



# Strain Gage Bridge Amplifier GSV-2

User's Manual  
GSV-2LS, GSV-2AS, GSV-2FSD  
GSV-2CAN, GSV-2TSD-DI



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ME-Meßsysteme GmbH  
Neuendorfstr. 18a  
16761 Hennigsdorf

Tel.: +49 3302 89824 60  
Fax: +49 3302 89824 69

Mail: [info@me-systeme.de](mailto:info@me-systeme.de)  
Web: [www.me-systeme.de](http://www.me-systeme.de)



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## Description

The GSV-2 is a strain gauge measuring amplifier with a serial output signal. Depending on the type, the following interfaces are available: RS232, RS422, USB, CANbus / CANopen, Ethernet.

The measuring amplifier GSV-2 is available in different housing models and equipment variants:

- GSV-2TSD-DI: Desktop housing with display, USB, RS232, and integrated, rechargeable battery
- GSV-2AS, GSV-2ASD: Aluminum housing with RS232, RS422, CANbus, display
- GSV-2FSD-DI: front panel mounting with display, RS232, RS422, CANbus
- The model GSV-2MSD-DI with display, USB, integrated rechargeable battery and SD memory card (data logger function) is especially suitable for mobile use.

The compact dimensions of the GSV-2TSD-DI and the GSV-2MSD-DI fit into any briefcase. With the built-in rechargeable battery 14.8V, 2.8Ah with this model, an operating time of at least 8 hours is possible.

Strain gauge sensors can be connected either via screw terminals or a 15-pin Sub-D connector.

The keyboard can be used to recall presettings of up to 6 sensors. In addition to the menu-driven adjustment of sensor data, the GSV-2TSD-DI and GSV-2MSD-DI allow you to configure the display for strain gauge stress analysis.

The setting of the display during stress analysis with strain gauges is menu-driven.

Strain gauge quarter bridges, half bridges and full bridges can be connected. The amplifier has built-in bridge complements for 120 ohms, 350 ohms and 1000 ohm strain gauges.

## Pin Configuration

### 15 pole terminal block for the sensor connection

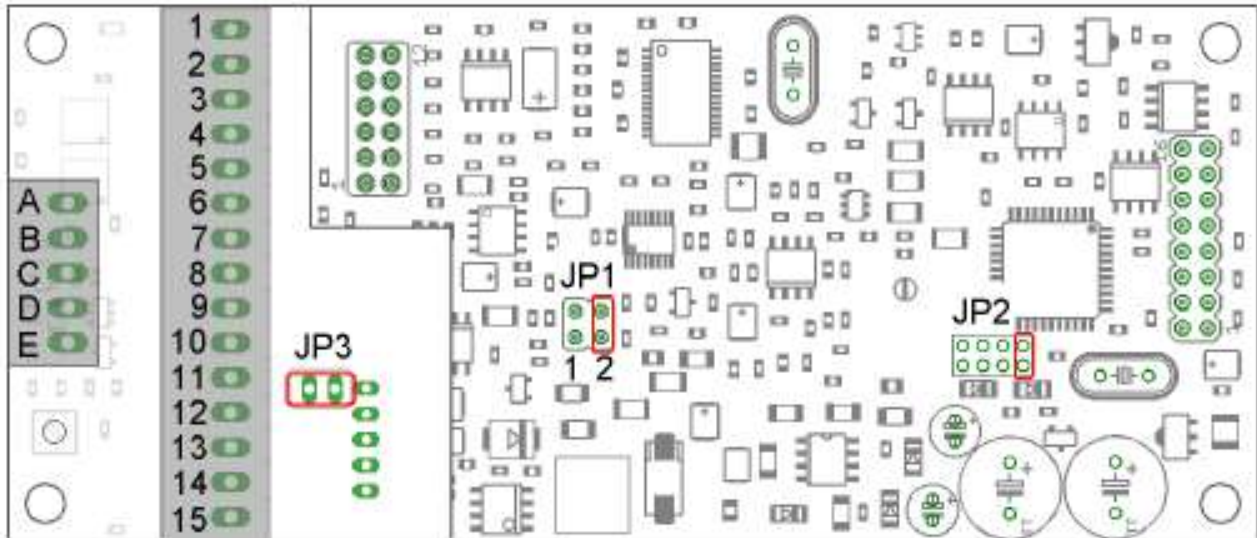


Figure 1: Terminal block 15pole and 5 pole in GSV-2LS, GSV-2AS, GSV-2ASD and GSV-2FSD

| Pin | Name              | Description                             | Tip   |
|-----|-------------------|---|---|
| 1   | GND <sub>B</sub>  | Supply ground                           | Connection for cable shield   |
| 2   | +U <sub>s</sub>   | Positive bridge sensor supply           | The signals at terminals 2..7 are recorded by software in channel 0. Connection of sensors in 4- or 6-wire technology. Bridging between +U <sub>s</sub> and +U <sub>F</sub> as well as between -U <sub>s</sub> and -U <sub>F</sub> are not necessary. |
| 3   | +U <sub>F</sub>   | Positive sens for 6-wire technology     |   |
| 4   | +U <sub>D</sub>   | Positive differential input             |   |
| 5   | -U <sub>D</sub>   | Negative differential input             |   |
| 6   | -U <sub>F</sub>   | Negative sens for 6-wire technology     |   |
| 7   | -U <sub>s</sub>   | Negative bridge sensor supply           |   |
| 8   | U <sub>E</sub>    | Analogue Input 0..10V                   |   |
| 9   | U <sub>A</sub>    | Analogue Output ±5 V / option. 4...20mA |   |
| 10  | GND <sub>A</sub>  | Ground analogue In/Output               |   |
| 11  | SW1 <sup>2</sup>  | Threshold output No. 1                  | Open Collector (Open Emitter alternatively), galvanically isolated  |
| 12  | Tara <sup>1</sup> | Tare input                              | Affects digital serial and analogue output  |
| 13  | SW2 <sup>2</sup>  | Threshold output No. 2                  | See Tip for SW1   |
| 14  | U <sub>B</sub>    | Supply voltage 12..24 VDC               | Connection for supply voltage   |
| 15  | GND <sub>B</sub>  | Supply ground                           |   |

Table 1: 15pole terminal block in GSV-2LS, GSV-2AS, GSV-2ASD and GSV-2FSD

<sup>1</sup> In case of voltages above 3.4 V at this terminal, a tare adjustment is initiated. Offset adjustment is then done in the analog part of the GSV. In addition the digital output is also set to zero.

<sup>2</sup> Threshold values are programmed via the RS 232 port.

## 5 pole terminal block for RS232 / RS422

| Pin | Standard | CAN/CANopen | Description                                  |                |
|-----|----------|-------------|--|----------------|
| A   | GNDC     | GNDC        | Ground RS232 / RS422 Interface               |                |
| B   | Rx / Rx- | Rx          | Data connection Rx for RS232 / Rx- for RS422 |                |
| C   | Tx / Tx- | Tx          | Data connection Tx for RS232 / Tx- for RS422 |                |
| D   | Rx+      | CAN_GND     | Rx+ for RS422                                | Ground CAN bus |
| E   | Tx+      | CAN_L       | Tx+ for RS422                                | CAN low        |
| F   | n.a.     | CAN_H       | n.c.   | CAN high       |

## Backplate of the table case (GSV-2TSD-DI)

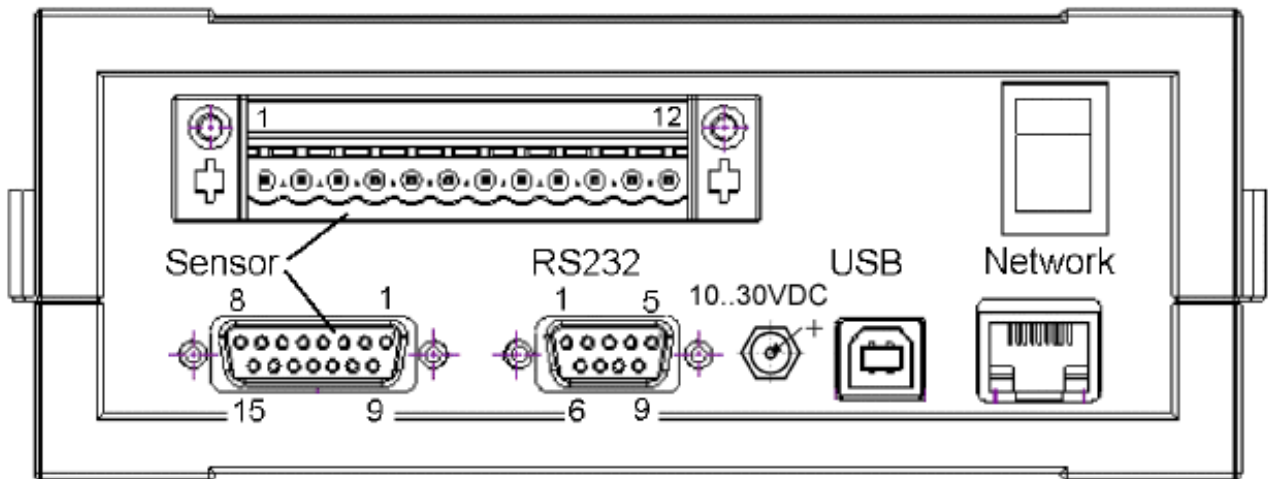


Figure 2: Backplate GSV-2TSD (-DI)

## M8 plug connector for GSV-2TSD-DI CANopen

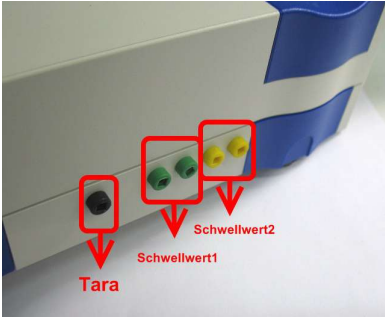
In the version with CANopen Interface there are two additional M8 male / female connectors on the backplate.

| Pin | Funktion | Wire colour |
|-----|----------|-------------|
| 1   | CAN-H    | brown       |
| 3   | CAN-L    | blue        |
| 4   | GND      | black       |

the CAN-Interface is galvanically isolated.

## Side panel GSV-2TSD-DI

Five 2mm plugs are arranged at the side panel. Two isolated threshold outputs and one input for the tare / set zero function are available.

|   |        |                |  |
|---|--------|----------------|--|
|  | black  | Set zero input | Input voltage 9 .. 30 Volts                  |
|   | green  | Threshold 1    | CMOS relay outputs, isolated, 60 VDC, 40 VAC |
|   | yellow | Threshold 2    | CMOS relay outputs, isolated, 60 VDC, 40 VAC |

## 12-pole terminal block GSV-2TSD

| Pin | Name      | Description                         | Tip  |
|-----|-----------|-------------------------------------|--|
| 1   | Shielding | Shield and GNDB                     | Connect the cable shield here  |
| 2   | +Us       | Positive bridge sensor supply       | The signals at terminals 2..7 are acquired by software. Connection of sensors in 4- or 6-wire technology. Bridging between +Us and +UF as well as between -Us and -UF are not necessary. |
| 3   | +UF       | Positive sens for 6-wire technology |  |
| 4   | +UD       | Positive differential input         |  |
| 5   | -UD       | Negative differential input         |  |
| 6   | -UF       | Negative sens for 6-wire technology |  |
| 7   | -Us       | Negative bridge sensor supply (GND) |  |
| 8   | -UD2      | Negative differential input 2       |  |
| 9   | HB        | Completion for halfbridge           | For connection of quarterbridge, 120, 350 or 1000 Ohms.  |
| 10  | QB120     | Completion quarterbridge 120 Ohms   |  |
| 11  | QB350     | Completion quarterbridge 350 Ohms   |  |
| 12  | QB1000    | Completion quarterbridge 1000 Ohms  |  |

Table 2: Connection of 12-pole terminal block GSV-2TSD (-DI)



## Connection scheme 12-pole terminal block

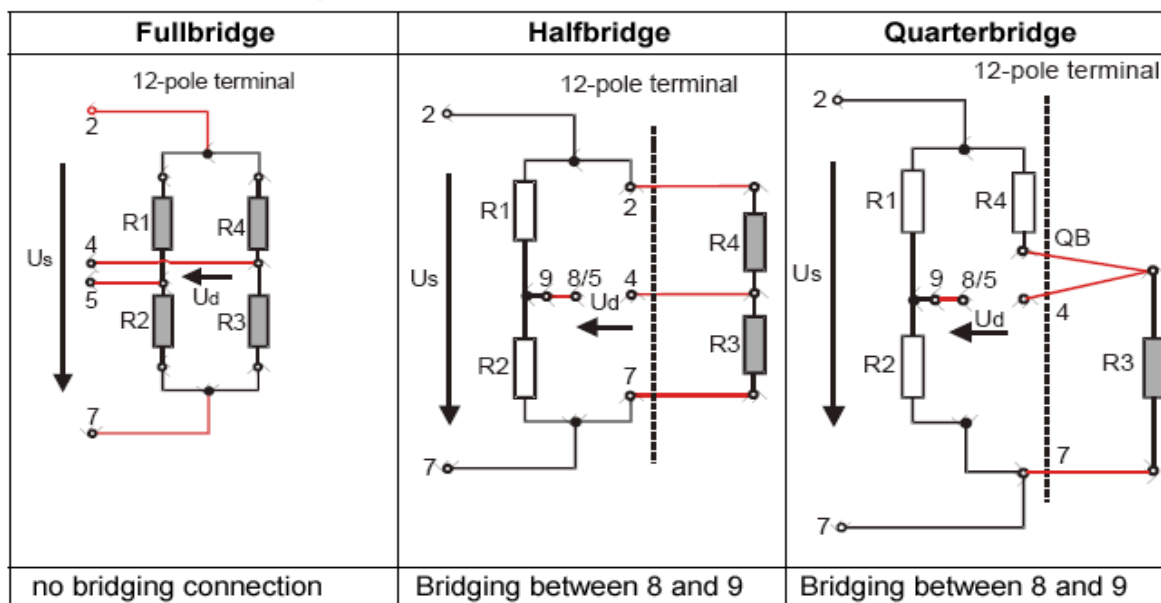
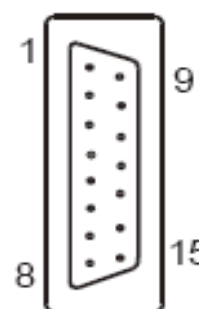


Figure 3: Connection of Full-, Half- and Quarterbridge sensors to the 12-pole terminal block

## 15-pole SUB-D connector of the GSV-2TSD (-DI)

| Pin | Name            | Description                         |
|-----|-----------------|-------------------------------------|
| 1   | Shielding       | Cable shield                        |
| 2   | GND A           | Analogue input ground               |
| 7   | Tare            | Tare input / Trigger input          |
| 9   | U <sub>E</sub>  | Analogue input                      |
| 10  | U <sub>A</sub>  | Analogue output                     |
| 6   | +U <sub>s</sub> | Positive bridge sensor supply       |
| 5   | -U <sub>s</sub> | Negative bridge sensor supply       |
| 8   | +U <sub>D</sub> | Positive differential input         |
| 15  | -U <sub>D</sub> | Negative differential input         |
| 13  | +U <sub>F</sub> | Positive sens for 6-wire technology |
| 12  | -U <sub>F</sub> | Negative sens for 6-wire technology |
| 14  | HB              | Completion for halfbridge           |
| 11  | QB120           | Completion quarterbridge 120 Ohms   |
| 3   | QB350           | Completion quarterbridge 350 Ohms   |
| 4   | QB1000          | Completion quarterbridge 1000 Ohms  |



To connect half- and quarterbridges, pin 14 and pin 15 must be connected together. Quarterbridges are connected in 3-wire technology at pins 5, 8 and QB (3, 11 or 4).

Table 4: Connection of SUB-D 15 plug

## Connection diagram 15-pole SUB-D connector

| Fullbridge             | Halfbridge                 | Quarterbridge              |
|------------------------|----------------------------|----------------------------|
|                        |                            |                            |
| no bridging connection | Bridging between 14 and 15 | Bridging between 14 and 15 |

Table 5: Connection of Full-, Half- and Quarterbridge sensors to the 15-pole SUB-D connector

All ground connections are individually protected by interference suppressor inductors in the GSV. Terminals GND<sub>B</sub> are connected to the housing via interference suppression inductor. Currents above 1A between the terminals and the housing result in damage to the interference suppression inductor. Before connecting, please check whether housing, supply ground, the ground of your data acquisition system and your port are at the same potential.

## Connection and start-up

### Charging the integrated battery

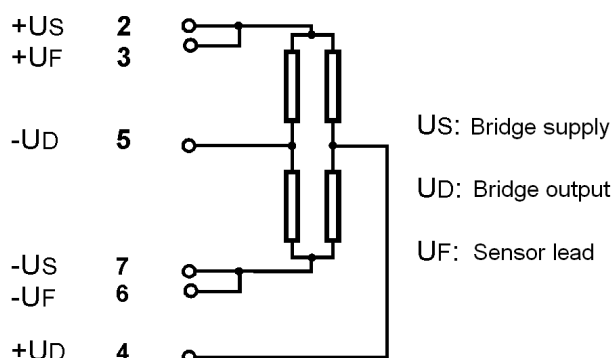
The integrated rechargeable battery of the GSV-2TSD-DI is charged via the DC socket 2.1 x 5.5 mm at the back of the device. The state of charge is indicated by the LED on the back of the device. When the battery is fully charged, the LED goes out or the brightness is reduced. The charging time is about 8 ... 12 hours.

### Connecting the sensor

A strain gage full bridge or a load cell is connected to the amplifier's terminal block as shown below:

| 4-Wire technology |       | 6-Wire technology <sup>1)</sup> : |       |
|-------------------|-------|-----------------------------------|-------|
| Sensor supply +   | PIN 2 | Sensor supply +                   | PIN 2 |
| Sensor supply -   | PIN 7 | Sensor supply -                   | PIN 7 |
| Sensor signal +   | PIN 4 | Sensor signal +                   | PIN 4 |
| Sensor signal -   | PIN 5 | Sensor signal -                   | PIN 5 |
|                   |       | Sense wire +                      | PIN 3 |

|  |  |              |       |
|--|--|--------------|-------|
|  |  | Sense wire - | PIN 6 |
|--|--|--------------|-------|



All cable shields should be connected to the metal of the cable entrance or to GND.

The supply voltage must be connected to the PINs 14 (+) and 15 (GND) of the GSV-2LS, GSV-2AS, GSV-2ASD and the GSV-2FSD

The analogue output transmits a signal which is proportional to the measured force. We offer the GSV-2 with the following options:  $\pm 5$  V, 0...10 V, or 4...20 mA current output. The output signal is present at the PINs 9 and 10 (Ground).

The sensitivity of the amplifier can be changed by removing the Jumper „JP1“ from 2 mV/V) to 1 mV/V. The jumper „JP1“ is located on the circuit board, For more detailed information have a look at page 64.

Connecting the PINs 12 and 13 triggers a zero-point adjustment at the analog and digital outputs. The analog output delivers a voltage from 0 V or a current of 4mA. The system is then ready for measurements.

1) At the analog output the benefits of the 6-conductor technology are not supported.

## Connecting the serial interface

If an RS 232 or RS422 port is used, the following connections should be set up to the PC:

| GSV-PIN                |            | Cable type       | 9-pol. Sub-D-Pin (PC-side) |   |
|------------------------|------------|------------------|----------------------------|---|
| A                      | GND        | Interface ground | GND                        | 5 |
| B                      | RX(-)      | Data wire        | TX                         | 3 |
| C                      | TX(-)      | Data wire        | RX                         | 2 |
| <b>D (RS 422 only)</b> | <b>TX+</b> | <b>Data wire</b> | <b>TX+</b>                 |   |
| E (RS 422 only)        | RX+        | Data wire        | RX+                        |   |

The data cables RX and TX between the amplifier and the PC are crossed at the SUB-D connector of the GSV-2TSD.

The measuring values will be displayed on the PC while starting the supplied configuration programm.

The measuring amplifier GSV-2TSD-DI needs a fully-connected null modem cable, which means crossing of RxD with TxD, RTS with CTS, and DCD+DSR with DTR also GND with

GND (2 with 3, 7 with 8, 1+6 with 4 as well as 5 with 5).

### Commissioning devices with CANopen interface

For devices with CANopen interface the changing of settings via USB port or via RS232 interface is blocked. These settings via USB or RS232 will be however possible only with the switch off of the CANopen interface.

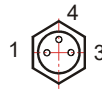
To ensure the conformity with the CANopen protocol, the CANopen interface must be switched on in the factory state.

The switch off of the CANopen interface is possible with the program "GSV-Term".

You can find the corresponding point to switch-off the CANbus under this path: "2" (for the second side) --> "b" (for baud rate / CAN) --> "c" (for CANbus) --> "1" (for switch on/off).

Please note the instructions ba-GSV2CanOpen.pdf.

### 3 pole connector plug / socket M8


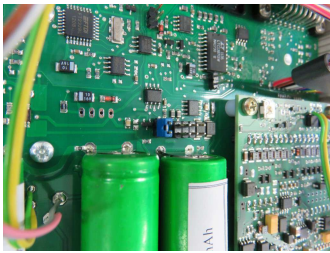


Connector plug and socket are 1:1 connected.

| Pin | Funktion                  | GSV-3CAN | Wire colour |
|-----|---------------------------|----------|-------------|
| 1   | Transmit Data TxD / CAN_H | 13       | brown       |
| 3   | Receive Date RxD / CAN_L  | 12       | blue        |
| 4   | GND                       | 11       | black       |

### Jumper for terminating resistor 120 Ohm

The fotos show the position for the jumper. For closed jumper the terminating resistor of 120 Ohm is activated.

|   |  |
|---|--|
|  |  |
| <p>Jumper for terminating resistor at GSV-2AS</p>                                   | <p>Jumper for terminating resistor at GSV-2TSD-DI</p>                                |

### Setting the input sensitivity

In the default configuration, the measurement amplifier's input sensitivity is  $\pm 2$  mV/V.

At this input sensitivity the measurement amplifier works with a bridge excitation voltage of 2.5V.

For specific applications it may be necessary to adjust the measurement amplifier's input sensitivity.

a) Enlargement of the input sensitivity and thus the measurement range to 3-5 mV/V, e.g. for using sensors with an output signal of 3.0 mV/V (mV output voltage per volt bridge excitation voltage).

b) Reduction of the input sensitivity to 1 mV/V with a bridge excitation voltage of 5.0 V, e.g. if an especially high resolution is to be achieved.

a) The enlargement of the measurement range from 2.0 mV/V to 3.5 mV/V can be performed with the help of the gsvterm.exe configuration software. Further information is to be found in ba-gsvterm.pdf, the instruction manual.

b) The bridge excitation voltage can be converted from 2.5V to 5.0V by relocating a jumper. Jumper JP1 must be relocated in position 1 for 5.0 V (page 13, GSV-2 circuit board). The input sensitivity is reduced to 1 mV/V with this measure. Jumper JP1 is located in position 2 in the original delivery status.

Please note: after a change in the bridge excitation voltage, an automatic calibration must be triggered with the GSVControl software. Further instructions are to be found in ba-gsvcontrol.pdf, the instruction manual for the software.

A sensor with a specific value of 1 mV/V supplies an analogue output signal of 5 V or 10 V, or 20 mA in position 1 at nominal load, depending on the option ordered.

A sensor with a specific value of 2 mV/V then supplies 100% of the output signal at half the nominal load.

### **Null-balance calibration**

The amplifier's calibration range is  $\pm 120\%$  of the measurement range which means that unsymmetric measuring bridges can also be calibrated.

The GSV-2's operating system performs a null-balance calibration if a level of over 3.4 V is present at input T relative to GND. It is permissible to connect input T with the operating voltage of 12V or 24V to perform a null-balance calibration. This voltage must be present for at least 8 ms to trigger the calibration.

A voltage level at input T triggers a combination of an offset calibration and a compensation of the digital output value to 0 in devices with a serial interface. The offset

calibration can be triggered and the output value set to 0 separately via the serial interface.

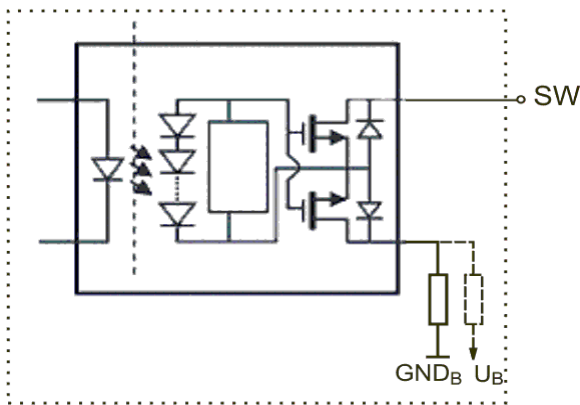
The null-balance calibration lasts approx. 0.12 s for devices with a 250 Hz analogue filter and a set transmission rate  $f$  of 10Hz.

During the calibration, there is no valid signal at the analogue output. Serial data transmission and control of the thresholds is deactivated for the duration of the calibration.

Please note: if the so-called Logger Mode is activated via the configuration software, no null-balance calibration is performed with a high level at input T. A measurement value is sent via the serial interface instead.

## Using switching output

The GSV-2 has two opto-decoupled, digital outputs (terminals 11 and 13). In the standard version, these outputs are configured as OpenCollector outputs. The coil of a relay can be switched between output SW1 or SW2 and supply voltage  $U_B$ . The relay is activated if the threshold is exceeded. The level at SW1 or SW2 then changes from High to Low.



By changing resistances on the circuit board, SW1 and SW2 can also be used as OpenEmitter outputs. The logic is inverted compared to configuration with an OpenCollector output.

The switching thresholds are calibrated via the serial interface.

The switching outputs can be configured via software either as a threshold switch or as a window comparer.

The hysteresis of the threshold switch can be adjusted by assigning the switch-on and switch-off thresholds their own values.

The switch-on threshold must be assigned a larger value than the switch-off threshold.

## Usage of the keyboard and the menu

| Menu entry level 1 | Menu entry level 2   | Menu entry level 3  |
|--------------------|--|---|
| Sensor config.     | <ul style="list-style-type: none"> <li>→unit</li> <li>→Sensor capacity</li> <li>→Rated output</li> </ul> | <p>Select the unit<sup>1</sup></p> <p>Setting the physical nominal value of the sensor.<sup>2</sup></p> <p>Setting the electrical rated output of the sensor.<sup>2</sup></p> |
| Strain analysis    | <ul style="list-style-type: none"> <li>→Set gage factor</li> <li>→Set bridge type</li> </ul>             | <ul style="list-style-type: none"> <li>→Setting the gage factor between 0,2 and 258<sup>3</sup></li> <li>→Full bridge: Full bridge circuit with 4 single</li> </ul>           |

1 Changing the unit doesn't change the measuring value's scaling!

2 Changing the sensor capacity or the rated output changes the measuring value's scaling.

3 Changing the strain gauge parameters of the strain analysis changes the measuring value's scaling and the unit.


| Menu entry level 1      | Menu entry level 2  | Menu entry level 3   |
|-------------------------|---|--|
|                         |   | strain gauges, all in longitudinal direction. <sup>3</sup><br>→ <b>Half bridge</b> : Half bridge circuit with 2 single strain gauges, both in longitudinal direction. <sup>3</sup><br>→ <b>Quarter bridge</b> : Quarter bridge circuit with one single strain gauge. <sup>3</sup><br>→ <b>PR.full bridge</b> : Full bridge circuit with 4 single strain gauges, 2 in longitudinal and 2 in lateral direction. <sup>3</sup><br>→ <b>PR.half bridge</b> : Half bridge circuit with 2 single strain gauges, 1 in longitudinal and 1 in lateral direction <sup>3</sup> |
|                         |   | <b>Menu entry level 4</b><br>Set <b>Poissons ratio</b> (only if PRfull or PR.half bridge was selected in level 3). Number value from 0 to 0,5. <sup>3</sup>  |
| <b>Load settings</b>    | → <b>Default</b> : Factory settings, i.e. restoring the GSV-2 parameters of the initial delivery state.<br>→ <b>User 1</b> : User configurable parameter record No.1, i.e. loading values that were previously saved in "User 1" with Save settings.<br>→ ...and so on, to<br>→ <b>User 6</b> like 1, but record No 6 |  |
| <b>Save settings</b>    | Storing the actual parameter configuration in <b>User 1</b> to <b>User 6</b>  |  |
| <b>Scaling</b>          | Number value between 0,15 and 1580000   |  |
| <b>Data acquisition</b> | → <b>Data frequency</b><br>→ <b>Data period</b>   | Number value for measuring values per second [Hz]<br>Number value for data period in seconds   |



| Menu entry level 1 | Menu entry level 2  | Menu entry level 3  |
|--------------------|---|---|
| Options            | <ul style="list-style-type: none"> <li>→Set channel</li> <li>→Set threshold</li> <br/> <li>→Offset value</li> <br/> <li>→Language<sup>2</sup></li> <li>→CAN settings<sup>2</sup></li> </ul> | Number value 0 or 1<br>→on-threshold 1 / 2 Number value of the on-threshold No. 1 or 2<br>→off-threshold 1 / 2 Number value of the off-threshold No. 1 or 2<br>→ Number value that will be added to every measuring value<br>→German or English<br>→CAN Node-ID<br>→CAN-Baudrate<br>→CAN on/off |

- By pressing the Menu-key the upper menu level will be re-entered.
- By pressing the OK-key an input will be confirmed or the next menu level will be entered.
- If any setting is selected, the message "OK to confirm" appears, which can be confirmed with the OK key or cancelled with MENU.

### Advice

- The symbol  on the right side of the display means that this setting is enabled.
- The entry into the menu is blocked if a communication via the serial interface is active (if megsv.dll is used). In this case the display shows "Menu blocked".

### Description of the keys

| Key            | Function  |
|----------------|---|
| MODE           | Switch on and off or enter the logger-menu  |
| MENU<br>(LEFT) | Enter into main menu or cancel an input.<br>Move to upper menu level.<br>If changing number: Move cursor left |
| UP             | Browsing the menu entries or augment a number / digit value.  |
| DOWN           | Browsing the menu entry or reduce a number / digit value.   |
| OK<br>(RIGHT)  | Confirm an input or change into a sub menu.<br>If changing number: Move cursor right.                         |
| SHORT          | Connecting the inputs +Ud and -Ud (Short-circuit the sensor signal)   |
| ZERO           | Triggering an automatic zero-adjustment   |

<sup>2</sup> Only if CAN-Bus available.



## Number format

To set the number value and the date or the time move with a short press of OK the cursor to the right and with MENU the cursor to the left. The number above the cursor is blinking and can be increased or reduced with UP / DOWN buttons.

**In order for the setting to take effect, the OK button must be kept pressing until the whole number flashes.**

Then release the OK button, it appears "OK to set". Confirm this with pressing on OK. To cancel the time setting press the MENU button long time.

## Settings of the measuring value display (scaling factor)

**scaling factor = Input sensitivity / Nominal excitation \* Nominal load**

|  |                      |
|--|----------------------|
| Input sensitivity of the measuring amplifier | e.g. 3,5 mV/V        |
| Measuring range of the sensor                | 20 kN                |
| Nominal excitation of the sensor             | 1,9998 mV/V at 20 kN |

This example results in an scaling factor of 35,004.

## RS 232/422 Protocol of the GSV-2 Strain Gage Bridge Amplifier GSV-2

### Data output

By default setting, the GSV operates with a communication bit rate of 38400 Baud<sup>3</sup>, 1 Start bit, 8 data bits, no Parity and 1 stop bit (8N1).

There are two types of data frames for the communication of the measuring values:

1. Binary format
2. Text format

The settings of the data formats may be changed with the software GSV Control.

In the normal mode, the GSV transmits its measuring values to the serial interface permanently. In the binary format the GSV transmits 5 bytes for every single measuring value (frame size is 5 Bytes):

|                |        |             |       |             |
|----------------|--------|-------------|-------|-------------|
| , (ASCII: 44d) | Status | Hbyte (MSB) | MByte | Lbyte (LSB) |
|----------------|--------|-------------|-------|-------------|

The first byte is used for synchronization.

<sup>3</sup> 1) The baud rate can be changed, SetBaud Page 41



From Firmware-Version 1.3.06 on, the status-byte contains in bits 3 and 4 information about the state of the threshold switches SW1 and SW2.

|       |       |       |       |      |       |       |       |
|-------|-------|-------|-------|------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit3 | Bit 2 | Bit 1 | Bit 0 |
| Res.  | Res.  | Res.  | SW 1  | SW 2 | Res.  | Res.  | Res.  |

Res.: reserved

SW1, SW2: State of the threshold switches SW1 and SW2

1: threshold switch is on, 0: threshold switch is off

After that there are the three data bytes, starting with the-most significant byte (MSByte), followed by the Mbyte, until the least significant byte, so that 24 Bits are transmitted. In the unipolar mode the measuring value zero is equal the data value zero (0x000000). In the bipolar mode the measuring value zero corresponds to the data value 0x800000 as a hexadecimal value.

At an amplification of 1 mV/V you will get the following raw data:

| Measuring value<br>(hexadecimal) | Unipolar   | Bipolar    |
|----------------------------------|------------|------------|
| 00 00 00                         | 0,0 mV/V   | -1,05 mV/V |
| 80 00 00                         | 0,525 mV/V | 0,0 mV/V   |
| FF FF FF                         | 1,05 mV/V  | 1,05 mV/V  |

If another amplification is used, it is necessary to multiply it with the corresponding factor of proportionality.

The full range of 1,05 mV/V was chosen to be able to measure measuring values which are a bit greater than 1,0 mV/V. See also p.59

If desired, you can switch the data output to the **ASCII Format** using the configuration program **GSV.EXE** or with the Windows-DLL (or with the firmware-command Set Mode, 38d) . The ASCII output corresponds to the values displayed in the LCD and it also can be shown with a terminal program.

In the default settings the data format of the ASCII frame is:

sign, 6 numbers, decimal point, free space, unit, CR, LF

for example

**+1.2345 kgCRLF**

Attention: If the unit is switched off (with the command number 15, Set unit, code 7), the output frame ends with „space“ and CRLF: **+1.2345 CRLF**

## Display settings

With the binary coded data protocol the measured values are transmitted standardized to  $\pm 1$ .

The values shown in the LC display and in the program are a result of the scaling factor multiplied by the measured value. This scaling factor can be set by the command "Set Norm" or with the configuration program.

This is the formula to calculate the scaling factor :

**scaling factor = input sensitivity / rated output \* normal load.**

**Example:**

normal load of the load cell: 100kg  
 rated output of the load cell: 2 mV/V  
 Input sensitivity of the strain gage amplifier: 2 mV/V  
 ==> scaling factor = 100

**Output of the register data**

After requesting the data, the answer frame sent begins with a semicolon as a prefix. From 2 up to 8 data bytes are getting transmitted in the frame depending on the size of the register. You receive the following format:

|              |               |       |       |       |
|--------------|---------------|-------|-------|-------|
| for 3 Bytes: | ;(ASCII: 59d) | HByte | MByte | LByte |
| for 2 Bytes: | ;(ASCII: 59d) | HByte | LByte |       |

**Commands to the GSV-2**

Commands to the GSV have the following format:

|                |    |    |    |    |
|----------------|----|----|----|----|
| Command number | P1 | P2 | P3 | P4 |
|----------------|----|----|----|----|

The Command number may be followed by up to four parameters P1...P4, depending on the command (see the commands description below).



## Table of commands

Note: the command number must be sent as Byte to GSV-2, followed by parameter-bytes. ( the command consist of 1 byte, followed by parameter-bytes).

| Command No. | Command No. (Hexadecimal) | Command name                | Number of parameters | Number of data bytes send by the GSV |
|-------------|---------------------------|-----------------------------|----------------------|--------------------------------------|
| 0           | 0                         | reset status                | 0                    | 0                                    |
| 1           | 1                         | read scale                  | 0                    | 3                                    |
| 2           | 2                         | read zero                   | 0                    | 3                                    |
| 3           | 3                         | read control                | 0                    | 3                                    |
| 4           | 4                         | read offset                 | 0                    | 2                                    |
| 5           | 5                         | write scale                 | 3                    | 0                                    |
| 6           | 6                         | write zero                  | 3                    | 0                                    |
| 7           | 7                         | write control               | 3                    | 0                                    |
| 8           | 8                         | write offset                | 2                    | 0                                    |
| 9           | 9                         | get all                     | 1                    | 0                                    |
| 10          | A                         | save all                    | 1                    | 0                                    |
| 11          | B                         | set cal                     | 0                    | 0                                    |
| 12          | C                         | set zero                    | 0                    | 0                                    |
| 13          | D                         | set scale                   | 0                    | 0                                    |
| 14          | E                         | set offset                  | 0                    | 0                                    |
| 15          | F                         | set unit                    | 1                    | 0                                    |
| 16          | 10                        | set norm                    | 3                    | 0                                    |
| 17          | 11                        | set dpoint                  | 1                    | 0                                    |
| 18          | 12                        | set frequency               | 2                    | 0                                    |
| 19          | 13                        | set gain                    | 1                    | 0                                    |
| 20          | 14                        | set bipolar                 | 0                    | 0                                    |
| 21          | 15                        | set unipolar                | 0                    | 0                                    |
| 22          | 16                        | <b>Read frequency</b>       | 0                    | 3                                    |
| 23          | 17                        | <i>Manufacturer setting</i> |                      |                                      |
| 24          | 18                        | <i>Manufacturer setting</i> |                      |                                      |
| 25          | 19                        | <i>Manufacturer setting</i> |                      |                                      |
| 26          | 1A                        | get norm                    | 0                    | 3                                    |
| 27          | 1B                        | get unit                    | 0                    | 1                                    |
| 28          | 1C                        | get dpoint                  | 0                    | 1                                    |
| 29          | 1D                        | switch                      | 1                    | 0                                    |
| 30          | 1E                        | <i>Manufacturer setting</i> |                      |                                      |
| 31          | 1F                        | get serial number           | 0                    | 8                                    |
| 32          | 20                        | set threshold1              | 4                    | 0                                    |
| 33          | 21                        | get threshold1              | 0                    | 4                                    |
| 34          | 22                        | set channel                 | 1                    | 0                                    |
| 35          | 23                        | stop transmission           | 0                    | 0                                    |
| 36          | 24                        | start transmission          | 0                    | 0                                    |
| 37          | 25                        | clear buffer                | 0                    | 0                                    |
| 38          | 26                        | set mode                    | 1                    | 0                                    |
| 39          | 27                        | get mode                    | 0                    | 1                                    |
| 40          | 28                        | <i>Manufacturer setting</i> |                      |                                      |
| 41          | 29                        | get equipment               | 0                    | 1                                    |
| 42          | 2A                        | <i>Manufacturer setting</i> |                      |                                      |
| 43          | 2B                        | firmware version            | 0                    | 2                                    |
| 44          | 2C                        | set gauge factor            | 2                    | 0                                    |
| 45          | 2D                        | get gauge factor            | 0                    | 2                                    |
| 46          | 2E                        | set poisson                 | 1                    | 0                                    |

| Command No. | Command No. (Hexadecimal) | Command name                         | Number of parameters | Number of data bytes send by the GSV |
|-------------|---------------------------|--------------------------------------|----------------------|--------------------------------------|
| 47          | 2F                        | get poisson                          | 0                    | 1                                    |
| 48          | 30                        | set bridge type                      | 1                    | 0                                    |
| 49          | 31                        | get bridge type                      | 0                    | 1                                    |
| 50          | 32                        | Set Range                            | 1                    | 0                                    |
| 51          | 33                        | get range                            | 0                    | 1                                    |
| 52          | 34                        | reserved                             |                      |                                      |
| 53          | 35                        | get offset wait                      | 0                    | 1                                    |
| 54          | 36                        | get options                          | 0                    | 3                                    |
| 55          | 37                        | reserved                             |                      |                                      |
| 56          | 38                        | reserved                             |                      |                                      |
| 57          | 39                        | reserved                             |                      |                                      |
| 58          | 3A                        | reserved                             |                      |                                      |
| 59          | 3B                        | get value                            | 0                    | 5 <sup>4</sup>                       |
| 60          | 3C                        | clear maximum value                  | 0                    | 0                                    |
| 61          | 3D                        | set Digits                           | 1                    | 0                                    |
| 62          | 3E                        | get Digits                           | 0                    | 1                                    |
| 63          | 3F                        | reserved                             |                      |                                      |
| 64          | 40                        | reserved                             |                      |                                      |
| 65          | 41                        | Get Channel                          | 0                    | 1                                    |
| 66          | 42                        | Get Last Error                       | 0                    | 1                                    |
| 67          | 43                        | Set Second Threshold                 | 4                    | 0                                    |
| 68          | 44                        | Get Second Threshold                 | 0                    | 4                                    |
| 69          | 45                        | Get Device Type                      | 0                    | 1                                    |
| 70          | 46                        | calc norm                            | 0                    | 0                                    |
| 128         | 80                        | Set TX mode                          | 1                    | 0                                    |
| 129         | 81                        | Get TXmode                           | 0                    | 1                                    |
| 130         | 82                        | Set Baud <sup>5</sup>                | 1                    | 0                                    |
| 131         | 83                        | Get Baud                             | 0                    | 1                                    |
| 132         | 84                        | reserved                             |                      |                                      |
| 133         | 85                        | reserved                             |                      |                                      |
| 134         | 86                        | Set Slow Rate                        | 2                    | 0                                    |
| 135         | 87                        | Get Slow Rate                        | 0                    | 2                                    |
| 136         | 88                        | Set Special Mode                     | 2                    | 0                                    |
| 137         | 89                        | Get Special Mode                     | 0                    | 2                                    |
| 138         | 8A                        | Write Sampling Rate                  | 3                    | 0                                    |
| 139         | 8B                        | Read Sampling Rate                   | 0                    | 3                                    |
| 140         | 8C                        | Set CAN setting                      | 3                    | 0                                    |
| 141         | 8D                        | Get CAN setting                      | 1                    | 2                                    |
| 142         | 8E                        | reserved                             |                      |                                      |
| 143         | 8F                        | reserved                             |                      |                                      |
| 144         | 90                        | Set Analogue Filter                  | 2                    | 0                                    |
| 145         | 91                        | Get Analogue Filter                  | 0                    | 2                                    |
| 146         | 92                        | Switch Blocking                      | 3                    | 0                                    |
| 147         | 93                        | Get Command Available                | 2                    | 1                                    |
| 148         | 94                        | Set Noise-Cut Threshold <sup>6</sup> | 3                    | 0                                    |
| 149         | 95                        | Get Noise-Cut Threshold <sup>6</sup> | 0                    | 3                                    |
| 150         | 96                        | Set Auto-Zero Counter <sup>6</sup>   | 2                    | 0                                    |

4 At a normal version with binary output

5 This command can only be executed with the configuration jumper set, see p.64

6 If function exists (see command description)



| Command No. | Command No. (Hexadecimal) | Command name                        | Number of parameters | Number of data bytes send by the GSV |
|-------------|---------------------------|-------------------------------------|----------------------|--------------------------------------|
| 151         | 97                        | Get Auto-Zero Counter <sup>1</sup>  | 0                    | 2                                    |
| 152         | 98                        | Set User-Text Char 1)               | 2                    | 0                                    |
| 153         | 99                        | <i>reserved</i>                     |                      |                                      |
| 154         | 9A                        | Set User Offset Value <sup>3</sup>  | 3                    | 0                                    |
| 155         | 9B                        | Get User Offset Value <sup>3</sup>  | 0                    | 3                                    |
| 156         | 9C                        | <i>reserved</i>                     |                      |                                      |
| 157         | 9D                        | <i>reserved</i>                     |                      |                                      |
| 158         | 9E                        | SetAdaptFilterMask <sup>3</sup>     | 3                    | 0                                    |
| 159         | 9F                        | GetAdaptFilterMask <sup>3</sup>     | 0                    | 3                                    |
| 160         | A0                        | SetAdaptFilterOptimize <sup>3</sup> | 2                    | 0                                    |
| 161         | A1                        | GetAdaptFilterOptimize <sup>3</sup> | 0                    | 2                                    |
| 162         | A2                        | Read Ranges <sup>7</sup>            | 1                    | 4                                    |
| 163         | A3                        | <i>reserved</i>                     |                      |                                      |
| 164         | A4                        | Get Sensor Capacity <sup>8</sup>    | 0                    | 4                                    |
| 165         | A5                        | Set Sensor Capacity <sup>10</sup>   | 4                    | 0                                    |
| 166         | A6                        | Get Rated Output <sup>10</sup>      | 0                    | 4                                    |
| 167         | A7                        | Set Rated Output <sup>10</sup>      | 4                    | 0                                    |

1 If funktion existent (s. command description)

3 Existent from firmware-version 1.3 on

7 From firmware version 1.3.07 on

8 From firmware version 1.5.06 on

## Description of the commands

**Comment:** For most of the commands described in this chapter there are public dll functions with almost the same name within a Windows-DLL named megsv.dll (they are described in the programming manual). Below there are useful tips to understand the direct RS 232-commands.

### reset status

Command number: 0  
number of parameters: 0  
Bytes sent by the GSV: 0

**Reset status:** resets the amplifier status and the error code (status=0).  
Possible error codes: 0x00

### read scale

Command number: 1  
Number of parameters: 0  
Bytes sent by the GSV: 3

**Read scale** determines the content of the scale-registers of the GSV. You can save the value read on your PC and you can restore it with *write scale*.  
Possible error codes: 0xA0, 0x91

### Read zero

Command number: 2  
number of parameters: 0  
Bytes sent by the GSV: 3

**Read zero** determines the content of the zero-registers of the GSV. You can save the value read on your PC and restore it with *write zero*  
possible error codes: 0xA0, 0x91

### Read control

Command number: 3  
number of the parameters: 0  
Bytes sent by the GSV: 3

**Read control** determines some of the current configuration settings of the GSV. The bytes returned consists of coded channel, data rate, kind of operation, polarity as well as amplification of the AD-converter. The received value can be send back with *write control*.



Possible error codes: 0xA0, 0x91

### Read offset

**Command number: 4**  
**number of parameters: 0**  
**Bytes sent by the GSV: 2**

*Read offset* determines the offset setting of the analog front end of the amplifier. The value received can be send back with *write offset*.

Possible error codes: 0xA0, 0x91

### Write scale

**Command number: 5**  
**number of parameters: 3**  
**Bytes sent by the GSV: 0**

*Write scale* sets the input sensitivity of the AD converter. The 3 bytes sent should contain a value which was recently determined with *read scale*.

**Affected register:** Scale.

Value Range: 0x20.00.00..0xFF.FF.FF  
possible error codes: 0xA0, 0x55,0x71

### Write zero

**Command number 6**  
**number of parameters: 3**  
**Bytes sent by the GSV: 0**

*Write zero* sets the zero adjustment of the AD converter. The 3 bytes sent should contain a value which was recently determined with *read zero*.

**Affected register:** Zero.

Value range: 0x00.00.00..0xFF.FF.FF  
possible error codes: 0xA0,0x71

### Write control

**Command number: 7**  
**Number of parameters: 3**  
**Bytes sent by the GSV: 0**

*Write control* resets the configuration which was determined with *read control* before. The type of operation, polarity, amplification and Notch-frequency (data frequency) are set.



**Affected register:** Channel, frequency, gain, polarity.  
Value Range: 0x00.00.00..0xFE.76.FF  
possible error codes: 0xA0,0x53,0x54,0x58,0x71

#### **write offset**

**Command number: 8**  
**Number of parameters: 2**  
**Bytes sent by the GSV: 0**

*Write offset* sets the Offset configuration of the preamplifier. The bytes sent should contain a value which was recently determined with *read offset*.

**Remarks:** Only the commands *write offset* and *set offset* affect the analog output.

**Affected register:** Offset.  
Value Range: 0x00.00..0x0F.FF  
possible error codes: 0xA0,0x54,0x71

#### **Get all**

**Command number: 9**  
**Number of parameters: 1**  
**Bytes sent by the GSV: 0**

*Get all* restores a set of configuration, (some might be stored previously with *Save All*), chosen by the parameter:

0: : Restore Setting before the last power on cycle.  
1: : Restore Manufacturer Settings  
2..7 : Restore configurations saved at dataset 1..6

**Affected registers:** channel, gain, frequency, offset, zero, scale, threshold.  
Value Range: 0x00..0x07  
possible error codes: 0xA1,0x54,0x80,0x71

#### **Save all**

**Command number: 10**  
**Number of parameters: 1**  
**Bytes sent by the GSV: 0**

*Save all* saves all relevant registers of the GSV to a configuration set in an internal memory. This data remains even when the device is turned off. It is possible to save different configuration sets. After turning on the amplifier up to 64 memory procedures are possible. The parameter indicates the number of the configuration set in the memory.

Parameters= 2 to 7: : configuration set 1 to 6, saved by the user.

The positions 0 and 1 can not be programmed by the user. On the position 0 the current



configuration of the GSV is automatically saved.  
You can restore the configuration set with **get all**.  
Value Range: 0x02..0x07  
Possible error codes: 0xA0,0x54,0x55,0x74,0x71

### Set cal

Command number: 11  
Number of parameters: 0  
Bytes sent by the GSV: 0

**Set cal accomplishes** an internal sensitivity calibration of the AD converter. After this calibration you are operating with the amplification selected by **set gain**.

**Attention:** The previous content of the ADCs calibration register is getting lost. The analog output is not affected.

**Remark:** After sending this command, the GSV is not sending data for a small period of time.  
Affected registers: Scale.  
Possible error codes: 0xA0,0x82

### Set zero

Command number: 12  
Number of parameters: 0  
Bytes sent by the GSV: 0

**Set zero accomplishes** a zero point adjustment of the connected sensor. The analog output is not affected.

**Remark:** After sending this command the GSV is not sending data for a small period of time. For this purpose all data loggers have to be deleted. If Log- and maximum value mode (have a look at **set mode**) is active, the latest maximum value is transmitted once.

Affected register: Zero.  
Possible error codes: 0xA0

### Set scale

Command number: 13  
Number of parameters: 0  
Number of parameters: 0

**Set scale accomplishes** an full sensitivity calibration of the AD converter. In contrast to **set cal**, the sensitivity of the entire system including the connected sensor is getting

updated. After a zero point adjustment with **set zero** this operation is able to calibrate the amplifier to the full load of the sensor, so the sensor must be loaded with its nominal load, while executing **Set Scale**. This command has no affect on the analog output.

**Attention:** Don't accomplish **Set scale** (with a normal load) if no zero point calibration with **set zero** (without load) was done before.

**Remark:** After sending this command the GSV is not sending data for a small period of time. For this purpose all data loggers have to be deleted.

Affected register: Scale.

Possible error codes: 0xA0,0x81,0x83,0x71

### Set offset

Command number: 14

Number of parameters: 0

Bytes sent by the GSV: 0

**Set offset** accomplishes an offset adjustment of the input stage of the GSV. In contrast to **set zero**, this adjustment does affect the analog output of the GSV.

**Remark:**

While adjusting the GSV is not sending any values.

The time needed to accomplish offset adjustment can be read with **get offset wait** or you may get it from the description of the technical data (below) as well.

**Affected register:** Offset.

Possible error codes: 0xA0,0x83

### Set unit

Command number: 15

Number of parameters: 1

Bytes sent by the GSV: 0

**Set unit** sets the desired unit shown on the LC-display and the ASCII measuring value frame. Changing the unit hasn't any influence on the scaling, i.e. the scaling has eventually to be adapted manually.

|    |         |     |      |
|----|---------|-----|------|
| 0: | mV/V    | 22: | oztr |
| 1: | kg      | 23: | dwt  |
| 2: | g       | 24: | kNm  |
| 3: | N       | 25: | %    |
| 4: | cN      | 26: | 0/00 |
| 5: | V       | 27: | W    |
| 6: | µm/m    | 28: | kW   |
| 7: | (keine) | 29: | rpm  |
| 8: | t       | 30: | bar  |
| 9: | kN      | 31: | Pa   |



|     |     |     |                   |
|-----|-----|-----|-------------------|
| 10: | lb  | 32: | hPa               |
| 11: | oz  | 33: | MPa               |
| 12: | kp  | 34: | N/mm <sup>2</sup> |
| 13: | lbf | 35: | °                 |
| 14: | pdl | 36: | Hz                |
| 15: | mm  | 37: | m/s               |
| 16: | m   | 38: | km/h              |
| 17: | cNm | 39: | m <sup>3</sup> /h |
| 18: | Nm  | 40: | mA                |
| 19: | °C  | 41: | A                 |
| 20: | °F  | 42: | m/s <sup>2</sup>  |
| 21: | K   |     |                   |

Value range: 0x00..0x2A

Possible error code: 0xA0,0x54,0x71

### Set norm

Command number: 16

Number of parameters: 3

Bytes sent by the GSV: 0

**Set norm** sets the scaling factor for the measuring values shown in the LC display, see chapter "Display settings" before. The decimal point has to be set separately with **Set dpoint**.

To calculate the parameter value for **set norm** the intermediate value dp for the decimal point has to be calculated first. To do so, the logarithm to the base of 10 of the desired scaling factor has to get calculated and rounded off to an integer value.

Then the desired scaling factor is divided by 10 to the power of dp.

If the result is greater than 1,6666/1,05 then it has to get divided by 10 again.

And you have to add 1 to the dp value.

The value calculated by this method is multiplied by 5250020 and then rounded to the next integer value. This value will be transmitted to the GSV in the order High byte (MSB), Mid byte, Low byte (LSB).

Value Range: 0x10.05.94..0x7F.26.E8

Possible error codes 0xA0,0x54,0x55,0x71

### Set dpoint

Command number: 17

Number of parameters: 1

Bytes sent by the GSV: 0

**Set dpoint** sets the decimal point in the LC-Display to its desired position. To calculate the parameter value on the basis of a desired scaling factor the calculated value of dp from the formula for **set norm** (described there) is used, increased by one. That parameter value is only accepted within its nominal range from 1 to <number of digits>, which means it cannot be greater than the number of digits displayed in the LC display, see **Set/Get digits** below.

Absolute Value Range: 0x01..0x08

Possible error codes 0xA0,0x55,0x56,0x71

## Set frequency

Command number: 18  
 Number of parameters: 2  
 Bytes sent by the GSV: 0

With **Set frequency** the measuring data rate of the GSV can be set. Frequencies between 0,3125 Hz and 2000Hz can be selected. For example: At a data range of 100 Hz, 100 values per second will be sent via the serial interface. The bandwidth of the digitized sensor signal depends on this data rate and on the settings of the analog and the digital filter.

The transmitted register value **N** does not consist the data rate itself. You can get the data rate parameter **N** using the following formula:

$$f_{Data} = \frac{10^7}{512 \cdot N} \quad N = \frac{19531.25}{fData}$$

**Attention:** After a change of the data rate a calibration with **set cal** and **set zero** is necessary.

### Affected register: Frequency

With the GSV-21 (new version, SerNo >=06xxxxxx), the data rate cannot be set continuously. Instead, a combination of the ADC conversion rate and an internal averaging factor will be selected by the GSV-21, whose combination results in the real data rate, which is closest to the desired value transmitted as parameter.

Absolute Value Range: 0x00.00..0xFA.12

The allowed value range of the data rate depends on the baud rate and on the data output format.

The following maximum values apply for:

| Baud rate (default value: 38400 Bits/s) | Maximum data rate Binary output (5 Bytes/measuring value) in Hz | Maximum data rate ASCII-output in Hz |
|---|---|--------------------------------------|
| 4800                                    | 90,9  | 25                                   |
| 9600                                    | 181,8   | 50                                   |
| 19200                                   | 333,3   | 100                                  |
| 38400                                   | 625   | 200                                  |
| 57600                                   | 1071  | 285,7                                |
| 115200                                  | 2000  | 666,7                                |

Possible error codes 0xA0,0x54,0x58,(0x80),0x71



## Set gain

Command number: 19

Number of parameters: 1

Bytes sent by the GSV: 0

**Set gain** sets the amplification of the AD-converter of the GSV as shown in the following table, which indicates the resulting value of the input sensitivity of the bridge input. The **Gain-Parameter 2 is the normal-input sensitivity**, it means that the amplification of the AD-converter is 1. The gain register has no affect on the analog output.

| Gain Parameter | Amplification of the AD converter | JP1 setting 1 | JP1-setting 2 with Input Sens= 2mV/V <sup>2</sup> | JP1-setting 2 with Input Sens= 3,5mV/V <sup>2</sup> |
|----------------|-----------------------------------|---------------|---|---|
| 0 <sup>1</sup> | 0,25                              | 4 mV/V        | 8 mV/V  | 14 mV/V   |
| 1              | 0,5                               | 2 mV/V        | 4 mV/V  | 7 mV/V  |
| 2              | 1                                 | 1 mV/V        | 2 mV/V  | 3,5 mV/V  |
| 3              | 2                                 | 0,5 mV/V      | 1 mV/V  | 1,75 mV/V   |
| 4              | 4                                 | 0,25 mV/V     | 0,5 mV/V  | 0,875 mV/V  |
| 5              | 8                                 | 0,125 mV/V    | 0,25 mV/V   | 0,4375 mV/V   |
| 6              | 16                                | 0,0625 mV/V   | 0,125 mV/V  | 0,21875 mV/V  |

**Attention:** After a change of the amplification a calibration with **set cal** and **set zero** is necessary.

**Affected register:** Gain.

Value Range: 0x00..0x06

Possible error codes 0xA0,0x54,0x71

## Set bipolar

Command number: 20

Number of parameters: 0

Bytes sent by the GSV: 0

**Set bipolar** sets the GSV in the bipolar mode. Zero corresponds to the data value 0x800000 hexadecimal.

Possible error codes 0xA0,0x71

---

2 Have a look at Set/Get Range

1 The final value of the input sensitivity can not be reached, because a digital over flow would occur.

## Set unipolar

Command number: 21  
Number of parameters: 0  
Bytes sent by the GSV: 0

*Set unipolar* sets the GSV in the unipolar mode (the measured value 0 corresponds to the data value 0).

Possible error codes 0xA0,0x71

## Read Frequency

Command number: 22  
Number of parameters: 0  
Bytes sent by the GSV: 3

The 3 parameter bytes returned from the command ReadFrequency are coding the measuring data rate.

With the GSV-21 the data range is not continuously settable (look at *Set Frequency*). That's why the decoded data rate read with Read Frequency may vary a little bit from the value setted before (e.g. with Set Frequency).

The decoding formula for the command 22 is:

**Data rate = 5000000 / (16777216 – register value read)**

Possible error codes 0xA0,0x91,(0x81)

## Get norm

Command number: 26  
Number of parameters: 0  
Bytes sent by the GSV: 3

*Get norm* determines the scaling factor register value, as described in *set norm* (without the related decimal point setting).

Possible error codes 0xA0,0x91

## Get unit

Command number: 27  
Number of parameters: 0  
Bytes sent by the GSV: 1

*Get unit* determines the unit register, as described in *set unit* (look at the list of unit codes).

Possible error codes 0xA0,0x91

## Get dpoint

Command number: 28  
Number of parameters: 0  
Bytes sent by the GSV: 1



**Get *dpoint*** determines the decimal point, as described in **set *dpoint***.  
Possible error codes 0xA0,0x91

## Switch

Command number: 29  
Number of parameters: 1  
Bytes sent by the GSV: 0

**Switch** switches the switch output corresponding to the parameter byte, which is either on (1) or off (0). The state of the switch output only remains if the measured value is within the switch thresholds (with window comparator turned off). The thresholds can be set with **set *threshold***. Thresholds at the measuring range end deactivate the threshold switch, so that the switch command should have effect regardless of the thresholds.

Value Range: 0x00..0x01  
Possible error codes 0xA0,0x71

## Get serial number

Command number: 31  
Number of parameters: 0  
Bytes sent by the GSV: 8

**Get *serial number*** determines the serial number of the amplifier as an ASCII character string.  
Possible error codes 0xA0,0x91

## Set threshold 1

Command number: 32  
Number of parameters: 4  
Bytes sent by the GSV: 0

**Set *threshold 1*** set the threshold of the amplifiers first threshold switch (terminal No 11). The first two parameter bytes are the switch on threshold, the next two bytes are the switch off threshold, both with the MSByte first. The switch on threshold always needs to be bigger than the turn off threshold. You can change the threshold functionality between hysteresis switch and window comparator. In the latter case, the values are to be interpreted as upper and lower switch thresholds.

Value Range: 0x00.01.00.00..0xFF.FF.FF.FE  
Possible error codes 0xA0,0x56,0x71

## Get threshold1

Command number: 33  
Number of parameters: 0  
Bytes sent by the GSV: 4

**Get *threshold*** determines the thresholds of the first threshold switch, as described in **set *threshold***.



Possible error codes 0xA0,0x91

### **Set channel**

**Command number: 34**

**Number of parameters: 1**

**Bytes sent by the GSV: 0**

**Set channel** Sets the analogue input channel of the AD- Converter and restores the operating parameters previously stored for this channel.

Channel=0 : bridge input (terminals 2..7)

Channel=1 : analog-measuring input (terminals 8 and 10)

Value Range: 0x00..0x01

Possible error codes 0xA1,0x54,0x71

### **Stop transmission**

**Command number: 35**

**Number of parameters: 0**

**Bytes sent by the GSV: 0**

**Stop transmission** stops the serial transmission of the measuring values. The serial transmit buffer of the GSV will be emptied. This operation status will get lost after turning off the amplifier.

Possible error codes 0xA0,0x71

### **Start transmission**

**Command number: 36**

**Number of parameters: 0**

**Bytes sent by the GSV: 0**

**Start transmission** starts the serial transmission of the measuring values, if they have been stopped with „stop transmission“ before.

Possible error codes 0xA0

### **Clear buffer**

**Command number: 37**

**Number of parameters: 0**

**Bytes sent by the GSV: 0**

**Clear buffer** deletes the output buffer of the GSV.

Possible error codes 0xA0

### **Set mode**

**Command number: 38**

**Number of parameters: 1**

**Bytes sent by the GSV: 0**

**Set mode** configures the GSV for different modes of operation. As with most of the



operating parameters, this mode remains as it is even after turning the amplifier off. Before you change particular bits of the mode-register you should to read it with **get mode**, change the bits as desired and write the byte back (read-modify-write). You can only change bits 1..5. Description of the mode-variable:

|          |       |           |                |          |          |           |          |
|----------|-------|-----------|----------------|----------|----------|-----------|----------|
| MSB      | Bit 6 | Bit 5     | Bit 4          | Bit 3    | Bit 2    | Bit 1     | LSB      |
| blocking | x     | AV-Filter | Window c. mode | Log-Mode | Max-Mode | Text-Mode | reserved |

Text-mode = 1: measuring value transmission in ASCII-Format is active  
 Max-Modus = 1: maximum value transmission is active  
 Log-Modus = 1: transmission of measuring values on request only is active  
 Window-Modus = 1: threshold switch works as window comparator  
 AV-Filter =1: Adaptive averaging filter is on. Can only be enabled, if SpecialMode,FIR =0  
 Block: =1: Blocking-State: All Set- Write-commands will be rejected (see Switch Blocking) **Read only**  
 x: do not change because of upwards compatibility (read GSV mode before)  
 Value Range: 0x00..0x1E

**Functionalities of activating the tare line (Input "T")**

|                                 | Sending of measuring value                   | Sending of maximum value               | zero adjustment | Reset Maximum value |
|---------------------------------|--|--|-----------------|---------------------|
| Log-Mode= off<br>Max-Mode = off | No (is permanently sending measuring values) | no                                     | yes             | no (irrelevant)     |
| Log-Mode = off<br>Max-Mode = on | no   | no (is sending permanently max-values) | yes             | yes                 |
| Log-Mode = on<br>Max-Mode = off | yes  | no                                     | no              | no (irrelevant)     |
| Log-Mode = on<br>Max-Mode = on  | no   | yes                                    | yes             | yes                 |

Possible error codes 0xA0,0x56,0x59,0x71

**Get mode**

Command number: 39  
 Number of parameters: 0  
 Bytes sent by the GSV: 1

**Get mode** reads the operation mode of the GSV, see **set mode**.  
 Possible error codes 0xA0,0x91

**Get equipment**

Command number: 41  
 Number of parameters: 0  
 Bytes sent by the GSV: 1

**Get equipment** reads informations about the hardware configuration of the GSV.  
 Description of the equipment-variable:

| MSB | Bit 6 | Bit 5   | Bit 4 | Bit 3 | Bit 2 | Bit 1 | LSB |
|-----|-------|---------|-------|-------|-------|-------|-----|
| x   | x     | AnaFilt | x     | SI    | x     | ADC   | LCD |

LCD = 1: Liquid Crystal Display installed  
 ADC = 1: Analog-Digital-Converter (always) existing  
 SI = 1: GSV is intended for use as strain indicator  
 AnaFilt: =1: Switchable analogue input filter available  
 x: reserved, not defined  
 Possible error codes 0xA0,0x91

### Firmware version

Command number: 43  
 Number of parameters: 0  
 Bytes sent by the GSV: 2

*Firmware version* reads the version-number of the GSVs firmware. The first Byte is the version-number multiplied by ten. The second byte contains the revision number.  
 Possible error codes 0xA0,0x91

### Set gage factor

Command number: 44  
 Number of parameters: 2  
 Bytes sent by the GSV: 0

*Set gage factor* sets the gage factor. When using the GSV as a strain indicator, the display scaling factor can be recalculated by the command **Calc Norm**, using the gage-factor, the bridge type and the poissons ratio stored (the latter only if applicable). The gage-factor register is transmitted as an integer value, as the real gage-Factor multiplied by 100, with the MSByte first.

Value Range: 0x00.09..0x7F.BC (corresponding K-Factor= 0,09 to 327,00).  
 Possible error codes 0xA0,0x54,0x55,0x71

### Get gage factor

Command number: 45  
 Number of parameters: 0  
 Bytes sent by the GSV: 2

*Get gage factor* reads the gage-factor in the format described in **Set Gage factor**.  
 Possible error codes 0xA0,0x91

### Set poisson

Command number: 46  
 Number of parameters: 1  
 Bytes sent by the GSV: 0

*Set poisson* sets the poissons ratio  $\mu$ . The poisson is important when calculating strain gage bridge types with one or two measuring grids which are aligned crosswise. The poisson register is transmitted as a whole byte, which is the poissons ratio multiplied by 500.  
 Value Range: 0x00..0xFA (correspondingly 0,000 to 0,500).



Possible error codes 0xA0,0x54,0x71

### Get poisson

Command number: 47

Number of parameters: 0

Bytes sent by the GSV: 1

*Get poisson* reads the poissons ratio as described in *Set Poisson*.

Possible error codes 0xA0,0x91

### Set bridge type

Command number: 48

Number of parameters: 1

Bytes sent by the GSV: 0

*Set bridge type* sets the bridge type of the strain gage sensor, with which the display scaling factor can be recalculated by *Calc Norm*.

0: Full Bridge

1: Half Bridge

2: Quarter Bridge

3: Half Bridge with transverse contraction

4: Full Bridge with transverse contraction

Value Range: 0x00..0x04

Possible error codes 0xA0,0x54,0x71

### Get bridge type

Command number: 49

Number of parameters: 0

Bytes sent by the GSV: 1

*Get bridge type* reads the bridge type with the coding described before.

Possible error codes 0xA0,0x91

### Set range

Command number: 50

Number of parameters: 1

Bytes sent by the GSV: 0

If the Jumper JP1 (see p.64) on the circuit board is in position 2, that means if the supply voltage of the sensor bridge is  $\approx 2,5V$ , you can choose the input sensitivity of the analog front end of the amplifier with *Set Range*. The range register transmitted is the real input range multiplied by ten. Valid values are 20d and 35d; corresponding to 2mV/V or 3,5mV/V.  
Value Range: 2 reliable values: 0x14 and 0x23

Possible error codes 0xA0,0x50,0x56,0x71

### Get range

Command number: 51  
Number of parameters: 0  
Bytes sent by the GSV: 1

**Get range** reads the input sensitivity of the analog input stage of the GSV21, that means that the position of the jumper JP1 can be determined, too. The range register value is also relevant for the automatic calculation of the display scaling factor used by the command **Calc norm**. The *Range* register is 10 times of the full-scale input sensitivity value in mV/V: 10 = 1 mV/V (Jumper position 1); 20 = 2 mV/V; 35 = 3,5 mV/V (both jp. pos. 2)  
Possible error codes 0xA0,0x91

### Get offset wait

Command number: 53  
Number of parameters: 0  
Bytes sent by the GSV: 1

**Get offset wait** determines the time, which the command **set** offset needs for execution. The value read has to be multiplied by 0,0062 to get the wait time in seconds.  
Possible error codes 0xA0,0x91

### Get options

Command number: 54  
Number of parameters: 0  
Bytes sent by the GSV: 3

**Get options** Determines information about the range of the instruction set and about special characteristics of the firmware as a 24 bit value. With the GSV-21 bit 6 and bit 8 are always set. The lower 6 bit value is to be interpreted as a whole number within the range from 0..63 and contains the identification of a possible special application. If this identification is different from zero you may have to expect restrictions of the firmware functionalities.  
Possible error codes 0xA0,0x91

### Get value

Command number: 59  
Number of parameters: 0  
Bytes sent by the GSV: 5 (at a binary data transmission)

**Get value** triggers the transmission of a measuring value. Normally the device transmits measuring values permanently, so this command is of special interest if that transmission was stopped by **stop transmission** (command 35) or if the logger mode is active; see **set mode**. The data format of the value returned by the GSV corresponds to the data format of the permanent transmission (binary or ASCII), as described in the chapter Data format (page 8).



Possible error codes 0xA0,0x91

### Clear maximum value

**Command number: 60**  
**Number of parameters: 0**  
**Bytes sent by the GSV: 0**

*Clear maximum value* resets the actual maximum value, if the maximum mode is active (look at **set mode**), so that a new maximum value can be generated.  
Possible error codes 0xA0,0x71

### Set Digits

Command number: 61  
Number of parameters: 1  
Bytes sent by the GSV: 0

*Set Digits* sets the number of the digits shown in the LC-Display. If the ASCII-data output is active (by **Set Mode**), the number of the transmitted digit bytes is set as well. The allowed value range of the digits is decimal point to 8, that means the number of digits is not allowed to be smaller than the decimal point position (look at **Set Dpoint**).  
Absolute Value Range: 0x01..0x08  
Possible error codes 0xA0,0x54,0x71

### Get Digits

Command number: 62  
Number of parameters: 0  
Bytes sent by the GSV: 1

*Get Digits determines* the number of digits shown in the LC-Display.  
Possible error codes 0xA0,0x54

### Get Channel

Command number: 65  
Number of parameters: 0  
Bytes sent by the GSV: 1

*Get Channel* reads the the active analog input channel. In the standard version there are two inputs available, the bridge input (channel 0) and the channel 1, which has an input voltage range from 0 to 10V.  
Possible error codes 0xA0,0x91

### Get Last Error

Command number: 66

Number of parameters: 0  
 Bytes sent by the GSV: 1

With get last error the the error status of the last command given can be determined. Every command – with the exception of **Get last error** itself – overwrites the error register. That is useful to determine the reason for the rejection of a write command. The command **Reset status** (No. 0) resets the error register to 0.

The following **error codes** are actually defined:

|  |      |
|--|------|
| Default: (no command given or error code cleared):     | 0x00 |
| No Error (OK), no additional parameter changes made:   | 0xA0 |
| No Error (OK), but* additional parameter changes made: | 0xA1 |

**From here on: command given was rejected because:**

|   |      |
|---|------|
| Command number not existent:                              | 0x40 |
| Command No existent but not implemented in this Firmware: | 0x41 |

|  |      |
|--|------|
| Access denied (unspecified):                                     | 0x70 |
| Access denied, because "Blocking" is active:                     | 0x71 |
| Access denied, because password not given or incorrect:          | 0x72 |
| Access denied, because configuration jumper is not set:          | 0x73 |
| Access denied, because number of allowed executions is too high: | 0x74 |
| Access denied, because Set/Write prohibited at this port:        | 0x75 |

|  |      |
|--|------|
| wrong parameter, (unspecified):                            | 0x50 |
| wrong parameter, (partly) wrong bits:                      | 0x53 |
| wrong parameter, parameter absolutely too big:             | 0x54 |
| wrong parameter, parameter absolutely too small:           | 0x55 |
| wrong parameter, invalid parameter combination:            | 0x56 |
| wrong parameter, parameter relatively** too big:           | 0x57 |
| wrong parameter, parameter relatively** too small:         | 0x58 |
| wrong parameter, functionality not implemented in this FW: | 0x59 |
| Not enough parameters or parameter timeout:                | 0x5A |

|  |      |            |
|--|------|------------|
| Sending of parameters was impossible (unspecified):              | 0x90 | (reserved) |
| Sending of parameters was impossible because tx-buffer was full: | 0x91 |            |
| Sending of parameters was impossible because (CAN-)Bus busy:     | 0x92 |            |
| Execution was impossible because the receive buffer is full:     | 0x99 |            |

**From this point: former command was eventually accomplished but:**

|  |      |
|--|------|
| Internal error (unspecified):                        | 0x80 |
| Intern arithmetical error:                           | 0x81 |
| Error at AD-converter settings                       | 0x82 |
| Error: measuring value unsuitable for desired action | 0x83 |
| EEPROM-Error (FW-Version 1.2.00 and above only)      | 0x84 |

\* possibly; mainly additional parameters were loaded, that are not directly associated to this command. Also, no additional parameters may have changed because the former settings and the loaded settings are similar.

\*\* because of prohibited setting combinations

**Set second threshold**

Command number: 67  
 Number of parameters: 4



Bytes sent by the GSV: 0

**Set second threshold** set the threshold of the amplifiers second threshold switch (terminal No 13). The first two parameter bytes are the switch on threshold, the next two bytes are the switch off threshold, both with the MSByte first. The switch on threshold always needs to be bigger than the turn off threshold. You can change the threshold functionality between hysteresis switch and window comparator. In the latter case, the values are to be interpreted as upper and lower switch thresholds.

Value Range: 0x00.01.00.00..0xFF.FF.FF.FE

Possible error codes 0xA0,0x56,0x71

### Get second threshold

Command number: 68

Number of parameters: 0

Bytes sent by the GSV: 4

**Get second threshold** determines the thresholds of the second threshold switch, as described in **set second threshold**.

Possible error codes 0xA0,0x91

### Get device Type

Command number: 69

Number of parameters: 0

Bytes sent by the GSV: 1

Get device Type reads the type number of the GSV, with the GSV-21 constantly 21d.

Possible error codes 0xA0,0x91

### calc norm

Command number: 70

Number of parameters: 0

Bytes sent by the GSV: 0

**Calc norm** triggers the calculation of the display scaling factor according to the strain indicator functionality. Hereby the K-factor, the bridgetype, the input sensitivity and - depending on the bridgetype - the poissons ratio will be considered. At the same time channel 0 will be setted, as well as the amplification of the AD-converter setted to one and the unit shown to  $\mu\text{m}/\text{m}$ .

Possible error codes 0xA1,0x81,0x71

### Set TXmode

Command number: 128

Number of parameters: 1

Bytes sent by the GSV: 0

With Set TX mode changes can be done to the serial data protocol. This command can only be executed if the configuration jumper JP2 is set, see **Set Baud** (next page), the changing procedure is also described there. With Bit 7 of the parameter byte the hardware-handshaking can be enabled, with bit 3 the size of the measuring data frame can be changed from 5 Bytes (bit 3 =1, default setting) to 3 bytes (bit 3 =0). The 3-byte-



protocol has 0xA5 as the prefix byte, then follows the measuring value as 16 bit value with the MSByte first. Higher data rates are possible with this protocol.

Hardware Handshake may be better – in some cases even necessary – if the GSV-2s serial port is connected to a bus-system or a wireless transmitter.

|          |       |       |       |           |       |       |     |
|----------|-------|-------|-------|-----------|-------|-------|-----|
| MSB      | Bit 6 | Bit 5 | Bit 4 | Bit 3     | Bit 2 | Bit 1 | LSB |
| Is H.sh. | x     | x     | x     | Is 5 Byte | x     | x     | x   |

**Is 5 Byte** =1: if the binary transmission protocol is aktive (see Set Mode), the measuring value frame consists of 5 bytes.

**Is H.Sh.** =1: Hardware handshake (RTS/CTS) enabled. Only possible with HW-Handshake special version.

**X:** Reserved. Do not change.

## GetTXmode

**Command number: 129**

**Number of parameters: 0**

**Bytes sent by the GSV: 1**

With **GetTXmode** you can read flags about the features of the measuring value transmission protocol.

|          |       |       |       |           |       |       |               |
|----------|-------|-------|-------|-----------|-------|-------|---------------|
| MSB      | Bit 6 | Bit 5 | Bit 4 | Bit 3     | Bit 2 | Bit 1 | LSB           |
| Is H.sh. | x     | x     | WRacc | Is 5 Byte | x     | x     | Configuration |

**Configuration:** If =1, the jumper JP2 for the configuration mode id set. Read Only!

**Is 5 Byte** =1: If the binary transmission protocol is active (see Set Mode), the measuring value frame consists of 5 bytes.

**Wracc** =0: RS232 serial port has write access. =1: All Write Commands blocked. Read Only!

**Is H.Sh.** =1: Hardware handshake (RTS/CTS) enabled. Only possible with HW-Handshake special version.

**X:** Reserved. Do not change.

Possible error codes 0xA0,0x91

## SetBaud

**Command number: 130**

**Number of parameters: 1**

**Bytes sent by the GSV: 0**

With **SetBaud** you can determine the bitrate of the serial communication. The bitrate can only be changed if the jumper for the configuration mode JP2 is set, see p.64. The procedure to change the bitrate is: turn off – set the jumper – turn on- open serial interface with 38400 bps – program desired new bitrate with **SetBaud** – turn off – remove JP2 – turn on. Then the new bitrate should be activated.

The bitrates are coded as follows:

| Parameter / Register                        | Baudrate |
|---|----------|
| 0   | 4800     |
| 1   | 9600     |
| 2   | 19200    |
| 3   | 38400    |
| 4   | 57600    |
| 5   | 115200   |
| 6   | 250000   |
| 7   | 625000   |
| 8   | 1,25M    |
| 9 (only Firmware-Version 1.3.06 and above)  | 230400   |
| 10 (only Firmware-Version 1.3.06 and above) | 460800   |
| 11 (only Firmware-Version 1.3.06 and above) | 921600   |

The command execution will be denied if the actual data rate is too high for the desired bit



rate.

If the jumper JP2 is set to the configuration mode, the communication bitrate is always 38400 bits/s, independently of the baud register value. The bitrate in the baud register applies only when jumper JP2 is removed.

Possible error codes 0xA0,0x54,0x58,0x73,0x71

### GetBaud

Command number: 131

Number of parameters: 0

Bytes sent by the GSV: 1

With GetBaud you can read the baud register as described before.

Possible error codes 0xA0,0x91

### Set Slow Rate

Command number: 134

Number of parameters: 2

Bytes sent by the GSV: 0

If the Slow-flag in the SpecialMode register is set (see **Set Special mode**), measuring values will be transmitted with the data period in seconds, that you can set with this command. The slow mode data period is transmitted with the MSByte first, the value range is from 1 s to 65535 s.

Possible error codes 0xA0,0x71,0x55,0x5A

### Get Slow Rate

Command number: 135

Number of parameters: 0

Bytes sent by the GSV: 2

With Get Slow rate the data period of the slow mode can be read.

Possible error codes 0xA0,0x91

### SetSpecialMode

Command number: 136

Number of parameters: 2

Bytes sent by the GSV: 0

With the Special-Mode-Register some special features of the GSV-21 can be set. The content of high byte is shown in the following table:

| MSB      | Bit 14   | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8             |
|----------|----------|--------|--------|--------|--------|-------|-------------------|
| NoiseCut | AutoZero | x      | x      | x      | AbsMax | LngEn | Storing Behaviour |

**Storing Behaviour:** If =1, all changes of all operating parameters are stored in the non volatile EEPROM memory immediately after changing them. If =0, most operating parameters are stored after the device is switched off. If power-on-cycles (switching on and off) are done more often than changing of values will be done, setting of this flag is recommended. If changing of values is done more often, leave it =0 (default setting).

**LngEn:** =1: Display menu language is english. =0: Display menu language is german

**AbsMax:** If Max-mode also set (s. SetMode): =1: The maximum of the absolute value of the measuring value is transmitted

**AutoZero:** (only if available, see **GetCommandAvailable**, otherwise X): =1: Automatic periodical zero-point adjustment enabled, see **SetAutoZeroCounter**, command 150.

**NoiseCut:** (only if available, see GetCommandAvailable, otherwise X): =1: Noise Supression enabled, see SetNoiceCutThreshold, command 148.

The content of the low byte is shown in the table below:

| Bit 7         | Bit 6 | Bit 5  | Bit 4    | Bit 3     | Bit 2      | Bit 1     | LSB  |
|---------------|-------|--------|----------|-----------|------------|-----------|------|
| Unipolar-Mode | x     | FIR_N5 | AutoFilt | Select.TX | FIR-Filter | MW-Filter | Slow |

**Slow:** =1: Slow mode enabled. In this mode, measuring values are transmitted with data periods  $\geq 1$  s. This period is communicated with the commands 134 / 135. The data rate communicated with commands 138/139, 3/7 and 18/22 is not valid in this mode.

**MW-Filter:** Read-Only Flag: Is =1, if Mwsum is  $>1$  (see commands 138, 139)

**FIR-Filter:** =1: Turns on FIR-Filter; a digital low pass filter, which takes place after the firmware-internal decimating average filter. Its cut-off frequency depends on the measuring data rate.

**Select.TX:** Selective Transmission: If this flag is =1 and the maximum value mode is enabled (see command **Set Mode**), only new maximum values will be transmitted, in order to avoid redundancy transmission.

**AutoFilt:** if =1 (default setting), the analogue pre filter will be set automatically according to the datarate Fdata.

In this case the cut-off frequency fg of the analogue filter will be set as follows:

|                | switches fg = 3,5 Hz   | switches fg = 260 Hz        | switches fg = 1,7 kHz  |
|----------------|------------------------|-----------------------------|------------------------|
| FIR-Filter off | if Fdata $\leq 7,14/s$ | if $7,14/s < Fdata < 625/s$ | if Fdata $\geq 625/s$  |
| FIR-Filter on  | if Fdata $\leq 15/s$   | if $15/s < Fdata < 1071/s$  | if Fdata $\geq 1071/s$ |

**FIR\_N5:** Defines the characteristic of the digital FIR-filter, if the FIR-Filter is on (Bit 2=1). If the FIR\_N5 is =0, it is a second order FIR filter, its -3dB-cut-off frequency is = Datarate \* 0,18 and its transfer function is gentle, without overshoot in the step response its operating time is only 3 measuring values. If FIR\_N5 =1, it's a 5th order FIR filter. Its cut-off frequency is = datarate \* 0,25 and its transfer function is much steeper in the attenuating band, but with 6% overshoot in the step response; and the operating time takes 6 measuring values. That's why the FIR-Filter 5. order is more recommendable at higher data rates, if (for example for vibration analysis) a quite linear frequency response in the transmission range and a steep tapered is desired in the attenuating band.

**Unipolar-Mode:** Read-Only Flag. Shows if the unipolar- or bipolar-Mode is set, see commands 20/21.

x: Reserved, do not change; should be the same as the value read, see GetSpecialMode.

Possible error codes 0xA0,0x53,0x59,0x71

## GetSpecialMode

**Command number: 137**

**Number of parameters: 0**

**Bytes sent by the GSV: 2**

With **GetSpecialMode** you can read the register described before.

Possible error codes 0xA0,0x91

## WriteSamplingRate

**Command number: 138**

**Number of parameters: 3**

**Bytes sent by the GSV: 0**

This command sets the sampling rate of the AD converter and the number of summands of the decimating average filter and as such also the resulting data rate.

The sampling rate determines how many analogue-digital conversions the AD-converter does per second.

The relation between measuring data range and sampling rate is as follows:



measured data range = sample rate / averaging summand amount  
The value range of the averaging summand is from 1 to 11.

Parameter 1: Number of averaging summands  
Parameter 2: High byte of the Sampling-Rate-Register  
Parameter 2: Low byte of the Sampling-Rate-Register

#### Parameter 1:

**Bits 6 und 7 must be =1.** Examples:

0xC1 means that the decimating average filter is disabled.

0xCB means that the averaging filter decimates over 11 values.

#### Parameter 2 and 3:

the computation formula for the Sampling-Rate-Register (second and third Parameter) of command 138/139 is:

Registervalue = sample rate \* 2

Der AD-converter of the GSV-21 supports the following discrete sampling rates:

2.5, 5, 10, 15, 25, 30, 50, 60, 100, 500, 1000, 2000, 3750, 7500 and 15000 samples per second. If the value coded by parameter 2 and 3 differs from these values, the closest available sampling rate will be set. If the resulting measuring data rate would be too high (see table in the **Set frequency** description) or too low (below 0.3125/s), the command is rejected.

Absolute Value Range: 0xC8.00.05..0xC1.75.30

Possible error codes 0xA0,0x53,0x54,0x55,0x57,0x58,(0x80),0x71

### ReadSamplingRate

**Command number: 139**

**Number of parameters: 0**

**Bytes sent by the GSV: 3**

With **ReadSamplingRate** the sampling rate and the number of the averaging values can be read, as described in **WriteSamplingRate**:

Byte 1: Number of the average values in Bits <5:0>, Bits 6 and 7 =1

Byte 2: Highbyte of the Sampling-Rate-Register

Byte 2: Lowbyte of the Sampling-Rate-Register

Whereby: sampling rate = Sampling-Rate-Register / 2

Possible error codes 0xA0,0x91

### Set CAN Setting (Only existent with GSV-2-CANopen)

**Command number: 140**

**Number of parameters: 3**

**Bytes sent by the GSV: 0**

With Set CAN Setting fundamental properties of the CANopen-Interface can be changed. The parameter to change (CAN-Flags, CAN-Bitrate and CAN-Node-ID) is selected with an index byte, which is passed as the first parameter. Then a WORD-sized data parameter follows. The parameters are passed in the order: <Index, DataHiByte, DataLoByte>. The following indices are writable:

**Index 0x7F: CAN-Flags:** Data-Bits <15:8> (HiByte) are reserved and have to match – as the Data-Bits<7:2> of the LoByte - the value read before with Get CAN Setting at Index

0x7F. Bits<7:0> (LoByte) are defined as follows:

| MSB | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1        | LSB       |
|-----|-------|-------|-------|-------|-------|--------------|-----------|
| x   | x     | x     | x     | x     | x     | <b>CANon</b> | HasCAN =1 |

CANon =1: CAN-Interface enabled. The CAN-Interface can be switched on and off with this. When switched on, (CANon before =0), the CAN-Interface is „bootet“, which is signalled to the CANbus by putting the bootup-frame (TX-NMT) on the bus.

**CANon =0:** Switched off. **When switching off the CANbus (CANon before =1) waiting CAN-Messages are aborted and the device disappears from the CAN-Bus, i.e. after switching off it is no CAN-device anymore!**

**HasCAN:** With CANopen devices always =1, i.e. bit 0 of the passed value must be set (read-only)

x: reserved, has to match the reading value

Possible error codes: 0xA0, 0x71, 0x51, 0x52, 0x5A

**Index 0x7E: CAN-Bitrate:** With this the bitrate of the CAN interface can be set. The bitrate is coded as follows:

| Data parameter | CAN-Bitrate |
|----------------|-------------|
| 0x0001         | 50 kBits/s  |
| 0x0005         | 125 kBits/s |
| 0x0006         | 250 kBits/s |
| 0x0007         | 500 kBits/s |
| 0x0008         | 1 MBit/s    |

The CAN-Bitrate can only be altered, if the **RS232-Interface has write permission**. Write permission is signalled by cleared “WRacc”-Bit in the TxMode value, see GetTXmode (that is the case, if the CAN-Interface is either off or on, but in the CANopen-State “Stopped”). Also, the **configuration jumper JP2 must be set** (see Set Baud).

After changing, the new CAN-Bitrate will be valid only after a Bootup-cycle (switch on and off) or after a reset cycle by CANopen network management, if the CAN-Interface is on. If it's off, the new CAN-Bitrate will be valid when switching on the CAN interface, see CAN-Flags.

Possible error codes: 0xA0, 0x71, 0x73, 0x75, 0x51, 0x52, 0x54, 0x58, 0x5A

**Index 0x7D: CAN-Node-ID:** With this, the Node-ID of the GSV-2-CANopen (the “Node”) can be altered: Datenparameter = gewünschte Node-ID. Diese muß im Bereich von 0x0001 bis 0x007F liegen. Die Node-ID kann nur verändert werden, wenn das RS232-Interface Schreibrecht besitzt. Schreibrecht wird durch gelöschtes “WRacc”-Bit im Txmode-Wert angezeigt, s. GetTXmode (das ist der Fall, wenn das CAN-Interface entweder aus ist oder an, aber im CANopen-State “Stopped”).

Nach Änderung kommt die neue Node-ID erst nach einem Bootup- (Aus- u. wieder Einschalten) oder einem Reset-Zyklus per CANopen-Network-Management zur Wirkung,



falls das CAN-Interface an ist. Ist es aus, kommt die neue Node-ID beim Einschalten des CAN-Interfaces zur Wirkung, siehe CAN-Flags.

Mögliche Fehlercodes: 0xA0, 0x71, 0x75, 0x51, 0x54, 0x55, 0x5A

## Get CAN Setting

**Befehlsnummer: 141**

**Anzahl der Parameter: 1**

**Vom GSV gesendete Bytes: 2**

Mit Get CAN Setting können Einstellungen des CAN-Interfaces gelesen werden. Die Wahl der Einstellungsparameter erfolgt hierbei über ein Index-Byte, welches als Parameter übergeben wird. Der GSV antwortet stets mit 2 Datenbytes mit der Reihenfolge <HiByte,LoByte>; auch im Fehlerfall (s. GetLastError), dann sind die Datenbytes =0. Bei den Indizes wird zwischen aktuell eingestellten Werten (Indexbereich 0x5A..0x5F) und solchen unterschieden, die erst beim nächsten Bootup- oder Reset-Zyklus zur Wirkung kommen (Indexbereich 0x7A..0x7F). Bei den Einstellungen CAN-Bitrate (Index 7E) und CAN-Node-ID (Index 7D) sind diese Werte nach einer Änderung mit Set CAN Settings u.U. jeweils unterschiedlich; der Erfolg von SetCANSetting kann an dementsprechenden Indizes 0x7D..0x7F ermittelt werden.

| Index Aktuell gültiger Wert | Index Wert nach nächstem BootUp / Reset | Dateninhalt                      | assoziertes CANopen-Objekt |
|-----------------------------|---|----------------------------------|----------------------------|
| 0x5F                        | 0x7F                                    | CAN-Flags, s. Set CAN Settings   | -                          |
| 0x5E                        | 0x7E                                    | CAN-Bitrate, s. Set CAN Settings | -                          |
| 0x5D                        | 0x7D                                    | CAN-Node-ID                      | (1200h/1800.1h)            |
| 0x5C                        | 0x7C                                    | Producer Heartbeat-Time, in ms   | 1017h                      |
| 0x5B                        | 0x7B                                    | Event-Timer-Period, in ms        | 1800.5h                    |
| 0x5A                        | 0x7A                                    | Inhibit-Time, in 100us           | 1800.3h                    |

Mit Get CAN Setting kann auch ermittelt werden, ob ein CAN-Interface vorhanden ist: An Index 0x7F lesen und Bit 0 auswerten: =1: CAN vorhanden; =0: CAN nicht vorhanden. In letzterem Fall ist der Fehlercode =0x41 an jedem Index; Dateninhalt =0.

Mögliche Fehlercodes: 0xA0, 0x51, 0x91, 0x41, 0x5A

## Set analogue filter

**Command number: 144**

**Number of parameters: 2**

**Bytes sent by the GSV: 0**

With Set analogue filter the cut-off frequency of the prefilter can be changed, if the AutoFilt-Flag of the Special-Mode-Registers is =0, see Set/Get special Mode. This low pass filter is before the AD-converter and it is able to improve the signal to noise ratio both of the digital and the analogue output.

The Standard version has 3 limit frequencies:

1. 3,5Hz, 1.order; from 260Hz on: 2.order
2. 260Hz, 1. order; from 1,7kHz on: 2. order
3. 1,7kHz 1. order

The parameter (1. parameter: Highbyte, 2. parameter: Lowbyte) is twice the amount of the desired cut-off frequency. The cut-off frequency closest to the parameters will be selected and setted.

Value Range: 0x00.07..0x0D.FF

Possible error codes 0xA0,0x54,0x55,0x56,0x71

### Get analogue filter

**Command number: 145**

**Number of parameters: 0**

**Bytes sent by the GSV: 2**

Get analogue filter delivers twice the amount of the cut-off frequency of the analogue prefilter. Possible return-values in standard version are:

0x00.07: limitfrequency = 3,5 Hz

0x02.08: limitfrequency = 260 Hz

0x0D.48: limitfrequency = 1,7 kHz

Possible error codes 0xA0,0x91

### Switch Blocking

**Command number: 146**

**Number of parameters: 3**

**Bytes sent by the GSV: 0**

With Switch Blocking the GSV-21 can be protected against unintentional changes of the operation parameters. If the blocking status is enabled, every set and write commands will be refused, the error-code for this case is 0x71. This status can be identified with Get Mode (Bit 7, read only). Because the GSV commands consist of only one byte, there could be an accidentally call of commands by the device connected to the serial port (PC, SPS or other). This may happen because of using a wrong portnumber or a wrong program and so on. The blocking status is controlled by two constant ASCII-strings as a parameter for this command:

Enable blocking: **Parameter = "e3F"**, that is Param.1=0x65, Param.2=0x33,  
Param.3=0x46

Disable Blocking: **Parameter = "k7B"**, that is Param.1=0x6B, Param.2=0x37,  
Param.3=0x42

**Attention: Every other parameter will be interpreted as a wrong blocking-password and after 3 trials with wrong parameters the command will always be denied (independent of the parameter), the error code in this case is 0x74. After a restart this status will be reset.**

Possible error codes 0xA0,0x70,0x74

### Get Command Available

**Command number: 147**

**Number of parameters: 2**

**Bytes sent by the GSV: 1**





With Get Command Available it can be examined if commands and their corresponding functionality are existent with the device connected. Hereby the upper command number of the command range to be checked will be transmitted first and the lower command number as the second parameter. Both command numbers may be equal (then only this command will be checked), but the first parameter should not be smaller than the second, otherwise the returned byte is an errorcode=0x56 (then similar to LastError).

If all commands in the range to be checked are existent, the byte returned is =0xA0. Otherwise – if at least one command within the range is not existent - **the byte returned is =0x41**.

So, with Get Command Available it can also be examined, if functionalities corresponding to certain commands are existent (especially with commands >=128d), for example:

To examine whether the automatic zero tracking is existent, give command 147 with the parameters 151d, 150d. These correspond to the command numbers for **Get/SetAutoZeroCounter**. **If the answer is 0xA0, the automatic zero tracking is existent is existent, otherwise it's not.**

Like this, you may for instance check the CAN-Interface (Parameters 140d, 140d), the noise-suppression „Noise-Cut“ (Parameters 149d, 148d) or the User-Display-functionality (Parameter 152d, 152d) or Handshake (Parameter 128d, 128d) and others for their existence. Advice: The property of existence will never change with the same device exemplar. (except maybe after a firmware update by ME-Systeme).

Possible error codes 0xA0, 0x56, 0x5A

### **Set NoiseCut Threshold (only if NoiseCut existent)**

**Command number: 148**  
**Number of parameters: 3**  
**Bytes sent by the GSV: 0**

With SetNoiseCutThreshold the threshold for the NoiseCut noise suppression can be set. If this noise suppression is set (see SetSpecialMode, Bit 15), the measuring value output will be set constantly to zero if the input measuring value is below this threshold (bipolar: if  $\text{abs}(\text{Messwert}) < \text{threshold}$  or  $-\text{threshold} < \text{measuring value} < \text{threshold}$ ). The number format of the NoiseCut threshold is the same as the one of the measuring values, see p.17 and 59. By using this, it can be achieved that the measuring value around zero is absolutely „quiet“, that means free of noise.

Example (bipolar):

Shall NoiseCut-Threshold be = 0x810000; then all measuring values, that are between 0x810000 and 0x7F0000, set to 0x800000 exactly.

Value range: bipolar: 0x800000..0xFFFFFFFF; unipolar: 0x000000..0x7FFFFFFF

possible error codes: 0xA0, 0x71,0x75, 0x54, 0x55, 0x84, 0x41

### **Get NoiseCut Threshold (only if NoiseCut existent)**

**Command number: 149**  
**Number of parameters: 0**



### Bytes sent by the GSV: 3

With **GetNoiseCutThreshold** you can read the register described before.

Possible error codes 0xA0,0x91, 0x41

### Set AutoZero Counter (only if AutoZero existent)

**Command number: 150**  
**Number of parameters: 2**  
**Bytes sent by the GSV: 0**

With Set AutoZero Counter the counter for the automatic periodic tare-function can be set. If this AutoZero function is enabled (see SetSpecialMode, Bit 14), after <AutoZero-Counter> number of measuring values a zero-point adjustment will be executed automatically, if the threshold switch 1 „SW1“ is off (meaning the measuring value is below this threshold). The measuring values are only counted, if the threshold switch 1 „SW1“ is off. By using this function, an eventual drift of the measuring value (e.g. because of temperature drift of the sensor) can be compensated. So, the time-period of this automatic zero-setting depends on the AutoZero counter and the data rate.

Example (bipolar):

Shall the upper threshold 1 be =0x810000, the data rate = 10/s and the AutoZero-Counter =100. Then every 10 seconds a zero-point adjustment will be executed automatically, if all measuring values within this period of time were below 0x810000.

Value range: 0x0001..0xFFFF

Possible error codes: 0xA0, 0x71,0x75, 0x55, 0x84, 0x41

### Get AutoZero Counter (only if AutoZero existent)

**Command number: 151**  
**Number of parameters: 0**  
**Bytes sent by the GSV: 2**

With **GetAutoZeroCounter** you can read the register described before.

Possible error codes 0xA0,0x91, **0x41**

### Set UserTextChar (devices with LC-Display only)

**Command number: 152**  
**Number of parameters: 2**  
**Bytes sent by the GSV: 0**

With **Set UserTextChar** a user defined text can be displayed in the LCD. The first parameter is the adress, that means the position of the character in the display. A text of up to 16 characters can be displayed, so the value range of this adress is from 0 (left side of LCD) to 0x0F (right side of LCD); at adress 0x10 a 0x00 for termination can be transmitted. The second parameter is the character itself, whereby the range of 0x20 ' ' to 0x7D '}' is ASCII-conform (expection: 0x5D is not '\').

To display a text array, please follow these steps:

The characters are transmitted to the GSV in a descending order, whereby they are copied to the device's RAM first. If the text array is shorter than 16 characters, a 0x00 as



data for termination must be transmitted first with the address <text length>. Then the last character of the text at address < text length - 1> and so on until the first character of the text at address 0. In case the text should begin shifted to the right, please fill up with blanks (0x20), so that at address 0 there's a value of > 0x1F. Because that's the signal to display the text in the LCD (whole text copied from RAM to LCD if data>0x1F at address 0x00).

Example:

Text = " Txt0" (length =5)

Complete byte sequence transmitted to the GSV

(Form: 0x<BefehlsNo>.<Adresse>.<Data>):

0x98.05.00 0x98.04.30 0x98.03.74 0x98.02.78 0x98.01.54 0x98.00.20

To switch off the displaying of that text, so that the measuring value appears again, you only have to transmit a 0x00 at address 0: 0x98.00.00. The text remains in RAM – except the first character - as long as the power supply is connected.

To display the same text (stored in RAM) again, you only have to transmit the first character (>0x1F) again.

Value range:

1. Parameter (address): 0x00..0x10

2. Parameter (Ascii-character): 0x00, 0x20..0x7F

Possible error codes: 0xA0, 0x71,0x51, 0x52, 0x41

## SetUserOffsetValue

**Command number: 154**

**Number of parameters: 3**

**Bytes sent by the GSV: 0**

With SetUserOffsetValue a summand can be passed to the device, that will be added to every measuring value. The number-representation is the same as with measuring values, see p. 17 and 59. The UserOffsetValue may be negative in bipolar mode.

(0x400000..0x7FFFFFFF).

Value range: bipolar: 0x400000..0xBFFFFFFF unipolar: 0x000000..0x7FFFFFFF

Possible error codes: 0xA0, 0x71,0x75, 0x54, 0x55

## GetUserOffsetValue

**Command number: 155**

**Number of parameters: 0**

**Bytes sent by the GSV: 3**

With **GetUserOffsetValue** you can read the register described before.

Possible error codes: 0xA0,0x91

## SetAdaptFilterMask

**Command number: 158**

**Number of parameters: 3**

**Bytes sent by the GSV: 0**

With SetAdaptFilterMask the comparison mask of the adaptive averaging filter can be set.

This special digital filter can be enabled or disabled with SetMode (Bit 5). It combines a moving average filter over up to 32 values with a quick step response of the measuring signal. „Moving average filter“ means that the filter is non-decimating, so the output data rate is equal to the input data rate. The filter distinguishes the wanted signal transient from a noise signal transient by bitwise comparison of this bitmask with the difference of a measuring value and its predecessor. If the absolute value of the difference of a measuring value  $X_k$  and its predecessor  $X_{k-1}$   $abs(X_k - X_{k-1})$  is within this comparison mask ( $abs(X_k - X_{k-1}) \leq AdaptFilterMask$ ), this measuring value  $X_k$  will be transmitted directly; otherwise the actual mean value will be transmitted. The comparison mask must have the following form:

0xFF.xx.00, whereby in the middle byte („xx“) all more significant bits must be =1 and the least significant bits =0 (example: 0xFF.F0.00).

Value range: 0xFF0000..0xFFFF00

Possible error codes: 0xA0, 0x71, 0x75, 0x53

### GetAdaptFilterMask

**Command number: 159**

**Number of parameters: 0**

**Bytes sent by the GSV: 3**

With GetAdaptFilterMask the compare mask of the adaptive averaging filter can be set, see SetAdaptFilterMask and SetAdaptFilterOptimize.

Possible error codes: 0xA0, 0x91

### SetAdaptFilterOptimize

**Command number: 160**

**Number of parameters: 2**

**Bytes sent by the GSV: 0**

With SetAdaptFilterOptimize the optimum compare mask of the adaptive averaging filter (see above) can be determined automatically. The number of measuring values, that are included into this automatic detection, will be transmitted to the GSV by using this command. Then this „self-learning period“ starts and during this period the GSV is calculating the peak-to-peak noise and after this number of measuring values has finished, the comparison mask is calculated, which can then be read with GetAdaptFilterMask. The adaptive averaging filter must be enabled during this period (SetMode, Bit 5). During this self-learning period the **wanted signal should not change**, since only the peak-to-peak noise should be taken into account.

Examples:

A typical application of this functionality is the so-called „cattle balance“. Let's assume you have one or more load cells with cattle on top of it, connected to our GSV-2 and now you want to attenuate the stamping of the cattle on the balance (that's the noise signal) with the adaptive averaging filter. Then you would follow these steps:

The adaptive averaging filter must be enabled. Now let some animals go onto the balance and give then SetAdaptFilterOptimize e.g. with Parameter =200. Then the self-learning period lasts 20 seconds at a data rate of 10/s. After these 20 seconds the animals may leave the balance; the „stamping“, that is the noise signal should now be attenuated, so theoretically reduced by the factor  $1/\sqrt{32}$ , which is about 1/5.



With the adaptive averaging filter any noise signal, e.g. present in an environment with harsh electromagnetic interference can be filtered, that means attenuated. Start the self-learning phase with `SetAdaptFilterOptimize` with the filter enabled, while the noise signal is strong, but the wanted signal doesn't change significantly.

A special functionality of `SetAdaptFilterOptimize` can be triggered with parameter `=0x0000`. Then the comparison mask will not be determined automatically, but it will be selected from 4 constant values considering the data rate. Using this special function is recommended after changing the data rate, provided the noise signal level at the GSVs input hasn't changed significantly. Otherwise `SetAdaptFilterOptimize` with Parameter `>4` (self-learning) should be done as described, if the data rate has changed.

The following special modes must be disabled in order to execute `SetAdaptFilterOptimize`; otherwise the command will be rejected with error code `=0x56`: maximum value mode, Slow-mode, NoiseCut, AutoZero.

Value range: `0x0000, 0x0004..0xFFFF`

Possible error codes: `0xA0, 0x71, 0x75, 0x55, 0x56`

## GetAdaptFilterOptimize

**Command number: 161**  
**Number of parameters: 0**  
**Bytes sent by the GSV: 2**

With GetAdaptFilterOptimize the number of remaining measuring values during the self-learning phase (as described above) can be read, until the self-learning phase is finished. This is useful to determine when that phase will be finished. As the self-learning is finished (or wasn't ever started), the answer to GetAdaptFilterOptimize is =0x0000; then the measuring system can be used again normally.

Possible error codes: 0xA0,0x91

## Read Ranges

**Command number: 162**  
**Number of parameters: 1**  
**Bytes sent by the GSV: 4**

With Read Ranges all configurable input sensitivities can be determined, this means even those, who are currently not configured. The transfer parameter indicates which of possible input sensitivities should be read. Here is High-Nibble (bits <7:4>) the channel coded, which may be only 0 (bit 4 = 0) or 1 (bit 4=1). The lower nibble (bits <3:0>) indicates whether the currently configured input sensitivity should be read (bits <3:0> =0) or which of 3 existing input sensitivities levels. These may deviate from standard variant (1 /2 /3,5 mV/V) depending on the option of hardware.

The first byte of return is the so-called „Jumper-Group-ID“, which indicates (Bit4) =0 on the channel nibble , for which jumper position applies the returned input sensitivity value.

The return value (bytes 2...4, High-endian) indicates the 100 time the input sensitivity in mV (mV/V), which means it must be divided by 100, to get mV/V, or by 100000 to get Volt.

### Transfer parameter

| Value (Hex) | Meaning   | Value at standard-version (decoded, dec.) |
|-------------|---|---|
| 0x00        | Currently configured input sensitivity  | 1 / 2 / 3,5 mV/V / 10V                    |
| 0x01        | First input sensitivity for setting 1 of JP1 (s.S.Error: reference not found) | 1 mV/V                                    |
| 0x02        | First input sensitivity for setting 2 of JP1                                  | 2 mV/V                                    |
| 0x03        | Second input sensitivity for setting 2 of JP1                                 | 3,5 mV/V                                  |
| 0x10        | Input sensitivity of channel 1 (if it is now activ)                           | 10 V                                      |
| 0x11        | Input sensitivity of channel 1  | 10 V                                      |



## Meaning of the Jumper-Group-ID bytes of answer:

| Value (Hex) | Meaning  |
|-------------|--|
| 0x01        | Jumper 1: position 1. if transfer param. =0: Jumper is in position 1 |
| 0x02        | Jumper 1: position 2. if transfer param. =0: Jumper is in position 2 |
| 0x03        | Channel 1  |
| 0xFF        | Error  |

Possible error codes: 0xA0,0x59,0x91

## Get Sensor Capacity

**Command number: 164**

**Number of parameters: 0**

**Bytes sent by the GSV: 4**

With Get Sensor Capacity the previously saved physical characteristic value of the connected sensor can be read. The return parameter is encoded as floating point number to basic 10, whereby the first byte indicates exponent +1 and the bytes 2 to 4 the mantissa in High-endian order. The returned mantissa is the 1000000 time mantissa in point presentation. Example:

The return is 0x04, 0x26.25.A0

The decimal exponent is then  $0x04 - 1 = 3$ .

Mantissa must be divided by  $10^6$ , in this example:  $2\ 500\ 000 / 10^6 = 2,5$

The characteristic value is then:  $2,5 * 10^3 = 2500$ .

possible error code: 0xA0,0x91

## Set Sensor Capacity

**Command number: 165**

**Number of parameters: 4**

**Bytes sent by the GSV: 0**

With Set Sensor Capacity the physical value of the connected sensor can be saved. The transfer parameter is thereby as floating point number to basic 10 coded, whereby the first byte indicates exponent +1 and the bytes 2 to 4 the mantissa in High-endian order. The transferred mantissa is the 1000000 time mantissa in point presentation. Example:

Shall the characteristic value be 150, this means  $1,5 * 10^2$  (1,5E2)

The exponent byte is then 0x03 (2 +1).

The mantissa must be multiplied by  $10^6$ , in this example:  $1,5 * 10^6 = 1.500.000$

value range uncoded: 0,01 bis 9.999.999

value range exponent byte: 0x00 bis 0x07

value range mantissa: 0x0186A0 bis 0x98967F

possible error code: 0xA0,0x54,0x55

## Get Rated Output

**Command number: 166**  
**Number of parameters: 0**  
**Bytes sent by the GSV: 4**

With Get Rated Output previously saved electrical characteristic value of the connected sensor can be read. The return parameter is thereby coded as floating point number to basic 10, whereby the first byte indicates exponent +1 and the bytes 2 to 4 the mantissa in High-endian order. The returned mantissa is the 1000000 time the mantissa in point presentation. Example:

Shall the return be 0x01, 0x35.67.E0

The decimal exponent is then  $0x01 - 1 = 0$ .

The mantissa must be divided by  $10^6$ , in this example:  $3.500.000 / 10^6 = 3,5$

The electrical characteristic value is then:  $3,5 * 10^0 = 3,5$ .

possible error code: 0xA0,0x91

## Set Rated Output

**Command number: 167**  
**Number of parameters: 4**  
**Bytes sent by the GSV: 0**

With Set Rated Output the electrical characteristic value of the connected sensor can be saved. The return parameter is thereby coded as floating point number to basic 10, whereby the first byte indicates exponent +1 and the bytes 2 to 4 the mantissa in High-endian order. The returned mantissa is the 1000000 time the mantissa in point presentation.

### The transferred exponent depends thereby on the input sensitivity:

| Input sensitivities<br>Channel 0 | Exponents byte | Value range (decimal, uncoded) |
|----------------------------------|----------------|--------------------------------|
| 0,1 / 0,2 / 0,35 mV/V            | 0x00           | 0,001 to 0,9999999 mV/V        |
| 1 / 2 / 3,5 mV/V                 | 0x01           | 0,01 to 9,999999 mV/V          |
| 10 / 20 / 35 mV/V                | 0x02           | 0,1 to 99,99999 mV/V           |
| 100 / 200 / 350 mV/V             | 0x03           | 1 to 999,9999 mV/V             |

The input sensitivity should have been determined before with Read Ranges.

Example:

Shall the electrical characteristic value be 2,123456 mV/V

Shall the input characteristic value be 3,5 mV/V

The exponent byte is then 0x01

The mantissa must be multiplied by  $10^6$ , in this example:  $2,123456 * 10^6 = 2.123.456$

Bytes to be transferred are then: 0x01, 0x20, 0x66, 0xC0

Value range exponent byte: 0x00 bis 0x03, defined with input sensitivity

Value range mantissa: 0x002710 bis 0x98967F

possible error code: 0xA0,0x54,0x55,0x56



### Get SensorText Assign

**Command number: 168**

**Number of parameters: 0**

**Bytes sent by the GSV: 2**

With Get SensorText Assign information about the assignment of settings to the saved sensors and their names defined by user can be read.

The answer contains two parameters, each is 1 byte big. The first byte is the assignment number. If it is =0, then there is no sensor(text) assigned to the settings. Otherwise it describes the number (1 to 6) of user data record, in which the copy of the settings belonging to sensor is taken (see Cmd 9/10: Get All / Save All).

The second byte contains flags about the presence of sensortext, s. table. If the bit is set, there is a valid text, otherwise the bit is =0.

See also the next chapter "Using and managing of the user data record assigned text".

| Data record-Nr.<br>(frist byte of<br>answer) | Address range of<br>sensor text (s.<br>Cmd. 56/57), Hex | Address range of<br>sensor text (s. Cmd.<br>56/57), Dec | Bit-Nr. Second byte of answer. Bit =<br>1: text available |
|--|---|---|---|
| 1  | 0x300...0x30D   | 768...781   | Bit 0   |
| 2  | 0x310...0x31D   | 784...797   | Bit 1   |
| 3  | 0x320...0x32D   | 800...813   | Bit 2   |
| 4  | 0x330...0x33D   | 816...829   | Bit 3   |
| 5  | 0x340...0x34D   | 832...845   | Bit 4   |
| 6  | 0x350...0x35D   | 848...861   | Bit 5   |

## CANbus / CANOpen protocol of the GSV-2-CANOpen

Conformity: CiA 301 (communication) and CiA 404 (application)

Other documents: gsv2can.eds, ba-gsv2CanOpen.pdf

### Connecting the CAN-Bus wires

The CAN-Bus wires are connected to the terminals D, E and F:

| Terminal | Description |
|----------|-------------|
| D        | CAN-GND     |
| E        | CAN-L       |
| F        | CAN-H       |

The CAN-Interface is galvanically isolated.



## Bus-termination

Just behind the 15-pole terminal block there's a 2-pole pin-connector for the bus-termination. By closing these 2 pins with a jumper (1/10" spacing) the bus-termination is enabled.

## Supported services

- 5 different mandatory RX-NMT objects for the state-management (see CiA 301)
- Heartbeat-producing with indication of the actual state and bootup-frame
- 1 Tx-PDO for measuring values
- 37 different SDOs in the Object dictionary, two of them manufacturer-defined, see EDS

## Interpretation of the 1<sup>st</sup> Tx-PDO

After Bootup the device is in the Preoperational state. In order to let the device send the 1<sup>st</sup> Tx-PDO, the „Enter Operational state NMT“ must be transmitted to the device. If all other send-conditions are met (see below), the following PDO-frames are sent, in time-order from left to the right:

| Analog Input Process Value |        |        |        | A.Input Status | Alarm Status |
|----------------------------|--------|--------|--------|----------------|--------------|
| LSByte                     | Byte 1 | Byte 2 | MSByte | Byte           | Byte         |

In the default configuration, the Analog Input Process Value is a Signed-Integer 32 number, which must be interpreted as following, to get scaled measuring-values:

$$\text{Measuring value} = \text{Analog\_Input\_Process\_Value\_Raw\_Value} / (10^{\text{Analog\_Input\_Decimal\_Digits}})$$

So, for interpretation the object 6132h (Analog\_Input\_Decimal\_Digits) must be read once and the A.I.Process\_Value\_Raw\_Value must then be divided by the power of the Analog\_Input\_Decimal\_Digits to the base of 10.

With the object 6126h the Analog Input Process Value can be scaled, to customize it to the application requirements. By writing to 6126h the Analog\_Input\_Decimal\_Digits may get altered in the background, so after writing to 6126h the object 6132h should be read again. Changing the Physical Units (Object 6131h) hasn't any influence on 6126h and on 6132h.

Future versions (from firmware version 1.4 on) will be able to transmit the Analog Input Process Value as a float, scaled directly to physical units, so that this lavish interpretation won't be necessary anymore.

The Analog Input Status Byte contains the following flags:

Bit 0 (LSBit): (still reserved, =0; future versions: sensor broken)

Bit1: Positive overflow of the measuring value

Bit2: Negative overflow (=underflow) of the measuring value



Bits 3..7: =0

With the GSV-2CANOpen, the Alarm Block is implemented as the threshold switch, whereby the measuring value is compared to a threshold and the threshold switching output is set on or off. The status of these switches are part of the Alarm Status.

The Alarm Status Byte contains the following flags:

Bit 0 (LSBit): Threshold switch 1 activated

Bit 1: Threshold switch 2 activated

Bits 2..7: =0

### Send-conditions for the 1<sup>st</sup> Tx-PDO

- State = operational AND
- PDO = valid (Object 1800.1 Data-Bit 31 =0)  
AND if Transmission-Type (1800.2) = 255 (default setting):
- Event-Timer (1800.5) ready OR
- Changing of measuring value  $\geq$  Analog Input Delta Transmission Value (6133h),  
if 6133.1  $>$  0

If the Transmission-Type is = 254, the Event-Timer is ignored.

If the Inhibit-Time (1800.3) is  $>$ 0 and not expired yet, no further PDO will be transmitted.

### Default settings:

|   |   |
|---|---|
| CAN-Bitrate   | 500kBits/s  |
| Node-ID   | 0x40  |
| Transmission-Type (Obj. 1800.2)                     | 255   |
| Inhibit-Time (Obj. 1800.3)                          | 0, that means disabled  |
| Event-Timer (Obj. 1800.5)                           | 0x03E8, that means 1 PDO /s   |
| Analog Input Delta Transmission Value (Obj. 6133.1) | 0, that means Delta-Interrupt-function disabled   |
| Producer Heartbeat Time (Obj. 1017)                 | 0, that means Heartbeat disabled. The Bootup-frame will be sent once after power-up or after reset. |

**All other objects and settings: see EDS and ba-gsv2CanOpen.pdf**

## General advices and Tips

Please attend the actual documents on:  
<http://www.me-systeme.de/software.html>

The command number is transmitted as a single byte to the measuring amplifier.

The command parameters and the return parameters are binary bytes and not numerical (ASCII-) values (e.g. the parameter „01“ means 0x01 and not 0x31).

A Windows dynamic-link-library (MEGSV.DLL) to access all the features of the measuring amplifier is available, also a LabView example VI with dll-function wrapper-VIs.

For direct programming via RS232 it is sometimes easier to use the text format for measuring values, provided that the scaling factor was calculated correctly, according to the application requirements, since in text format the GSV-2 itself does the multiplication of the raw values with the scaling factor.

Otherwise, in the binary format every measuring value needs to be multiplied with the scaling factor, in order to show physical measurement values (for example  $\pm 2\text{mV/V}$ ). To calculate measuring values scaled in physical units please calculate as follows:

1. Without using the Windows-DLL, Mode „bipolar“:  
Measuring value =  $((\text{Raw binary} - 8388608) / 8388607) * 1,05 * \text{scaling factor}^9$
2. If using the Windows-DLL:  
Measuring value =  $\text{GSVread\_pointer-content} * \text{scaling factor}$

The setting of the datarate and the scale factor is by using direct programming via RS232 is a little bit difficult – see above descriptions of Set Scale, Set Dpoint and WriteSamplingFrequency.

You can save up to 6 different configurations in the EEPROM of the GSV-2 (by using the configuration program GSV.EXE) and restore them with the command „GetAll“.

In the text format there's always one blank character (0x20) between the numerical value and the CR/LF (even if the unit was turned off by unit-code 0x07).

**Attention: After every replacement of the jumper JP1, after every change of the datarate or changing the amplification or using other commands which affects the analogue-digital conversion, the command „Set Cal“ must be applied.**

The configuration software GSV.EXE gives the command Set Cal automatically under the conditions mentioned.

It is recommended to use the bipolar mode rather than unipolar.

---

<sup>9</sup> If you use the mode „unipolar“:  
Measuring value =  $(\text{Raw binary} / 16777215) * 1,05 * \text{scaling factor}$



## Technical Data

(At  $U_B = 12 \dots 26V$  DC in the nominal temperature range)

| Model  | GSV-2LS /<br>GSV-2AS   | GSV-2ASD / FSD /TSD             | Unit /<br>remarks          |
|--|--|---------------------------------|----------------------------|
| <b>Accuracy class</b>  |  |                                 |                            |
| analog   | 0.1  | 0.1                             |                            |
| digital  | 0.1  | 0.1                             |                            |
| <b>Measuring ranges</b>  |  |                                 |                            |
| Analog output  | $\pm 1$ (JP1 set to pos.1, 5V Sensorspeisung)<br>$\pm 2$ or $\pm 3.5$ (by software and JP1 to pos.2, 2.5V sensor supply) |                                 | mV/V<br>mV/V               |
| Display / serial output  | 0.125, 0.25, 0.50, 1.00, 2.00, 3.50 (by software)  |                                 | mV/V                       |
| <b>Connectable fullbridges*</b>  | 4 x 350  | 4 x 350                         | Ohms                       |
| <b>Bridge sensor supply</b>  | 2,5 / 5  | 2,5 / 5                         | V                          |
| <b>Input impedance</b>   | >20 / 300pF  | >20 / 300pF                     | MOhms                      |
| <b>Common mode rejection ratio</b>   |  |                                 |                            |
| DC   | >120   | >120                            | dB                         |
| 100Hz  | >100   | >100                            | dB                         |
| <b>Non-linearity</b>   | <0,02  | <0,02                           | % o.up.rang                |
| <b>Temperature influence on the zero point per 10K</b>   | Messbereich 1mV/V: <0.4 typ. 0.2<br>Messbereich 2mV/V: <0.2 typ. 0.1   |                                 | % o.up.rang<br>% o.up.rang |
| <b>Temperature influence on the measuring sensitivity per 10K referred to the measured value</b> |  |                                 |                            |
| Analog output  | < 0.1; typ. 0.05   | < 0.1; typ. 0.05                | %                          |
| Display / digital  | <0.01; typ. 0.005  | <0.01; typ. 0.005               | %                          |
| <b>Output filter Analog output</b>   |  |                                 |                            |
| 3dB cutoff frequency analog, Bessel, 2 <sup>nd</sup> order                                       | 3.5, 260, 1700 (by softw.)   | 3.5, 260, 1700 (by softw.)      | Hz                         |
| <b>Output filter digital</b>   |  |                                 |                            |
| 3dB cutoff frequency,  | 0.06..1700   | 0.06..1700                      | Hz                         |
| Data rate digital  | 0.3125..2000   | 0.3125..2000                    | Hz                         |
| <b>Resolution</b> Peak-to-peak<br>RMS  | >30000 counts<br>>150000 counts  | >30000 counts<br>>150000 counts | -->See p.62                |
| <b>Analog output</b>   |  |                                 |                            |
| Usable output range at:  |  |                                 |                            |
| - Nominal range 0...10V  | -10 ...+11   |                                 | V                          |
| - Nominal range $\pm 5V$   | -5.5...+5.5  |                                 | V                          |
| Output resistance  | 47   |                                 | Ohms                       |
| Minimum load resistance  | 8  |                                 | kOhms                      |
| <b>Analog input (Channel 1)</b>  |  |                                 |                            |
| Input voltage range  | 0...10   | 0...10                          | V                          |
| Input resistance   | 56   | 56                              | kOhms                      |
| <b>Control wires</b>   |  |                                 |                            |
| Zero-point adjustment  | Low level: <1.4 High level: >3.4 (active high)   |                                 | V                          |
| <b>Switching output</b>  |  |                                 |                            |

| Model   | GSV-2LS /<br>GSV-2AS  | GSV-2ASD / FSD /TSD   | Unit /<br>remarks |
|---|---|-----------------------|-------------------|
| of threshold switch   | 200mA / 30V   | 200mA / 30V           |                   |
| Saturation voltage  | <1.0  | <1.0                  | V DC              |
| maximum voltage (switch off)                                  | 60  | 60                    | V                 |
| maximum current (switch on)                                   | 1   | 1                     | A                 |
| On resistance DC  | 0.12  | 0.12                  | Ohms              |
| Off resistance  | 10  | 10                    | TeraOhms          |
| insulation strength   | 250   | 250                   | V                 |
| <b>Digital serial interface</b>                               | RS 232/RS422  | RS 232/RS422          |                   |
| Bit rate (dafault state)                                      | 38400 (8N1)   | 38400 (8N1)           | Bits/s            |
| <b>Supply voltage</b>   |   |                       |                   |
| <b>Nominal range</b>  | 9.8...30  | 9.8..30               | V DC              |
| Operating range <sup>2)</sup>                                 | 9.8...36  | 10...36               | V DC              |
| <b>Supply current</b>   | <120  | <120                  | mA                |
| With display  |   | <180                  | mA                |
| <b>Parameter memory</b>                                       | Last settings,<br>manufacturer settings,<br>6 user-records  |                       |                   |
| <b>Other functions of the serial interface</b>                | - Programmable threshold with hysteresis<br>- Programmable gain<br>- Programmable calibration of the final value (scaling function)<br>- Programmable zero adjustment |                       |                   |
| <b>Nominal temperature range</b>                              | -10...+65   | 0...+50 <sup>3)</sup> | °C                |
| <b>Storage temperature range</b>                              | -40...+85   | -20...+70             | °C                |
| <b>Dimensions (L x W x H)</b>                                 |   |                       |                   |
| Print board (GSV-2LS)   | 125 x 53 x 30   |                       | mm                |
| Housing (GSV-2AS/ASD)   | 180 x 65 x 36   | 180 x 65 x 40         | mm                |
| <b>Protection degree of enclosure</b> (DIN 40 050/IEC50(426)) | IP66  | IP40                  |                   |

1) For version LS and AS 2 further control wires optionally available

2) Temperature range and accuracy may be reduced

3) LCD with extended temperature range optionally available

#### Absolute maximum values

(all voltages with reference to the supply ground)

|                            |            |
|----------------------------|------------|
| <b>Operating voltage:</b>  | -5...+42V  |
| <b>Single pulse 200ms:</b> | +100V      |
| <b>Differential input:</b> | -4...+12V  |
| <b>Sense inputs:</b>       | -4...+12V  |
| <b>Control wires:</b>      | -30...+30V |
| <b>Analog input:</b>       | -20...+20V |

## CANbus Interface

The bus voltages are expected to be in the range from 0.5 to 4.5V (Common mode);

Withstand voltage: 0..+26V referred to CAN-GND.

## CANOpen Vendor-ID

31

24 23

0

|            |         |    |    |
|------------|---------|----|----|
| department | company |    |    |
| 00         | 00      | 02 | 70 |



## Resolution

By changing the data rate (amount of measuring values transmitted per second) the analogue filter is changed automatically by default, as well as the filter properties of the delta sigma A/D Converter.

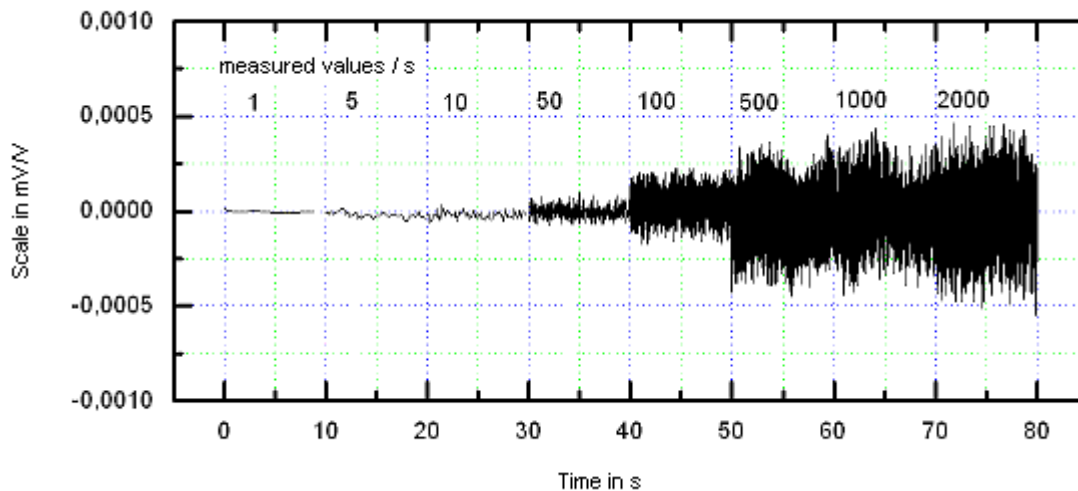
Because of the internal oversampling and filtering, normally the user doesn't need to perform extra filtering and averaging.

The charts below show measuring values with a shielded sensor cable of 1 meter, and twisted pairs of wires, shield connected to GND. The lower the data rate is, the better is the resolution.

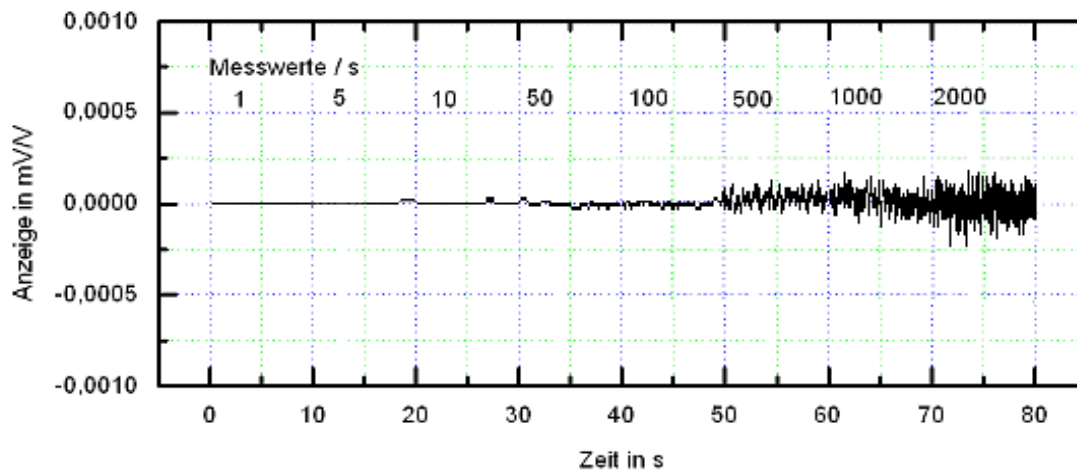
Comparable results can be obtained in practice also with cable lengths of 50 meters, if the control and the sensor-cables are installed separately and a good electromagnetic shielding is provided.

**The shielding of the RS232-interface cable should be connected to the grounding-plug of the housing.**

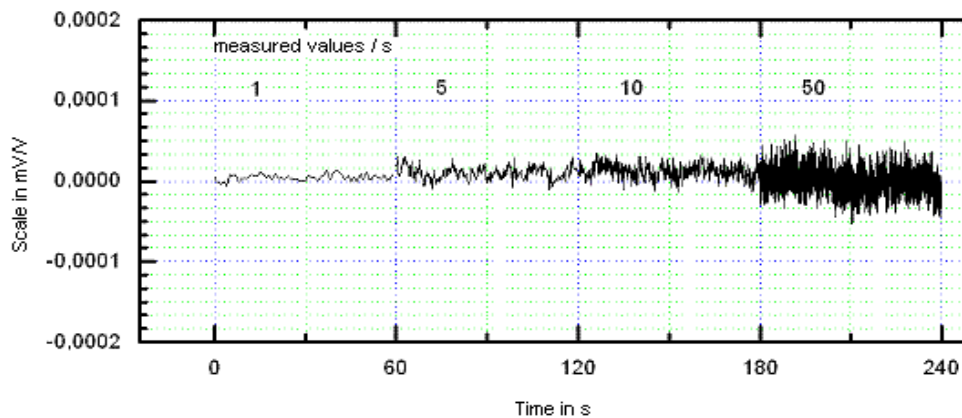
Resolution in the measuring range „2 mV/V“ (2.5V supply voltage, JP1 in position 2)



As above, but with adaptive averaging filter enabled, see p.42



Resolution in the measuring range „1mV/V“ (5V supply voltage, JP1 in position 1)



The peak-to-peak resolution at a data rate of 10/s is at least 30,000 counts, without additional digital filter, if this resolution is defined as the ratio of the measuring range to the amplitude of the peak-to-peak values, with sensor input shorted (Measuring range / peak-to-peak deviation).

The effective resolution at a data rate of 10/s is at least 150,000 counts (measuring range / standard-deviation).

With the adaptive averaging filter these values increase to better results by the factor 5 – e.g. 150,000 counts peak-to-peak resolution at 10Hz. This is valid with suitably adjusted filter only (see p.42).

More informations <http://www.me-systeme.de/gsv2-dat.html#resolution>

## Description of the jumpers / selectors

**JP1:** Changing the bridge supply voltage:

position 1 (left): bridge supply voltage = 5V, input sensitivity = 1mV/V

position 2 (right): bridge supply voltage = 2.5V, input sensitivity = 2 or 3.5mV/V  
(see Set/Get Range) **Attention: the jumper has to be plugged!**

**JP2:** Configuration mode for baudrate and protocol settings

Set: Configuration mode is enabled, Baudrate is fixed to 38400 Bits/s

Not set: Configuration mode is disabled, the baudrate of the baudrate-register is valid (see Set /Get Baud)

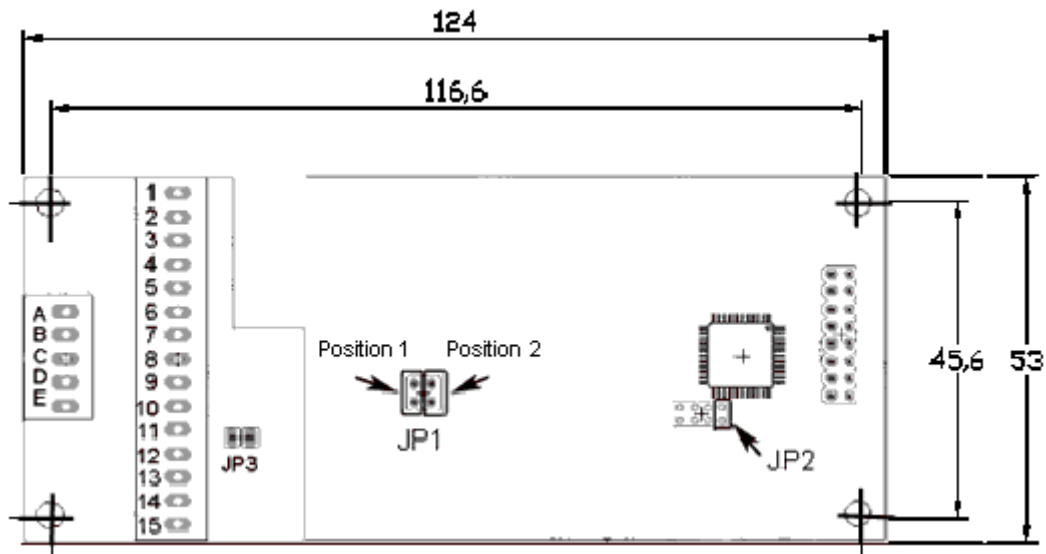
**JP3:** Change the serial interface from RS232 (V24) to RS422:

set: RS422 (4 wires). Not set: RS232 (V24), state at delivery

**Connector pin assignment RS232: A: GND, B: RX, C: TX**

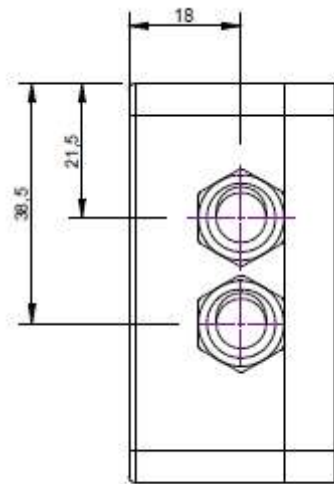
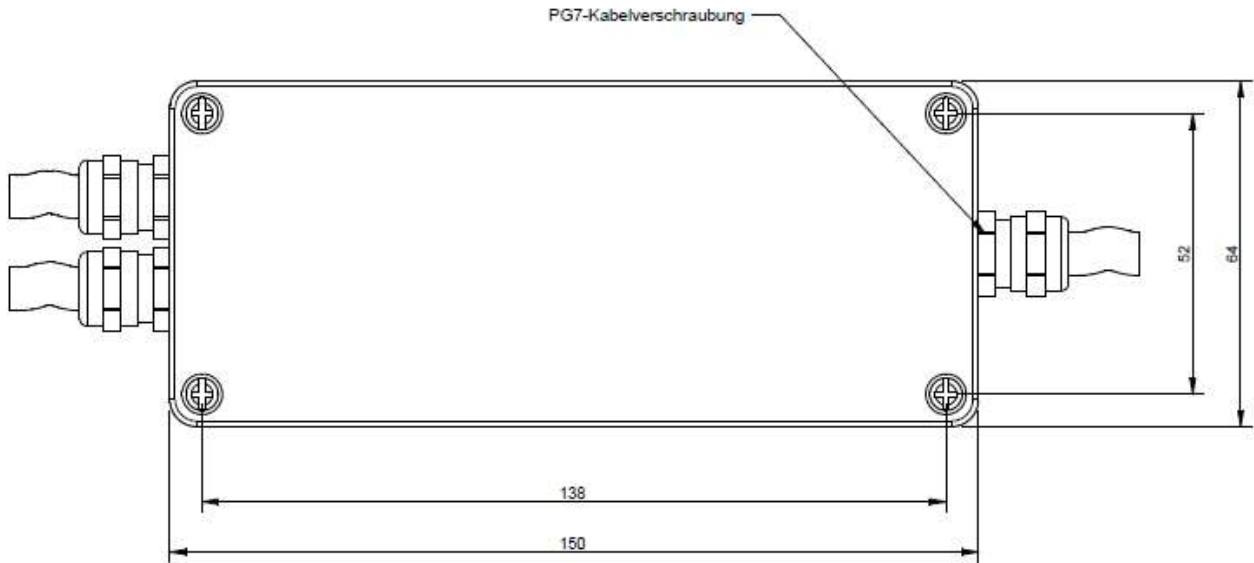
**Connector pin assignment RS422: A: GND, B: RX-, C: TX-, D: RX+, E: TX+**

## Dimensions of the circuit board GSV-2L

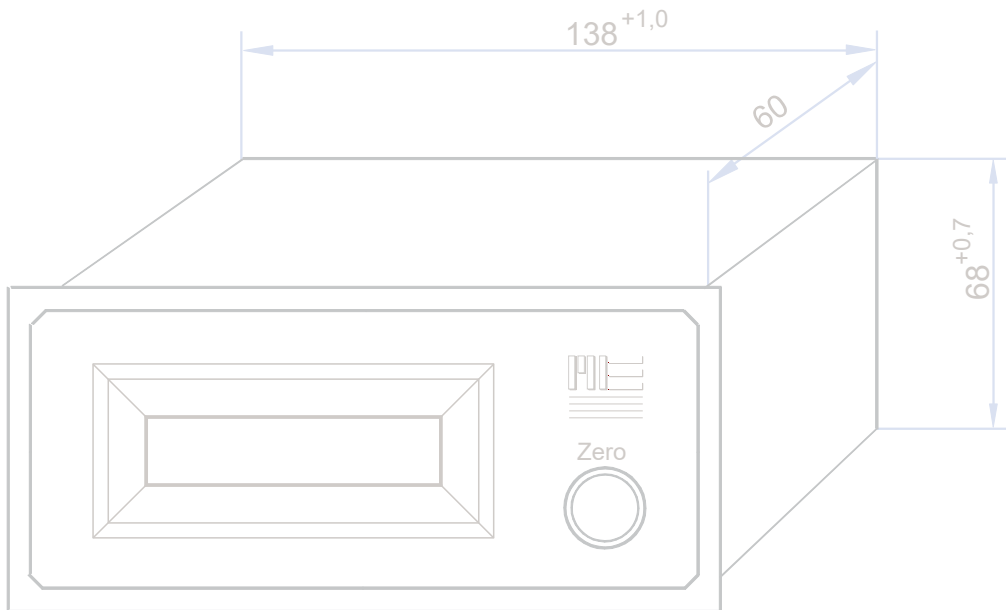




## Dimensions of the aluminium housing of the GSV-2AS



## Front panel cut out and housing of the GSV-2FSD



## Dimensions of the GSV-2TSD-DI

L x B x H: 200 x 175 x 75 mm

|              |                             |
|--------------|-----------------------------|
| Updated:     | 14.11.17                    |
| Version      | ba-gsv2-v1.3_en             |
| editor       | Holger Kabelitz             |
| Released by: | Holger Kabelitz, 14.11.2017 |
| Änderungen   | Changelog Seite 66          |

## Changelog

| Version             | Datum    | Änderungen                               |
|---------------------|----------|--|
| ba-gsv2-v1.1_en.odt | 15.03.16 | first version                            |
| ba-gsv2-v1.2_en.odt | 28.02.17 | new formatting                           |
| ba-gsv2-v1.3_en.odt | 14.11.17 | Details of the battery in GSV-2TSD added |
|                     |          |  |
|                     |          |  |



Subject to change without notice.  
Every information describes the product in general.  
They are no assurance of features in the sense of §459 Abs. 2, BGB (German civil code)  
and assume no liability.