DEWETRON

HSI-STG Module

TECHNICAL REFERENCE MANUAL

WELCOME TO THE WORLD OF DEWETRON!

Congratulations on your new device! It will supply you with accurate, complete and reproducible measurement results for your decision making.
Look forward to the easy handling and the flexible and modular use of your DEWETRON product and draw upon more than 30 years of DEWETRON expertise in measurement engineering.

ISO9001

EN ISO 14001

THE MEASURABLE DIFFERENCE.

Notice

The information contained in this document is subject to change without notice.

DEWETRON GmbH (DEWETRON) shall not be liable for any errors contained in this document. DEWETRON MAKES NO WARRANTIES OF ANY KIND WITH REGARD TO THIS DOCUMENT, WHETHER EXPRESS OR IMPLIED. DEWETRON SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. DEWETRON shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory, in connection with the furnishing of this document or the use of the information in this document.

Warranty Information:

A copy of the specific warranty terms applicable to your DEWETRON product and replacement parts can be obtained from your local sales and service office.

Restricted Rights Legend:

Use austrian law for duplication or disclosure.

DEWETRON GmbH
Parkring 4
8074 Grambach
Austria

Printing History:

Please refer to the page bottom for printing version.

Notice

Safety symbols in the manual

	*Indicates hazardous voltages.*

WARNING	*Calls attention to a procedure, practice, or condition that could cause bodily injury or death.*

CAUTION	*Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.*

WARNINGS

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. DEWETRON Elektronische Messgeraete Ges.m.b.H. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as option and will not be shipped as standard parts.

Safety instructions for DEWETRON amplifiers

- The DEWETRON data acquisition systems and amplifiers may only be installed by experts.
- Read your manual carefully before operating.
- Observe local laws when using the amplifiers.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), a non interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.
- DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to a DEWETRON sales and service office for service and repair to ensure that safety features are maintained.
- Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.
- No modifications are allowed at the amplifiers.
- DO NOT service or adjust alone. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
- DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to a DEWETRON sales and service office for service and repair to ensure that safety features are maintained.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- Safety of the operator and the unit depend on following these rules.

Support

For any support please contact your local distributor first or DEWETRON directly.

For Asia and Europe, please contact:

DEWETRON GmbH
Parkring 4
8074 Grambach
AUSTRIA
Tel.: +43 316 3070
Fax: +43 316 307090
Email: support@dewetron.com
Web: http://www.dewetron.com

The telephone hotline is available Monday to Friday between 08:00 and 12:00 CET (GMT -1:00) and Monday to Thursday between 13:00 and 17:00 CET.

For the Americas, please contact:

DEWETRON, Inc.
2850 South County Trail, Unit 1
East Greenwich, RI 02818
U.S.A.
Tel.: +1 401 284 3750
Toll-free: +1 866 598 3393
Fax: +1 401 284 3755
Email: us.support@dewetron.com
Web: http://www.dewetron.us

The telephone hotline is available Monday to Friday between 08:00 and 17:00 GST (GMT +5:00)

Calibration information

All DEWETRON modules are calibrated at 25 °C after a warmup time of 30 minutes and meet their specifications when leaving the factory.
The time interval for recalibration depends on environmental conditions. Typically, the calibration should be checked once a year.

Calibration certificates are available from DEWETRON as an option. DEWETRON offers two types:

- ISO traceable DEWETRON certificate
- Calibration certificate according to ÖKD (equivalent to DKD)

This manual contains no calibration information. For self calibration, there is a separate calibration kit for the DAQ series modules available. The CAL-KIT contains the required cables, software and instructions.

General module specifications

Module dimensions:	20 x 65 x 105 mm (W x H x D without front cover and connectors)	(0.79 x 2.56 x 4.13 in.)
Frontcover:	20 x 87 x 2 mm (W x H x D without connector)	(0.79 x 3.43 x 0.08 in.)
Environmental:		
Temp. range storage:	-30 °C to +85 °C	(-22 °F to 185 °F)
Temp. range operating:	-5 °C to +60 °C	(23 °F to 140 °F)
Relative humidity (MIL202):	0 to 95 % at 60 °C, non-condensing (unless otherwise noticed)	
RFI susceptibility:	±0.5 % span error at 400 MHz, 5 W, 3 m	

All specifications within this manual are valid at 25 °C!

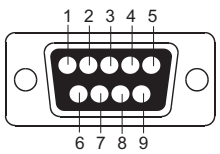
All modules are produced according ISO9001 and ISO14001.

Module connectors

Frontpanel connector: Accessable to the user. The connector type and pin assignment varies from module to module. Detailed pin assignment of each module is shown in the appropriate module description.

Rear connector: 9-pin male SUB-D, interface to the DEWE-System, not accessable to the user.

HSI/DAQx and PAD module rear view



9-pin male SUB-D connector

Interface pin assignment:

1 Module output (±5 V)
2 RS-485 (A)
3 RS-485 (B)
4 GND
5 +9 V power supply
6 +12 V power / sensor supply
7 Module input (from D/A converter of the A/D board)[1)]
8 reserved
9 -9 V power supply

[1)] Triggerout at DAQP-FREQ-A

General Module Information

RS-232/485 interface

HSI/DAQP modules can be configured via RS-485 interface, PAD modules require this interface for all data transfers.

For all DEWETRON systems, an internal RS-232/485 converter is available (standard with DEWE-800, -2000, -2500, -3000, -4000, -5000 series systems). This converter allows communication with HSI/DAQP and PAD modules.

To communicate with the modules, the RS-232 interface has to be set to the following parameters:

baud rate:	9600 bps
data bits:	8
parity:	no parity
stop bits:	1
handshake:	not required

HSI/DAQP module configuration

1. Push button selection

All ranges and filters can be selected directly by pressing the push buttons on the module. Approx. 15 sec. after changing range and / or filter, the range and filter information is stored in an EEPROM. This procedure increases the livetime of the EEPROM.

The current input range setting is shown all the time by LED. To change the range just press ***RANGE*** button a few times until the required range is displayed.

To see the current filter setting just press the ***FILTER*** button once. The corresponding LED is flashing for approx. 3 seconds. Within this time, the filter can be selected by pressing the ***FILTER*** button again. Approx. 3 seconds after the last key activity, the information will be stored, the LED stops flashing and shows the input range again.

CAUTION: Power loss during this time leaves the module in the former settings.

2. RS-232/485 programming

All ranges and filters can also be selected via RS-232/485 interface. All new DEWE-800, -2000, -2500, -3000, -4000, -5000 series systems are prepared as a standard to work with HSI/DAQP modules.

The easiest way to change the configuration is to use the DEWEConfig software, which comes as a standard with the DEWETRON data acquisition system.

Detailed information about HSI/DAQP modules programming for customer applications is available in the *DEWE-Modules Programmers Reference Manual*.

CAUTION: All range and filter changes which are done via RS-232/485 interface are not stored in the EEPROM of the HSI/DAQP modules! You have to store this information in a separat initialisation file to keep settings information for next system start!

PAD module communication

All PAD modules are only working through the RS-232/485 interface. All new DEWE-800, -2000, -2500, -3000, -4000, -5000 series systems are prepared as a standard to work with PAD modules. The easiest way to change the configuration is to use the DEWEConfig software, which comes as a standard with the DEWETRON data acquisition system.

Detailed information about PAD modules programming for customer applications is available in the *DEWE-Modules Programmers Reference Manual*.

High-speed isolated strain gage amplifier

- Bandwidth: 2 MHz
- Input ranges: 0.05 mV/V to 1000 mV/V; 500 µV to 10 V; 25 mΩ to 100 kΩ
- Isolation: 350 VDC
- Bridge completion: Internal completion for ½ and ¼ bridge (120 and 350 Ohm)
- Shunt: Two internal shunts (59.88 kOhm, 175 kOhm)
- Bridge Excitation: 0 to 12 V_{DC} or 0.1 to 60 mA 16 bit programmable
- TEDS: Support for TEDS sensors and DEWETRON MSI series

Module specifications

	HSI-STG
Gain	0.5 to 10 000; free programmable
Voltage input ranges Sensitivity @ 5 V_{DC} excitation	±0.5[3], ±1[3], ±2.5[3], ±5, ±10, ±25, ±50, ±100, ±250, ±500 mV, ±1 V, ±2V, ±5 V,±10 V[3] ±0.1[3], ±0.2[3], ±0.5[3], ±1, ±2, ±5, ±10, ±20, ±50, ±100, ±200, ±400, ±1000 mV/V
Resistance	25 mΩ to 100 kΩ
Input impedance	>100 MΩ (power off: 50 kΩ)
Input noise	7 nV * √Hz
Voltage input 1 year accuracy[1] Gain drift Offset drift linearity	±0.05 % of reading ± 0.02 % of range ±10 µV typical 10 ppm/°K max. 20 ppm/°K typical 0.3 µV/°K + 5 ppm of range/°K, max 2 µV/°K + 10 ppm of range typical 0.03 %
Input coupling	DC or AC (-3 dB @ 1 Hz); max. DC voltage when AC coupled: 35 V
Excitation voltage 1 year accuracy[1] Drift Current limit Protection	0, 0.25, 0.5, 1, 2.5, 5,10 and 12 V_{DC} software programmable (16 Bit DAC) ±0.03 % ±1 mV ±10 ppm/°K ±50 µV/°K 100 mA Continuous short to ground
Excitation current 1 year accuracy[1] Compliance voltage Output impedance	0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 mA software programmable (16 Bit DAC) 0.1 mA to 5 mA: 0.05% ±0.5 µA typical 15 ppm/°C >5 mA to 60 mA: 0.3% ±20 µA typical 100 ppm/°C 12 V >1 MOhm
Supported sensors	4- or 6-wire full bridge 3- or 5-wire ½ bridge with internal completion (software programmable) 3- or 4-wire ¼ bridge with internal resistor for 120 and 350 Ohm (software programmable)[1] 4-wire full bridge with constant current excitation (piezoresistive bridge sensors) Potentiometric Resistance Resistance Temperature Detection with Software linearization: Pt100, Pt200, Pt500, Pt1000
Bridge resistance	80 Ω to 10 kΩ @ ≤ 5 V_{DC} excitation
Shunt calibration	Two internal shunt resistors 59.88 kOhm and 175 kOhm
Shunt and completion resistor accuracy	0.05 % ±15 ppm/°K
Automatic bridge balance	Input range 500 µV to 25 mV: ±400 % of Range >25 mV to 10 V : ±200% of Range, or limited by input range to maximum ±10 V
Bandwidth[2] (-3 dB)	5 mV to 5V input range: 2 MHz; 500 µV: 1 MHz; 1 mV: 1.5 MHz, 2.5 mV 1.9 Mhz, 10 V: 1 MHz
Filters (low pass)	100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz (±1.5 dB @ f_0)
Filter characteristics	100 Hz to 1 MHz: Butterworth or Bessel 40 dB/dec (2nd order; ±1.5 dB @ f_0) 2 MHz: Butterworth 60 dB/dec (3rd order; 0 to -3 dB @ 2 MHz)
Signal delay @ 2 MHz bandwidth	450 nsec
Rise time @ 2 MHz bandwidth	≥ 200 nsec
Typical THD	95 dB, 1 KHz input signal at 1 V range

Typical SFDR and SNR	1 kHz bandwidth		10 kHz bandwidth		100 kHz bandwidth		1 MHz bandwidth	
	SFDR	SNR	SFDR	SNR	SFDR	SNR	SFDR	SNR
1 mV	80 dB	66 dB	80 dB	62 dB	80 dB	55 dB	47 dB	46 dB
100 mV	100 dB	82 dB	90 dB	78 dB	90 dB	71 dB	66 dB	60 dB
1000 mV	110 dB	100 dB	110 dB	97 dB	106 dB	91 dB	87 dB	79 dB

continued on next page

continued from previous page

Typical CMRR 50Hz 1kHz 10kHz 100kHz	0.5mV to 1V range 160 dB 126 dB 104 dB 87 dB	2V to 10V range 160 dB 105 dB 87 dB 71 dB
Isolation	±350 V_{DC} continuous (for input, excitation and TEDS interface)	
Common mode voltage	±350 V_{DC} input to housing	
Over voltage protection	±30 V_{DC} input (+) to input (-)	
ESD protection	IEC61000-4-2: ±8 kV air discharge, ±4 kV contact discharge	
Output voltage	±5 V	
Output resistance	10 Ω	
Output current	Max. 5 mA	
Output protection	Short to ground for 10 seconds	
RS-485 interface	Yes	
Special function	Integrated temperature sensor	
Supported TEDS chips	DS2406, DS2430A, DS2431, DS2432, DS2433	
MSI support	MSI-BR-TH-x, MSI-BR-ACC, MSI-BR-V-200, MSI-BR-CH-50	
Power supply voltage	±9 V_{DC} (±1 %)	
Power consumption	Typ. 1.5 W @ 350 Ohm, 2 W @ 120 Ohm (both full bridge @ 5 V_{DC} excitation) Max. 3 W (depending on sensor); overall current should not exceed DEWE-30-xx maximum power.	

[1] Conditions fo accuracy: module temperature is calibration temperature ±5 °C; humidity is 30 % to 90 % relative humidity.

[2] Please consider possible bandwidth limitation of further components in the measuring chain e.g. A/D card or signal conditioning mainframe.

[3] This range has limited full power bandwidth.

General description

The HSI-STG is a high speed isolated strain gage amplifier with a bandwidth of 2 MHz.The analog design of the amplifier provides a highly accurate output voltage with very low signal delay.
Typical applications for this module:

- Explosive tests
- Impact tests for metal structures
- High-speed pressure sensors (resistive or piezo-resistive)
- High-speed, low-voltage pre-amplifier with low drift

Typical high-speed amplifiers have relatively high input drift and therefore they are not suitable for accurate DC measurements. The HSI-STG combines a very low input drift of 0.3 µV/°C with a bandwidth of 2 MHz.

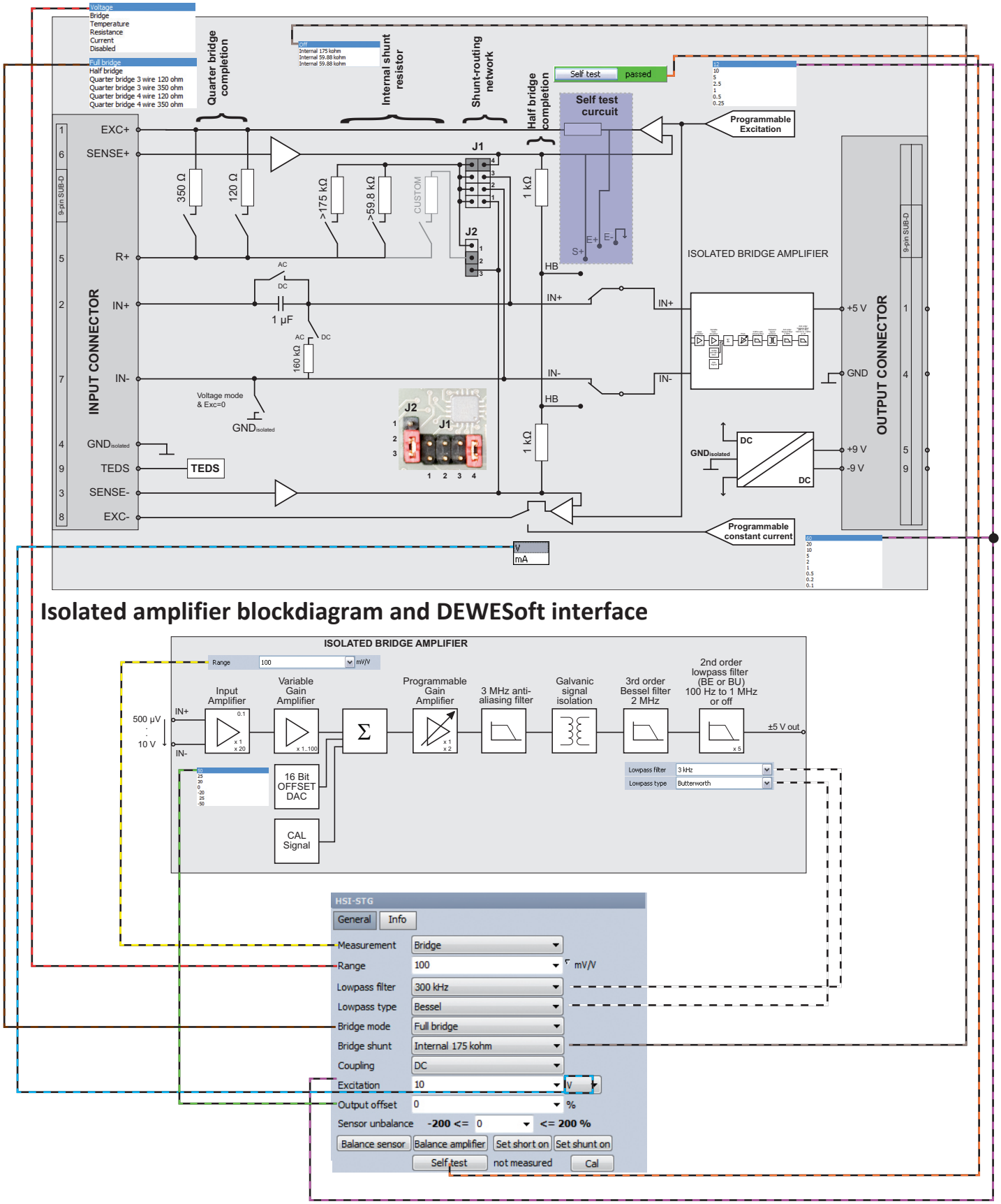
At this bandwidth the "Johnson noise" (thermal noise) of a 350 Ω strain gage is already 3.5 µV. To improve the SNR of your measurement you can use one of the 9 analog filters whenever lower bandwidth is acceptable for your application.

Isolation:

The isolation of the module has many advantages:

- It allows very high common mode voltages of up to 350 V.
- Well protection. For example: If the strain gage is mounted on a 230 V power line and the isolation of the strain gage fails.
- Ground loops are eliminated
- Noise reduction

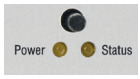
Input blockdiagram



Isolated amplifier blockdiagram and DEWESoft interface

Front panel control

LED indication:



Power LED: This LED is always on when the module is supplied.
Status LED: This LED is flashing three times when the Module receives a valid command.

Push button operation

Module readdressing: Press the ID button for allowing the software to change the address.

Amplifier functions

Input range overview

Voltage	Strain gage							Resistance	Current source bridge								
Excitation	0.25 V	0.5 V	1 V	2.5 V	5 V	10 V	12 V	0.1 mA	0.2 mA	0.5 mA	1 mA	2 mA	5 mA	10 mA	20 mA	60 mA	Max. adjustable offset
Input range	Range							Range									
mV	mV/V	mV/V	mV/V	mV/V	mV/V	mV/V	mV/V	Ohm*	Ohm*	Ohm*	Ohm*	Ohm*	Ohm*	Ohm*	Ohm*	Ohm*	
10000	40000	20000	10000	4000	2000	1000	833.3	1E+05	50000	20000	10000	5000	2000	1000	500		±50 %
5000	20000	10000	5000	2000	1000	500	416.7	50000	25000	10000	5000	2500	1000	500	250	166.67	±100 %
2000	8000	4000	2000	800	400	200	166.7	20000	10000	4000	2000	1000	400	200	100	83.33	±200 %
1000	4000	2000	1000	400	200	100	83.33	10000	5000	2000	1000	500	200	100	50	33.33	±200 %
500	2000	1000	500	200	100	50	41.67	5000	2500	1000	500	250	100	50	25	16.67	±200 %
250	1000	500	250	100	50	25	20.83	2500	1250	500	250	125	50	25	12.5	8.33	±200 %
100	400	200	100	40	20	10	8.333	1000	500	200	100	50	20	10	5	4.17	±200 %
50	200	100	50	20	10	5	4.167	500	250	100	50	25	10	5	2.5	1.67	±200 %
25	100	50	25	10	5	2.5	2.083	250	125	50	25	12.5	5	2.5	1.25	0.83	±400 %
10	40	20	10	4	2	1	0.833	100	50	20	10	5	2	1	0.5	0.42	±400 %
5	20	10	5	2	1	0.5	0.417	50	25	10	5	2.5	1	0.5	0.25	0.17	±400 %
2.5	10	5	2.5	1	0.5	0.25	0.208	25	12.5	5	2.5	1.25	0.5	0.25	0.125	0.0833	±400 %
1	4	2	1	0.4	0.2	0.1	0.083	10	5	2	1	0.5	0.2	0.1	0.05	0.0417	±400 %
0.5	2	1	0.5	0.2	0.1	0.05	0.042	5	2.5	1	0.5	0.25	0.1	0.05	0.025	0.0167	±400 %

not usefull in strain gage mode
Resistance mode

*) Ohm = mv/mA

Free variable gain and excitation

The gain, excitation and offset values of this module are free programmable. So it is possible to normalize any physical sensor input signal to the ±5V output of the module. By using these settings as power on default, standalone solutions could be easily realized.

- **Gain:** from 0.5 to 10000. The module input ranges are based on predefined gain values. The module automatically chose the best gain combination of the internal amplifiers to keep the overall noise and drift as low as possible.
- **Output offset:** Could be programmed from the positive to the negative full scale range.
- **Input offset:** The input offset could be programmed up to ±400 % of input range. It is automatically recalculated when changing the measurement range. The input offset could be automatically determined with the sensor balance function.
- **Excitation Voltage:** The excitation voltage is programmable from 0 to 12 V in 185 µV steps. Setting the excitation to 0 V for example allows you to determine the noise of the sensor cabling. The sense terminals have to be connected to the excitation terminals all the time. Even if the remote sensing is not required.
- **Excitation current:** The current could be programmed from 0.1 mA to 60 mA in 1 µA steps. The maximum compliance voltage is 12 V. The compliance voltage is automatically balanced around the internal GND. This minimizes the common mode error.

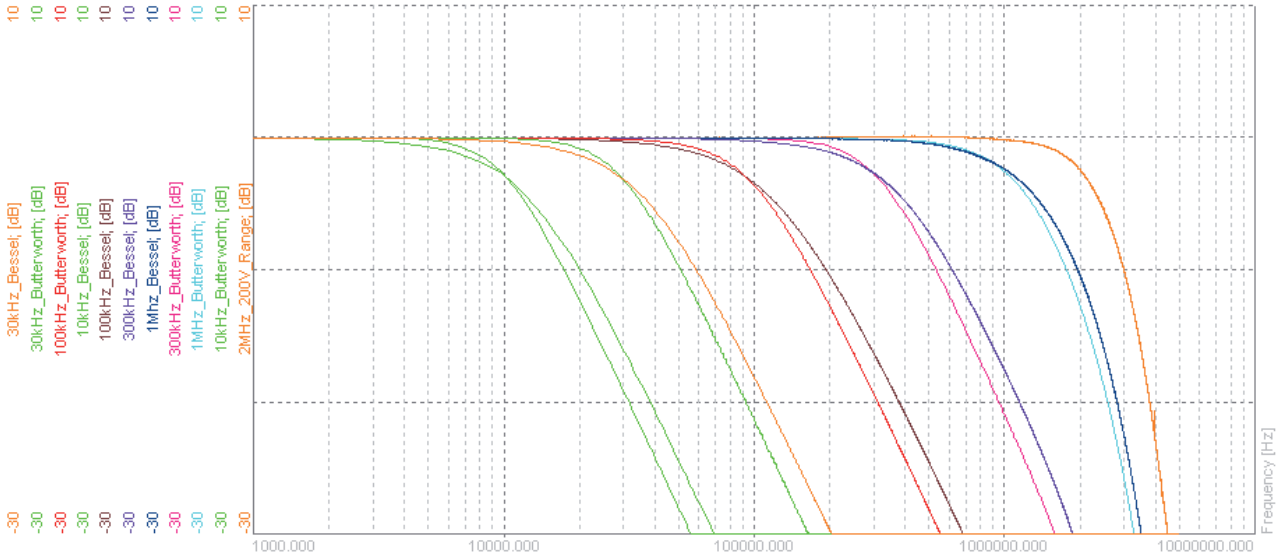
Power On Default function

You can store the actual settings of the module in the internal EE-Prom memory. Once the module restarts, it comes up automatically with these setting. This is important for stand alone applications and for fail save reasons.

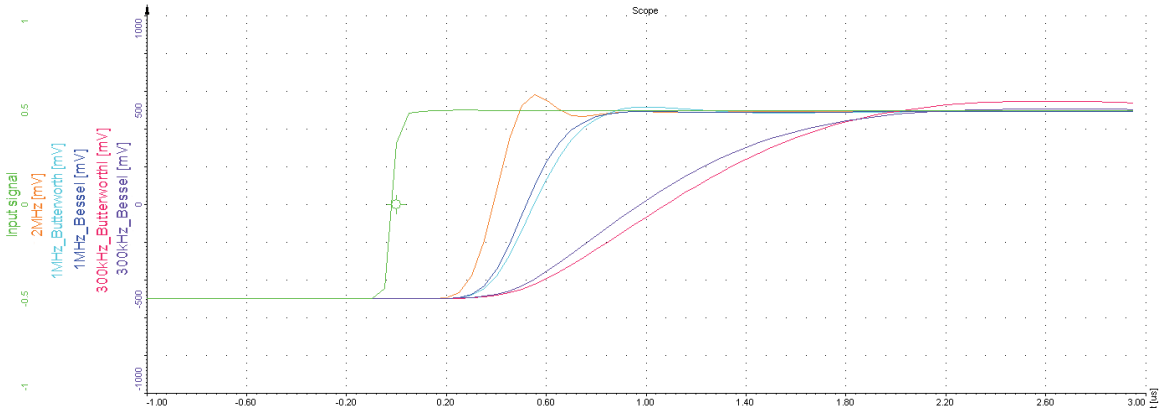
Filter

The module has 9 selectable low pass filters from 100 Hz to 1 MHz. The filter characteristic could be chosen between Butterworth 2nd order or Bessel 2nd order. The highest filter is a 3rd order filter with a guaranteed -3 dB bandwidth of 2 MHz. This filter structure is the same for all HSI modules.

Typical filter transfer function:



HSI-STG step response



AC accuracy with activated filter

With activated hardware filter an additional % of reading error has to be considered due to the damping of the filter. This error depends on the signal frequency *f* and the selected filer frequency *f0*.

Frequency	additional error with activated Butterworth filter	additional error with activated Bessel filter
f/f_0	% of reading	% of reading
<0.1	0	0
0.01	0.00	0.00
0.02	0.00	0.02
0.03	0.00	0.04
0.05	0.00	0.11
0.1	0.01	0.47
0.2	0.14	1.9
0.3	0.73	4.3
0.5	5.24	12
0.75	20.34	25
1	40.45	40.45

Amplifier balance

The amplifier balance allows eliminating automatically all internal amplifier offsets. It switches the differential amplifier inputs IN+ and IN- to the internal isolated GND reference point. Then the output offset of the module is automatically adjusted to zero for all ranges. This function takes up to 8 seconds. Automatically previous stored sensor offset values are cleared.

Sensor Balance

Typically every strain gage sensor has a certain offset. That comes from manufacturing tolerances or because of sensor mounting. By performing a bridge balance this sensor offset could be completely removed on the analog side up to 400 % of the actual range. This allows using the full dynamic of the AD-board instead of losing resolution because of digital offset shifting. The maximum adjustable offset is mentioned in the range overview table. The sensor offset is stored in the module and automatically recalculated when changing the range.

Internal Completion Resistors

The HSI-STG has an internal half bridge completion and two internal quarter bridge completions for 120 Ohm and 350 Ohm strain gages. The used high precision resistors with low temperature drift allow a long-time stable measurement of almost every strain gage type without using an external completion network.

Internal Shunt

With two internal shunt resistors (59.88 kOhm and 175 kOhm) and one spare socket for a customised shunt, the HSI-STG has wide flexibility in case of shunt calibration. A jumper network gives the possibility to connect the internal shunts to either Sense+ Sense – IN+ or IN- to be compatible to existing sensor types and correction calculation methods. This technology is used to correct the complete measurement chain gain error from the sensor input to the digital signal output. It is based on the known ratio between the shunt resistor and the strain gage resistance.

Short

It switches the differential amplifier inputs IN+ and IN- from the input terminals to the internal isolated GND reference point. With this function the absolute sensor offset could be determined.

CAL

It applies a high precision internal reference signal with 80% of the full scale value to the module.

AC coupling

The HSI-STG has an AC coupling circuit integrated. That allows removing DC components of the signal and using a much smaller input range. The maximum DC input voltage should not exceed ±35 V_{DC}.

Self Test

The self test function is a software controlled procedure that checks in the first step the amplifier itself. In the second step a basic sensor check will be performed. This test is only available in DeweSoft if an AD-Card is installed.

Part 1: Amplifier Test

- The amplifier offset is checked by using the Short function
- The 80% Cal signal is applied to the amplifier. The complete isolation amplifier including the AD-Card is checked by using this test signal.
- The self test circuit switches the amplifier input to the positive excitation voltage, so also the input amplifier is checked. Warning: if there is a short circuit on the excitation this test will fail.

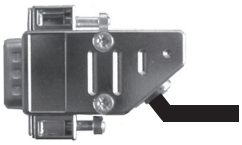
Part 2: Basic Sensor Test

- Bridge Sensor: It is checked if the supply current doesn't exceed the maximum value, and if the excitation voltage is within the predefined value.

Signal connection

HSI-STG-D module

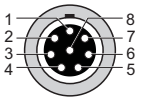
Signal connection via D-SUB connector



1 EXC+
2 IN+
3 Sense -
4 GND (isolated)
5 R+
6 Sense +
7 IN-
8 EXC-
9 TEDS

HSI-STG-LEMO module

Signal connection via LEMO connector

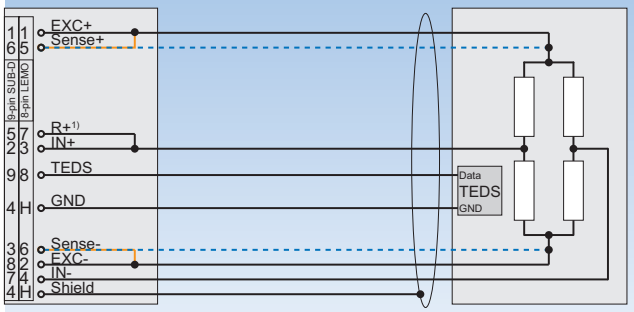


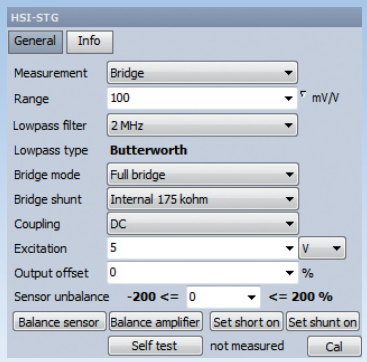
8-pin LEMO connector female
EGG.1B.308.CLL

1 EXC+
2 EXC-
3 IN+
4 IN-
5 Sense +
6 Sense -
7 R+
8 TEDS
H GND (isolated)

Full bridge signal connection

6-wire and 4-wire sensor connection

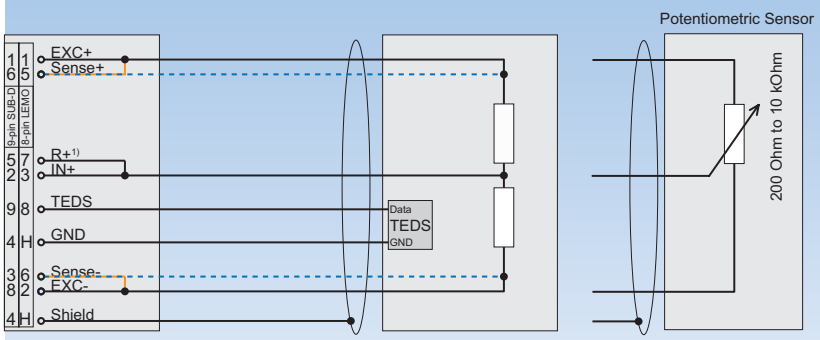


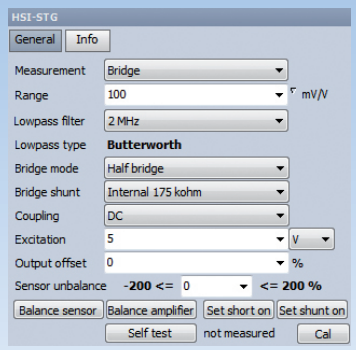


Voltage or Current excitation is allowed.
Senses terminals have to be connected to the excitation also when 4-wire connection is used.
6-wire sensor connection: Sense+ is connected to EXC+ at the sensor
4-wire sensor connection: Sense+ is connected to EXC+ at the connector

Half bridge signal connection

5-wire and 3-wire sensor connection, potentiometric sensors





5-wire sensor connection: Sense+ is connected to EXC+ at the sensor
3-wire sensor connection: Sense+ is connected to EXC+ at the connector

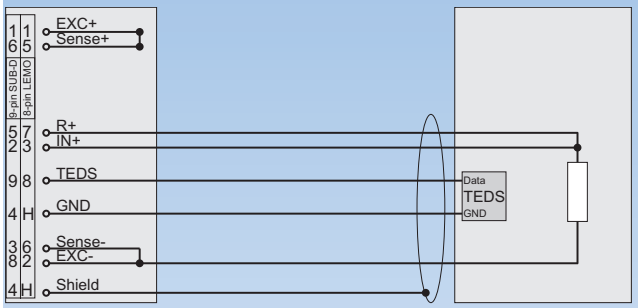
Voltage or Current excitation is allowed.
Sense terminals have to be connected to the excitation also when 4-wire connection is used.
A potentiometer can be seen similar to a half bridge sensor with ±500 mV/V sensitivity. Therefore potentiometric sensors can be measured with bridge amplifiers.

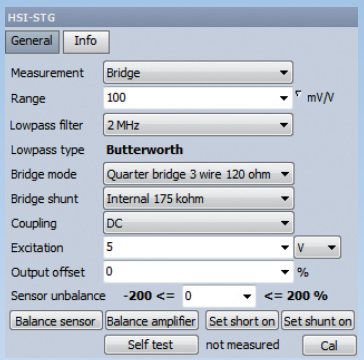
[1] 'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.

Quarter bridge signal connection

3-wire sensor connection

(Sense+ is connected to EXC+ at the connector)



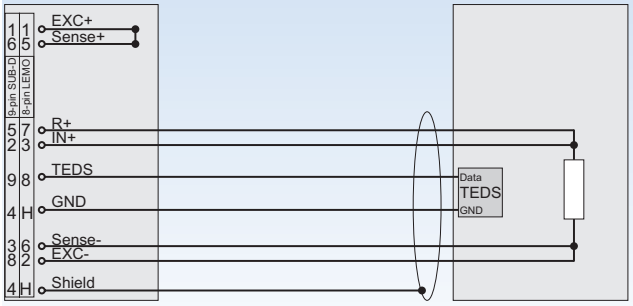


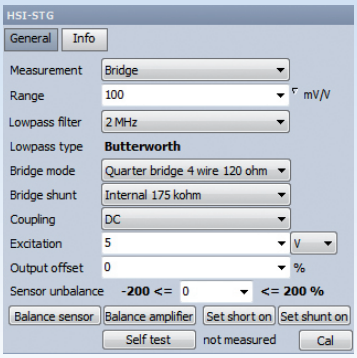
Sense leads (D-SUB: pin 3 and 6) have to be connected!

The 3-wire quater bridge is only able to compensate symmetric wire resistance!

4-wire sensor connection

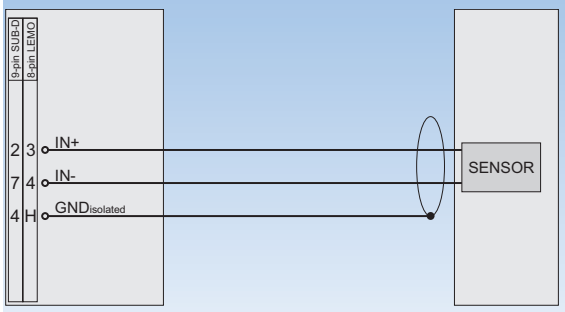
(Sense+ is connected to EXC+ at the sensor)

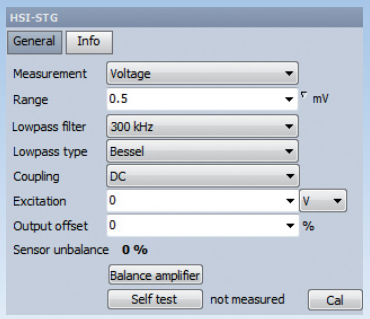




In the quarter bridge 4-wire mode the HSI-STG internally adjusts its excitation in that way, that on the gage the resistor terminals exactly on the half of the excitation voltage. All wire resistances are compensated.

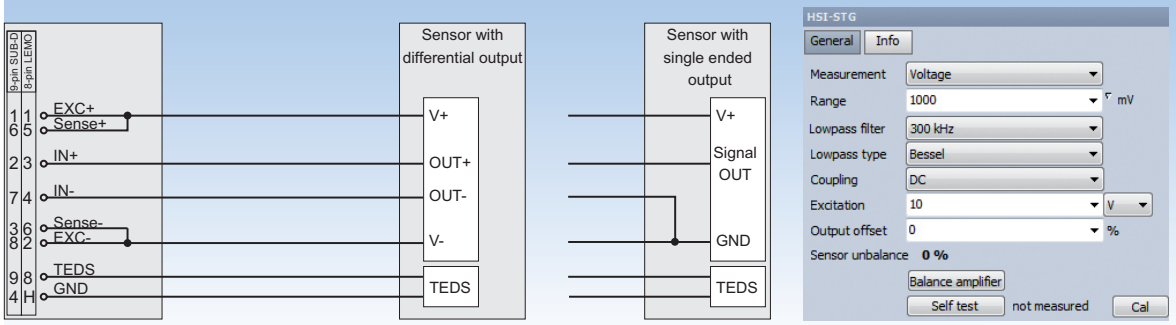
Voltage measurement and µV measurement



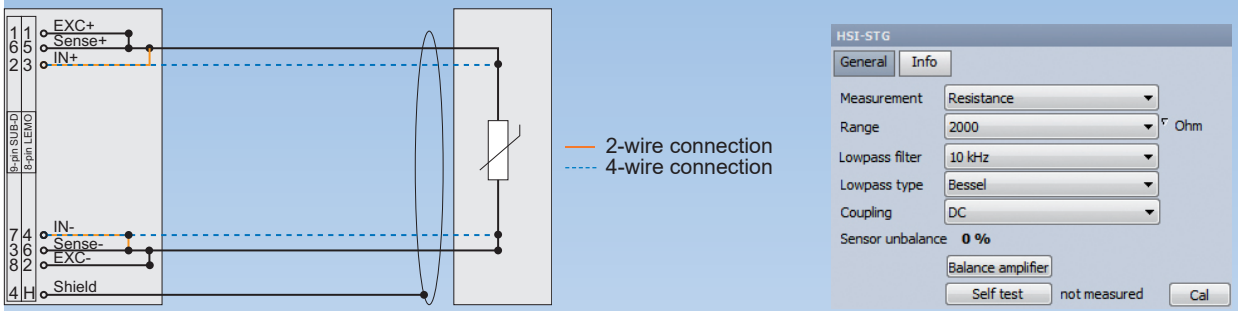


CAUTION: If the excitation is not used for sensor supply it has to be deactivated by setting it to 0 V. This will internally connect the IN- to the $GND_{isolated}$ to improve the common mode rejection.

Sensor with sensor supply and voltage output



Resistance, RTD 2-wire and 4-wire



For resistance and RTD mode the 4-wire connection is recommended. The 2-wire connection will not compensate the wire resistance.

HSI-STG RTD accuracy

RTD	max. Resistor	Excitation current	Range	Accuracy
Type	Ω	mA	Ω	
PT100	390.48	1	500	0.5 °C ±0.14 % of reading
PT200	780.96	1	1000	0.4 °C ±0.15 % of reading
PT500	1952.4	1	2000	0.35 °C ±0.14 % of reading
PT1000	3904.8	0.5	10000	0.4 °C ±0.2 % of reading
PT2000	7809.6	0.5	10000	0.4 °C ±0.2 % of reading

HSI-STG resistance accuracy

Range	Excitation current	Accuracy
Ohm	mA	
100k	0.1	20 Ω ±0.6 % of reading
10k	0.5	0.8 Ω ±0.2 % of reading
2000	1	0.2 Ω ±0.15 % of reading
1000	1	0.1 Ω ±0.15 % of reading
100	1	30 mΩ ±0.15 % of reading
10	1	10 mΩ ±0.15 % of reading
0.5	5	2 mΩ ±0.11 % of reading
0.1	10	1 mΩ ±0.55 % of reading

Why to use more wire technology

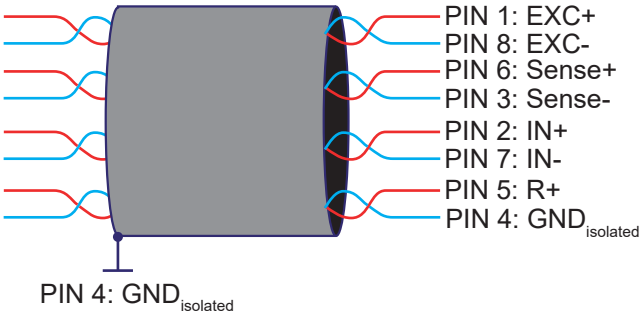
- **Sensitivity:** For sensor wiring typically copper cables are used. For example a 120 Ohm full bridge connected with a 4 x 0.14 mm² cable will have an sensitivity error of 2.1 % just because of the 1.27 Ohm wire resistance. With the 6 wire technology this could be completely compensated.
- **Temperature drift:** Copper has a temperature drift of 0.4 %/°C. This is especially a problem at quarter bridges, because also the offset changes with the wire resistance. The following table shows the difference between the 3 wiring methods for a 120 Ω strain gage with a 50m cable at 0.25 mm² diameter.

	Initial error		Drift because of 10 °C warm-up	
	Offset	Sensitivity	Offset	Sensitivity
2-wire	25183 µm/m	-4.97 %	956 µm/m	-0.18 %
3-wire	0 µm/m	-2.6 %	0 µm/m	-0.01 %
4-wire	0 µm/m	0.0 %	0 µm/m	0.00 %

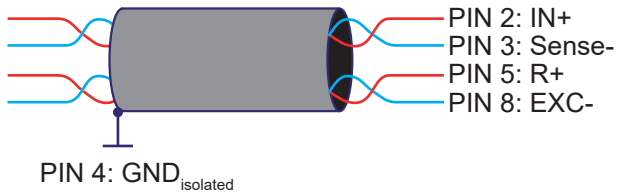
Cables and Shielding

To keep the influence of electromagnetic disturbances as small as possible, shielded twisted pair cables are recommended. Connect the shield to the isolated GND (Pin4) to get the best result.

The twisted pairs for **full bridge**, **half bridge**, **voltage** and **resistance** mode are:



For **quarter bridge** mode:



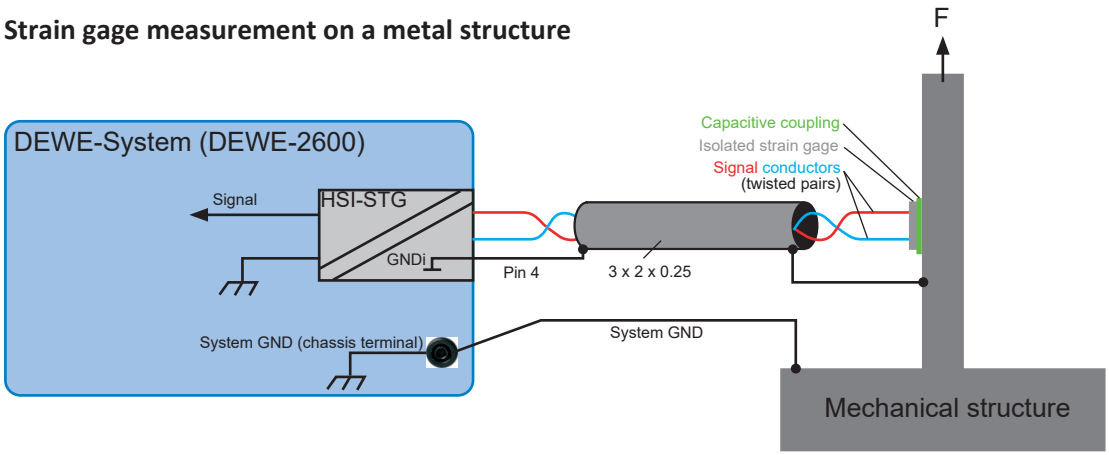
If TEDS is used it is recommended to mount the TEDS chip nearby the module. The ideal case would be if the chip is mounted inside the DSUB housing.
The maximum distance between module and TEDS chip: 20 m.

High-speed strain gage measurement (>100 kHz)

For high speed applications (bandwidth >100 kHz) it is not recommended using the internal completion circuit, especially if you have long sensor cables. Usually it is better using external completion resistors nearby the strain gage or use full bridge sensors. The advantage is you will get a differential signal out of the sensor. Disturbances and sensor cable included noise will be attenuated by the modular CMRR. Also lower resistance values of the strain gages reduces the noise because of lower thermal noise and signal source resistance. These resistors should have the same value as the srtain gage. They should also have a low temperature coefficient. A value below 50 ppm/°C is recommended.

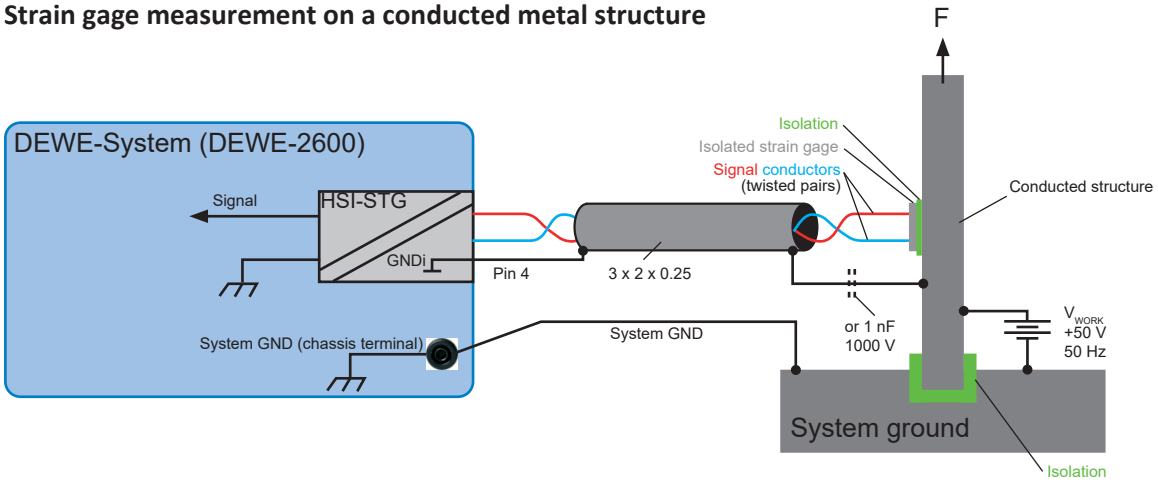
Shielding / Noise reduction

Strain gage measurement on a metal structure



It is always important that you connect your DEWETRON system ground (chassis terminal) to the ground potential of your measured object. This guarantees that the measurement system is not floating against the measured structure. It could simply be a connection to the metal structure of your proving ground. In case of an automotive application for example, it would be a connection to the cars chassis. Only if the DEWETRON system and the measured structure have an earth connection the system grounding line might not be needed.

Strain gage measurement on a conducted metal structure



If the strain gage is mounted on a conducted material you get additional problems. You can't connect the system GND directly to the structure anymore because this would short circuit it or apply dangerous voltages to the measurement instrument. You get the working voltage cpacitive coupled into your signal across the thin isolation film of the strain gage. To get rid of that problem, you can connect the isolated ground of the HSI-STG to the conducted structure. That allows the input amplifier to float with the working voltage and so the coupling is minimized. Also in that case it is recommended using external completions like described in chapter "High-speed strain gage measurement".

CAUTION: Since the cable is on working voltage potential, it is necessary to take care about the isolation of the cabling and connectors. For savety reasons use a coupling capacitor of 10 nF 1000V instead of the direct connection between cable and conducted structure.

HSI-STG

HSI Ready

Please ensure that also the Hardware that carries the HSI Module is not limiting the 2 MHz bandwidth.

Older systems may have a fix installed 350 kHz filter. The HSI series modules will also work in these systems, but the bandwidth will be limited to the system bandwidth.

Supported MSI

MSI-BR-TH
MSI-BR-ACC
MSI-BR-CH-50
MSI-BR-RTD

CE-Certificate of conformity

Manufacturer:

Address:

DEWETRON GmbH

Parkring 4
8074 Grambach, Austria

Tel.: +43 316 3070 0
Fax: +43 316 3070 90
e-mail: sales@dewetron.com
http://www.dewetron.com

Name of product: **DEWE-MODULES**

Kind of product: *Signal conditioning modules*

The product meets the regulations of the following EC-directives:

73/23/EEC
"Directive on the approximation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits amended by the directive 93/68/EEC"

89/336/EEC
"Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility amended by the directives 91/263/EEC, 92/31/EEC, 93/68/EEC and 93/97/EEC

The accordance is proved by the observance of the following standards:

LV	**Safety**	IEC/EN 61010-1:1992/93 IEC/EN 61010-2-031	IEC 61010-1:1992/300 V CATIII Pol. D. 2 IEC 1010-2-031
EMC	**Emissions**	EN 61000-6-4	EN 55011 Class B
	Immunity	EN 61000-6-2	Group standard

Graz, April 28, 2010

Place / Date of the CE-marking

Dipl.-Ing. Roland Jeutter / Managing director

Notes