8-Channel measuring amplifier GSV-8

Operating manual

Updated:	10/07/2021
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Author	
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Measuring amplifier GSV-8

8-channel measuring amplifier
Additionally: 2x Counter/Frequency Encoder channels

8x analog input configurable

full, half, quarter bridges, 120- 350- 1000 Ohm, PT1000, Type K, ±10V

Outputs 1x USB Port, 8x analog output ±10V, 4...20mA configurable, 1x UART,

alternatively EtherCat, CANbus/CANopen

16x Digital in- and output

5x Galvanic isolation: analog-input, analog-output, digital-I/O, UART, USB

8x 48kS/s Simultaneous sampling

6-wire technology, bridge supply 2.5V, 5.0V, 8.75V configurable

Automatic configuration of analog and digital filters by specifying the data frequency

Additional Digital Filters IIR 4th order and FIR 14th order individually configurable

Resolution < 20 nV/V

1-axis, 3- and 6-axis sensors connectible
Autonomous calculation of 3 forces and moments of six-axis sensors
Two operating hours counters
Sensors with TEDS supported (readable and writeable)
Integration of a Raspberry PI in the housing cover of the GSV-8AS
Compatible free software, convenient and extensive

Figure 1: GSV-8DS front side

Figure 2: GSV-8DS back side

Figure 3: GSV-8AS

EtherCAT®

CANopen®

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Description

This 8-channel measuring amplifier amplifies and digitizes analog signals of various sensors, e.g. passive ones with Wheatstone bridge, such as force or torque sensors, strain gauges (strain gauge, full- half-quarter bridge), active sensors and temperature sensors. Digital position sensors are also supported.[1]

The GSV-8 is characterized by a high resolution at data frequencies from 1 Hz to 48000 Hz. The 8 input channels are recorded simultaneously, without multiplexing.

Versions

Type	Sensor Input	Signal-Output
GSV-8DS SubD15HD	8x SubD15HD	1xUSB, UART, analog, Digital-I/O
GSV-8DS EC/SubD15HD	8x SubD15HD	1xUSB, EtherCat, analog, Digital-I/O
GSV-8DS CAN/SubD15HD	8x SubD15HD	1xUSB, UART, CAN, analog, Digital-I/O
GSV-8DS SubD44HD	4x SubD44HD	1xUSB, UART, analog, Digital-I/O
GSV-8DS EC/SubD15HD	4x SubD44HD	1xUSB, EtherCat, analog, Digital-I/O
GSV-8DS CAN/SubD15HD	4x SubD44HD	1xUSB, UART, CAN, analog, Digital-I/O
GSV-8AS	1x 24pol M16, screw terminal	1xUSB, UART, analog, Digital-I/O
GSV-8AS EC	1x 24pol M16, screw terminal	1xUSB, EtherCat, analog, Digital-I/O
GSV-8AS CAN	1x 24pol M16, screw terminal	1xUSB, UART, CAN, analog, Digital-I/O
GSV-8AS PI-3	1x 24pol M16, screw terminal	like GSV-8AS, but with Raspberry PI

Interfaces

Communication interfaces such as USB port or EtherCAT or CANbus are available. The device has 8 configurable analog outputs (±10 V and 4...20 mA among others). UART interface may be used to control the measuring amplifier via the Raspberry PI (not for versions with EtherCat).

The interface protocol of USB and UART is identical and described in a separate documentation (ba-gsvcom.pdf). The fieldbus protocols EtherCAT and CANopen are

1 From firmware version 1.45 on

standardized in the lower protocol layers and the application layer is described in separate documents (ba-gsv8canopen.pdf and ba-gsv8ethercat_en.pdf).

Software

The Windows programs GSVmultichannel with graphical user interface and the console terminal program Gsv8terminal are suitable. A Windows function library (MEGSV8w32.dll) with commented C header is available for self-programming users and a LabView library with wrapper VIs for this DLL for programming with LabView ©.

Features

There are 8 analog inputs available. They are individually configurable as:

- Strain gauge input for full bridges in 4 and 6 wire technology or
- Strain gauge input for half bridges or
- Strain gauge input for quarter bridges 120 ohm, 350 ohm, 1 kOhm or
- Single-ended input ±10 V or
- Input for PT1000 temperature sensor
- Input for thermocouple sensor type K[2]

Additionally there are 2 digital inputs for square wave signals for counter and frequency measurements.[3]

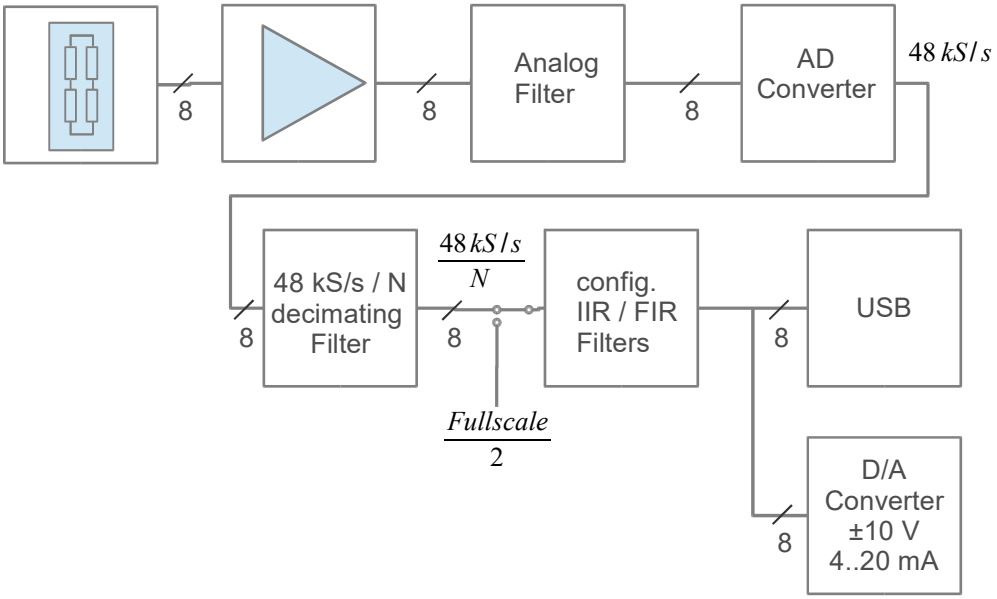
The strain gauge supply voltage can be switched between 8.75 V, 5.00 V and 2.5 V, assigned to input sensitivities 2 mV/V, 3.5 mV/V or 7 mV/V.

Bridge supply voltage	Resulting input sensitivity
8,75 V	2 mV/V
5 V	3,5 mV/V
2,5 V	7 mV/

Up to 2 additional channels can be configured for counter or frequency measurements.[3], so that the GSV-8 then communicates data of up to 10 measuring channels. The number of channels in the measuring data frame is configurable[3]
The encoder signals or rectangle signals are wired to digital inputs (see p.29); up to 2 single rectangle signals or A/B outputs of up to 2 encoders can be processed. So, Frequency/speed or position/angle can me measured with suitable encoders, also simultaneously (see p. 41).

2 From firmware version 1.39 on
3 From firmware version 1.45 on

Signal flow



Galvanic isolation

The supply voltage UB+ / 0V is galvanically isolated from the modules for

- ✔ analog input
- ✔ analog output
- ✔ digital in- outputs
- ✔ interfaces

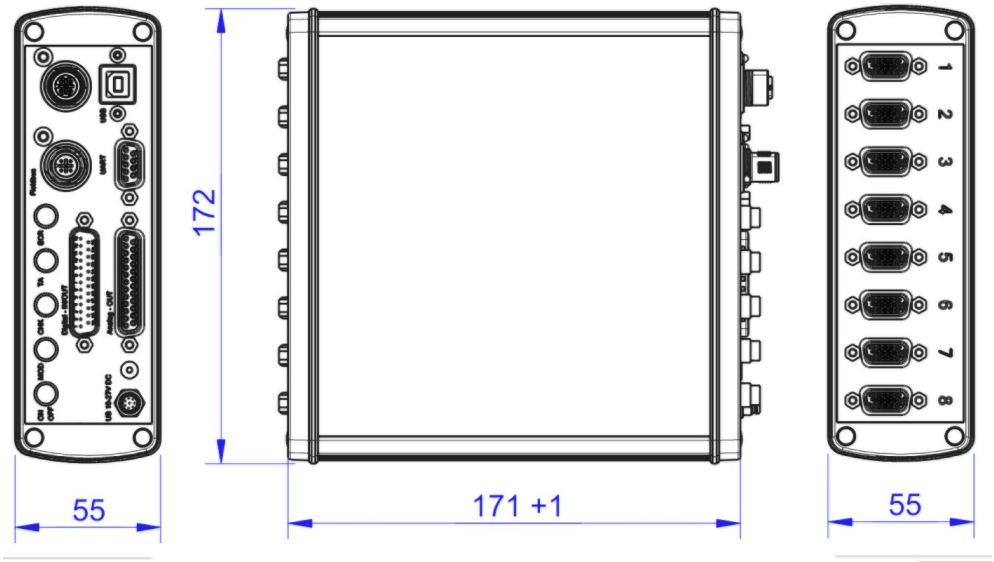
All these modules are also galvanically isolated from each other. The insulation voltage is 50 V. Ground lines (see table) can be connected together, the insulation doesn't apply then. Both housing types AS and DS have a ground connection, which is connected to the housing. With a high measurement data rate, it often happens that the measurement is superimposed by an external interference signal ("mains humming"). In this case, it is often helpful to connect this ground connection to a suitable ground. If the 50 or 100 Hz line noise signal is not sufficiently attenuated, you can also connect the ground of the analog input GNDE to the ground. However, this procedure eliminates the protective effect of the galvanic isolation of the analog inputs.

UB+	Supply voltage 12...28V DC
0V	Ground Supply voltage
GNDE	Ground analog input
-Us	Negative bridge supply
GNDA	Ground analog output
GNDD	Ground digital input / output

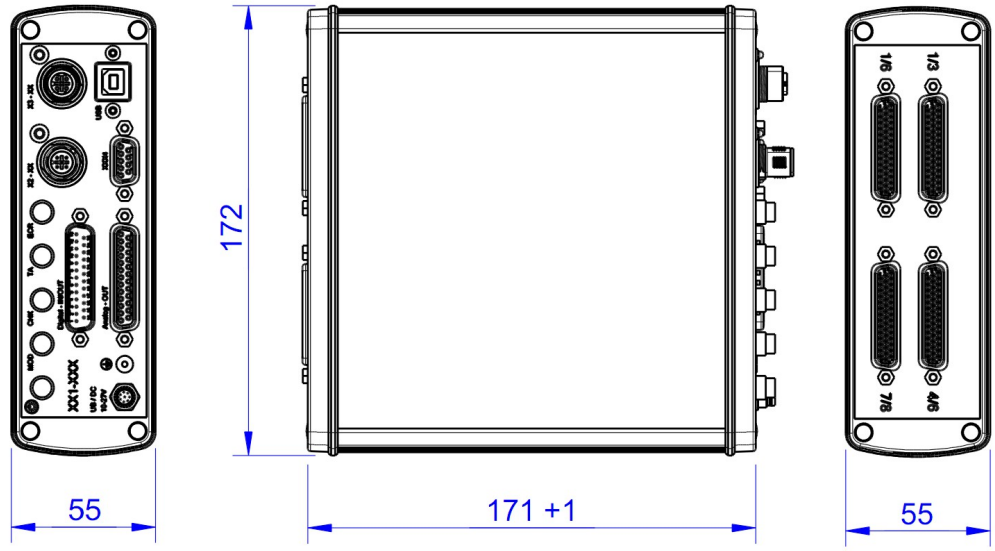
GNDU	Ground UART port („Raspberry PI Port“)
GNDR	Ground RS232 port (V24 only as special version)

Dimensions

GSV-8DS SubD15HD



GSV-8DS SubD44HD



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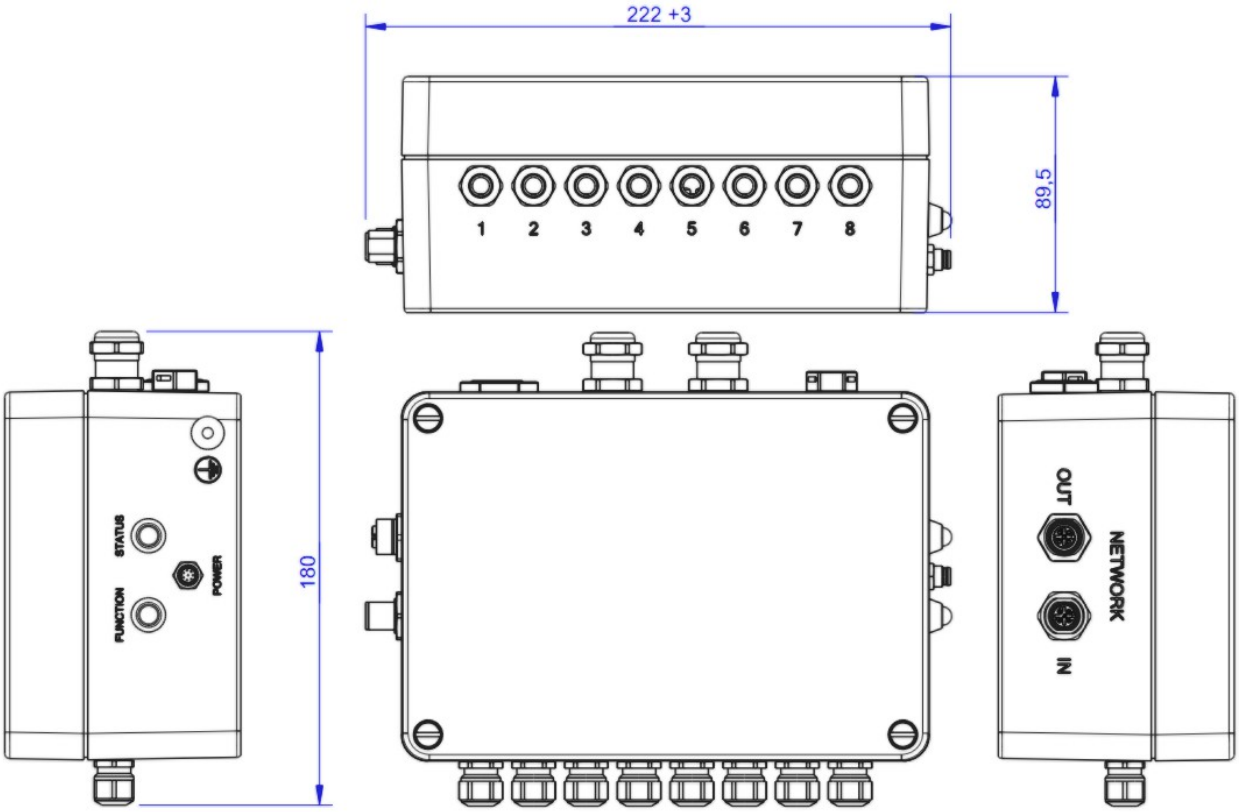
GSV-8AS



Specifications

Analog input

Accuracy class	0,05%
Number of analog inputs	8
Strain gauge bridge input	Quarter, half, full bridge
Input impedance	> 20 MOhm (300pF)
Common mode rejection ratio DC	> 120 dB
Common mode rejection ratio AC 100Hz	> 100 dB
Strain gauge bridge completions	120 Ohm, 350 Ohm, 1 kOhm
Strain gauge bridge supply	2.50 V, 5.00 V, 8.75 Volt
Total current across all channels	200 mA
Max. current per channel at bridge supply 2.5V	40 mA (min. bridge resistance 62,5 Ohm)
Max. current per channel at bridge supply 5V	60 mA (min. bridge resistance 83,3 Ohm)
Max. current per channel at bridge supply 8.75V	26 mA (min. bridge resistance 336,5 Ohm)
Input sensitivities	7 mV/V, 3.5 mV/V, 2 mV/V
Input voltage, single-ended	±10 V
Input resistance	10 MOhm
Input for PT1000 sensor	-230 °C ... +1500 °C
Excitation voltage PT1000	1.25 V
Step response delay time	0.92 ms[4]
Delay + Settling time	1.5 ms max[5]., 1 ms typ.

4 Measured from ±10V input to analog output, Step 0->5V, data frequency 16000/s, without additional filters
5 100% step, completely settled, worst-case

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Digital input / digital output

Number of in-/ outputs	16
Output	TTL (0V 5V), push-pull
total current across all channels	140 mA
max. load current per output	25 mA
Input	
max. input voltage	5.5 V
min. input voltage	-0.5 V
Resistance Pull-up +5V	10 kOhm
Sampling period	40 msec
Counter / Frequency Input	
Measuring range counter	± 8.388.608 (internally: 32-Bit)
Measuring range frequency	1/60s = 16,667 mHz to 10 MHz
Sampling rate	= configured data frequency 1...16000 /s
Supply voltage for encoders	5V, 20mA (max)

Analog output

Number of analog outputs	8
Configuration of analog outputs	0...10V, -10V..+10V, 0...5V, -5V...+5V, 4...20mA

Voltage source

Number of voltage outputs	8
power	8x 24V DC, 250mA

Supply

Supply voltage	12 V to 28 V
Power	< 12 W

Environmental data

Operating temperature	0 °C ... +50 °C
Power	< 12 W

Interfaces

USB	2.0 Full speed
Devices class	Communication Device Class, HID (firmware update only)
UART	Level 3.3V, galvanically isolated; auxiliary voltage 24V DC, 2A
EtherCat	protocol: CoE device profile 404, Mailbox- and buffered mode. Synchronization: Hardware-Latching
CANbus	CANopen, device profile 404, 4x TxPDOs, galvanically isolated

Resolution of strain gauge input

The resolution of measuring amplifier depends on the adjusted input sensitivity and the data frequency. The input sensitivity is assigned to the bridge supply voltage: 8.75V with 2.0 mV/V, 5V with 3.5 mV/V, 2.5V with 7 mV/V.

The excitation voltage with 8.75V is recommended only with sensors of minimum 1kOhm bridge resistance and sufficient construction size. For miniature sensors under 500g weight the bridge supply of 8.75V shall not be applied!

	+Us	10 Hz	50 Hz	100 Hz	1 kHz	5 kHz	8 kHz
3.5 mV/V	5 V	$2.0\ 10^5$	$1.2\ 10^5$	$8.0\ 10^4$	$2.5\ 10^4$	$1.0\ 10^4$	$8.0\ 10^3$
2.0 mV/V	8.75 V	$3.0\ 10^5$	$2.5\ 10^5$	$1.5\ 10^5$	$6.0\ 10^4$	$4.0\ 10^4$	$1.4\ 10^4$

At a data frequency of 10 Hz the measuring range from 0 to +3.5 is quantised in $2.0\ 10^5$ steps.

The noise amplitude is 17.5 nV/V.

At a sensor with rated force of 10 N and rated output of 0.5 mV/V the noise amplitude is

$$10\,N \cdot \frac{0{,}5}{3{,}5} \cdot \frac{1}{2.0\,10^5} = 7{,}14 \cdot 10^{-6}\,N$$

Noise Amplitude at Analog Output

The noise amplitude at the analog output is approx. 25mV (peak values) or 10mV (RMS). It is due to the galvanic isolation of the analog output. The frequency components of the noise signal are predominantly at frequencies above 300 kHz and higher. These can be largely attenuated by the use of oversampling with subsequent digital filtering (e.g. arithmetic averaging) in the subsequent analog-

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digital conversion.

Digital filters

The GSV-8 adjusts automatically the analog filter and the „decimating“ digital input filter. The user provides only the required number of measured values per second (data frequency), which is send via USB-interface or made available to the field bus. Additionally there are two adjustable digital filters: 1x FIR filter and 1x IIR filter. Each of these filter is individually adjustable for any of the 8 input channels. In the measured data signal processing chain, the FIR filter is processed first, followed by the IIR filter.

Finite Impulse response Filter

The FIR filter is a low pass filter with which the filter order N and the cut-off frequency fg can be set. The cut-off frequency is the frequency at which the signal is already attenuated by -3 dB. This corresponds to a factor of approx. 0.7. Frequencies lying above this will continue to be attenuated.
The filter order determines the maximum and minimum adjustable cut-off frequency fg in terms of the data rate Fa, and the steepness of the attenuation range. Higher orders have a steeper slope, i.e. an increase in the signal frequency causes the attenuation to increase faster. The so-called step response is slower at higher orders however, i.e. it always takes N+1 measured values until the filter's output value corresponds to the input value.

Order	fg/Fa min in Hz	fg/Fa min in Hz
14	0,05	0,190
12	0,06	0,225
10	0,07	0,270
8	0,09	0,340
6	0,12	0,350
4	0,18	0,410

Infinite Impulse Response Filter

The infinite Impulse Response Filter (IIR) of fourth order allows four different filter types:

1) Low pass filter: Sensor signals at low frequency (including DC size with f=0) pass through the filter, signals at a higher frequency are attenuated.
2) High pass filter: Sensor signals at low frequency (including DC size with f=0) are attenuated, signals at a higher frequency pass through the filter. Note: Frequencies above half of the measured data rate cannot be processed. The measuring amplifier includes an analog-to-digital sampling system, which in itself acts as a low pass.
3) Band pass filter: Signals are allowed to pass through within a frequency range,

signals which are above or below this range are attenuated.

4) Band stop filter ('Notch filter'): Signals are attenuated within a frequency range, signals which are above or below this range are allowed to pass through.

The cut-off frequency can be configured for low and high pass filters. The cut-off frequency is the frequency at which the signal is already attenuated by -3 dB. This corresponds to a factor of approx. 0.7. Frequencies lying above for low pass and lying below for high pass will continue to be attenuated.
Two cut-off frequencies can be configured for band pass and band stop filters; the upper and the lower. Attenuation by -3 dB also occurs here. The two cut-off frequencies may not be the same. Signal frequencies lying between these are allowed to pass through for the band pass filter, and are attenuated for the band stop filter.
The maximum (and also the minimum if need be) of each cut-off frequency is dependent on the measured data rate. Cut-off frequencies can be set to (0.49 * measured data rate), i.e. almost to half.
The filters can be individually configured for each channel and also switched on and off. The configuration also remains the same for filters that have been switched off.

Buttons and indicators

Power-button with LED function	Switch on and off the device (only GSV-8DS) Function LED
Mod-button with Led status	a) reset the status LED; b) start the Firmware-updates, if during the Power On activates
CHK button with Check LED	Sensor Test; by pressing the CHK button the sensor signal for the unloaded condition is emulated on the input of the measuring amplifier; for sensors with calibration matrix the documented zero signals of the sensor are emulated on the inputs.
TA	„Tara", Set-Zero": trigger an automatic zero adjustment for all outputs (analog and digital)
ECR-LED	EtherCat EC Run;

Pin Configuration

Input SUB-D15 HD

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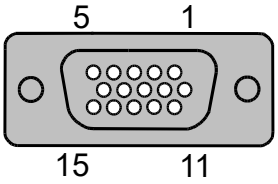
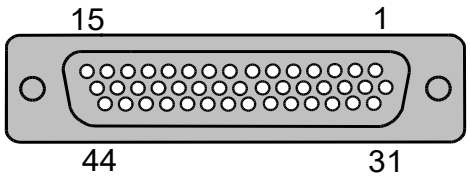


Connection of strain gauges, active sensors, temperature sensors and TEDS. Activation of the bridge completion with external wire from “HB” (12) to -UD (10).

No	Symbol	Description
1	TEDS	Transducer Electronic Data according to IEEE 1451.4
2	-Us	Negative bridge supply
3	+Us	Positive bridge supply
4	Q350	Quarter bridge completion 350 Ohm
5	+UD	Positive differential input
6	GNDE	Ground, analog input
7	-Uf	Negative sense line (6-wire connection only)
8	+Uf	Positive sense line (6-wire connection only)
9	Q120	Quarter bridge completion 120 Ohm
10	-UD	Negative differential input
11	Q1k	Quarter bridge completion 1000 Ohm
12	HB	Half bridge completion
13	VCCIO	Voltage source 24V DC, 250mA
14	Ue	analog input voltage, single ended ±10V
15	GNDIO	Ground voltage source
Shield	PE	Earth (housing)

Input Sub-D44 HD



Up to 3 channels can be connected to the 44-pin Sub D socket. The labelling on the front panel is 1/3 for connecting the channels 1 to 3.

1/3 Channels 1,2,3, Sub-D HD 44			
Pin	Signal	Description	Channel
Shield	PE	Earth (housing)	-
1	TEDS	Transducer Electronic Data according IEEE 1451.4	1
2	US-	Negative bridge supply	1
3	US+	Positive bridge supply	1
4	Q350	Quarter bridge completion 350Ohm	1
5	UD+	Positive differential input	1
6	GNDE	Ground, analog input	1
7	UF-	Negative sense line (6-wire connection only)	1
8	UF+	Positive sense line (6-wire connection only)	1
9	Q120	Quarter bridge completion 120Ohm	1
10	UD-	Negative differential input	1
11	Q1k	Quarter bridge completion 1000Ohm	1
12	HB	Half bridge completion	1
13	UE	analog input voltage, single ended ±10V	1
14	GNDIO	Ground voltage source	1
15	PE	Earth (housing)	-
16	TEDS	Transducer Electronic Data according IEEE 1451.4	2
17	US-	Negative bridge supply	2
18	US+	Positive bridge supply	2
19	Q350	Quarter bridge completion 350Ohm	2
20	UD+	Positive differential input	2
21	GNDE	Ground, analog input	2
22	UF-	Negative sense line (6-wire connection only)	2
23	UF+	Positive sense line (6-wire connection only)	2
24	Q120	Quarter bridge completion 120Ohm	2
25	UD-	Negative differential input	2
26	Q1k	Quarter bridge completion 1000Ohm	2
27	HB	Halt bridge completion	2
28	UE	analog input voltage, single ended ±10V	2

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1/3 Channels 1,2,3, Sub-D HD 44			
Pin	Signal	Description	Channel
29	GNDIO	Ground voltage source	2
30	VCCIO	Voltage source 24V DC, 250mA	1,2,3
31	TEDS	Transducer Electronic Data acc. to IEEE 1451.4	3
32	US-	Negative bridge supply	3
33	US+	Positive bridge supply	3
34	Q350	Quarter bridge completion 350Ohm	3
35	UD+	Positive differential input	3
36	GNDE	Ground, analog input	3
37	UF-	Negative sense line (6-wire connection only)	3
38	UF+	Positive sense line (6-wire connection only)	3
39	Q120	Quarter bridge completion 120Ohm	3
40	UD-	Negative differential input	3
41	Q1k	Quarter bridge completion 1000Ohm	3
42	HB	Half bridge completion	3
43	UE	analog input voltage, single ended ±10V	3
44	GNDIO	Ground voltage source	3

The labelling on the front panel is 4/6 for connecting the channels 4 to 6.

4/6 Channels 4,5,6, Sub-D HD 44			
Pin	Signal	Description	Channel
Shield	PE	Earth (housing)	-
1	TEDS	Transducer Electronic Data acc. to IEEE 1451.4	4
2	US-	Negative bridge supply	4
3	US+	Positive bridge supply	4
4	Q350	Quarter bridge completion 350Ohm	4
5	UD+	Positive differential input	4
6	GNDE	Ground, analog input	4
7	UF-	Negative sense line (6-wire connection only)	4
8	UF+	Positive sense line (6-wire connection only)	4
9	Q120	Quarter bridge completion 120Ohm	4

4/6 Channels 4,5,6, Sub-D HD 44			
Pin	Signal	Description	Channel
10	UD-	negative bridge supply	4
11	Q1k	Quarter bridge completion 1000Ohm	4
12	HB	Half bridge completion	4
13	UE	analog input voltage, single ended ±10V	4
14	GNDIO	Ground voltage source	4
15	PE	Earth (housing)	-
16	TEDS	Transducer Electronic Data acc. to IEEE 1451.4	5
17	US-	Negative bridge supply	5
18	US+	Positive bridge supply	5
19	Q350	Quarter bridge completion 350Ohm	5
20	UD+	Positive differential input	5
21	GNDE	Ground, analog input	5
22	UF-	Negative sense line (6-wire connection only)	5
23	UF+	Positive sense line (6-wire connection only)	5
24	Q120	Quarter bridge completion 120Ohm	5
25	UD-	Negative differential input	5
26	Q1k	Quarter bridge completion 1000Ohm	5
27	HB	Half bridge completion	5
28	UE	analog input voltage, single ended ±10V	5
29	GNDIO	Ground voltage source	5
30	VCCIO	Voltage source 24V DC, 250mA	4,5,6
31	TEDS	Transducer Electronic Data acc. to IEEE 1451.4	6
32	US-	Negative bridge supply	6
33	US+	Positive bridge supply	6
34	Q350	Quarter bridge completion 350Ohm	6
35	UD+	Positive differential input	6
36	GNDE	Ground, analog input	6
37	UF-	Negative sense line (6-wire connection only)	6
38	UF+	Positive sense line (6-wire connection only)	6

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4/6 Channels 4,5,6, Sub-D HD 44			
Pin	Signal	Description	Channel
39	Q120	Quarter bridge completion 120Ohm	6
40	UD-	Negative differential input	6
41	Q1k	Quarter bridge completion 1000Ohm	6
42	HB	Half bridge completion	6
43	UE	analog input voltage, single ended ±10V	6
44	GNDIO	Ground voltage source	6

At the 44-pole SubD socket 1/6 up to 6 channels can be connected. The labelling on the front panel is 1/6 for connecting the channels 1 to 6. The connections are parallel to the input jacks 1/3 and 4/6 .If 1/6 is used, please leave 1/3 and 4/6 opened.

Channels 1,2,3,4,5,6, Sub-D HD 44			
Pin	Signal	Description	Channel
Shield	PE	Earth (housing)	-
1	UF+	Positive sense line (6-wire connection only)	1
2	US+	Positive bridge supply	1
3	UD+	Positive differential input	1
4	UD-	Negative differential input	1
5	US-	Negative bridge supply	1
6	UF-	Negative sense line (6-wire connection only)	1
7	TEDS	Transducer Electronic Data according IEEE 1451.4	1
8	UF+	Positive sense line (6-wire connection only)	2
9	US+	Positive bridge supply	2
10	UD+	Positive differential input	2
11	UD-	Negative differential input	2
12	US-	Negative bridge supply	2
13	UF-	Negative sense line (6-wire connection only)	2
14	TEDS	Transducer Electronic Data according IEEE 1451.4	2
15	PE	Earth (housing)	-
16	UF+	Positive sense line (6-wire connection only)	3
17	US+	Positive bridge supply	3
18	UD+	Positive differential input	3
19	UD-	Negative differential input	3
20	US-	Negative bridge supply	3
21	UF-	Negative sense line (6-wire connection only)	3
22	TEDS	Transducer Electronic Data according IEEE 1451.4	3
23	UF+	Positive sense line (6-wire connection only)	4
24	US+	Positive bridge supply	4
25	UD+	Positive differential input	4
26	UD-	Negative differential input	4
27	US-	Negative bridge supply	4
28	UF-	Negative sense line (6-wire connection only)	4

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Pin	Signal	Description	Channel
29	TEDS	Transducer Electronic Data acc. to IEEE 1451.4	4
30	PE	Earth (housing)	-
31	UF+	Positive sense line (6-wire connection only)	5
32	US+	Positive bridge supply	5
33	UD+	positiver differential input	5
34	UD-	Negative differential input	5
35	US-	Negative bridge supply	5
36	UF-	Negative sense line (6-wire connection only)	5
37	TEDS	Transducer Electronic Data according IEEE 1451.4	5
38	UF+	Positive sense line (6-wire connection only)	6
39	US+	Positive bridge supply	6
40	UD+	Positive differential input	6
41	UD-	Negative differential input	6
42	US-	Negative bridge supply	6
43	UF-	Negative sense line (6-wire connection only)	6
44	TEDS	Transducer Electronic Data acc. to IEEE 1451.4	6

Note: Six-axis sensors K6D with Sub-D HD44 connectors are connected to this socket "1/6"
At the 44-pin Sub D socket 7/8 up to 2 channels can be connected (channel 7 and channel 8) .

Channels 7, 8, Sub-D HD 44			
Pin	Signal	Description	Channel
Shield	PE	Earth (housing)	-
1	UE	analog input voltage, single ended ±10V	1
2	GNDE	Ground, analog input	1
3	UE	analog input voltage, single ended ±10V	2
4	GNDE	Ground, analog input	2
5	UE	analog input voltage, single ended ±10V	3
6	GNDE	Ground, analog input	3
7	UE	analog input voltage, single ended ±10V	4
8	GNDE	Ground, analog input	4
9	UE	analog input voltage, single ended ±10V	5
10	GNDE	Ground, analog input	5
11	UE	analog input voltage, single ended ±10V	6
12	GNDE	Ground, analog input	6
13	PE	Earth (housing)	-
14	PE	Earth (housing)	-
15	PE	Earth (housing)	-
16	TEDS	Transducer Electronic Data according IEEE 1451.4	7
17	US-	Negative bridge supply	7
18	US+	Positive bridge supply	7
19	Q350	Quarter bridge completion 350Ohm	7
20	UD+	Positiver differential input	7
21	GNDE	Ground, analog input	7
22	UF-	Negative sense line (6-wire connection only)	7
23	UF+	Positive sense line (6-wire connection only)	7
24	Q120	Quarter bridge completion 120Ohm	7
25	UD-	Negative differential input	7
26	Q1k	Quarter bridge completion 1000Ohm	7
27	HB	Half bridge completion	7
28	UE	analog input voltage, single ended ±10V	7

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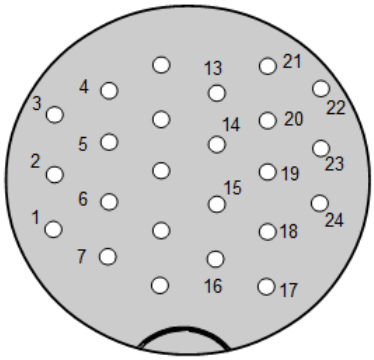
Channels 7, 8, Sub-D HD 44			
Pin	Signal	Description	Channel
29	GNDIO	Ground voltage source	7
30	VCCIO	Voltage source 24V DC, 250mA	7,8
31	TEDS	Transducer Electronic Data according IEEE 1451.4	8
32	US-	Negative bridge supply	8
33	US+	Positive bridge supply	8
34	Q350	Quarter bridge completion 350Ohm	8
35	UD+	Positive differential input	8
36	GNDE	Ground, analog input	8
37	UF-	Negative sense line (6-wire connection only)	8
38	UF+	Positive sense line (6-wire connection only)	8
39	Q120	Quarter bridge completion 120Ohm	8
40	UD-	Negative differential input	8
41	Q1k	Quarter bridge completion 1000Ohm	8
42	HB	Half bridge completion	8
43	UE	analog input voltage, single ended ±10V	8
44	GNDIO	Ground voltage source	8

Input M16 Binder 423



View from the plug-in side

A 6-axis sensor type K6D can be connected to the 16-pin socket of the GSV-8AS.

Channels 1,2,3,4,5,6, M16			
Pin	Signal	Description	Channel
Shield	PE	Housing	-
1	US+	Positive bridge supply	1
2	US-	Negative bridge supply	1
3	UD+	Positive bridge output	1
4	UD-	Negative bridge output	1
5	US+	Positive bridge supply	2
6	US-	Negative bridge supply	2
7	UD+	Positive bridge output	2
8	UD-	Negative bridge output	2
9	US+	Positive bridge supply	3
10	US-	Negative bridge supply	3
11	UD+	Positive bridge output	3
12	UD-	Negative bridge output	3
13	US+	Positive bridge supply	4
14	US-	Negative bridge supply	4
15	UD+	Positive bridge output	4
16	UD-	Negative bridge output	4
17	US+	Positive bridge supply	5
18	US-	Negative bridge supply	5

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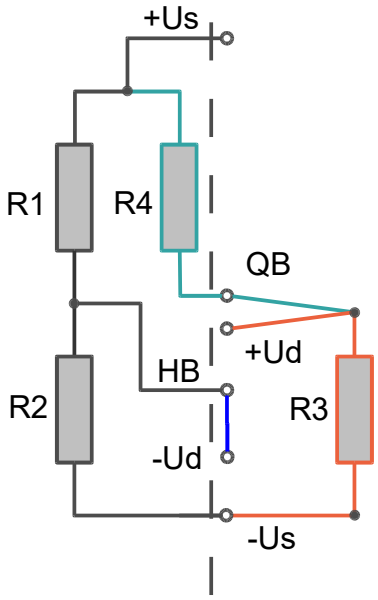
Channels 1,2,3,4,5,6, M16			
Pin	Signal	Description	Channel
19	UD+	Positive bridge output	5
20	UD-	Negative bridge output	5
21	US+	Positive bridge supply	6
22	US-	Negative bridge supply	6
23	UD+	Positive bridge output	6
24	UD-	Negative bridge output	6

Connection strain gauge quarter bridge

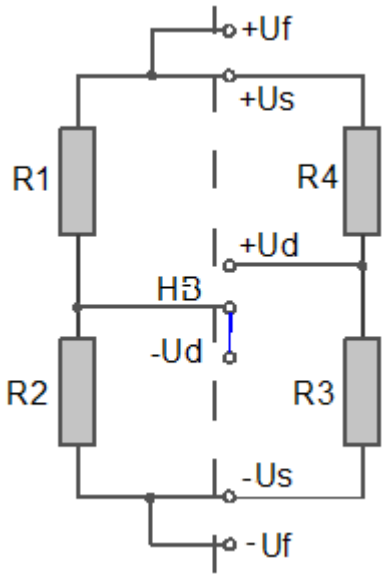


The active strain gauge R3 is connected by 3-wire technology.

The internal completion resistors 120 Ohm (QB = Q120), 300 Ohm (QB = Q350) and 1 kOhm (QB = Q1k) are lead through on the connection "QB".

The internal half bridge R1, R2 is activated with a wire jumper from HB to -Ud.

Connection strain gauge half bridge

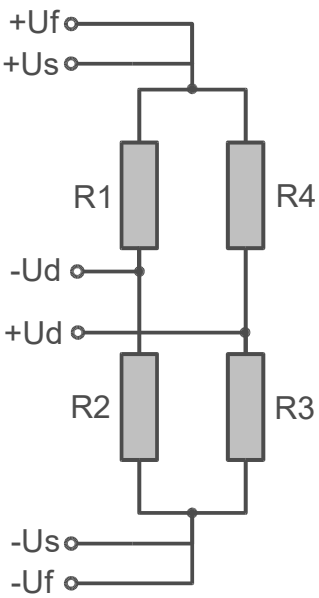


The active strain gauges R3 and R4 are connected to **+Us, +Ud** and **-Us**.

For very long cable lengths the sense lines +Uf and -Uf can be used.

The internal half bridge R1, R2 is activated with a wire jumper from HB to -Ud.

Connection strain gauge full bridge



The active strain gauges R1 to R4 are connected on **+Us,, -Us, +Ud, -Ud**.

For very long cable lengths the sense lines +Uf and -Uf can be used additionally (6-wire technology).

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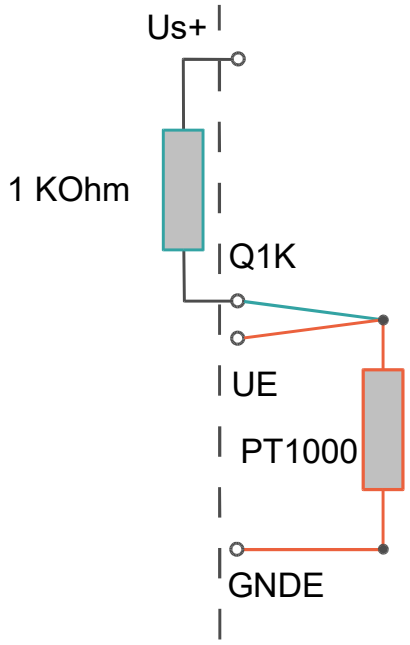
Connection of PT1000



The temperature sensor PT1000 is connected in three-wire technology to the terminals Q1K, UE and GNDE.

To measure temperature, the input type "PT1000" must be activated once by software.

Connection of thermocouple type-K

The + wire of the temperature sensor type K is connected to the +Ud input of one of the analog input channels 1 to 7, the - wire to -Ud.
To measure the absolute temperature with thermocouple K, a PT1000 reference sensor is required, which must be connected to input channel 8. It should have the same temperature as the type K sensor connector (cold junction compensation).
Relative measurement is also possible with type K; in this case you do not need a reference sensor.

Connection of the active sensors

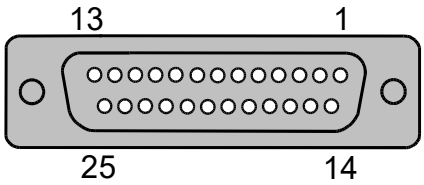
The single-ended voltage signal of active sensors is applied to Ue and GNDE.

Potentiometric sensors can be supplied via +Us. The energy supply for active sensors can be via galvanic isolated voltage VCCIO and GNDIO.

Connection of the TEDS cables for sensors with Transducer Elec. Data sheet

The 1-wire EEPROM memory module located in the sensor or in the sensor connector is connected with two wires: the ground of the EEPROM to GNDE and the signal cable (corresponding to its 3.3V supply cable) at the TEDS connector.
However, TEDS are supported only from firmware version 1.32 on and hardware version 4.0, which are devices that were purchased from about 11/2016.

Analog output SUB-D25 socket



Analog outputs voltage or current for channels 1 to 8.

Pin	Signal	Meaning
1	Ua1/ Ia1	Analog output channel 1
2	Ua2/ Ia2	Analog output channel 2
3	Ua3/ Ia3	Analog output channel 3
4	Ua4/ Ia4	Analog output channel 4
5	Ua5/ Ia5	Analog output channel 5
6	Ua6/ Ia6	Analog output channel 6
7	Ua7/ Ia7	Analog output channel 7
8	Ua8/ Ia8	Analog output channel 8
9	/	Internal usage
10	/	Internal usage
11	/	Internal usage
12	OutB-	60kHz frequency -6V Out (optional)
13		Internal usage
14	GNDA	Analog GND
15	GNDA	Analog GND
16	GNDA	analog GND
17	GNDA	Analog GND
18	GNDA	Analog GND
19	GNDA	Analog GND
20	GNDA	Analog GND
21	GNDA	Analog GND
22		Internal usage

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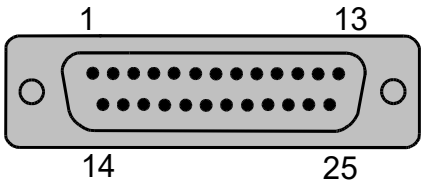
Pin	Signal	Meaning
23		Internal usage
24	OutB+	60kHz frequency +6V Out (optional)
25	GNDINT	GNDINT
Shield	PE	Earth (housing)

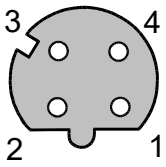
Digital in- and outputs Sub-D25 plug connector



Pin	Name	Meaning
1	VCC	5V voltage supply, digital
2	DGND	Digital ground (GND)
3	DGND	Digital ground (GND)
4	DGND	Digital ground (GND)
5	DGND	Digital ground (GND)
6	DIO 2	Group 1, 1.2
7	DIO 4	Group 1, 1.4
8	DIO 6	Group 2, 2.2
9	DIO 8	Group 2, 2.4
10	DIO 10	Group 3, 3.2
11	DIO 12	Group 3, 3.4 QEI 1: Encoder input B
12	DIO 14	Group 4, 4.2 QEI 2: Encoder / rectangle input A
13	DIO 16	Group 4, 4.4 QEI 2: Reset input I
14	DGND	Digital ground (GND)
15	DGND	Digital ground (GND)
16	DGND	Digital ground (GND)
17	DGND	Digital ground (GND)
18	DIO 1	Group 1, 1.1

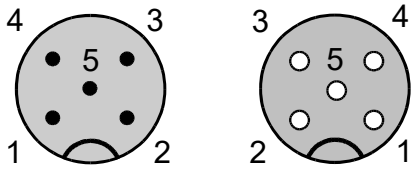
Pin	Name	Meaning
19	DIO 3	Group 1, 1.3
20	DIO 5	Group 2, 2.1
21	DIO 7	Group 2, 2.3
22	DIO 9	Group 3, 3.1
23	DIO 11	Group 3, 3.3 QEI 1: Encoder / square wave input A
24	DIO 13	Group 4, 4.1 QEI 1: Reset / Index Input I
25	DIO 15	Group 4, 4.3 QEI 2: Encoder input B

EtherCat M12 4-pole socket D-coded



Pin	Name	Meaning
1	TD+	Transmit +
2	RD+	Receive +
3	TD-	Transmit -
4	RD-	Receive -
Shield	PE	Earth (housing)

CANbus M12 5-pole socket / plug A-coded



Pin	Name	Meaning
1	Shield	Shielding
2	V+	Power (UB+)

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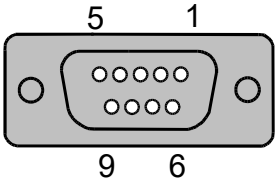
3	V-	GND (0V)
4	CAN_H	Dominant High
5	CAN_L	Dominant Low
	Housing	Shield

UART Port Sub-D9 socket

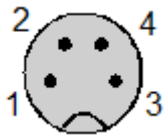
The UART Port may be used for connection of Raspberry PI (3.3V high level)

The UART Port is not available for variants "EC" with EtherCat.



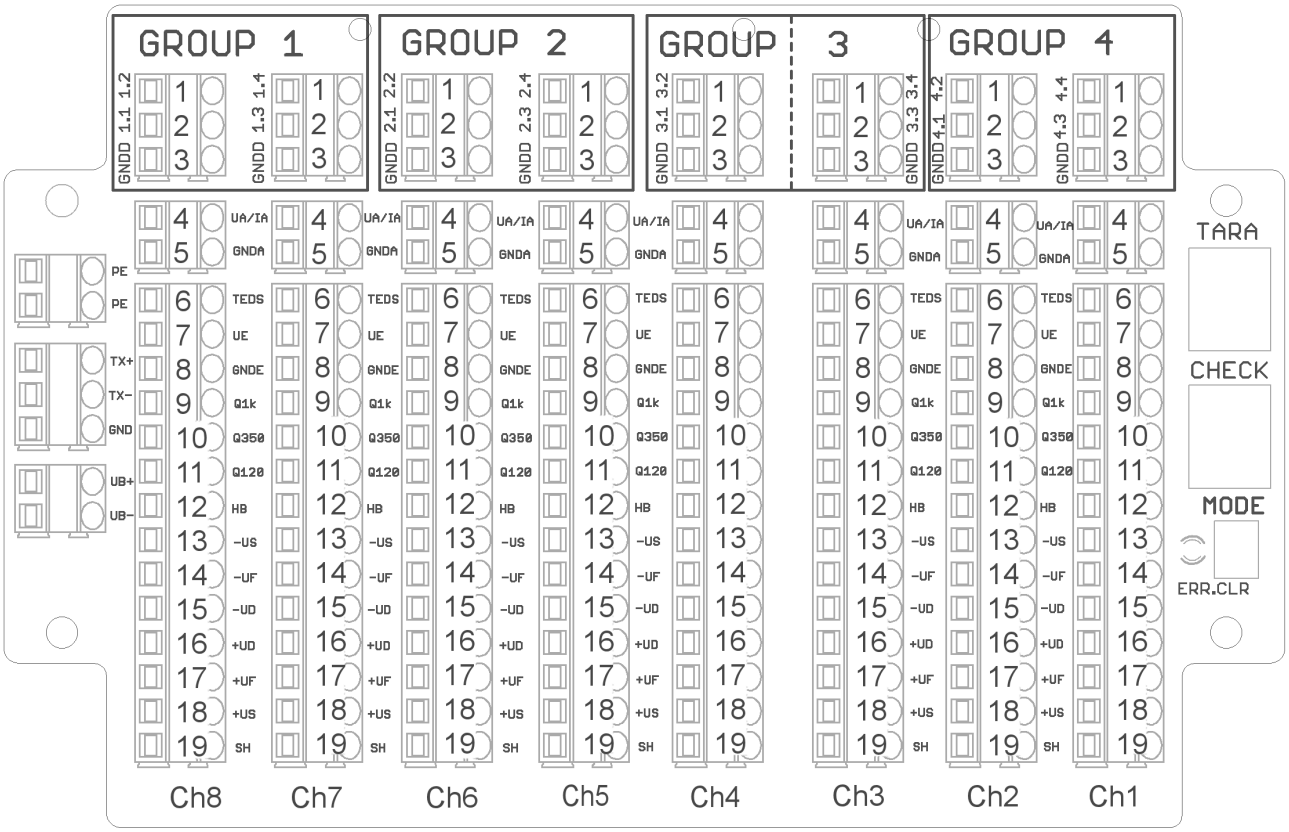
Pin	Name	Meaning
1	UB-	Ground supply voltage
2	RX	Receive data of GSV-8, 3.3Volt level
3	TX	Transmit data of GSV-8, 3.3 Volt level
4	/	Internal usage
5	UB-	Ground supply voltage
6	UB+	Supply voltage
7	/	Internal
8	UB+	Supply voltage
9	OFF	GSV-8 Disable
	Housing	Shield

Voltage supply M8, 4-pole



1	UB+	brown	Positive supply voltage 10-27V, brown
2	PE	white	Earth (housing) PE, white
3	0V	blue	Negative supply voltage (GND), blue
4	PE	black	Earth (housing) PE, black

Screw terminal GSV-8AS



Pos.	Terminal labelling	Description
1	n.2 / n.4 Group n	Digital In/Out No. 2 / 4 / 6 / 8 / 10 / 12 / 14 / 16
2	n.1 / n.3 Group n	Digital In/Out No. 1 / 3 / 5 / 7 / 9 / 11 / 13 / 15
3	GNDD	Ground, digital In/Out
4	UA/IA	Analog output, current or voltage
5	GNDA	Ground, Analog output
6	TEDS	Transducer Electronic Data according to IEEE 1451.4
7	UE	Voltage, Analog input

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8	GNDE	Ground, Analog input
9	Q1k	Quarter bridge completion 1000 Ohm
10	Q350	Quarter bridge completion 350 Ohm
11	Q120	Quarter bridge completion 120 Ohm
12	HB	Half bridge completion
13	-US	Negative bridge supply
14	-UF	Negative sense line
15	-UD	Negative differential input
16	+UD	Positive differential input
17	+UF	Positive sense line
18	+US	Positive bridge supply
19	SH	Earth, analog input (shielding)

Additional information

LED indicators

The LED indicators differ according to the housing versions AS and DS as well as the field bus versions CANopen and Ethercat. The DS housing is equipped with all the LEDs on the front panel, integrated into the buttons. The green ECR or green FUNCTION LED only has significance for Ethercat devices.

LED	Color AS	Color DS	Meaning	Position AS	Labelling DS
FUNCTION	yellow	blue	on/off, Bootloader	outside, yellow/green combined	ON OFF
	green	green	Ethercat-State EC-RUN		ECR
STATUS	red	red	Error state	outside	MOD
CHECK	yellow	yellow	Measuring value-emulation	inside	CHK

For devices with fieldbus (CANopen, Ethercat), there are two small green LEDs next to the field bus connections. These have the following meaning:

Ethercat: Link activity

CANopen: Field bus switched on

LED indicators STATUS and FUNCTION on Ethercat devices

Device state	FUNCTION-LED	EC-RUN-LED
EtherCAT State=INIT (not active)	Permanently on	Off
EtherCAT State=PREOP	Off	Blinking 200ms on 200ms off
EtherCAT State= SAFEOP	Off	Single flash 200ms on, 1s off
EtherCAT State= OP	Off	Permanently on
USB-Bootloader active (EtherCAT not used)	300ms on 300ms off	Off

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LED-display for error condition (all device models)

Error condition	Prio	STATUS LED	Meaning
EtherCAT: State-transition inhibited	1	Blinking 200ms on 200ms off	Requested status transition impossible, e.g. because of invalid settings or invalid hardware settings
EtherCAT: State automatically reset	1	Single flash 200ms on, 1s off	Device switched from operating state to SafeOpError because of a synchronization error
EtherCAT: Application watchdog timeout	1	Double flash 200ms on, 200ms off 200ms on 1sec off	If Watchdog-timer is active: process data frame not received within watchdog time
Measuring application: Sensor error	2	Permanent on	1. A sensor or its cable is defective, for example, the cable Ud+ or Ud- could be interrupted or could have short circuited with one of the cables Us+ or Us-. 2. A measured value is saturated, i.e. the measuring signal lies outside of the measuring range. This could be ascribed to a defective sensor. 3. The maximum value is exceeded for a six-axis sensor.
Measuring application: Error at the digital output	3	Blinks slowly 500ms on 500ms off	Short-circuit at the digital output, i.e. if this is connected as an output and switched to High, it has short-circuited with GNDD, or if it is switched to Low, a voltage >=3 V is applied.
Measuring application: Error at the analog output	4	Blinks very slowly 1s on 1s off	Open current output or overheating of the output driver, for example as a result of a short-circuited voltage output.
Bootloader: Firmware-update failed	1	Permanent on	Checksum error after writing to flash memory during firmware update

FUNCTION LED

The FUNCTION LED lights up permanently in yellow (blue for GSV-8DS) during normal operation. It blinks after activating the firmware update function (see Annex A).

In EtherCAT devices, this LED lights up or blinks in green depending on the EtherCAT states (with GSV-8DS: separate green LED).

STATUS LED (red)

The STATUS LED indicates errors that have occurred.

If it lights up permanently in red, an error at the sensor input has occurred. This can be ascribed to three causes:

- A sensor or its cable is defective, for example, the cable Ud+ or Ud- could be interrupted or short circuited with one of the cables Us+ or Us-.
- A measured value is saturated, i.e. the measuring signal lies outside the measuring range. This could be ascribed to a defective sensor.
- The maximum value is exceeded for a six-axis sensor.

If the STATUS LED blinks slowly (approx. 1x/s), an error has occurred at the analog output. This could be an open current output or overheating of the output driver, for example, as a result of a short-circuited output voltage.

If the STATUS LED blinks quickly (approx. 2x/sec), an error has occurred at the digital output, namely a short circuit, i.e. if this is connected as an output and switched to High, it has short-circuited with GNDD, or if it is switched to Low, a voltage >=3 V is connected.

The status display of the error can be cleared by pressing the MODE button (located in the housing) if the error is currently no longer present.
Detailed error information is stored in the device and can be displayed by pressing the keyboard key E in the terminal program.

Digital inputs and outputs

The GSV-8 has 16 configurable 5V TTL compatible digital inputs and outputs ('DIOs'). These are organised into 4 groups which are identified on the GSV-8AS terminal connections as 'Group 1' to 'Group 4'. The respective DIOs are identified here as <GroupNo.>.<DIOno>.

The DIOs can be configured as an input or output function, whereby the DIOs within one

group must all have the same data direction.

Digital-I/O Numbers

In the devices and windows API (DLL), the numbers of the DIOs are assigned to the terminal connection identification as follows:

Number in the API and terminal program	Belongs to group	Identification on the terminal board	Assigned optional function / remark
1	1	1.1	
2	1	1.2	
3	1	1.3	
4	1	1.4	
5	2	2.1	
6	2	2.2	
7	2	2.3	
8	2	2.4	
9	3	3.1	Pull-up may be disabled by QEI configuration
10	3	3.2	Pull-up may be disabled by QEI configuration
11	3	3.3	QEI 1: Pulse input A
12	3	3.4	QEI 1: Pulse input A
13	4	4.1	Slave-Input or QEI 1: Reset input I
14	4	4.2	Slave-Input or QEI 2: Pulse input A
15	4	4.3	Slave-Input or QEI 2: Pulse input B
16	4	4.4	Slave-Input or QEI 2: Reset input I

Digital I/O Functions

The following functions can be configured:

No	Function	Data direction	Parameter Device- or DLL-Command (GSV86)Get/SetDIOtype	Short description
1	General-Purpose Input	Input	0x000004	General input. The logic level can be queried with GetDIOlevel / GSV86getDIOlevel.
2	Zero setting single channel	Input	0x000010	The active input level sets an analog input channel to zero.
3	Zero setting all channels	Input	0x000020	The active input level sets all analog input channels to zero.
4	Reset the maximum and minimum value determination	Input	0x000040	The active input level resets all maximum and minimum values.
5	Set the default values of all digital outputs	Input	0x000050	Active input level sets all I / Os configured as output to the (configurable) default level.[6]
6	Trigger Send actual value	Input	0x000080	Triggers the sending of a measured value frame with actual measured values via a USB interface to the inactive-to-active edge of the digital input.
7	Trigger minimum value	Input	0x000100	The maximum value determination is started for the inactive-to-active edge at the digital input (all input channels) and a frame with these maximum values is sent to the USB interface at the active-to-inactive edge.
8	Trigger minimum value	Input	0x000200	The minimum value determination is started for the inactive-to-active edge at the digital input (all input channels) and a frame with these minimum values is sent to the USB interface at the active-to-inactive edge.
9	Trigger mean	Input	0x000400	A decimating mean value formation is started for

6 Available from firmware-version 1.45

	value			the inactive-to-active edge on the digital input (all input channels) and a frame with these mean values is sent to the USB interface at the active-to-inactive edge.
10	Trigger Send actual value	Output	0x000800	While the input level is active, measured value frames with actual measured values are sent via a USB interface at the set data rate.
11	Sync-Slave Input	Input	0x000002	Input for synchronous measurement data frame transmission in combination with several GSV-8, whereby the line is connected to the master (see no.20)
12	QEI-Encoder	Input	0x000008	Input for quadrature counter / frequency measurement. Read-Only. To change, the command Write Counter/Freq Mode at Index 0 must be used. [7]
13	General-Purpose Output	Output	0x001000	General output. The actual logic level can be defined with SetDIOlevel / GSV86setDIOlevel.
14	Threshold output actual value	Output	0x010000	Threshold value output: The output is activated if the assigned measured value is larger than the upper threshold value and is deactivated if it is smaller than the lower threshold value.
15	Threshold output maximum value	Output	0x014000	Threshold value output: The output is activated if the assigned maximum value is larger than the upper threshold value and is deactivated if it is smaller than the lower threshold value.
16	Threshold output minimum value	Output	0x018000	Threshold value output: The output is activated if the assigned minimum value is larger than the upper threshold value and is deactivated if it is smaller than the lower threshold value.
17	Window comparator output actual value	Output	0x012000	Window comparator: The output is activated if the assigned measured value is smaller than the upper threshold value and larger than the lower threshold value; otherwise it is deactivated.
18	Window comparator output maximum value	Output	0x016000	Window comparator: The output is activated if the assigned maximum value is smaller than the upper threshold value and larger than the lower threshold value; otherwise it is deactivated.

7 Available from firmware-version 1.45

19	Window comparator output minimum value	Output	0x01A000	Window comparator: The output is activated if the assigned minimum value is smaller than the upper threshold value and larger than the lower threshold value; otherwise it is deactivated.
20	Sync-Master output	Output	0x020000	Output to the synchronous data frame transmission in combination with several GSV-8, whereby the line is connected to the slave(s) (see no.11)

Inverting digital inputs

The DIOs have pull-up resistances that generate high levels when the input is open. For input trigger functions that are intended to be used with a switch or button, that one must be connected between the DIO and the GNDD terminal. The line must be functionally inverted by software so that the function can be executed when the switch is closed. When using the device interfaces or DLL, the specified value in the above mentioned column 'Value' must be ORed with 0x80000 for this purpose.

The threshold value outputs can also be inverted in this way.

The terms in the above mentioned table mean:

Level	Non-inverted	Inverted
Active	Logic 1 = High = 5V	Logic 0 = Low = 0V
Inactive	Logic 0 = Low = 0V	Logic 1 = High = 5V

When using the general purpose functions or the Value-frame sync. functions (no. 1, 11, 13 and 20 in the above table) the inversion has no effect. The software functions/device commands GSV86get/setDIOlevel and Get/SetDIOlevel always read the level directly, i.e. not inverted.

Further Notes Digital I/O

The default level can be defined for digital outputs, i.e. the level that the output should take after restarting and after a reconfiguration. This setting also applies directly, i.e. independent of the inversion state.

The general permanent data transmission should be turned off for measured value-send-trigger functions (no. 6 to 10 in the above-mentioned table). This can be done with the button y in the terminal program.

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For functions, that are associated with the acquisition of maximum and minimum values (in the table above no. 4,7,8,15,16,18,19) the determination of maximum and minimum values of the firmware should be activated. This can be done with the button m in the terminal program.

Master-Slave Frame Synchronization

When using several GSV-8s at the same time, the transmission of the measurement data frames can be synchronized via digital I / Os. For this, one of the devices must be configured as a master by selecting one of the DIO lines as a synchronization line and configuring the function of this line as a sync master output (no.20). All other devices are configured as sync slave input (No. 2) on one of the DIO lines 13 to 16, that are connected to the master.

When using the optional GSV-8 master-slave adapter cable, the synchronization line for all devices is set to DIO no. 16.

The synchronization line always consists of two wires: signal (e.g., DIO 16 <-> DIO 16) and GND = digital reference mass.

Counter, frequency and speed measurement

Devices with firmware version 1.45 and following can also evaluate data of incremental encoders, such as rotary encoder sensors ("QEI"). Up to two quadrature encoders can be connected, each with A, B and optional reset input I, see Digital Inputs Sub-D25 connector. The 6 connection lines have a fixed assignment to the I/O lines: QEI 1: DIO11 to 13. QEI 2: DIO 14 to 16.
Likewise, pulses of digital square wave signals can be counted, e.g. for rotation angle or distance measurements. In this case, the input A is the pulse input and B determines the counting direction. Also, the frequency and the quantities associated with it (e.g., translatory motion or rotational speed) can be acquired by the GSV-8, and the sign of the measured value thereby indicates the direction.
For this purpose, one to two separate measuring channels are used, which are only available after activation of the function. These are always the last two measurement channels in the measurement data frame, or only the last one. As a result, up to 10 measuring channels can be transmitted.
The first encoder "QEI 1" can be used to measure counter, frequency or both counter and frequency / speed at the same time. In the latter case, two measurement channels are generated.
Encoders which generate single-ended square wave signals having the states 0V (connected to GND) and 5V, or 0V and high impedance, i.e. 5V TTL push-pull outputs or open drain, can be connected directly. A power supply with 5V and max. 20mA is available. The maximum input frequency is 10 MHz.

Details on configuration and mode of operation are described in a separate document "BA-GSV8-Incrementalencoder_en.pdf".

Data acquisition and Bandwidth

The GSV-8 has a 24-bit sigma delta AD converter that acquires all 8 channels simultaneously (simultaneous sampling). It is set to a fixed single sampling rate of 48000 samples/second (total sampling rate = 48000/s x 8 channels = 384000/s). These are decimated down by a digital anti-aliasing filter to fixed values depending on the selected data rate, whereby all input samples are included in the calculation (output decimation). The cut-off frequencies mentioned in the following table is a result of this input filter, i.e. these apply if:

- The analog input filter is set to the highest value of 11.4 kHz and
- The additional digital filters (see above) are switched off.

In this case, the data frequency also automatically corresponds to the update of the analog output. However, the analog output is updated up to 16000 samples / s. The analog output is switched off from 24000 samples / s and higher.

Data frequency in frames/s	Decimation divisor	-3 dB cut-off frequency in Hz
1	48000	0,4
2	24000	0,8
3	16000	1,2
4	12000	1,6
5	9600	2
6	8000	2,4
8	6000	3,2
10	4800	4
12	4000	4,8
15	3200	6
16	3000	6,4
20	2400	8
24	2000	9,6
25	1920	10
30	1600	12
32	1500	12,8

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Data frequency in frames/s	Decimation divisor	-3 dB cut-off frequency in Hz
40	1200	16
48	1000	19,2
50	960	20
60	800	24
75	640	30
80	600	32
96	500	38,4
100	480	40
120	400	48
125	384	50
150	320	60
160	300	64
192	250	76,8
200	240	80
240	200	96
250	192	100
300	160	120
320	150	128
375	128	150
384	125	153,6
400	120	160
480	100	192
500	96	200
600	80	240
640	75	256
750	64	300
800	60	320
960	50	384
1000	48	400

Data frequency in frames/s	Decimation divisor	-3 dB cut-off frequency in Hz
1200	40	480
1500	32	600
1600	30	640
1920	25	768
2000	24	800
2400	20	960
3000	16	1200
3200	15	1280
4000	12	1600
4800	10	1920
6000	8	2400
8000	6	3200
9600	5	3840
12000	4	4800
16000	3	6400
24000	2	9600
48000	1	11400

Note: The configurable maximum data frequency depends on other settings of the device.

When setting the data frequency, the GSV-8 checks if the desired data frequency is possible and refuses the command, if not. The maximum configurable data frequency can be determined by a read command. Examples of settings that have an impact on the maximum data frequency, are:

- Measured data type
- Bit rate of the UART interface, if activated (if present)
- Digital FIR- and IIR-filters
- Trigger- and threshold functions of the digital I/Os
- Activated six-axis sensor measuring

At the highest data rates of 24000 / s and 48000 / s, the range of functions of the GSV-8 is limited to digital data transmission.

Data frames and data troughput

The GSV-8 transmits the measured data in single frames via a serial USB interface, whereby

each measured data frame contains samples of all 8 channels that were acquired simultaneously.

The data format for the measured data can be changed. There are 3 different data formats available:

Data type	Description	Maximum data frequency[8]
INT16	Integer 16-Bit-value in binary offset format. Unscaled raw value.	48000 frames/s
INT24	Integer 24-Bit-value in binary offset format. Unscaled raw value.	24000 frames/s
Float	32-bit floating-point number according to IEEE 754. Measured value has been completely scaled.	12000 frames/s (six-axis sensor = off) [9] 12000 frames/s (six-axis sensor = on) [10]

Using the example of the strain gauge input with a bridge supply voltage of 8.75 V, the following applies for the integer measured value display INT16 and INT24:

Sensor deviation in mV/V	Integer measuring value, 16-Bit Hex	Integer measuring value, 24-Bit Hex	Read value MEGSV8w32.dll:: GSVread and other measuring value -read functions[11]
<= -2,1	0x0000	0x000000	-1,05
-2,0	0x0618	0x061862	-1,0
0	0x8000	0x800000	0,0
2,0	0xF9E7	0xF9E79E	1,0
>= 2,1	0xFFFF	0xFFFFFF	1,05

The measuring amplifier is factory-calibrated so that the value for the nominal input sensitivity (here 2.0 mV/V) is as exact as possible.

The multiplication with the scaling value (button ‘n’ in the terminal program) is carried out by external software for the INT data types.

The GSV-8 independently calculates the completely scaled measured values for the **data type float** either by taking the scaling value (general sensors) into consideration or by multiplying with the coefficient matrix for the activated six-axis sensors or by using the calculation for PT1000 RTDs.

8 This value may be smaller depending on configuration. The GSV-8 rejects an attempt to set a data frequency that is too high.
9 from Firmware 1.36 and higher
10 from Firmware 1.36 and higher
11 This value doesn't apply for the GSV-8, if the configured data type is float.

Analog outputs

The signals of the 8 analog corresponds to the 8 analog inputs[12], but their signal conforms to that of the digital communication interfaces, so configurations such as physical values of the 6-axis sensors and digital filters also apply to the analog outputs. The maximum value given by the configuration (e.g., + 3.5mV / V or maximum value of the 6-axis sensor) corresponds to the maximum value of the output signal (e.g., + 10V or 20mA). This relation can be reconfigured by individual scaling values for each analog output, also the zero point can be adjusted. The following 5 output types can be configured individually for each channel:
Voltage: 0-10V, ± 10V, 0-5V, ± 5V, current: 4-20mA, 0-20mA

Transducer Electronic Data Sheet according to IEEE1451.4 (TEDS)

The GSV-8 can be configured to automatically read and use sensors with TEDS memory that contain (currently) TEDS 33 (Bridge Sensor) or 35 (Strain Gauge) data , The value of the user scaling is adjusted based on the TEDS data. The setting whether TEDS data is to be used or not is individually configurable for each of the 8 input channels. It is also possible to set whether the unit and the input measuring range should also be adjusted automatically. The previously manually set values of these parameters remain stored in the GSV-8; If the TEDS sensor is no longer connected, it will be restored.
With the GSV-8, the recalibration of a TEDS sensor with templates 33 or 35 can also be stored in it, he is TEDS writeable.

Frequency output 60kHz ±30khz (devices option)

The measuring signal of the channel 1 can be additionally represented as a frequency modulated square wave signal. It is a differential signal with an amplitude of 6Vpp. The signal can be picked up on the terminals Tx+, Tx- and GND.
The connection on GND is optional.
The representation of sensor zero signal is with 60kHz. At maximum positive nominal input detuning of the amplifier the frequency increases to 90kHz. At maximum negative nominal input detuning of the amplifier the frequency sinks to 30kHz.
An user scaling value can be supplied which allows for changing the output scaling.
The total range of the frequency output, however, is set to 28500Hz to 91500Hz (30000-5% from the hub to 90,000 + 5%).

12 From firmware version 1.46, output channel 7 and 8 can be assigned to one of the counter/frequency channels. However, the assignment to analog input 7 and 8 remains in delivery state.

Changelog

Version	Changes
ba-gsv8_ver7d.odt	updated Pin Assignment for SubD25 female (analog out)
ba-gsv8_ver7e.odt	updated formatting of document
ba-gsv8_ver7f.odt	updated formatting of document
ba-gsv8_ver7g.odt	Chapter Interfaces, Buttons & LEDs, DIOs expanded, TEDS added, corrected
ba-gsv8_ver7h.odt	Chapter "noise amplitude of analog output"; Paragraph over the bandwidth of the analog output; Maximum bandwidth with K6D sensors;
ba-gsv8_ver7i.odt 07/Feb/2019	Description, introduction: Type-K and Counter new, paragraph about ground (p. 7) and counter / frequency measurement new (p. 41), pin assignment updated. New analog output section. TEDS connection postponed Voltage source 24V DC 250mA added to the sensor connection sockets SubD15HD and SubD44HD

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