Signal flow diagram for GSV-6

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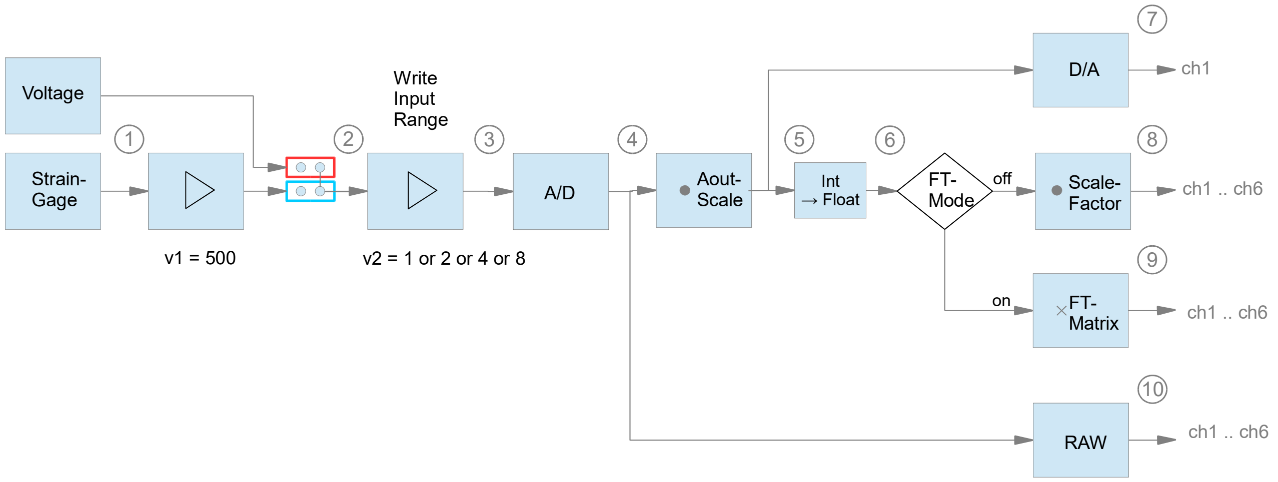

Differential input for strain gauges (1)

Differential input signal or output signal of the Wheatstone bridge; the maximum measuring range is 8 mV/V.

Voltage signal 0V ... 3V (2)

Analog signal; by selecting the gain, the maximum measurement range of 8 mV/V can be configured to 8, 4, 2, or 1 mV/V. Gain level 1 corresponds to a configured measurement range of 8 mV/V, level 2 corresponds to 4 mV/V, and so on. The gain can be selected using the command MEweriteInputRange (No. 0x34).

The physical input range for channels 2 to 6 with GSV-6CPU is 1.5 V ± 1.5 V (nominal). In some variants (GSV-6PI), these channels can be used for various input signals, such as ± 10 V, PT1000, full-bridge, half-bridge, and quarter-bridge strain gauges, by means of additional circuitry.

Amplified voltage signal 0V ... 3V (3)

The configured measurement range can be set using the firmware command MEwriteInputRange (No. 0x34) and read using GetInputType (No. 0xA2).

Note: MEwriteInputRange cannot be set individually for each channel; it affects all six channels.

Prerequisites for executing MEwriteInputRange: Firmware version up to 3.10: Set manufacturer ID

A reset should then be performed for it to take effect.

The usable range of the configured measurement range is 105% of the nominal range of the configured measurement range (5% overhead).

16-bit numerical value (4)

The configured measurement range (8, 4, 2, or 1 mV/V) is digitized to a value range from 0x8619 (-100% of the measurement range) to 0x79E7 (+100% of the measurement range).

These numerical values result from the bipolar 16-bit range minus 5% overhead: ±2^15 / 1.05.

With a gain of 2, 4, or 8, the input range of voltage inputs is reduced accordingly to ±0.75V, ±0.375V, and ±0.187V, respectively.

Scaled 16-bit numerical value (5)

The tare offset is subtracted from the digitized numerical value (4), and it is then multiplied by a (total) scaling factor “AoutScale”.

The configured measurement range (8, 4, 2, or 1 mV/V) is thereby reduced by the factor AoutScale:

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Scaled measurement range (5) = configured measurement range (4) / AoutScale.
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In this way, the adjustment range for the tare offset (SetZero) can also be adjusted; for example, to ±100% if AoutScale = 2.

AoutScale can be set with the firmware command WriteAoutScale (No. 0x07) and read with ReadAoutScale (No. 0x06).

The tare offset changes when SetZero (No. 0x0C) is executed. It can also be read with ReadZero (No. 0x02) and set with WriteZero (No. 0x03).

The value at 5) corresponds to the communicated 16-bit measurement value if the data type in the measurement frame is set to Int16. The data type of the values in the measurement frame can be changed with SetTXmode (No. 0x81).

The nominal range end values at 5) are also 0x79E7 (positive) and 0x8619 (negative).

The value (5) for input channel 1 is also the basis for calculating the value at the analog output. A separate offset is added, which is communicated using the commands ReadAoutOffset (No. 0x04) and WriteAoutOffset (No. 0x05).

32-bit floating-point number (6)

The 16-bit numerical value (5) is converted into a floating-point number with the nominal range -1 ... +1, where the value 1.0 corresponds to the positive scaled measurement range and -1 to the negative. This range is saturated to -1.05 ... 1.05. These floating-point values of the 6 input channels are the input values for the calculation with six-axis matrices, see (9).

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Analog output signal (7)

An analog signal is available for channel 1.

The analog output signal of the CPU module is 1.25V (zero) ±1.25V (range).

The GSV-6 L variant has a configurable output driver that allows the signal to be converted into various electrical formats or ranges, e.g., -10 to 10V or 4 to 20mA.

Scaled measurement value (8)

If the calculation with six-axis sensors is not active, the floating-point value (6) is first multiplied by the UserScale value, and then the UserOffset is added. The UserScale is communicated using the commands ReadUserScale (No. 0x14) and WriteUserScale (No. 0x15), and the UserOffset using ReadUserOffset (No. 0x9A) and WriteUserOffset (No. 0x9B).

The value (8) is communicated in the measurement data frame if the data type is set to Float.

The data type of the values in the measurement frame can be changed using SetTXmode (No. 0x81).

Force/torque display for 6-axis sensors

If the calculation using six-axis sensors is active, the values (6) of the six input channels are multiplied by the calibration matrix of the six-axis sensors.

Up to device firmware version 3.10, the values (6) are calculated directly with the calibration matrix "as is," without taking the measurement ranges and the scaling of the matrix values into account. Therefore, the user may need to multiply the matrix by a factor before passing it to the amplifier to scale the input values to 1 mV/V.

Example: Let the output matrix be scaled in N/mV/V or Nm/mV/V, and let the nominal input range be 8 mV/V (i.e., gain = 1) and AoutScale = 2. Then the matrix must be multiplied by 8/2 = 4 so that the raw value vector is scaled in mV/V.

From firmware version 3.11 onwards, the calibration matrix is scaled by the GSV-6 itself as follows:

Matrix scaling factor = (OutScaleFactor * 8) / (InScaleFactor * gain * AoutScale) or:

Matrix scaling factor = (OutScaleFactor/InScaleFactor) * nominal range (5)

Where OutScaleFactor and InScaleFactor are the scaling factors that apply to the calibration matrix passed to the measuring amplifier.

They are typically named with this key identifier in the sensor calibration data file <SensorSerNo>.dat. If the passed matrix is already scaled in N/mV/V or Nm/mV/V, then the values 1.0 must be passed for both OutScaleFactor and InScaleFactor.

OutScaleFactor and InScaleFactor are set to 1.0. All six-axis sensor calibration values are read using the ReadFTSensorCal command (No. 0x47) and written using WriteFTSensorCal (No. 0x48); see protocol description.

Raw value (10)

The raw value at (4) can be read using the GetRawValue command (No. 0x3A).

Default settings

UART Baudrate 230400/s

CAN Bitrate 1 Mbit/s

Number of Channels: 6

	Range of Values	Default Setting
v1	not configurable	
v2	1, 2, 4, 8	2 (corresponds to 4 mV/V configured measuring range)
AoutScale		2 (corresponds to a 2 mV/V scaled measuring range and a 2 mV/V reserve for zero adjustment) in conjunction with v2 = 2;

Maximale Datenfrequenzen

Number of Channels	Protocol	min Data Frequency	max. Data Frequency
1	UART (230400/s)	10 Hz	2304 Hz
6	UART (230400/s)	10 Hz	658 Hz
1	CAN (1 Mbit/s)	10 Hz	3200 Hz
6	CAN (1 Mbit/s)	10 Hz	800 Hz

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Recommended settings for the IIR filter

The GSV-6 features a fourth-order IIR filter. Configuring it requires expertise in signal processing. The IIR filter is suitable for specific tasks, such as high-pass or band-stop filtering.

For general applications, using the IIR filter is unnecessary. Simply adjusting the data frequency is sufficient: The data frequency should be set as low as possible and only as high as absolutely necessary.

The table lists some possible configurations as examples.

Low-pass filter

Setting the maximum data frequency is recommended for use with the analog output.

When configured as a 1-channel system with a baud rate of 230400/s, the UART interface transmits a maximum of 2304 measurements per second.

Cut off frequency in Hz	min. Data Frequency in Hz	max. Data Frequency in Hz
0,05	1	1
0,1	1	1
1	2,5	10
10	25	100
50	125	500
100	250	1000
250	625	2500
1000	2500	10000
2500	6250	25000

High-pass filter

When using the high-pass filter, setting the maximum data frequency is recommended.

Cut off frequency in Hz	min. Data Frequency in Hz	max. Data Frequency in Hz
0,1	2	10
0,5	10	50
1	20	100
10	200	1000

Bandstop filter

Center frequency in Hz	Data Frequency in Hz	Difference between lower and upper cutoff frequency
1 ... 49	100	1 ... 20
2 ... 99	200	2 ... 40
40...460	1000	5...200

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