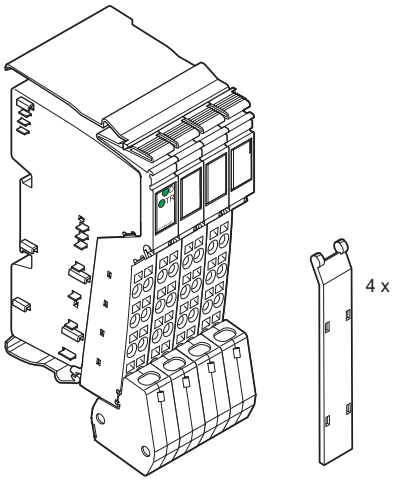
IB IL AO 4/8/U/BP ...

Inline Terminal
With Eight Analog Voltage Outputs



AUTOMATIONWORX

Data Sheet
7082_en_03

1 Description

The terminal is designed for use within an Inline station. This terminal provides an 8-channel output module to output analog standard voltage signals.

The output values are represented by 16-bit or 8-bit values.

Features

- Eight analog signal outputs
- Actuator connection in 2-wire technology with shield connection
- Communication either via process data or via parameter channel (PCP)
- Channels are configured independently of one another using the bus system
- Measured values can be represented in four different formats
- Diagnostic indicator

This data sheet is only valid in association with the IL SYS INST UM E user manual or the Inline system manual for your bus system.

Make sure you always use the latest documentation.
It can be downloaded at www.download.phoenixcontact.com.

A conversion table is available on the Internet at
www.download.phoenixcontact.com/general/7000_en_00.pdf.

This data sheet is valid for the terminals listed on page 3.

Table of Contents

2 Ordering Data

Products

Description	Type	Order No.	Pcs./Pkt.
Inline terminal with eight analog output channels for analog standard voltage signals; complete with accessories (connectors and labeling fields), transmission speed: 500 kbps	IB IL AO 4/8/U/BP-PAC	2878036	1
Inline terminal with eight analog output channels for analog standard voltage signals; without accessories, transmission speed: 500 kbps	IB IL AO 4/8/U/BP	2878049	1
Inline terminal with eight analog output channels for analog standard voltage signals; complete with accessories (connectors and labeling fields), transmission speed: 2 Mbps	IB IL AO 4/8/U/BP-2MBD-PAC	2878052	1
Inline terminal with eight analog output channels for analog standard voltage signals; without accessories, transmission speed: 2 Mbps	IB IL AO 4/8/U/BP-2MBD	2878065	1

Four connectors with shield connection are needed for the complete fitting of the IB IL AO 4/8/U/BP and IB IL AO 4/8/U/BP-2MBD terminals.

Accessories

Description	Type	Order No.	Pcs./Pkt.
Inline shield connector for analog Inline terminals	IB IL SCN 6-SHIELD-TWIN	2740245	5
Shield connection clamp for applying the shield on busbars	SK 8	3025163	10
Shield connection clamp for applying the shield on busbars	SK 14	3025176	10
Shield connection clamp for applying the shield on busbars	SK 20	3025189	10
Shield connection clamp for applying the shield on busbars	SK 35	3026463	10
Support for mounting on the NS 35/7,5 DIN rail, for 10 mm x 3 mm busbars	AB-SK	3025341	10
Support for direct mounting with contact to the mounting surface	AB-SK 65	3026489	10
Support, made of insulation material, with fixing screws, can also be used for 10 mm x 3 mm or 6 mm x 6 mm busbars	AB-SK/E	3026476	10
PEN conductor busbar, 3 mm x 10 mm, length: 1000 mm	NLS-CU 3/10 SN 1000MM	0402174	10
Power terminal, cross section: 0.5 - 4 mm², width: 7 mm	AK 4	0404017	50
Power terminal, cross section: 0.5 - 4 mm², width: 7 mm, color: green-and-yellow	AK 4 GNYE	0421029	50
Power terminal, cross section: 0.5 - 4 mm², width: 7 mm, color: black	AKG 4 BK	0421032	50

Documentation

Description	Type	Order No.	Pcs./Pkt.
User manual: "Automation Terminals of the Inline Product Range"	IL SYS INST UM E	2698737	1
User manual: "Configuring and Installing the INTERBUS Inline Product Range"	IB IL SYS PRO UM E	2743048	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), 215 g (with connectors)
Operating mode	Process data mode with 5 words/1 word PCP
Connection method for actuators	2-wire technology with shield connection
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 according to VDE 0106, IEC 60536
Connection data for Inline connector	
Connection method	Spring-cage terminals
Conductor cross-section	0.2 mm^2 to 1.5 mm^2 (solid or stranded), 24 - 16 AWG

Interface	
Local bus	Data routing

Transmission Speed	
IB IL AO 4/8/U/BP; IB IL AO 4/8/U/BP-PAC	500 kbps
IB IL AO 4/8/U/BP-2MBD; IB IL AO 4/8/U/BP-2MBD-PAC	2 Mbps

Power Consumption	500 kbps	2 Mbps
Communications power U_L	7.5 V DC	7.5 V DC
Current consumption from U_L	80 mA (typical)	100 mA (typical)
I/O supply voltage U_{ANA}	24 V DC	24 V DC
Current consumption at U_{ANA}	72 mA (typical)	72 mA (typical)
Total power consumption	2.35 W (typical)	2.35 W (typical)

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

Analog Outputs		
Number	Eight analog voltage outputs	
Connection of the signals	2 or 3-wire, shielded twisted pair cable	
Signals	0 V to 10 V, 0 V to 5 V, ±10 V, ±5 V	
Representation of output value	16 bits (15 bits with sign bit) or 8 bits (7 bits with sign bit)	
Resolution of the DAC	16 bits	
Resolution (quantization)	Inline format	
0 V to 10 V	0 V to 10.837 V	V0.333 mV/LSB
0 V to 5 V	0 V to 5.419 V	V0.167 mV/LSB
±10 V	-10.837 V to +10.837 V	0.333 mV/LSB
±5 V	-5.419 V to +5.419 V	0.167 mV/LSB
Basic error limit	Voltage: ±0.1% (typical) of the output range final value	
Output load	2 kΩ, minimum, 30 kΩ, typical	
Process data update including conversion time of the D/A converter	2 ms	
Slew rate (> 99% of the final value)	< 1 ms at ohmic load	
Actuator cable length	250 m, maximum, using shielded cable 10 m, maximum, using unshielded cable	

Analog Outputs (Continued)	
Default	
Output range	±10 V
Format	IB IL
Behavior upon bus reset	HOLD (hold last value)

Safety Equipment	
Transient protection of analog outputs	Yes
Short-circuit protection of analog outputs	Yes, for at least 1 minute

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	Test Voltage
7.5 V supply voltage / ±15 V	500 V AC, 50 Hz, 1 min
7.5 V supply voltage (bus logic) / functional earth ground	500 V AC, 50 Hz, 1 min
±15 V-, +5 V analog supply (analog I/O) / functional earth ground	500 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 coupler
Failure of or insufficient communications power U_L	Yes, I/O error message sent to the bus coupler

Tolerance and Temperature Response

The tolerance values refer to the measuring range final value at a typical load (30 kΩ)..

T_A = 25°C

Output range	Absolute (Typical)	Absolute (Maximum)	Relative (Typical)	Relative (Maximum)
0 V to 5 V, ±5 V	±18 mV	±25 mV	±0.36%	±0.50%
0 V to 10 V, ±10 V	±19 mV	±25 mV	±0.19%	±0.25%

T_A = -25°C ... +55°C

Output Range	Absolute (Typical)	Absolute (Maximum)	Relative (Typical)	Relative (Maximum)
0 V to 5 V, ±5 V	±22 mV	±40 mV	±0.44%	±0.80%
0 V to 10 V, ±10 V	±26 mV	±40 mV	±0.26%	±0.40%

Signal Rise Times: Voltage Output 0 V to 10 V (Typical Values)

	10% to 90%	0% to > 99% (Including Overshoots)
No-load operation	9 µs	20 µs
Ohmic load R_L = 2 kΩ	10 µs	22 µs
Ohmic/capacitive load R_L = 2 kΩ / C_L = 10 nF (parallel)	9 µs	28 µs
Ohmic/capacitive load R_L = 2 kΩ / C_L = 220 nF (parallel)	71 µs	175 µs
Ohmic/inductive load R_L = 2 kΩ / L_L = 3.3 mH (serial)	9 µs	19 µs

Signal Rise Times: Voltage Output 0 V to 5 V (Typical Values)

	10% to 90%	0% to > 99% (Including Overshoots)
No-load operation	8 µs	18 µs
Ohmic load R_L = 2 kΩ	9 µs	20 µs
Ohmic/capacitive load R_L = 2 kΩ / C_L = 10 nF (parallel)	8 µs	26 µs
Ohmic/capacitive load R_L = 2 kΩ / C_L = 220 nF (parallel)	29 µs	118 µs
Ohmic/inductive load R_L = 2 kΩ / L_L = 3.3 mH (serial)	8 µs	20 µs

Signal Rise Times: Voltage Output ±5 V (Typical Values)

	10% to 90%	0% to > 99% (Including Overshoots)
No-load operation	9 µs	19 µs
Ohmic load R_L = 2 kΩ	10 µs	20 µs
Ohmic/capacitive load R_L = 2 kΩ / C_L = 10 nF (parallel)	9 µs	28 µs
Ohmic/capacitive load R_L = 2 kΩ / C_L = 220 nF (parallel)	54 µs	150 µs
Ohmic/inductive load R_L = 2 kΩ / L_L = 3.3 mH (serial)	9 µs	20 µs

Signal Rise Times: Voltage Output ±10 V (Typical Values)

	10% to 90%	0% to > 99% (Including Overshoots)
No-load operation	12 µs	24 µs
Ohmic load R_L = 2 kΩ	13 µs	27 µs
Ohmic/capacitive load R_L = 2 kΩ / C_L = 10 nF (parallel)	12 µs	32 µs
Ohmic/capacitive load R_L = 2 kΩ / C_L = 220 nF (parallel)	117 µs	220 µs
Ohmic/inductive load R_L = 2 kΩ / L_L = 3.3 mH (serial)	12 µs	24 µs

Additional Tolerances Influenced by Electromagnetic Fields

Type of Electromagnetic Interference	Typical Deviation of the Output Range Final Value (Relative)
Electromagnetic fields; field strength 10 V/m according to EN 61000-4-3/IEC 61000-4-3	< ±0.5%
Conducted interference Class 3 (test voltage 10 V) according to EN 61000-4-6/IEC 61000-4-6	< ±0.5%
Fast transients (burst) 4 kV supply, 2 kV input according to EN 61000-4-4/ IEC 61000-4-4	< ±0.5%

Approvals

Information on current approvals can be found on the Internet at www.download.phoenixcontact.com.

4 Local Diagnostic and Status Indicators and Terminal Point Assignment

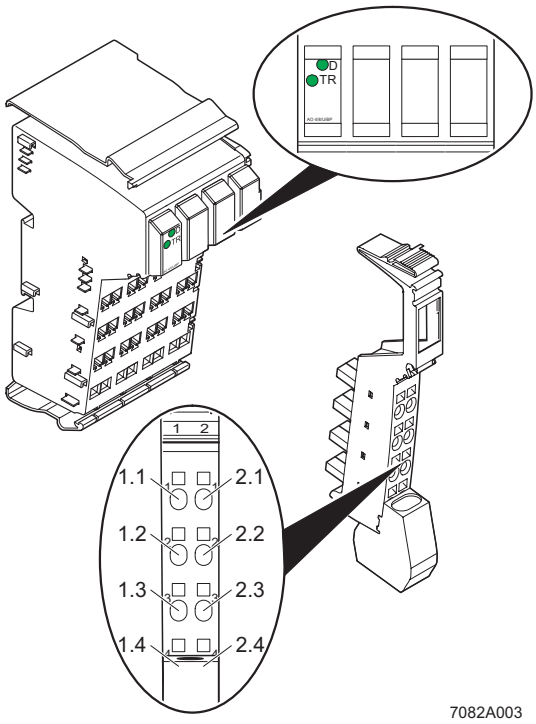


Figure 1 Terminal with an appropriate connector

4.1 Local Diagnostic and Status Indicators

Desig.	Color	Meaning
D	Green	Diagnostics
TR	Green	PCP active

4.2 Function Identification

Yellow

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

4.3 Terminal Point Assignment for Each Connector

Terminal Points	Signal	Assignment
1.1	**U_1**	Voltage output 1
2.1	**U_2**	Voltage output 2
1.2, 2.2	**–**	Not used
1.3, 2.3	**AGND**	Ground of voltage outputs
1.4, 2.4	**Shield**	Shield connection

5 Internal Circuit Diagram

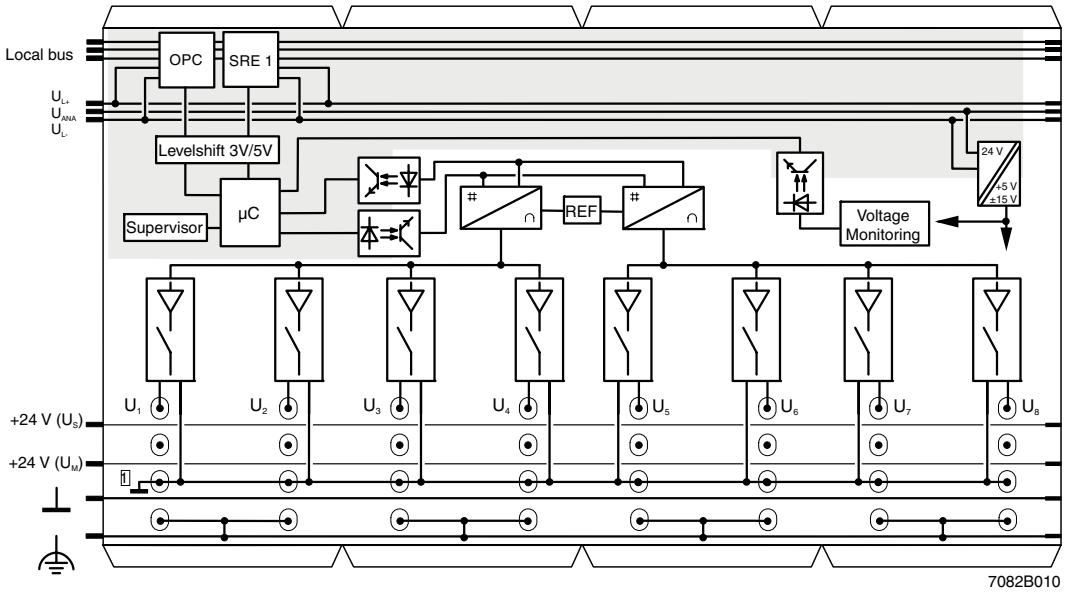


Figure 2 Internal wiring of the terminal points

Key:

OPC — Protocol chip

SRE 1 — Register expansion

Levelshift 3V/5V — Level adaptation

Supervisor — Hardware monitoring

µC — Microcontroller

Optocoupler

Digital/analog converter

REF — Reference voltage

Output level

Voltage Monitoring — Voltage monitoring

DC/DC converter with electrical isolation

1 — Analog ground, electrically isolated from ground of the potential jumper

Other symbols used are explained in the IL SYS INST UM E user manual or in the Inline system manual for your bus system.

6 Electrical Isolation

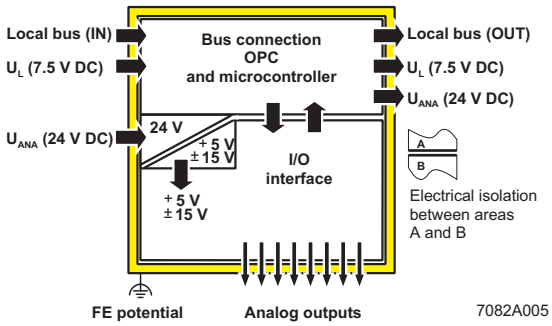


Figure 3 Electrical isolation of the individual function areas

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 behind all the other terminals at the end of the main circuit.

8 Connection Notes

Analog actuators with a cable length of **< 10 m** can be connected using unshielded twisted-pair cables.

Connect analog actuators with a cable length of **> 10 m** using shielded twisted-pair cables.

Connect one end of the shielding to PE. Fold the outer cable sheath back and connect the shield to the terminal via the shield connector clamp (with strain relief). The clamp connects the shield directly to FE on the terminal side.

Ensure that the braided shield is 15 mm longer than the strain relief, when connecting a shielded actuator cable to the I/O connector. Connect the actuator cable as described in "Connecting Shielded Cables Using the Shield Connector" on page 11.

9 Connection Example

Use a connector with shield connection when installing the actuators. Figure 4 shows the connection schematically (without shield connector).

Connecting Actuators

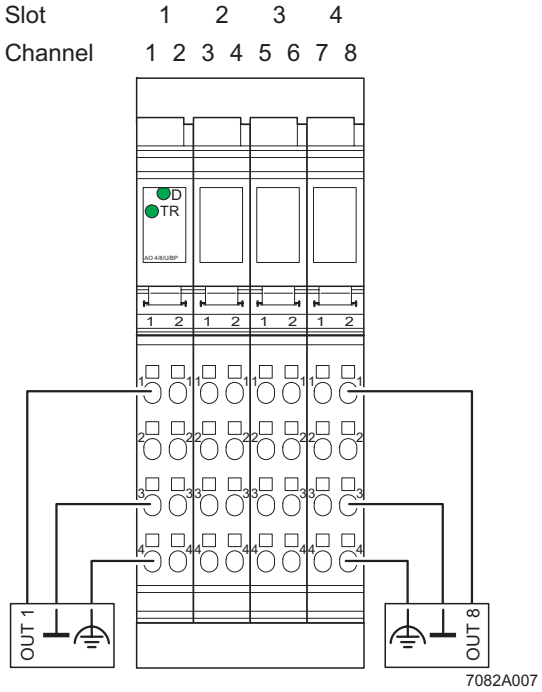


Figure 4 Connecting two actuators

10 Connecting Shielded Cables Using the Shield Connector

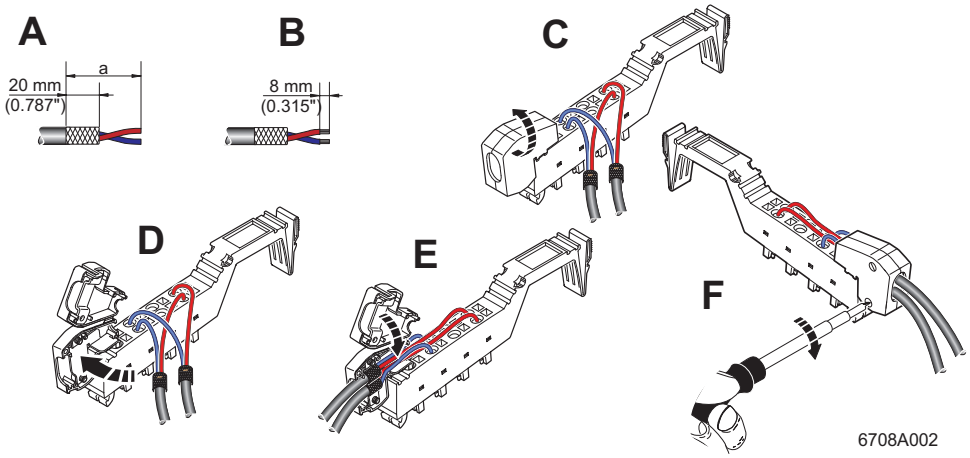


Figure 5 Connecting the shield via the shield connector

The diameter of the actuator cable is usually too large to allow the cable to be installed into the strain relief of the shield connector with sheathed and folded shield. The connection procedure for this cable therefore differs from the connection procedure described in the user manual. The comparative differences with the user manual are marked in bold text.

Connection of the cables according to Figure 5 should be carried out as follows:

Stripping Cables

- Strip the outer cable sheaths to the desired length (a). (A)
  The desired length (a) depends on the connection position of the wires and whether the wires should have a large or small amount of space between the connection point and the shield connection.
- Shorten the braided shield to **20 mm**. (A)
- **Do not** fold the braided shield back over the outer sheath. (B)
- Remove the protective foil.
- Strip 8 mm off the wires. (B)

Inline wiring is normally without ferrules. However, it is possible to use ferrules. If using ferrules, make sure they are properly crimped.

Wiring Connectors
(According to User Manual)

- Push a screwdriver into the slot of the appropriate terminal point, so that you can insert the wire into the spring opening.
  Phoenix Contact recommends using an SZF 1-0,6X3,5 screwdriver (Order No. 1204517).
- Insert the wire. Remove the screwdriver from the opening. The wire is now clamped.

The connector pin assignment can be found in the table on page 7.

Connecting the Shield

- Open the shield connector (see user manual). (C)
- Place the shield connection clamp in the shield connector corresponding to the cable width (see user manual).
- Place the cables in the shield connection. (D)
  Push the outer cable sheaths up to the shield connection clamp. The wires with the braided shield must be underneath the shield connection clamp. The braided shield must project approximately 15 mm over the shield connection clamp.
- Close the shield connector. (E)
- Fasten the screws for the shield connector using a screwdriver. (F)

11 Programming Data/Configuration Data

Local Bus (INTERBUS))

ID code	DF_{hex} (223_{dec})
Length code	05_{hex}
Process data channel	80 bits
Input address area	5 words
Output address area	5 words
Parameter channel (PCP)	1 word
Register length (bus)	6 words

Other Bus Systems

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

12 Process Data

The device has 5 process data words and 1 PCP word.

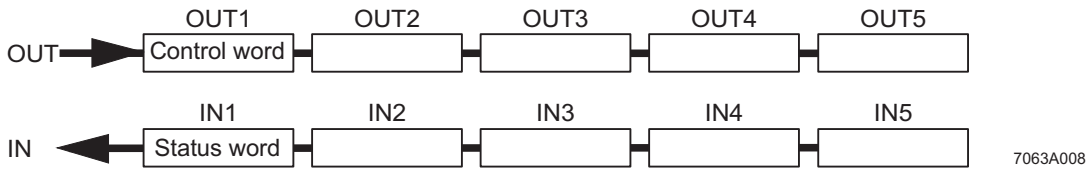


Figure 6 Order of the process data words

13 OUT Process Data

Five OUT process data words are available.

Configure the terminal channels via the OUT1 process data word.

If you are changing the configuration, the corresponding channel is re-initialized. If the configuration is invalid, a corresponding error message is output in the status word. The configuration settings are only stored in a volatile memory.

13.1 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				Channel/output				0	0	0	0	0	0	0	0

Bit 15 to Bit 8 (Command Code and Channel/Output):

Bit 15 to Bit 12				Bit 11 to Bit 8				OUT1	Command Function
0	0	0	0	0	0	0	0	0000_{hex}	All outputs are disabled
0	0	0	0	0	0	0	1	0100_{hex}	Output at channels 1 to 4
0	0	0	0	1	0	0	1	0900_{hex}	Output at channels 5 to 8
0	0	0	1	0	**C**	**C**	**C**	$1x00_{hex}$	Read configuration in IN2 channel-by-channel
0	0	1	1	1	1	0	0	$3C00_{hex}$	Read firmware version and module ID in IN2
0	1	0	0	0	**C**	**C**	**C**	$4xyy_{hex}$	Configure channel
0	1	0	1	0	0	0	1	5100_{hex}	Output at channels 1 to 8 in 8-bit resolution
0	1	1	0	0	0	0	0	$60yy_{hex}$	Configure entire terminal (all channels)

CCC = channel number; CCC = 000: Channel 1; CCC = 111: Channel 8: yy = Parameters for configuration

Control Word Assignment With Command Code 0_{hex}

	OUT1															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	0	0	0	0	**Gr**	0	**B**	**EAO**	0	0	0	0	0	0	0	0

EAO
- 0 All outputs disabled
- 1 Outputs are set to the value specified last

B
- 0 Output value directly; the buffered values for the channels that are not addressed are also output
- 1 Buffer value only

Gr
- 0 Channels 1 to 4
- 1 Channels 5 to 8

Gr Group
B Buffering action
EAO Enabling the analog output channels

Output Word Assignment With Command "Output at Channels 1 to 8 in 8-Bit Resolution"

Word	OUT 1		OUT 2		OUT 3		OUT 4		OUT 5	
Byte	1	2	3	4	5	6	7	8	9	10
	5100_{hex}		Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8

13.2 Parameters in Output Word OUT1

For command $4xyy_{hex}$ and $60yy_{hex}$ the parameters must be specified in OUT1 in addition to the command code. The parameters are only evaluated for these commands.

	OUT1															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4xyy assignment	0	1	0	0	0	C	C	C	0	OB	Format		Output range			
60yy assignment	0	1	1	0	0	0	0	0	0	OB	Format		Output range			

OB	Output behavior upon bus reset
Format	Representation of the output value in the OUT process data
Output range	Output range settings

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 set error bit.

13.3 Parameters for Configuration

The values displayed in bold are default settings.

Bit 6:

Code		Output Behavior Upon Bus Reset
dec	bin	
0	**0**	**Hold**
1	1	Reset

Bit 5 and Bit 4:

Code		Format
dec	bin	
0	**00**	**IB IL format (15 bits + sign bit with extended diagnostics)**
1	01	IB ST format (12 bits + sign bit + 3 diagnostic bits)
2	10	Format compatible with S7 (15 bits + sign bit)
3	11	Standardized representation format

Bit 3 to Bit 0:

Code		Output Range
dec	bin	
0	0000	0 V to 10 V
1	**0001**	**±10 V**
2	0010	0 V to 5 V
3	0011	±5 V
4	0100	Reserved
...	...	
15	1111	

14 IN Process Data

14.1 Input Word IN1 (Status Word)

Five IN process data words are available.

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	Bits 14 to 8 of the control word are mirrored							0	0	0	0	0	0	0	0

EB: Error Bit

EB = 0 No error has occurred.

EB = 1 An error has occurred.

Mirrored Command Code:

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

14.2 Input Words IN2 to IN5

The mirrored output words, the configuration or the firmware version are transmitted to the controller board or the PC via the process data input words IN2 up to IN5 in accordance with the configuration.

For control word **3C00**$_{hex}$, 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				4_{hex}			
Meaning	Firmware version 1.23												Module ID			

15 Formats for Representing Output Values

15.1 IB IL Format (Default Setting)

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

Output value representation in IB IL format; 15 bits

MSB LSB

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

SB Sign bit

Typical Analog Values Depending on the Output Range

INTERBUS Output Word		0 V to 10 V U_{Output} [V]	+/-10 V U_{Output} [V]	0 V to 5 V U_{Output} [V]	+/-5 V U_{Output} [V]
[hex]	[dec]				
≤7FFF	≤32767	+10.837	+10.837	+5.419	+5.419
7F00	32512	+10.837	+10.837	+5.419	+5.419
7530	30000	+10.0	+10.0	+5.0	+5.0
0001	1	+333.33 µ	+333.33 µ	+166.67 µ	+166.67 µ
0000	0	≤0	0	≤0	0
FFFF	-1	0	-333.33 µ	0	-166.67 µ
8AD0	-30000	0	-10.0	0	-5.0
8100	-32512	0	-10.837	0	-5.419
80FF to 8000 (without 8001 and 8080)	-32768...-32513	HOLD	HOLD	HOLD	HOLD
8001	-32767 Overrange	+10.837	+10.837	+5.419	+5.419
8080	-32640 Underrange	0	-10.837	0	-5.419

15.2 IB ST Format

The output value is represented in bits 14 through 3. The remaining 4 bits are sign and error bits.

Output value representation in IB ST format; 12 bits

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

SB Sign bit

0 Reserved

Typical Analog Values Depending on the Output Range

INTERBUS Output Word		0 V to 10 V U_{Output} [V]	+/-10 V U_{Output} [V]	0 V to 5 V U_{Output} [V]	+/-5 V U_{Output} [V]
[hex]	[dec]				
≤7FFF	32767	9.9976	9.9976	4.9988	4.9988
7FF8	32760	9.9976	9.9976	4.9988	4.9988
4000	16384	5.0000	5.0000	2.5000	2.5000
0008	8	0.002441	0.002441	0.001221	0.001221
0000	0	0	0	0	0
FFF8	-8	0	-0.002441	0	-0.001221
C000	-16384	0	-5.0000	0	-2.5000
8008	-32760	0	-9.9976	0	-4.9988
≥8000	-32768	0	-9.9976	0	-4.9988

15.3 Format Compatible With S7

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

Output value representation in the format compatible with S7 (15 bits)

MSB LSB

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

SB Sign bit

Typical Analog Values Depending on the Output Range

INTERBUS Output Word		0 V to 10 V U_{Output} [V]	+/-10 V U_{Output} [V]	0 V to 5 V U_{Output} [V]	+/-5 V U_{Output} [V]
[hex]	[dec]				
≤7FFF	≤32767	0	0	0	0
7F00	32512	0	0	0	0
7EFF	32511	+11.7589	+11.7589	+5.8800	+5.8800
6C01	27649	+10.0004	+10.0004	+5.0002	+5.0002
6C00	27648	+10.0000	+10.0000	+5.0000	+5.0000
5100	20736	+7.5000	+7.5000	+3.7500	+3.7500
1	1	+361.69 µ	+361.69 µ	+180.845 µ	+180.845 µ
0	0	0	0	0	0
FFFF	-1	0	-361.69 µ	0	-180.845 µ
E501	-6911	0	-2.4996	0	-1.2498
E500	-6912	0	-2.5000	0	-1.2500
AF00	-20736	0	-7.5000	0	-3.7500
9400	-27648	0	-10.0000	0	-5.0000
93FF	-27649	0	-10.0004	0	-5.0002
8101	-32511	0	-11.7589	0	-5.8800
8000 to 8100	-32768 to -32512	0	0	0	0

15.4 Standardized Representation Format

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

Output value representation in standardized representation format (15 bits)

MSB LSB

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

SB Sign bit

Typical Analog Values Depending on the Output Range

INTERBUS Output Word		0 V to 10 V U_{Output} [V]	+/-10 V U_{Output} [V]	0 V to 5 V U_{Output} [V]	+/-5 V U_{Output} [V]
[hex]	[dec]				
2A56 to 7FFF	10838 to 32767	+10.837	+10.837	+5.419	+5.419
2A55	10837	**+10.837**	**+10.837**	+5.419	+5.419
2710	10000	+10.0	+10.0	+5.419	+5.419
152B	5419	+5.419	+5.419	**+5.419**	**+5.419**
1388	5000	+5.0	+5.0	+5.0	+5.0
0001	1	+0.001	+0.001	+0.001	+0.001
0000	0	0	0	0	0
FFFF	-1	0	-0.001	0	-0.001
EC78	-5000	0	-5.0	0	-5.0
EAD5	-5419	0	-5.419	0	**-5.419**
D8F0	-10000	0	-10.0	0	-5.419
D5AB	-10837	0	**-10.837**	0	-5.419
D5AA to 8100	-10838 to -32512	0	-10.837	0	-5.419
80FF to 8000 (without 8001 and 8080)	-32768 to -32513	HOLD	HOLD	HOLD	HOLD
8001	-32767 Overrange	+10.837	+10.837	+5.419	+5.419
8080	-32640 Underrange	0	-10.837	0	-5.419

16 Configuration and Analog Value Transmission

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

Example for Terminal Configuration via Process Data

All channels are to hold their value (HOLD), use the IB IL format and output the values in the range 0 V to 5 V. The parameter value therefore is 0002_{hex}.

Step	Process Data	Meaning
1	OUT1 = 6002_{hex}	Specified configuration
2	Wait until IN1 = 6002_{hex}	Awaiting confirmation
3	Analog value OUT2 = channel 1, ..., OUT5 = channel 4 OUT1 = 0100_{hex}	Analog value output at channels 1 to 4
4	Wait until IN1 = 0100_{hex}	Awaiting confirmation
5	Analog value OUT2 = channel 5, ..., OUT5 = channel 8 OUT1 = 0900_{hex}	Analog value output at channels 5 to 8
6	Wait until IN1 = 0900_{hex}	Awaiting confirmation

Secure process data transmission requires process data consistency of five words.

In the event that consistency of five words cannot be ensured, an intermediate step is recommended after every output command. The buffer bit in the "Write analog values" command is used for this purpose. As a result, step 3 and step 5 become more complicated:

Step	Process Data	Meaning
1	OUT1 = 6002_{hex}	Specified configuration
2	Wait until IN1 = 6002_{hex}	Awaiting confirmation
3a	OUT1 = 0300_{hex}	Buffer command
3b	Wait until IN1 = 0300_{hex}	Awaiting confirmation
3c	OUT2 = analog value of channel 1 OUT3 = analog value of channel 2 OUT4 = analog value of channel 3 OUT5 = analog value of channel 4	Buffer the analog values for channels 1 to 4
3d	OUT1 = 0100_{hex}	Output the analog values for channels 1 to 4
4	Wait until IN1 = 0100_{hex}	Awaiting confirmation
5a	OUT1 = $0B00_{hex}$	Buffer command
5b	Wait until IN1 = $0B00_{hex}$	Awaiting confirmation
5c	OUT2 = analog value of channel 5 OUT3 = analog value of channel 6 OUT4 = analog value of channel 7 OUT5 = analog value of channel 8	Buffer the analog values for channels 5 to 8
5d	OUT1 = 0900_{hex}	Output the analog values for channels 5 to 8
6	Wait until IN1 = 0900_{hex}	Awaiting confirmation

17 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 15. The terminal can be configured via process data or PCP to adapt it to suit your application.

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

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

Additional information can be found in the IBS CMD SWT G4 UM E (Order No. 2722250) user manual as well as in the quick start guide for your PC WORX version.

17.1 Object Dictionary

Index	Data Type	N	L	Meaning	Object Name	Rights
0080_{hex}	Array of Unsigned 16	10	2	Terminal configuration	Config Table	rd/wr
0085_{hex}	Array of Unsigned 16	8	2	Analog values of the channels	Analog Out Values	rd/wr

N: Number of elements

L: Element length in bytes

rd: Read access permitted

wr: Write access permitted

17.2 Object Description

Config Table Object

Configure the terminal using this object.

Object Description:

Object	Config Table
Access	Read, write
Data type	Array of Unsigned 16 10 x 2 bytes
Index	0080_{hex}
Subindex	00_{hex} Write all elements 01_{hex} Configuration of channel 1 02_{hex} Configuration of channel 2 03_{hex} Configuration of channel 3 04_{hex} Configuration of channel 4 05_{hex} Configuration of channel 5 06_{hex} Configuration of channel 6 07_{hex} Configuration of channel 7 08_{hex} Configuration of channel 8 09_{hex} System settings $0A_{hex}$ Reserved
Length (bytes)	14_{hex} Subindex 00_{hex} 02_{hex} Subindex 01_{hex} to $0A_{hex}$
Data	Terminal configuration

Element Value Range

The "**Configuration of 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	0	0	0	0	0	0	0	0	0	OB	Format		Output range			

For the value range for 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_{hex}, 00_{hex} or $xx30_{hex}$. The low byte of the additional error code is 30_{hex} (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 6 is invalid. In this case, the additional error code equals 0630_{hex}.

Additional Functions in Element 9 (System Settings):

0001_{hex}: Configuration via process data not locked

0002_{hex}: Writing of the "Analog Out Values" object is permitted.

Analog Out Values Object

The elements of this object contain the analog values of the channels in a format that has been selected for this channel.

Writing to this object must be enabled in the Config Table object. Write value 0002_{hex} to subindex 09 in the "Config Table" object for this purpose.

Object Description:

Object	Analog Values	
Access	Read, write	
Data type	Array of Unsigned 16	8 x 2 bytes
Index	0085_{hex}	
Subindex	00_{hex} Read/write all elements 01_{hex} Analog value of channel 1 02_{hex} Analog value of channel 2 03_{hex} Analog value of channel 3 04_{hex} Analog value of channel 4 05_{hex} Analog value of channel 5 06_{hex} Analog value of channel 6 07_{hex} Analog value of channel 7 08_{hex} Analog value of channel 8	
Length (bytes)	10_{hex} Subindex 00_{hex} 02_{hex} Subindex 01_{hex} to 08_{hex}	
Data	Analog values of the channels	