximum**
Error at 23°C (73.4°F)		
Offset error	±0.03%	±0.06%
Gain error	±0.05%	±0.10%
Differential non-linearity	±0.10%	±0.20%
Total error of the voltage inputs at 23°C (73.4°F) **Offset error + gain error + linearity error**	±0.15%	±0.30%
Temperature response at -25°C to +55°C (-13°F to +131°F)		
Offset drift T_{KVO}	±6 ppm/K	±12 ppm/K
Gain drift T_{KG}	±30 ppm/K	±50 ppm/K
Total voltage drift $T_{Ktot} = T_{KVO} + T_{KG}$	±36 ppm/K	±62 ppm/K
Total error of the voltage inputs **(-25°C [-13°F] to +55°C [+131°F])** **Offset error + gain error + linearity error + drift error**	±0.30%	±0.50%

Tolerance and Temperature Response of the Current Inputs
(The error indications refer to the measuring range final value of 20 mA.)

	Typical	Maximum
Error at 23°C (73.4°F)		
Offset error	±0.03%	±0.06%
Gain error	±0.10%	±0.10%
Differential non-linearity	±0.10%	±0.30%
Total error of the current inputs at 23°C (73.4°F) **Offset error + gain error + linearity error**	±0.20%	±0.40%
Temperature response at -25°C to +55°C (-13°F to +131°F)		
Offset drift T_{KIO}	±6 ppm/K	±12 ppm/K
Gain drift T_{KG}	±30 ppm/K	±50 ppm/K
Total drift $T_{Ktot} = T_{KIO} + T_{KG}$	±36 ppm/K	±62 ppm/K
Total error of the current inputs (-25°C [-13°F] to +55°C [+131°F]) offset error + gain error + linearity error + drift error	±0.35%	±0.60%

Additional Tolerances Influenced by Electromagnetic Fields

Type of electromagnetic interference	Typical deviation of the measuring range final value (voltage input)		Typical deviation of the measuring range final value (current input)	
	Relative	Absolute	Relative	Absolute
Electromagnetic fields; field strength 10 V/m according to IEC 61000-4-3	< ±2%	< ±200 mV	< ±2%	< ±400 µA
Conducted interference Class 3 (test voltage 10 V) according to IEC 61000-4-6	< ±1%	< ±100 mV	< ±1%	< ±100 µA
Fast transients 4 kV supply, 2 kV input according to IEC 61000-4-4	< ±1%	< ±100 mV	< ±1%	< ±100 µA

Safety Devices

Surge voltage	Suppressor diodes in the analog inputs

Electrical Isolation
⚠ To provide electrical isolation between the logic level and the I/O area it is necessary to supply the bus terminal and the sensors using a power terminal from separate power supplies. Interconnection of power supply units in the 24 V range is not allowed! (For detailed information refer to the user manual.)

Common potentials
24 V main power, 24 V segment voltage, and GND have the same potential. FE (functional earth ground) is a separate potential area.

Separate system potentials consisting of bus terminal/power terminal and I/O terminal	
- Test distance	**- Test voltage**
5 V supply incoming remote bus / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min.
5 V supply outgoing remote bus / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min.
7.5 V supply (bus logic) / 24 V supply U_{ANA} / I/O	500 V AC, 50 Hz, 1 min.
7.5 V supply (bus logic) / 24 V supply U_{ANA} / functional earth ground	500 V AC, 50 Hz, 1 min.
I/O / functional earth ground	500 V AC, 50 Hz, 1 min.

Error Messages to the Higher-Level Control or Computer System	
Breakdown of the internal voltage supply	Yes
I/O error/user error	Yes, error message through the process data input words (see page 12)

Ordering Data

Description	**Order Designation**	**Order No.**
Terminal with two analog input channels	IB IL AI 2/SF	27 26 28 5
Connector with shield connection, pack of 5	IB IL SCN-6 SHIELD	27 26 35 3
"Configuring and Installing the INTERBUS Inline Product Range" user manual	IB IL SYS PRO UM E	27 43 04 8

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