

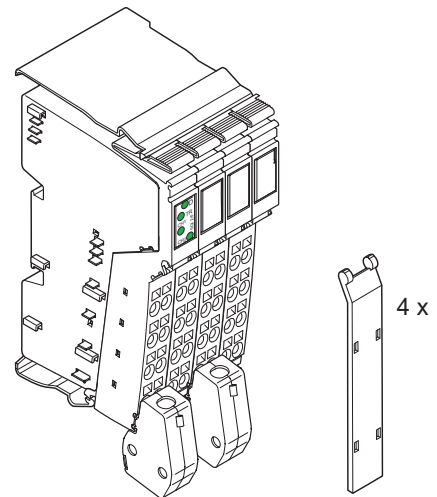
# IB IL SGI 2/F ...

**Inline terminal with two fast analog input channels for connecting strain gauges**

## AUTOMATION

Data sheet  
7210\_en\_02

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### 1 Function description

The terminal is designed for use within an Inline station. This terminal is a fast two-channel input module used to connect load cells, force transducers, mass pressure transducers, and similar devices based on strain gauges.

The strain gauges can be connected using 6 or 4-wire technology. The strain gauge output signals are measured in each bus cycle and updated in the process data (bus-synchronous process data update). The terminal is designed for control system applications with increased speed requirements.

There are two options for data exchange:

- Via process data (both inputs in one bus cycle)
- Via PCP (both inputs in the "Analog Values" PCP object)

The measuring values are represented by standardized 16-bit values.

### Features

- Two inputs for the strain gauges
- Sensor supply voltage provided by the terminal, no external power supply required
- Connection of strain gauges in 6 and 4-wire technology
- Communication via either process data or parameter channel (PCP)
- Channels are configured independently of one another using the bus system
- Bus-synchronous process data update
- Diagnostic indicators



A short circuit in the strain gauge supply at one of the two channels also prevents measured data acquisition at the other channel for the duration of the short circuit.



This data sheet only is valid in connection with the IL SYS INST UM E user manual (see "Documentation" on page 3).



Make sure you always use the latest documentation.  
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This data sheet is valid for all products listed on the following page.

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## 2 Ordering data

### Products

Description	Type	Order No.	Pcs./Pkt.
Inline terminal with two analog input channels for connecting strain gauges, without accessories, transmission speed of 500 kbps	IB IL SGI 2/F	2878434	1
Inline terminal with two analog input channels for connecting strain gauges; complete with accessories (connectors and labeling fields), transmission speed of 500 kbps	IB IL SGI 2/F-PAC	2878638	1
Inline terminal with two analog input channels for connecting strain gauges, without accessories, transmission speed of 2 Mbps	IB IL SGI 2/F 2MBD	2878531	1
Inline terminal with two analog input channels for connecting strain gauges; complete with accessories (connectors and labeling fields), transmission speed of 2 Mbit/s	IB IL SGI 2/F-2MBD-PAC	2878735	1



You need two connectors with shield connection and two standard connectors for the IB IL SGI 2/F and IB IL SGI 2/F 2MBD terminals.

### Accessories

Description	Type	Order No.	Pcs./Pkt.
Inline shield connector for analog Inline terminals, without color print	IB IL SCN-6 SHIELD	2726353	5
Connector for digital single-channel, two-channel or 8-channel Inline terminals	IB IL SCN-8	2726337	10
Shield connection clamp for applying the shield on busbars, 8 mm diameter	SK8	3025163	10
Shield connection clamp for applying the shield on busbars, 14 mm diameter	SK14	3025176	10
Shield connection clamp for applying the shield on busbars, 20 mm diameter	SK20	3025189	10
Shield connection clamp for applying the shield on busbars, 35 mm diameter	SK35	3026463	10
Support for assembly on DIN rails for 10 mm x 3 mm busbars	AB-SK	3025341	10
Support for mounting on the NS 35/7,5 DIN rail, for 10 mm x 3 mm busbars	AB-SK 65	3026489	10
Support for direct mounting with contact to the mounting surface	AB-SK/E	3026476	10
PEN conductor busbar, 3 mm x 10 mm, length: 1000 mm	NLS-CU 3/10	0402174	1
Power terminal, cross section: 0.5 - 4 mm <sup>2</sup> , width: 7 mm, Color: Gray	AK 4	0404017	50
Power terminal, cross section: 0.5 - 4 mm <sup>2</sup> , width: 7 mm, Color: Green/yellow	AK G GNYE	0421029	50
Power terminal, cross section: 0.5 - 4 mm <sup>2</sup> , width: 7 mm, Color: Black	AKG 4 BK	0421032	50

### Documentation

Description	Type	Order No.	Pcs./Pkt.
"Automation terminals of the Inline product range" user manual	IL SYS INST UM E	2698737	1

### 3 Technical data

#### General data

Housing dimensions (width x height x depth)	48.8 mm x 120 mm x 71.5 mm
Weight	125 g without connectors; 190 g with connectors
Operating mode	Process data mode with 3 words/1 PCP word
Strain gauge connection method	6 and 4-wire technology
Ambient temperature (operation)	-25°C to +55 °C
Ambient temperature (storage/transport)	-25°C to +85 °C
Permissible humidity (operation/storage/transport)	10% to 95% according to DIN EN 61131-2
Permissible air pressure (operation/storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20 according to IEC 60529
Class of protection	Class 3 in acc. with VDE 0106, IEC 60536
Connection data for Inline connectors	
Connection method	Spring-cage terminal
Conductor cross-section	0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup> (solid or stranded), 24 - 16 AWG

#### Interface

Local bus	Data routing
-----------	--------------

#### Transmission speed

IB IL SGI 2/F (-PAC)	500 kbps
IB IL SGI 2/F 2MBD (-PAC)	2 Mbps

#### Power consumption

	500 kbps	2 Mbps
Communications power $U_L$	7.5 V	7.5 V
Current consumption from $U_L$	75 mA, typical	100 mA, typical
I/O supply voltage $U_{ANA}$	24 V DC	24 V DC
Current consumption at $U_{ANA}$		
Without strain gauge	8 mA, typical	8 mA, typical
With maximum load of 60 $\Omega$	32 mA (at $U_V = 5$ V), typical	32 mA (at $U_V = 5$ V), typical
Total power consumption	0.755 W, typical	0.942 W, typical

#### Supply of the module electronics and I/O through the bus coupler/power terminal

Connection method	Potential routing
-------------------	-------------------

#### Outputs

Number	2 voltage outputs ( $U_V = 3.3$ V, $U_V = 5$ V)
Total impedance of the Inline terminal	> 58.3 $\Omega$ (typical)
Maximum current at $U_V = 3.3$ V	$I_{max} = 55$ mA (typical)
Maximum current at $U_V = 5$ V	$I_{max} = 85$ mA (typical)

Analog inputs	
Number	Two input channels for strain gauges (four voltage inputs)
Connection of signals	6 or 4-wire, twisted pair shielded cable
Voltage inputs	
Jumper difference $U_d$	Two, can be configured by selecting the characteristic and the jumper supply
Jumper voltage $U_0$	3.3 V $\pm$ 0.5 V or 5 V $\pm$ 0.5 V
Characteristics	
Unipolar	+1 mV/V, +2 mV/V, +3 mV/V, +4 mV/V
Bipolar	$\pm$ 1 mV/V, $\pm$ 2 mV/V, $\pm$ 3 mV/V, $\pm$ 4 mV/V
Measured value representation	15 bits + sign bit
Process data update	Once every bus cycle (bus synchronous)
Bus cycle time	$\geq$ 1 ms
Jumper difference input limit frequency	1.6 kHz (typical)

Tolerances at $T_A = 25^\circ\text{C}$		
Nominal characteristic value	Relative deviation in % related to the measuring range final value	
	Typical	Maximum
Unipolar 1 mV/V, 2 mV/V, 3 mV/V, 4 mV/V	$\pm$ 0.1%	$\pm$ 0.3%
Bipolar $\pm$ 1 mV/V, $\pm$ 2 mV/V, $\pm$ 3 mV/V, $\pm$ 4 mV/V	$\pm$ 0.2%	$\pm$ 0.6%

The typical values contain the typical offset error, gain error and linearity error in the respective configuration related to the positive measuring range up to 100% of the nominal characteristic value. This data is valid for nominal operation (preferred mounting position,  $U_S = 24\text{ V}$ ) with 16-sample average value filter. The maximum tolerance values represent the worst case measurement inaccuracy. Besides the maximum offset error, the gain error and the linearity error, the maximum tolerance values also comprise the longtime drift as well as the maximum tolerances of the test and calibration equipment.

Please also observe the values for temperature drift and the tolerances influenced by EMI.

This data is valid for at least twelve months.

Additional tolerances influenced by electromagnetic fields	
Type of electromagnetic interference	Relative deviation in % related to the measuring range final value
Electromagnetic fields, field strength 10 V/m in acc. with EN 61000-4-3	$< \pm$ 0.7%
Conducted interference, Class 3 (10 V test voltage) according to EN 61000-4-6	$< \pm$ 0.2%
Fast transients (burst) up to an interference voltage of $\pm$ 2.2 kV according to EN 61000-4-4	$< \pm$ 0.3%
You can minimize the interference by connecting the sensor cable shield to the DIN rail in front of the terminal via a shield connection clamp (see "Accessories" on page 3).	

Temperature and drift response ( $T_A = 25^\circ\text{C}$ to $55^\circ\text{C}$ )		
	Relative drift in ppm/K related to the measuring range final value	
	Typical	Maximum
Unipolar 1 mV/V, 2 mV/V, 3 mV/V, 4 mV/V	15 ppm/K	50 ppm/K
Bipolar $\pm$ 1 mV/V, $\pm$ 2 mV/V, $\pm$ 3 mV/V, $\pm$ 4 mV/V	500 ppm/K	980 ppm/K

The typical values contain the typical offset value and gain value in the respective configuration in the temperature range from  $-25^\circ\text{C}$  up to  $+55^\circ\text{C}$  related to the positive measuring range up to 100% of the nominal characteristic value. This data is valid for nominal operation (preferred mounting position,  $U_S = 24\text{ V}$ ) with 16-sample average value filter.

The maximum tolerance values represent the worst case measurement inaccuracy. Besides the maximum offset drift and gain drift, they also comprise the longtime drift as well as the maximum tolerances of the test and calibration equipment in the temperature range from  $-25^\circ\text{C}$  up to  $+55^\circ\text{C}$ .

**Protective equipment**

Short-circuit protection	Yes
--------------------------	-----

**Electrical isolation****Common potentials**

24 V main voltage  $U_M$ , 24 V segment voltage  $U_S$ , and GND have the same potential. FE is a separate potential area.

**Separate potentials in the terminal****Test distance**

7.5 V supply (bus logic)/  
±5 V analog supply (analog I/O)

7.5 V supply (bus logic) / functional earth ground

±5 V analog supply (analog I/O)/functional earth ground

**Test voltage**

600 V AC, 50 Hz, 1 min

600 V AC, 50 Hz, 1 min

600 V AC, 50 Hz, 1 min

**Error messages to the higher-level control or computer system**

Failure of the internal I/O voltage supply	Yes, I/O error message sent to the bus terminal
--	---

Failure of or insufficient communications power $U_L$	Yes, I/O error message sent to the bus terminal
---	---

**Error messages via process data**

Peripheral fault/user error	Yes (see page 17)
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**Approvals**

For the latest approvals, please visit [www.download.phoenixcontact.com](http://www.download.phoenixcontact.com).

## 4 Local diagnostic and status indicators and terminal point assignment

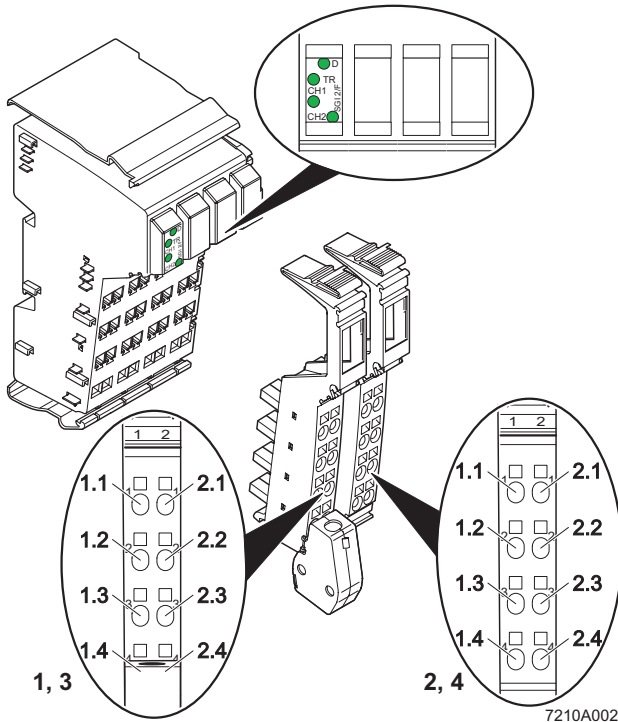


Figure 1 Terminal with an appropriate connector

### 4.1 Local diagnostic and status indicators

Des.	Color	Meaning
<b>D</b>	Green	Diagnostics
<b>TR</b>	Green	PCP active
<b>CH1</b>	Green	Diagnostic indicator of channel 1
		ON: Channel 1 OK OFF: Channel 1 not connected or not supplied or open circuit
<b>CH2</b>	Green	Diagnostic indicator of channel 2
		ON: Channel 2 OK OFF: Channel 2 not connected or not supplied or open circuit

### 4.2 Function identification

Green

2 Mbps: White stripe in the vicinity of the D LED

### 4.3 Terminal point assignment

Terminal points	Signal	Assignment
<b>Connectors 1 and 3</b>		
1.1	$+U_V$	Jumper supply $U_V$
2.1	$GND_{UV}$	
1.2	$+U_0$	Jumper voltage $U_0$
2.2	$-U_0$	
1.3	$+U_d$	Jumper difference $U_d$
2.3	$-U_d$	
1.4, 2.4	FE	Shielding
<b>Connectors 2 and 4</b>		
1.1	5 V	Optional voltages to supply the jumper
2.1	3.3 V	
1.2, 2.2	$+U_V$	Routing of the selected supply voltage to the "Jumper supply $U_V$ " connection on connector 1 or 3
1.3, 2.3	-	Not used
1.4, 2.4	FE	Shielding



Connect the terminal point of the selected voltage for the jumper supply to terminal point  $+U_V$  on connector 2 (or 4). Terminal points  $+U_V$  on slot 2 (or 4) are connected internally to terminal point  $+U_V$  on slot 1 (or 3) (see Figure 2). Therefore, the selected voltage at  $+U_V$  is available on slot 1 (or 3) (see also "Connection examples" on page 10).

## 5 Internal circuit diagram

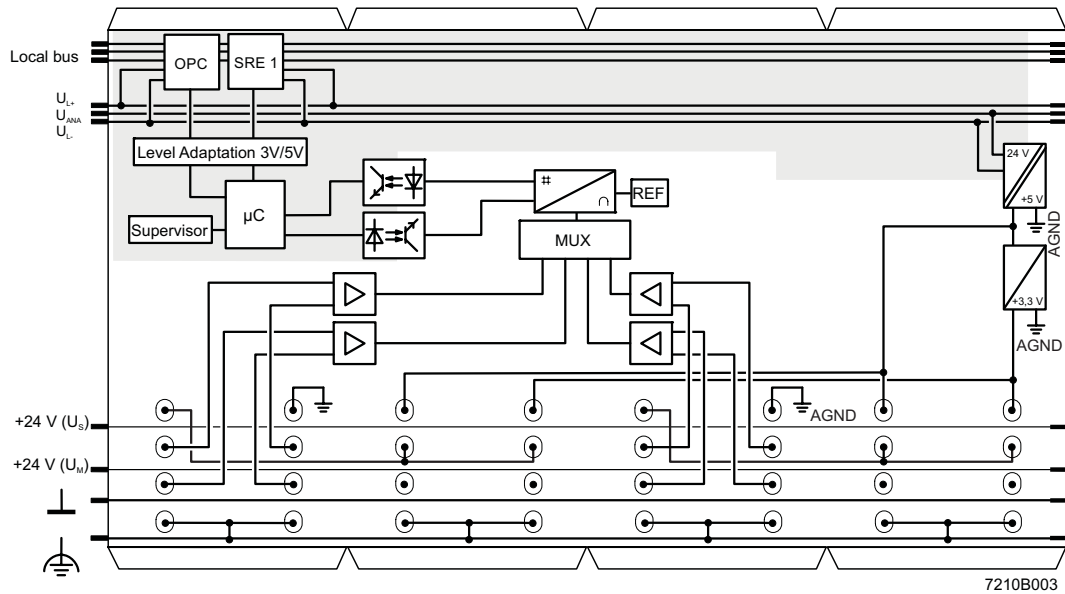














Figure 2 Internal circuit diagram

Key:

	Protocol chip		Analog/digital converter
	Register expansion		Reference voltage
	Level adaptation		Multiplexer
	Hardware monitoring		Amplifier
	Microcontroller		DC/DC converter with electrical isolation
	Optocoupler		
	Other symbols used are explained in the IL SYS INST UM E user manual.		



## 6 Electrical isolation

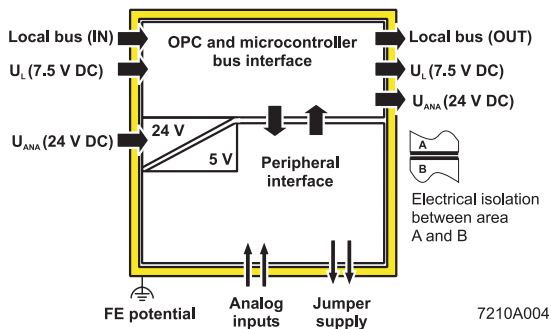


Figure 3 Electrical isolation of the individual function areas

## 7 Installation instructions

High current flowing through potential jumpers  $U_M$  and  $U_S$  leads to a temperature rise in the potential jumpers and inside the terminal. Observe the following instructions to keep the current flowing through the potential jumpers of the analog terminals as low as possible:



### Create a separate main circuit for the analog terminals

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

## 8 Connection notes

### Connecting the strain gauges



Connect the strain gauges using shielded twisted pair cables.

### Shield connection



Only connect the shielding at one point, preferably to the terminal. If the shield is securely connected to the sensor, insulate the shield on the terminal side.

### Unused channels

For unused channels, follow the instructions for parameterization (see notes on bit 15 on page 15).

## 9 Connection examples



The IB IL SGI 2/F terminal can measure both unipolar and bipolar jumper differences. Observe the polarity when connecting  $+U_d$  and  $-U_d$ .

If the analog terminal expects unipolar jumper differences, the signal excursion may be negative in the worst-case scenario. The measured value would therefore always be 0. In this case, adapt the signal excursion to the input voltage range by switching cables  $+U_d$  and  $-U_d$ .

If the analog terminal is set to a bipolar jumper difference, the signal excursion may be mixed up in the sign bit in the worst-case scenario. In this case, adapt the signal excursion to the input voltage range again by switching cables  $+U_d$  and  $-U_d$ .

Connections  $+U_0$  and  $-U_0$  are led back to a unipolar input. If the cables are mixed up, the terminal indicates a configuration error.

### 9.1 6-wire connection (several strain gauge load cells per channel)

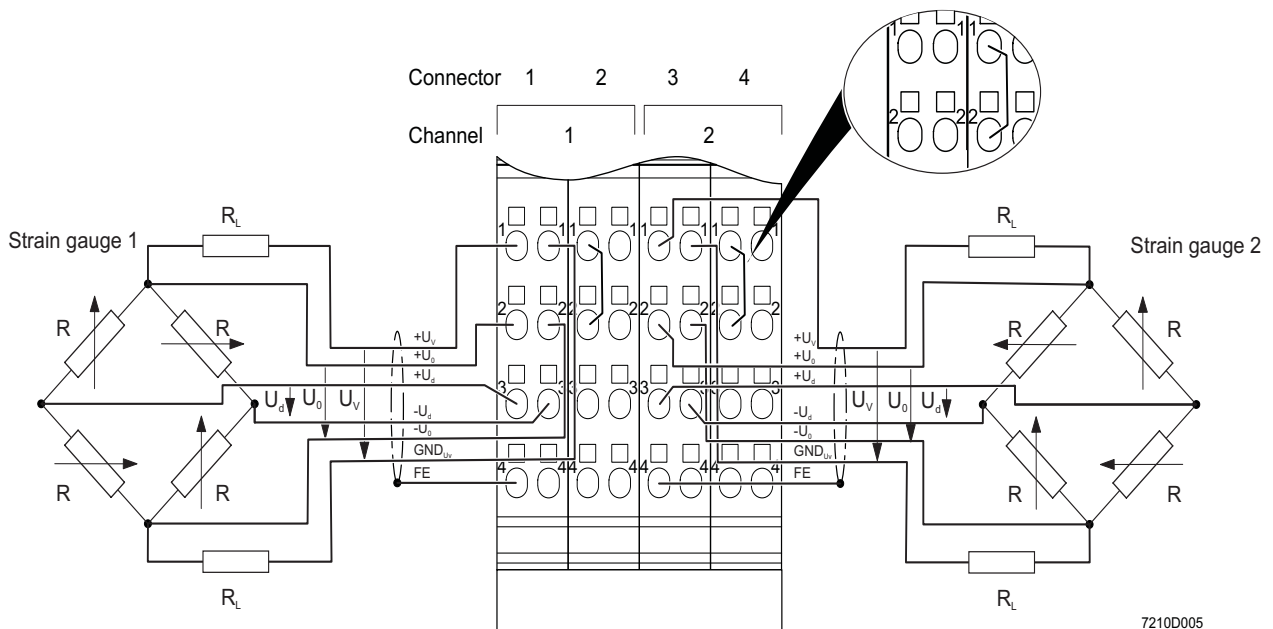


Figure 4 Connection of strain gauges in 6-wire technology

$R_L$ : Cable resistance

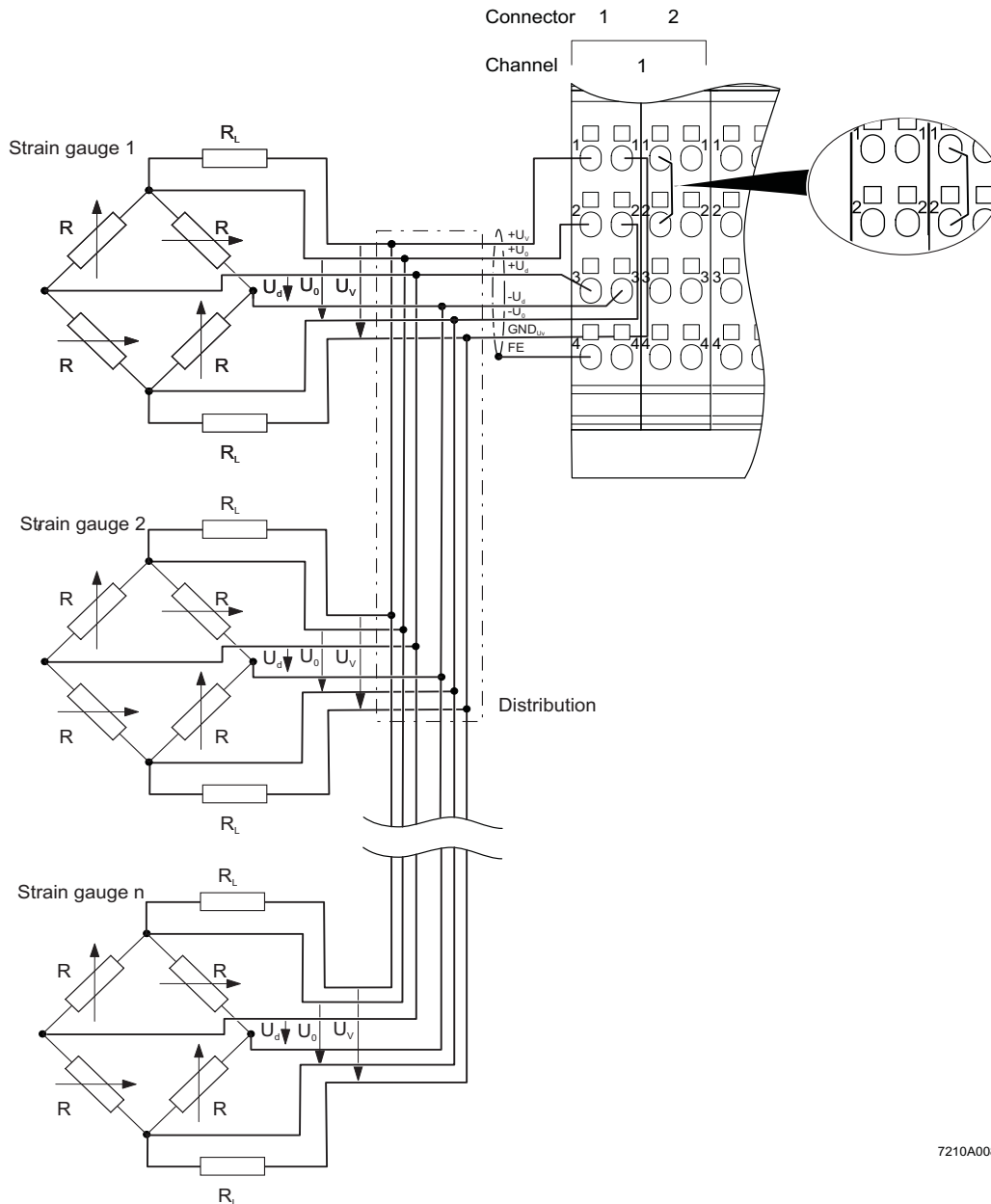
**Channel 1:** Connect the strain gauge to connector 1 using 6-wire technology. At connector 2 select the jumper supply level. The terminal provides supply voltages of 5 V and 3.3 V. Connections  $+U_V$  of connector 1 and  $+U_V$  of connector 2 are connected internally. At connector 2, connect either 5 V or 3.3 V to  $+U_V$ . This supplies the 6-wire connection of channel 1 with power.

**Channel 2:** Connect the strain gauge to connector 3 using 6-wire technology. At connector 4 select the jumper supply level. The terminal provides supply voltages of 5 V and 3.3 V. Connections  $+U_V$  of connector 3 and  $+U_V$  of connector 4 are connected internally. At connector 4, insert a jumper to connect either 5 V or 3.3 V to  $+U_V$ . This supplies the 6-wire connection of channel 2 with power.



Channels 1 and 2 can be supplied with different supply voltages (5 V or 3.3 V).

9.2 6-wire connection (several strain gauge load cells per channel)



7210A008

Figure 5 Connection of several strain gauges in 6-wire technology

$R_L$ : Cable resistance



In this operating mode you may connect several strain gauge load cells in parallel to connector 1 (channel 1) and/or connector 3 (channel 2), depending on the impedance of the strain gauge used.

Please note, that the total impedance of the wired Inline terminal (channel 1 and channel 2) must not be lower than  $58.3 \Omega$  (typically).

**Channel 1:** Connect the required number of strain gauges in parallel to connector 1 using 6-wire technology. At connector 2 select the jumper supply level. The terminal provides supply voltages of 5 V and 3.3 V. Connections  $+U_V$  of connector 1 and  $+U_V$  of connector 2 are connected internally. At connector 2, connect either 5 V or 3.3 V to  $+U_V$ . This supplies the 6-wire connection of channel 1 with power.

**Channel 2:** Connect the required number of strain gauges to connector 3 using 6-wire technology. At connector 4 select the jumper supply level. The terminal provides supply voltages of 5 V and 3.3 V. Connections  $+U_V$  of connector 3 and  $+U_V$  of connector 4 are connected internally. At connector 4, insert a jumper to connect either 5 V or 3.3 V to  $+U_V$ . This supplies the 6-wire connection of channel 2 with power.



Channels 1 and 2 can be supplied with different supply voltages (5 V or 3.3 V).

### 9.3 4-wire termination

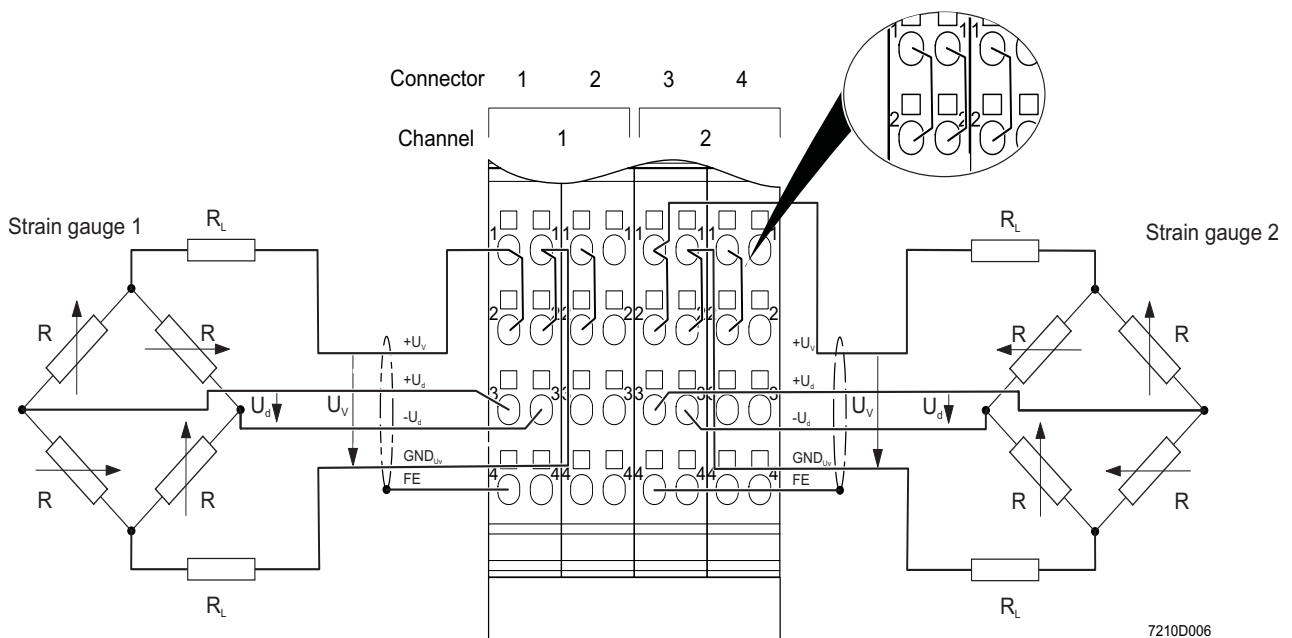


Figure 6 Connection of strain gauges in 4-wire technology (channel 1 and channel 2)

$R_L$ : Cable resistance

**Channel 1/channel 2:** Strain gauges can also be connected to the terminal in 4-wire technology. In this case, connect connections  $+U_V$  to  $+U_0$  and  $GND_{UV}$  to  $-U_0$  (magnified in the diagram for channel 2) at the connector for the relevant channel (connector 2 and/or 3).

There is no temperature and long-term drift compensation for the connecting cable in 4-wire technology.

**9.4 Permissible characteristics according to the jumper supply**

The table below indicates which characteristic can be configured for which jumper supply.

Characteristic	U <sub>V</sub> = 3.3 V	U <sub>V</sub> = 5 V
+1 mV/V	Yes	Yes
±1 mV/V	Yes	Yes
+2 mV/V	Yes	Yes
±2 mV/V	Yes	Yes
+3 mV/V	Yes	Yes
±3 mV/V	Yes	No
+4 mV/V	Yes	Yes
±4 mV/V	Yes	No

**10 Programming data/configuration data**

**Local bus (INTERBUS))**

ID code	DF <sub>hex</sub> (223 <sub>dec</sub> )
Length code	03 <sub>hex</sub>
Process data channel	48 bits
Input address area	3 words
Output address area	3 words
Parameter channel (PCP)	1 word
Register length (bus)	4 words

**Other bus systems**



For the programming/configuration data of other bus systems, please refer to the corresponding electronic device data sheet (e.g., GSD, EDS).

**11 Process data**

The terminal occupies three process data words and one PCP word.

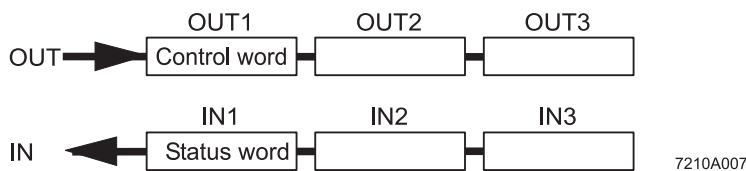


Figure 7 Order of the process data words

## 12 OUT process data output words

Three OUT process data words are available.

Configure the terminal channels via the OUT process data words.

Where:

- Output word OUT1 contains the command
- Output word OUT2 contains the parameters for channel 1
- Output word OUT3 contains the parameters for channel 2

The following configurations are possible:

Configuration	Short designation	Default
Selection of mean value generation (filtering)	Filter	16-sample mean value
Characteristic for calculating the gain (see "Startup/measuring jumper detuning" on page 21)	Characteristic	$\pm 2$ mV/V

Configuration errors are indicated in the status word. The configuration settings are stored in a volatile memory.

If you change the configuration, the message "Measured value invalid" appears (diagnostic code 8004<sub>hex</sub>), until new measured values are available.

### 12.1 Output word OUT1 (control word)

		OUT1															
Bit		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment		Command code								0	0	0	0	0	0	0	0

Bit 15 to bit 8 (command code):

Bit 15 to bit 8	OUT1	Command function
0 0 0 0 0 0 0 0	0000 <sub>hex</sub>	Read measured values
0 0 0 1 0 0 0 C	1x00 <sub>hex</sub>	Read configuration channel-by-channel in IN2 (C = Channel number; 0 = Channel 1, 1 = Channel 2)
0 0 1 1 0 0 0 0	3000 <sub>hex</sub>	Read min. value; IN2: Min. value channel 1, IN3: Min. value channel 2
0 0 1 1 0 0 0 1	3100 <sub>hex</sub>	Read max. value; IN2: Max. value channel 1, IN3: Max. value channel 2
0 0 1 1 0 0 1 0	3200 <sub>hex</sub>	Delete minimum and maximum value of channel 1
0 0 1 1 0 0 1 1	3300 <sub>hex</sub>	Delete minimum and maximum value of channel 2
0 0 1 1 1 1 0 0	3C00 <sub>hex</sub>	Read firmware version and module ID in IN2.
0 1 0 0 0 0 0 0	4000 <sub>hex</sub>	Configure device; configuration for channel 1 in OUT2 and for channel 2 in OUT3



During the transient response (e.g., following a configuration command), the fluctuating measured values may exceed the minimum and maximum values. Therefore, at the start of acquisition delete the minimum and maximum values using command 3200<sub>hex</sub> and/or 3300<sub>hex</sub>.

One measurement is performed for each bus cycle.

## 12.2 Output word OUT2 and OUT3 (parameter word)

For command 4000<sub>hex</sub> the parameters must be specified in OUT2 and OUT3. This parameter word is only evaluated for this command.

Bit	OUT2 and OUT3															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	1	0	0	0	0	0	0	Filter	0	0	0	0	0	Characteristic		

Bit 15 The set bit ensures that the relevant channel is configured.

In the event that only one channel is used and there is no jumper supply at the other channel due to missing wire jumpers, the configuration is acknowledged negatively in the status word. In this case, set bit 15 of the configuration word of the unused channel to 0 to remedy the situation.

Filter Selection of mean value generation. After every conversion, the measured value is saved in a mean value memory via which the mean value is generated. The memory size can be selected with the filter option. E.g., for a 16-sample mean value, the mean value is generated using the last 16 measured values.

Characteristic Depending on the characteristic in relation to the available jumper supply, the terminal calculates the required gain for the configured input and thus has the best possible resolution in the unipolar and bipolar area.

If in the **unipolar** area the strain gauge is supplied with a load greater than 130% or a negative load, the jumper detuning is outside the measuring range and an error is triggered.

If in the **bipolar** area the strain gauge is supplied with a load greater than 130% in the positive or negative direction, the jumper detuning is outside the measuring range and an error is triggered.



If invalid parameters are specified in the parameter word, the command will not be executed. The command is acknowledged in the input words with the error bit set.

## 12.3 Parameters for configuration

The values in **bold** are default settings.

Bit 15:

Code		Configure
dec	bin	
0	0	Channel is not configured
1	1	Channel is configured

Bit 8:

Code		Filter
dec	bin	
0	0	<b>No mean value</b>
1	1	16-sample mean value

Bit 3 to bit 0:

Code		Characteristic
dec	bin	
0	000	+1 mV/V
1	001	±1 mV/V
2	010	+2 mV/V
<b>3</b>	<b>011</b>	<b>±2 mV/V</b>
4	100	+3 mV/V
5	101	±3 mV/V
6	110	+4 mV/V
7	111	±4 mV/V

## 13 IN process data input words

### 13.1 Input word IN1 (status word)

Input word IN1 performs the task of a status word.

		IN1															
Bit		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	EB	Mirroring of the command code							0	0	0	0	0	0	0	0	0

#### EB: Error bit

EB = 0 No error has occurred.

EB = 1 An error has occurred.

#### Mirroring of the command code:

A command code mirrored from the control word. Here, the MSB is suppressed.

The set error bit indicates an invalid configuration value for command 4000<sub>hex</sub>. Possible reasons:

- At least one of bits 3 - 7 or 9 - 14 is set
- The jumper voltage is not 3.3 V ± 0.5 V or 5 V ± 0.5 V.
- The characteristic value is 5 or 7 and the jumper voltage is 5 V ± 0.5 V.
- The terminal has already been configured with PCP using the "Config Table" object.

### 13.2 Input words IN2 and IN3

The measured values, configuration or firmware version are transmitted to the controller board or the PC via process data input words IN2 to IN3 according to the configuration.

For control word 3C00<sub>hex</sub>, IN2 provides the firmware version and the module ID.

#### Example: Firmware version 1.23:

		IN2															
Bit		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment (hex)		1				2				3				1			
Meaning		Firmware version 1.23												Module ID			



The measured values are available in IB IL format.

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

MSB														LSB	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SB	Analog value														

MSB Most significant bit

LSB Least significant bit

SB Sign bit

This format supports extended diagnostics. Values >8000<sub>hex</sub> and <8100<sub>hex</sub> indicate an error.

The following diagnostic codes are possible:

Code (hex)	Error
8001	Overrange
8002	Open circuit
8004	Measured value invalid/no valid measured value available (e.g., because the channel has not been configured)
8020	Faulty supply voltage
8040	Device faulty
8080	Underrange

Typical measured values:

Detuning for all bipolar characteristics [%]	Detuning for all unipolar characteristics [%]	IB input word [Hex]	IB input word [dec]
> 130.048	> 130.048	8001	Overrange
+ 130.048	+ 130.048	7F00	32512
+ 100.000	+ 100.000	61A8	25000
+ 1.000	+ 1.000	00FA	250
+ 0.004	+ 0.004	0001	1
0.0	0.0	0000	0
- 0.004	-	FFFF	-1
- 100.000	-	9E58	-25000
-130.048	-	8100	-32512
< -130.048	-	8080	Underrange
-	-	8002	Open circuit

To calculate the detuning as a percentage for other measured values, please use the following formula:

$$\text{Detuning} = \text{Process data value} * 0.004 \text{ or}$$

$$\text{Detuning} = \text{Process data value}/250$$

Example:

Characteristic: 2m V/V

Process data value: 10000<sub>dec</sub>

$$\text{Detuning} = 10000/250 = 40\%$$

$$40\% \text{ of } 2 \text{ mV/V} = 0.8 \text{ mV/V}$$

## 14 PCP communication



For information on PCP communication, please refer to the IBS SYS PCP G4 UM E (Order No. 2745169) and IBS PCP COMPACT UM E (Order No. 9015349) user manuals.

By default upon delivery, the terminal is configured according to the default settings on page 14. The terminal can be configured using process data or PCP to suit your application.

In PCP mode, the terminal is configured with the "Config Table" object.



The programs IBS CMD (for standard controller boards) and IBS PC WORX (for Field Controllers [FC] and Remote Field Controllers [RFC]) are available for the configuration and parameterization of your INTERBUS system.

For additional information, please refer to the IBS CMD SWT G4 UM E user manual and the documentation for the version of PC WorX used.

### 14.1 Object dictionary

Index	Data type	N	L	Meaning	Object name	Rights
0080 <sub>hex</sub>	Array of Unsigned 16	4	2	Terminal configuration	Config Table	rd/wr
0081 <sub>hex</sub>	Array of Unsigned 16	2	2	Analog values of the channels	Analog Values	rd

N: Number of elements

rd: Read access permitted

L: Length of an element in bytes

wr: Write access permitted

## 14.2 Object descriptions

### Config Table object

Configure the terminal using this object.

#### Object description:

Object	Config Table	
Access	Read, write	
Data type	Array of Unsigned 16	4 x 2 bytes
Index	0080 <sub>hex</sub>	
Subindex	00 <sub>hex</sub>	Write all elements
	01 <sub>hex</sub>	Configuration of channel 1
	02 <sub>hex</sub>	Configuration of channel 2
	03 <sub>hex</sub>	Reserved
	04 <sub>hex</sub>	Reserved
Length (bytes)	08 <sub>hex</sub> 02 <sub>hex</sub>	Subindex 00 <sub>hex</sub> Subindex 01 <sub>hex</sub> to 04 <sub>hex</sub>
Data	Terminal configuration	

#### Element value range

The "Configuration channel x" elements are structured as follows:

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	1	0	0	0	0	0	0	Filter	0	0	0	0	0	Characteristic		

For the value ranges of the individual parameters, please refer to Section "Parameters for configuration" on page 15.

If an invalid configuration is specified, a negative confirmation is generated with error message 08<sub>hex</sub>, 00<sub>hex</sub> or xx30<sub>hex</sub>. The low byte of the additional error code is 30<sub>hex</sub> (value is out of range), the high byte contains the number of the affected element.

**Example:** Config Table is completely filled with data (subindex 00) and the entry for channel 2 is invalid. In this case, the additional error code is equal to 0230<sub>hex</sub>.

**Analog Values object**

The elements of this object contain the analog values of the channels in IB IL format.

**Object description:**

Object	Analog Values	
Access	Read	
Data type	Array of Unsigned 16	2 x 2 bytes
Index	0081 <sub>hex</sub>	
Subindex	00 <sub>hex</sub>	Read all elements
	01 <sub>hex</sub>	Analog value of channel 1
	02 <sub>hex</sub>	Analog value of channel 2
Length (bytes)	04 <sub>hex</sub> 02 <sub>hex</sub>	Subindex 00 <sub>hex</sub> Subindex 01 <sub>hex</sub> to 02 <sub>hex</sub>
Data	Analog values of the channels	

## 15 Startup/measuring jumper detuning

To start the terminal, proceed as follows:

- Install the terminal within the Inline station. To do so, proceed as described in the package slip.
- Connect the strain gauge in 6 or 4-wire technology (see "Connection examples" on page 10).
- Connect the voltage to the Inline station.
- On this power up the terminal is configured with the default values.
- If you do not wish to operate the terminal with the default values, configure the terminal via process data (see "OUT process data output words" on page 14) or PCP (see "PCP communication" on page 18).
- Jumper detuning can now be measured.



Jumper detuning can only be measured if the corresponding input is configured. To configure the input, the jumper supply  $U_V$  must be present.

## 16 Configuration and analog values

Terminal configuration is only required if at least one of the channels is to be operated outside the default values (see "Parameters for configuration" on page 15).

You can configure the terminal **either** using process data **or** using PCP and transmit the analog values accordingly.

If you have configured the terminal via PCP, the configuration can no longer be modified using the process data.



For easy terminal configuration a function block can be downloaded at [www.phoenixcontact.com](http://www.phoenixcontact.com).

### Example 1: Configuring the terminal via process data

A strain gauge pressure force transducer for control system applications is connected to **channel 1**. Its data sheet specifies a characteristic of +2 mV/V at a nominal load of 500 N. The following configuration is thus selected for channel 1:

<b>Channel 1</b>	
Characteristic:	+2 mV/V
Filter:	No mean-value generation
Configuration value OUT2:	8002 <sub>hex</sub>

A tractive and pressure force transducer with the characteristic  $\pm 4$  mV/V at a load of 1 kN is connected to channel 2. The following configuration is thus selected for channel 2:

<b>Channel 2</b>	
Characteristic:	$\pm 4$ mV/V
Filter:	16-sample mean-value generation
Configuration value OUT3:	8107 <sub>hex</sub>



If **both** channels are operated in the default configuration, configuration is not required. When a configuration command is sent, however, both channels will always be configured. Therefore also enter the corresponding parameterization for the channel that is to be operated in the default configuration. If a "0" is transmitted for channel 1 in bit 15 (do not configure, see bit 15 on page 15), the channel does not provide any values in the following.

Step	Process data	Meaning
1	OUT3 = 8107 <sub>hex</sub> OUT2 = 8003 <sub>hex</sub> OUT1 = 4000 <sub>hex</sub>	Specify configuration
2	Wait until IN1 = 4000 <sub>hex</sub>	Wait for confirmation
3	OUT1 = 0000 <sub>hex</sub>	Requesting measured values
4	Wait until IN1 = 0000 <sub>hex</sub>	Wait for confirmation
5	Measured value channel 1 = IN2 Measured value channel 2 = IN3 If the measured value = 80xx <sub>hex</sub> , this corresponds to an error message	Read measured values

### Channel 1

Read measured value IN2:                    5A78<sub>hex</sub> (= 23160<sub>dec</sub>)  
 Current jumper detuning:                    = IN2 \* 0.004% \* characteristic  
     = 23160 \* 0.004% \* 2 mV/V  
     = 1.853 mV/V  
 Current load:                                    = IN2 \* 0.004% \* nominal load  
     = 23160 \* 0.004% \* 500 N  
     = 463.2 N

### Channel 2

Read measured value IN3:                    CBDE<sub>hex</sub> (= 52190<sub>dec</sub>); following evaluation of the MSB: -19422<sub>dec</sub>  
 Current jumper detuning:                    = IN3 \* 0.004% \* characteristic  
     = -19422 \* 0.004% \* 4 mV/V  
     = -3.11 mV/V  
 Current load:                                    = IN3 \* 0.004% \* nominal load  
     = -19422 \* 0.004% \* 1 kN  
     = -776.9 N

### Example 2: Minimum/maximum evaluation

The channel 1 and channel 2 pressure transducers are loaded and unloaded several times. Only the maximum load is of interest during the entire process.

Step	Process data	Meaning
1	OUT1 = 3200 <sub>hex</sub>	Delete minimum and maximum values of channel 1
2	Wait until IN1 = 3200 <sub>hex</sub>	Wait for confirmation
3	OUT1 = 3300 <sub>hex</sub>	Delete minimum and maximum values of channel 2
4	Wait until IN1 = 3300 <sub>hex</sub>	Wait for confirmation
5		Load and unload channel 1 and 2 pressure transducers
6	OUT1 = 3100 <sub>hex</sub>	Read maximum values
7	Wait until IN1 = 3100 <sub>hex</sub>	Wait for confirmation
8	Maximum value of channel 1 = IN2 Maximum value of channel 2 = IN3 If measured value = 80xx <sub>hex</sub> , then error message	Read maximum value; to calculate the current jumper detuning and the current load, see above.