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Automotive
Energy & Power Analysis
Aerospace & Defense
Transportation
General Test & Measurement

DEWE-Modules

Technical reference manual

ISO9001

Test & Measurement Solutions

worldwide
DEWETRON
www.dewetron.com

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CE-Certificate of conformity
CE-Certificate of conformity C1

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DEWETRON GesmbH
Parkring 4
8074 Graz-Grambach
Austria

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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.

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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.

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Support

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

For Asia and Europe, please contact:

DEWETRON Ges.m.b.H.
Parkring 4
A-8074 Graz-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.

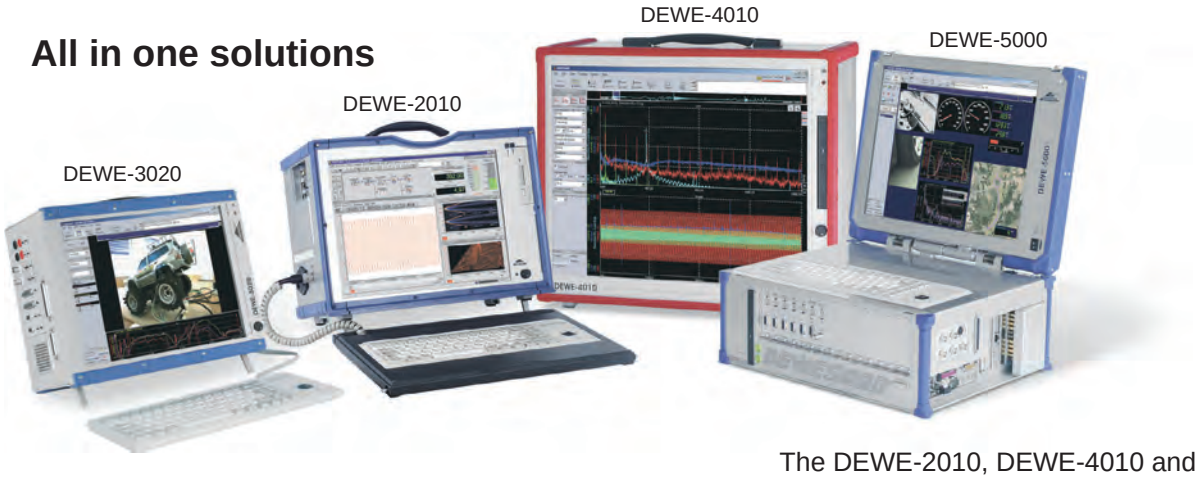
For the Americas, please contact:

DEWETRON, Inc.
10 High Street, Suite K
Wakefield, RI 02879
U.S.A.
Tel.: +1 401 284 3750
Toll-free: +1 877 431 5166
Fax: +1 401 284 3755
Email: support@dewamerica.com
Web: http://www.dewamerica.com

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

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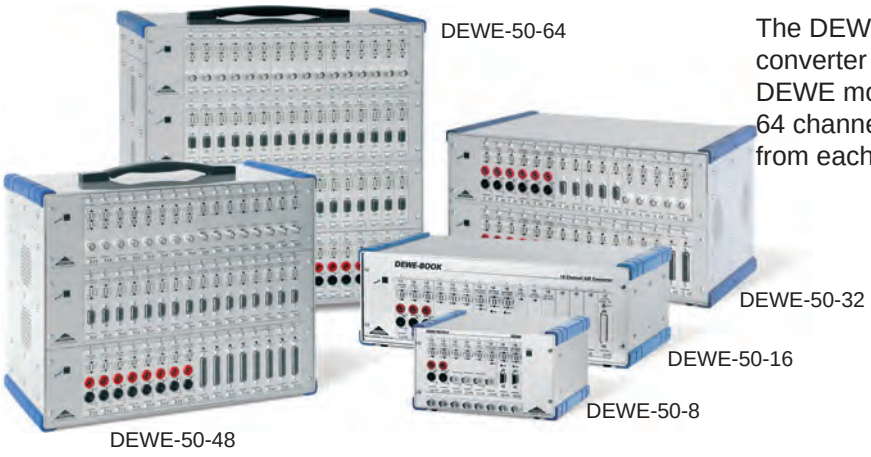
All in one solutions



The DEWE-2010, DEWE-4010 and DEWE-5000 offers 16 slots, the DEWE-3020 8 slots for DEWE modules. All systems are expandable up to several hundred channels.

Signal conditioning solutions

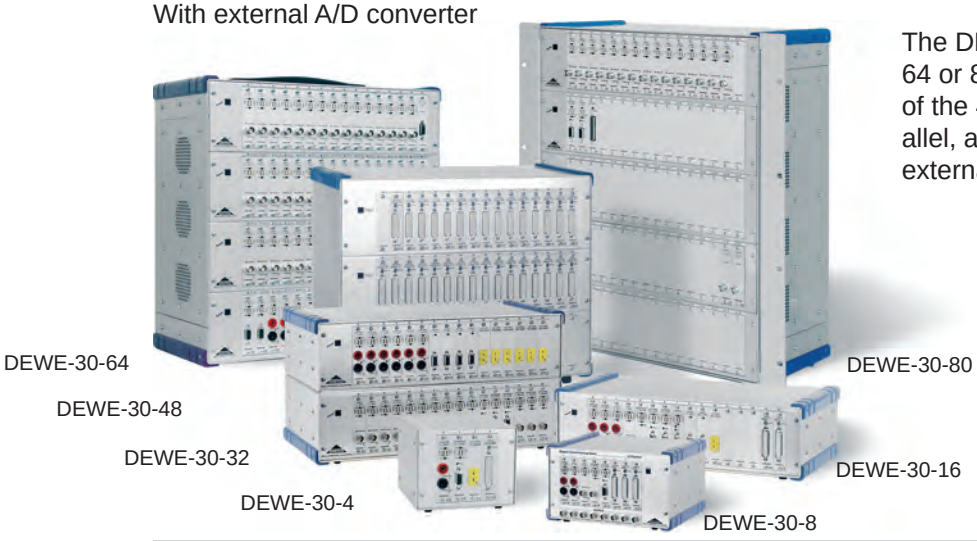
With internal A/D converter



The DEWE-50 series with integrated A/D converter offers 8, 16, 32, 48 or 64 slots for DEWE modules and except of the 48 and 64 channel version, in parallel, a ±5 V output from each module to an external device.

Signal conditioning solutions

With external A/D converter



The DEWE-30 family offers 4, 8, 16, 32, 48, 64 or 80 slots for DEWE modules and except of the 48, 64 and 80 channel version, in parallel, a ±5 V output from each module to an external device.

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DEWE-Modules Overview

Analog input amplifiers (HSI/DAQx series)										
Module	**Input connector**	**# CH**	**Progr. ranges & filter**	**TEDS**	**Ranges**	**Filters**	**Bandwidth**	**Isolation**	**Output**	**Details on page**
High voltage amplifier										
DAQN-DMM	Banana plugs	1			±10, ±40, ±100, ±200, ±400, ±1000V	10, 100 Hz, 1, 3 kHz	3 kHz	1.5 kV_{RMS}	±5 V	15
DAQP-DMM	Banana plugs	1	✓		±10, ±40, ±100, ±200, ±400, ±1000V	10, 100 Hz, 1, 3, 20 / 30 kHz	3 kHz	1.5 kV_{RMS}	±5 V	15
DAQP-HV	Banana plugs	1	✓		±20, ±50, ±100, ±200, ±400, ±800, ±1400 V	10, 30, 100, 300 Hz 1, 3, 10, 30, 100, 300 kHz	300 kHz, 700 kHz[1]	1.8 kV_{RMS}	±5 V	17
HSI-HV	Banana plugs	1	✓		±20, ±50, ±100, ±200, ±400, ±800, ±1400 V	100, 300 Hz, 1, 3, 10, 30, 100, 300 kHz, 1, 2 MHz	2 Mhz	1.8 kV_{RMS}	±5 V	19
Voltage amplifier										
DAQN-V-B	Banana plugs	1			±0.01, ±0.1, ±1, ±5, ±10, ±50 V	10, 100 Hz, 1, 10 kHz	10 kHz	1 kV_{RMS}	±5 V	23
DAQN-V-BNC	BNC							1 kV_{RMS}		
DAQN-V-D	9-pin SUB-D							350 V_{DC}		
DAQP-V-B	Banana plugs	1	✓		±0.01, ±0.1, ±1, ±5, ±10, ±50 V	10, 100 Hz, 1, 10, 50 kHz	50 kHz	1 kV_{RMS}	±5 V	23
DAQP-V-BNC	BNC							1 kV_{RMS}		
DAQP-V-D	9-pin SUB-D							350 V_{DC}		
DAQP-V-LEMO	7-pin LEMO							350 V_{DC}		
DAQP-LV-B-B	Banana plugs	1	✓	✓	±10, ±20, ±50, ±100, ±200, ±500 mV ±1, ±2.5, ±5, ±10, ±25, ±50 V	10, 30, 100, 300 Hz, 1, 3, 10, 30, 100, 180 kHz	300 kHz	1 kV_{RMS}	±5 V	27
DAQP-LV-B-BNC	BNC							350 V_{DC}		
DAQP-LV-B-D	9-pin SUB-D							350 V_{DC}		
DAQP-LV-B-LEMO	7-pin LEMO							350 V_{DC}		
HSI-LV-B	Banana plugs	1	✓	✓	±10, ±20, ±50, ±100, ±200, ±500 mV ±1, ±2.5, ±5, ±10, ±25, ±50 V	100, 300 Hz, 1, 3 ,10, 30, 100, 300 kHz, 1, 2 MHz	2 MHz	1 kV_{RMS}	±5 V	33
HSI-LV-BNC	BNC							350 V_{DC}		
HSI-LV-D	9-pin SUB-D							350 V_{DC}		
HSI-LV-LEMO	7-pin LEMO							350 V_{DC}		
Current amplifier										
DAQP-LA-B	Banana plugs	1	✓		0.1 A, 0.3 A, 1 A, 3 A, (10 A, 30 A peak)	10, 30, 100, 300, 1000 Hz, 3, 10, 30, 100, 180, 300[2] kHz	300 kHz	1.4 kV_{RMS}	±5 V	39
DAQP-LA-SC	Screw terminals				2, 6, 20, 60, 200, 600 mA					
Bridge / strain gage amplifier										
DAQP-STG-D	9-pin SUB-D	1	✓	✓	±0.5 , ±1, ±2.5, ±5, ±10, ±25, ±50, ±100, ±250, ±500 mV, ±1 V, ±2V, ±5 V,±10 V	10, 30, 100, 300 Hz, 1, 3, 10, 30, 100, 300 kHz	300 kHz	350 V_{DC}	±5 V	43
DAQP-STG-LEMO	8-pin LEMO									
HSI-STG-D	9-pin SUB-D	1	✓	✓	±0.5, ±1, ±2.5, ±5, ±10, ±25, ±50, ±100, ±250, ±500 mV, ±1 V, ±2V, ±5 V,±10 V	100, 300 Hz, 1, 3, 10, 30, 100, 300 kHz, 1 MHz, 2 MHz	2 MHz	350 V_{DC}	±5 V	53
HSI-STG-LEMO	8-pin LEMO									
DAQP-BRIDGE-A	9-pin SUB-D	1	✓		±1, ±2, ±5, ±10, ±20, ±50 mV/V (@ 5 V_{DC})	10 Hz, 100 Hz, 1 kHz, 5 kHz	20 kHz	350 V_{DC}	±5 V	65
DAQP-BRIDGE-A-LEMO	8-pin LEMO									
DAQP-BRIDGE-B	9-pin SUB-D	replaced by DAQP-STG								
DAQP-BRIDGE-B-LEMO	8-pin LEMO									
Carrier frequency amplifier										
DAQP-CFB	9-pin SUB-D	1	✓		±0.1 to ±1000 mV/V	10, 30, 100, 300 Hz, 1 kHz	2.3 kHz	-	±5 V	71
Charge / IEPE® amplifier for vibration measurement										
DAQP-ACC-A	BNC	1	✓		IEPE®: ±50, ±166, ±500 mV, ±1.66, ±5 V	1, 10, 100, 300 kHz	0.5 Hz to 300 kHz	-	±5 V	77
DAQP-CHARGE-A	BNC	1	✓		Charge: 5, 50, 500, 5000, 50000 pC IEPE®: ±5, ±50, ±500 mV, ±5 V	1 kHz, 5 kHz, 10 kHz, 20 kHz	0.1 Hz to 50 kHz	-	±5 V	79
DAQP-CHARGE-B	BNC	1	✓		Charge: ±100, ±500, ±2 000, ±10 000, ±40 000, ±200 000, ±1 000 000 pC	10, 30, 100, 300 Hz, 1, 3, 10, 30, 100 kHz	DC to 100 kHz	350 V_{DC}	±5 V	83
Frequency to voltage converter										
DAQP-FREQ-A	9-pin SUB-D	1	✓		100 Hz, 1, 5, 20, 100, 200 kHz	100 Hz, 1, 5, 20, 100, 200 kHz	according to range	350 V_{DC}	±5 V	87
Multifuncitonal amplifier										
DAQP-MULTI	9-pin SUB-D Mini-TC	1	✓	✓	Min. to max. of the input range is free programmable within the full thermocouple input span	6 progr. low pass filter (3Hz to 3 kHz) and progr. filter orders (2nd, 4th, 6th, 8th)	3 kHz	1 kV_{RMS}	±5 V; 0 to ±5 V[3]	91
Thermocouple amplifier										
DAQP-THERM	Mini-TC	1	✓	✓	Min. to max. of the input range is free programmable within the full thermocouple input span	6 progr. low pass filter (3Hz to 3 kHz) and progr. filter orders (2nd, 4th, 6th, 8th)	3 kHz	1 kV_{RMS}	±5 V; 0 to ±5 V[3]	91

1) DAQP-HV-S3 only.
2) 300 kHz exclusively for Bessel filter characteristic.
3) ±10 V and 0 to 10 V with special DEWE-30.

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Analog input amplifiers, continued (HSI/DAQx series)										
Module	**Input connector**	**# CH**	**Progr. ranges & filter**	**TEDS**	**Ranges**	**Filters**	**Bandwidth**	**Isolation**	**Output**	**Details on page**
Thermocouple amplifier										
DAQN-THERM-1	Mini-TC	replaced by DAQP-THERM								
DAQN-THERM-2										
DAQN-THERM-3										
DAQN-THERM-4										
DAQN-THERM-5										
DAQN-THERM-SPEC	Mini-TC									
RTD amplifier										
DAQN-RTD-1	9-pin SUB-D	replaced by DAQP-MULTI								
DAQN-RTD-2										
DAQN-RTD-3										
DAQN-RTD-SPEC	9-pin SUB-D									
Potentiometric and ohmic amplifier										
DAQN-OHM	9-pin SUB-D	replaced by DAQP-MULTI								
1:1 analog voltage input										
DAQN-AIN-B	Banana plugs	1			depending on A/D board (1:1 input)	-	-	overvoltage protection (< ±500 V)	max. ±10 V	99
DAQN-AIN-BNC	BNC									
DAQN-AIN-D	9-pin SUB-D									
Customer defined modules										
DAQN-CUSTOM-B	Banana plugs	Customer defined, prototype board inside							max. ±10 V	101
DAQN-CUSTOM-BNC	BNC									
DAQN-CUSTOM-D	9-pin SUB-D									

Analog output amplifiers (DAQx series)										
Voltage output module										
DAQN-V-OUT-B	Banana plugs	1			1:1 output module with isolation Input voltage: ±10 V Output voltage: ±10 V	-	400 Hz	240 V_{RMS}	max. ±10 V	103
DAQN-V-OUT-BNC	BNC									
DAQN-V-OUT-D	9-pin SUB-D									

Amplifiers with integrated A/D converter and DIO modules (PAD series)										
Voltage / current amplifier										
PAD-V8-P	25-pin SUB-D	8	✓		±100, ±150, ±500 mV, -150 mV to +1.5 V, ±1, ±2.5, ±5, ±10, ±50 V	1 / 4 / 8 values averaging	3 Hz	350 V_{DC}	RS232/485	105
High accuracy thermocouple and RTD amplifier										
PAD-TH8-P	25-pin SUB-D	8	✓		±15, ±50, ±100, ±150 mV, -150 mV to +1.5 V, Thermocouple type J, K and T	1 / 4 / 8 values averaging	3 Hz	350 V_{DC}	RS232/485	109
PAD-TH8-P + CB8-RTD	9-pin SUB-D (8x)	8	✓		Pt100, Pt200, Pt500, Pt1000, Pt2000, Ni120	1 / 4 / 8 values averaging	3 Hz	350 V_{DC}	RS232/485	112
Analog output module										
PAD-AO1	25-pin SUB-D	1	✓		0 to 20 mA, 4 to 20 mA, 0 to 10 V	-		300 V_{DC}	RS232/485	115
Frequency / counter module										
PAD-CNT2	25-pin SUB-D	2	✓		32 bit counter; low: 0 to 1 V, high: 3.5 to 30 V	-	1 Hz to 100 kHz	300 V_{DC}	RS232/485	116
Digital input / output module										
PAD-DI8	25-pin SUB-D	8	✓		Opto input low: 0 to 1 V, high: 3.5 to 30 V	-		300 V_{DC}	RS232/485	119
PAD-DO7	25-pin SUB-D	7	✓		Relay outputs (dry contacts)	-		300 V_{DC}	RS232/485	121

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Notes

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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	
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.

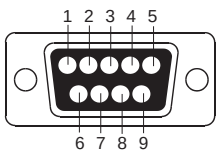
Module connectors

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

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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*.

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High voltage isolation amplifier

- Voltage input: ±10 V, ±40 V, ±100 V, ±200 V, ±400 V and ±1000 V
- Ranges and filter: Button and / or software selection
- Isolation: 1.5 kV_{RMS}
- Signal connection: Safety banana plugs



Module specifications

	DAQN-DMM	DAQP-DMM
Input ranges	±10, ±40, ±100, ±200, ±400, ±1000 V	±10, ±40, ±100, ±200, ±400, ±1000 V
Range selection	Push button	Push button
DC accuracy	0.1 % of reading ±0.1 % of range	0.1 % of reading ±0.1 % of range
Gain linearity	Better than ±0.03 %	Better than ±0.03 %
Gain drift	Typ. 20 ppm/°K, max. 40 ppm/°K	Typ. 20 ppm/°K, max. 40 ppm/°K
Input resistance	10 MOhm (±0.1 %)	10 MOhm (±0.1 %)
Bandwidth (-3 dB ±1.5 dB @ f0) 10 V to 40 V range 100 V to 200 V range 400 V to 1000 V range	 3 kHz 3 kHz 3 kHz	 Typical 20 kHz Typical 25 kHz 30 kHz
Filters (lowpass)	10 Hz, 100 Hz, 1 kHz (±1.5 dB @ f0)	10 Hz, 100 Hz, 1 kHz, 3 kHz (±1.5 dB @ f0)
Filter selection	Push button	Push button or software
Filter characteristics @ 0.01, 0.1, 1, 3 kHz @ 30 kHz	Butterworth 40 dB / decade (12 dB / octave) 100 dB / decade (30 dB / octave)	Butterworth 40 dB / decade (12 dB / octave) 100 dB / decade (30 dB / octave)
Typ. SNR @ max. bandwidth 10 V range 100 V range 1000 V range	 60 dB 76 dB 81 dB	 60 dB 76 dB 81 dB
Typical CMRR	73 dB @ 0 Hz 70 dB @ 50 Hz 57 dB @ 400 Hz	73 dB @ 0 Hz 70 dB @ 50 Hz 57 dB @ 400 Hz
Isolation voltage	1.5 kV_{RMS}	1.5 kV_{RMS}
Output voltage	±5 V	±5 V
Output resistance	< 10 Ohm	< 10 Ohm
Output current	Max. 5 mA	Max. 5 mA
Output protection	Continuous short to ground	Continuous short to ground
RS-485 interface	No	Yes
Power supply voltage	±9 VDC (±10 %)	±9 V_{DC} (±10 %)
Power consumption	Typical 0.65 W	Typical 0.65 W

LED state

The DAQx-DMM series module has a set of 6 LEDs showing the current input range (constant active) and filter range (flashing) setting.

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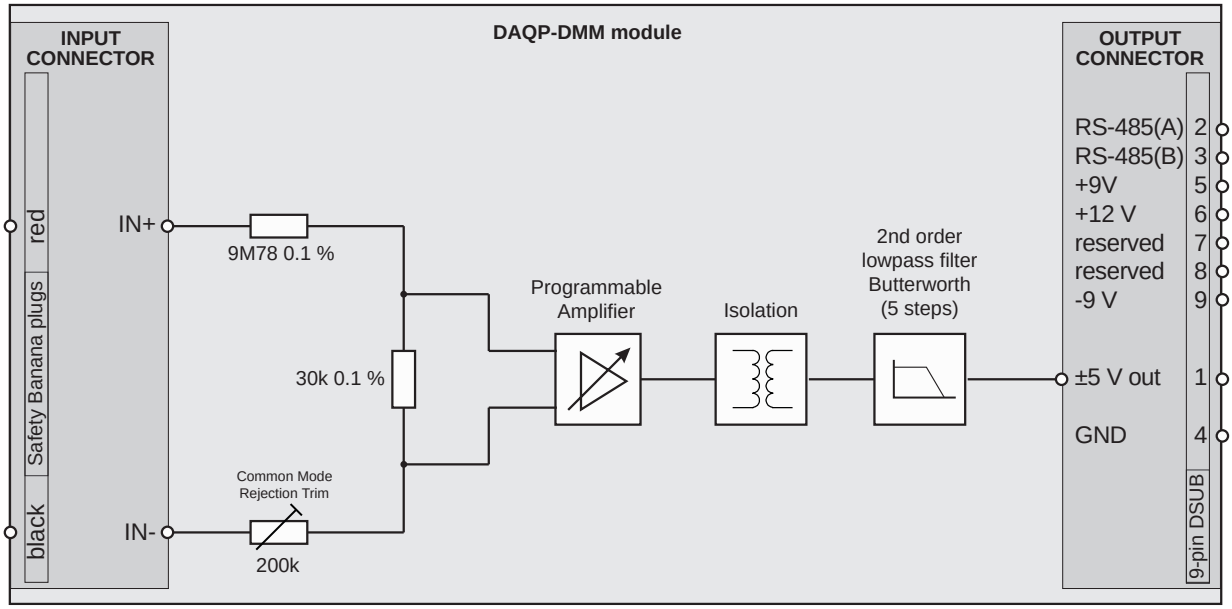
Input range and filter selection

The DAQx-DMM series module has two push buttons.

- Range button: Push the ***RANGE*** button several times until the LED displays the desired input range.
- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting.
  Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

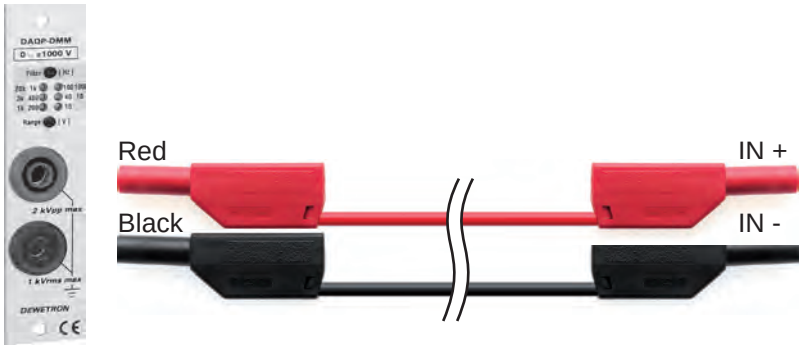
Block diagram

The base block diagram of the DAQP-DMM gives an idea of the internal structure.



Signal connection

DAQx-DMM module



Voltage measurement up to ±1000 V
only with safety banana plug cords!

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Isolated voltage amplifier



- Filter bandwidth: 300 kHz, (version DAQP-HV-S3: 700 kHz)
  10 selectable lowpass filters
- Input ranges: 7 ranges (±20 V to ±1400 V)
- Isolation: 1.8 kV_{RMS} line to line
  1.4 kV_{RMS} line to ground
- Protection: ±4 kV surge / burst
- Signal connection: Banana plugs
  Screw terminals

Module specifications

	DAQP-HV
Input ranges unipolar and bipolar	20 V, 50 V, 100 V, 200 V, 400 V, 800 V, 1400 V
DC accuracy 20 V and 50 V 100 V to 1400 V	 ±0.05 % of reading ±40 mV ±0.05 % of reading ±0.05 % of range
Gain linearity	0,03 %
Gain drift range	Typically 20 ppm/°K (max. 50 ppm/°K)
Offset drift 20 V to 100 V 200 V to 1400 V	 typical 0.5 mV/°K max. 4 mV/°K typical 5 ppm/°K max. 20 ppm of Range/°K
Long term stability	100 ppm/sqrt (1000 hrs)
Input resistance	10 MOhm
-3 dB Bandwidth (DAQP-HV)	300 kHz(1)
-3 dB Bandwidth (DAQP-HV-S3)	700 kHz(2)
Filter selection	Push button or software
Filter (lowpass)	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz
Filter characteristics	10 Hz to 100 kHz: Butterworth or Bessel 40 dB/dec (2nd order; ±1.5 dB @ f0) 300 kHz: Bessel 60 dB/dec (3rd order; 0 to -3 dB @ 300kHz)
Typical SFDR and SNR 50 V 200 V 1400 V	300 kHz 100 kHz 10 kHz SFDR SNR SFDR SNR SFDR SNR 98 76 101 81 dB 108 90 dB 98 84 101 89 dB 108 91 dB 98 86 102 91 dB 107 92 dB
Typical CMRR	>80 dB @ 50 Hz 70 dB @ 400 Hz 60 dB @ 1 kHz 48 dB @ 10 kHz
Isolation voltage	Line to Ground 1.4 kVrms Line to Line 1.8 kVrms
Protection Surge (1.2/50) Burst (5 kHz)	CAT III 600 CAT IV 300 ±4000 V ±4000 V
Output voltage	±5 V
Output resistance	<10 Ohm
Output current	5 mA
Output protection	Short to ground for 10 sec.
Power supply	±9 V_{DC} ± 1%
Power consumption	0.7 W
Power On default settings	Software programable
Interface	RS-485

(1) 300 kHz exclusively for Bessel filter characteristic
(2) 700 kHz exclusively for Bessel filter characteristic

LED state

The DAQP-HV modules have a set of 8 LEDs showing the current input range (constant active) and the filter range (flashing).

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Due to the large number of low pass filters, two LEDs are used to display the current frequency. The left LED indicates the multiplier, the right one shows the exponent with the base of 10. Example: for the 10 kHz frequency range, the lower left and the upper right LED are flashing (1x 10^4 Hz = 10 000 Hz).

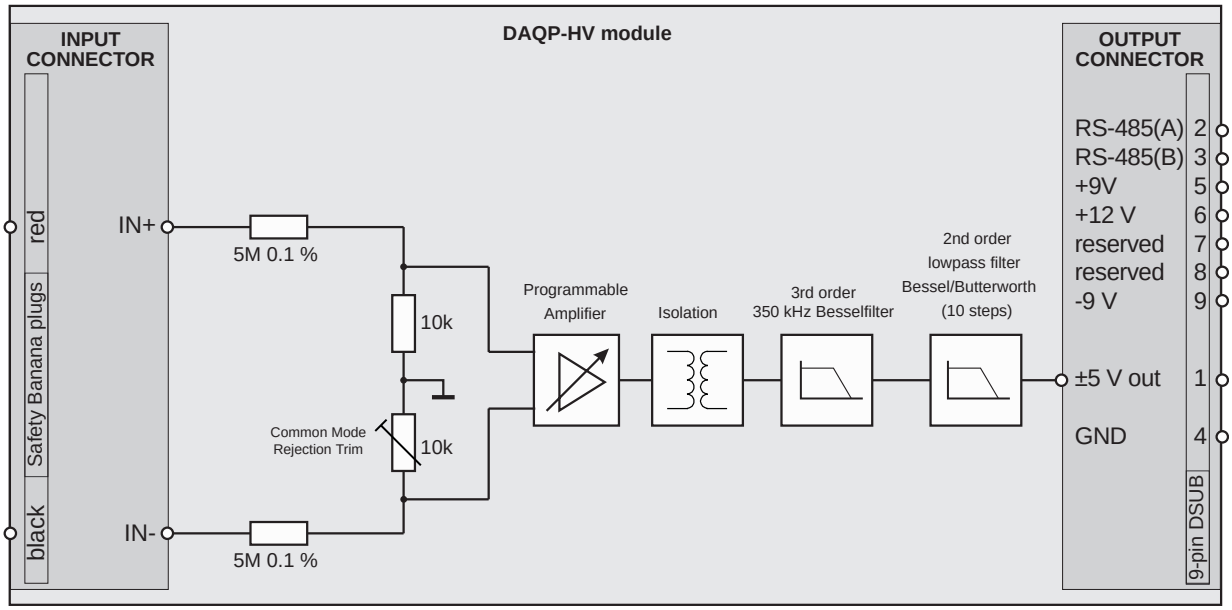
Input range and filter selection

The DAQP-HV module has two push buttons with multiple functions.

- Range button: Push the ***RANGE*** button several times until the LED displays the desired input range.
- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting. Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

Block diagram

The base block diagram of the DAQP-HV gives an idea of the internal structure.

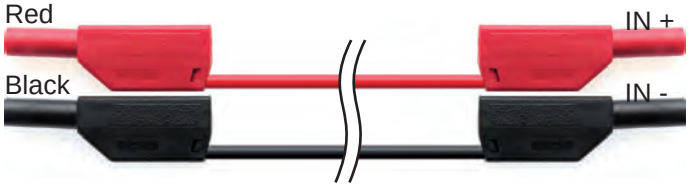


Signal connection

DAQP-HV module



Voltage measurement via banana plug cords



Voltage measurement up to ±1000 V only with safety banana plug cords!

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Isolated high voltage amplifier



- Input ranges: 1400 V to 20 V
- Bandwidth: 2 MHz
- Isolation: 1.8 kV_{RMS} line to line
  1.4 kV_{RMS} line to ground
- Input resistance: 10 MΩ
- Protection: ±4 kV surge / burst

Module specifications

	HSI-HV							
Input ranges unipolar and bipolar	20 V[1], 50 V[1], 100 V, 200 V, 400 V, 800 V, 1400 V							
1 year accuracy[2]	Range	Signal frequency	Accuracy					
	20 V; 50 V	DC	±0.05 % of reading ±60 mV					
	100 V to 1400 V	DC	±0.05 % of reading ±0.05 % of range					
		0.1Hz to 1kHz	±0.05 % of reading ±0.01 % of range					
		>1kHz to 10kHz	±0.1 % of reading ±0.05 % of range					
		>10kHz to 50kHz	±0.4 % of reading ±0.05 % of range					
		>50kHz to 100kHz	±(0.016*f) % of reading ±0.1 % of range					
		>100kHz to 1MHz	±(0.010*f) % of reading ±1 % of range					
		>1MHz to 2MHz	±(0.014*f) % of reading ±3 % of range f = signal frequency in kHz					
Gain linearity	0.05 %							
Gain drift range	Typically 20 ppm/°C (max. 50 ppm/°C)							
Offset drift 20 V to 100 V 200 V to 1400 V	 typical 1.5 mV/°C of range typical 5 ppm/°C	 max. 4 mV/°C max. 20 ppm of range/°C						
Long term stability	100 ppm/sqrt (1000 hrs)							
Input resistance	10 MΩ || 2.2 pF							
-3 dB Bandwidth	2 MHz							
Signal delay @ full bandwidth	approx. 390 ns							
Filter selection	Push button or software							
Filter (lowpass)	100, 300, 1k, 3k, 10k, 30k, 100k, 300 kHz, 1 MHz, 2 MHz[3]							
Filter type	Bessel or Butterworth 40 dB/decade							
Typical SFDR and SNR	10kHz bandwidth		100kHz bandwidth		1MHz bandwidth		2 MHz bandwidth	
	SFDR	SNR	SFDR	SNR	SFDR	SNR	SFDR	SNR
50 V	110 dB	91 dB	110 dB	82 dB	94 dB	76 dB	84 dB	73 dB
400 V	110 dB	95 dB	110 dB	92 dB	94 dB	82 dB	84 dB	77 dB
1400 V	110 dB	95 dB	110 dB	95 dB	94 dB	82 dB	84 dB	77 dB
Typical CMRR	>80 dB @ 50 Hz 70 dB @ 400 Hz		60 dB @ 1 kHz 48 dB @ 10 kHz					
Isolation voltage	Line to Ground 1.4 kVrms Line to Line 1.8 kVrms							
Protection Surge (1.2/50) Burst (5 kHz)	CAT III 600 CAT IV 300 ±4000 V ±4000 V							
Output voltage	±5 V							
Output resistance	10 Ohm							
Output current maximum	35 mA	CAUTION: do not exceed maximum output current!						
Power supply	±9 V_{DC} ± 1%							
Power consumption	1.2 W							
Power On default settings	Software programable							
Special functions	Integrated temperature sensor							
Programming interface	RS-485							

[1] 20 V and 50 V are auxiliary ranges and have a limited bandwidth.
20 V range typically 0.9 Mhz
50 V range typically 1.9 Mhz

[2] Conditions for accuracy: Module temperature is calibration temperature ±5 °C; humidity is 30 to 90 RH;
AC accuracy: the highest filter (2 Mhz) has to be activated. f = signal frequency in kHz.
for the 2 year accuarcy multiply all % of range and % of reading values by 1.5.

[3] 2 MHz filter: exclusively Butterworth 60 dB/decade. Please consider possible bandwidth limitation of further components in the measuring chain, e.g. A/D cards or signal conditioning mainframe

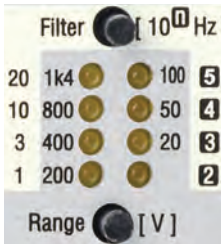
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Front panel control

LED indication:

The HSI-HV series module has a set of 8 LEDs showing the current input range (constant active) and filter range (flashing) setting.

Filter	Range
20 Hz	1400 V
10 Hz	800 V
3 Hz	400 V
1 Hz	200 V



Range	Filter
100 V	10^5
50 V	10^4
20 V	10^3
	10^2

Push button operation:

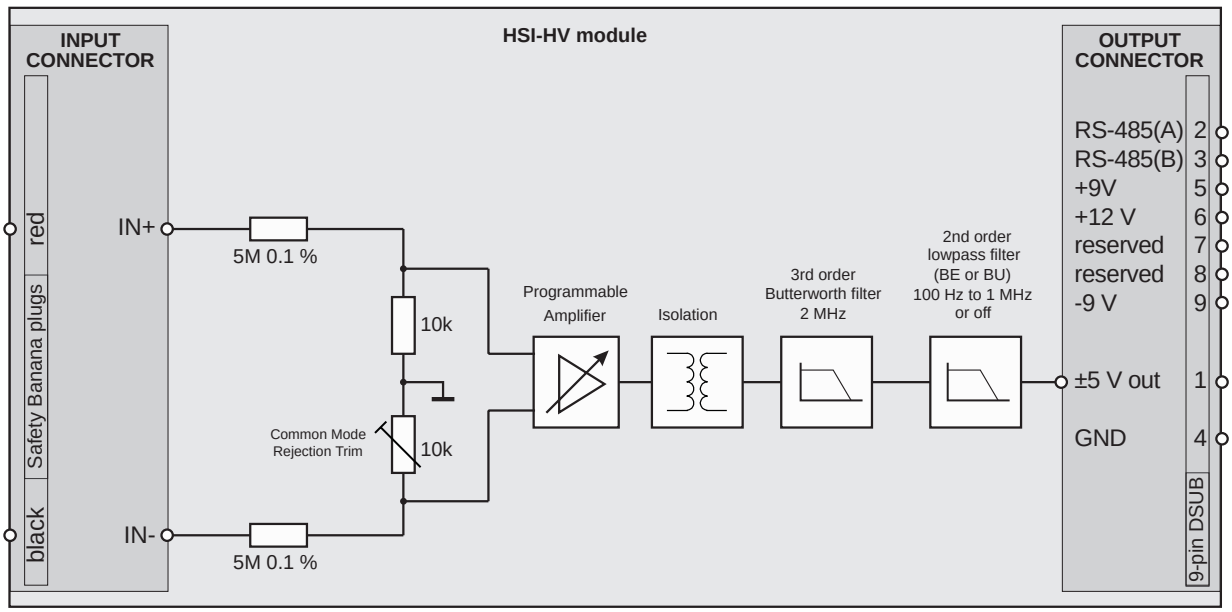
- Select range: Push the ***RANGE*** button several times shortly until the LED displays the desired input range.
- Select filter: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting. Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

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. If the function is deactivated the module automatically remembers the last pushbutton selected range and filter.

Block diagram

The basic block diagram of the HSI-HV gives an idea of the internal structure.

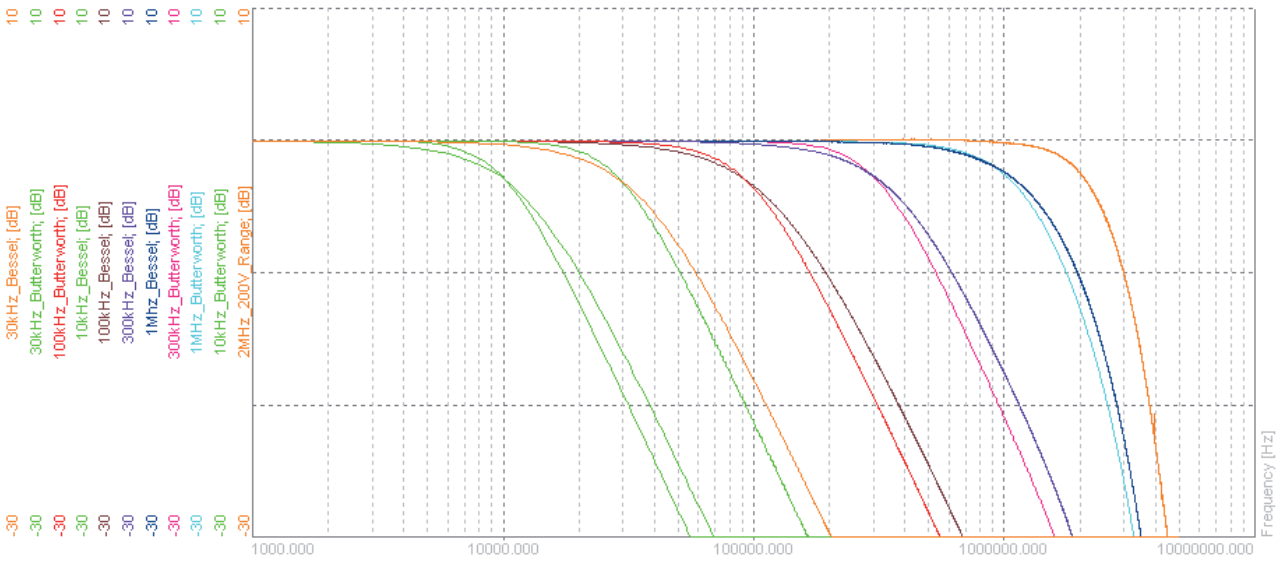


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Filter

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:



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

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HSI Ready

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

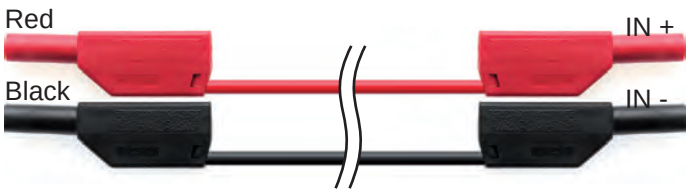
Older systems may have a fix installed 350 kHz filter. The HSI series modules will also work in these systems, but the bandwidth will be limited to the system bandwidth.

Signal connection

HSI-HV module



Voltage measurement via banana plug cords



Voltage measurement up to ±1000 V only with safety banana plug cords!

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Isolated voltage amplifier



- Voltage input: ±10, ±100 mV, ±1, ±5, ±10, ±50 V
- Current input: Depending on shunt resistor
- Ranges and filter: Button or software selection
- Isolation: 1 kV_{RMS} (with banana connector)
- Signal connection:
  - DAQP-V-B: Banana plugs
  - DAQP-V-BNC: BNC connector
  - DAQP-V-D: 9-pin SUB-D connector
  - DAQP-V-LEMO: 7-pin LEMO connector

Module specifications

	DAQN-V	DAQP-V
Input ranges	±0.01, ±0.1, ±1, ±5, ±10, ±50 V	±0.01, ±0.1, ±1, ±5, ±10, ±50 V
Range selection	Push button	Push button or software
DC accuracy 10 mV range 100 mV range 1 V to 50 V ranges	 0.05 % of reading ±40 µV 0.05 % of reading ±100 µV 0.05 % of reading ±0.05 % of range	 0.05 % of reading ±40 µV 0.05 % of reading ±100 µV 0.05 % of reading ±0.05 % of range
Gain linearity	Better than ±0.03 %	Better than ±0.03 %
Gain drift	Typ. 20 ppm/°K, max. 40 ppm/°K	Typ. 20 ppm/°K, max. 40 ppm/°K
Input resistance	1 MOhm (±0.1 %)	1 MOhm (±0.1 %)
Bandwidth (-3 dB)	50 kHz (±1.5 dB @ f_0)	50 kHz (±1.5 dB @ f_0)
Filters (lowpass)	10 Hz, 100 Hz, 1 kHz (±1.5 dB @ f_0)	10 Hz, 100 Hz, 1 kHz, 10 kHz (±1.5 dB @ f_0)
Filter selection	Push button	Push button or software
Filter characteristics @ 0.01, 0.1, 1, 10 kHz @ 50 kHz	Butterworth 40 dB / decade (12 dB / octave) 100 dB / decade (30 dB / octave)	Butterworth 40 dB / decade (12 dB / octave) 100 dB / decade (30 dB / octave)
Typ. SNR @ max. bandwidth 10 mV range 10 V range 50 V range	 61 dB 78 dB 78 dB	 61 dB 78 dB 78 dB
Typical CMRR	90 dB @ 0 Hz 78 dB @ 50 Hz 60 dB @ 400 Hz	90 dB @ 0 Hz 78 dB @ 50 Hz 60 dB @ 400 Hz
Isolation voltage	350 V_{DC} (1 kV_{RMS} with banana connector)	350 V_{DC} (1 kV_{RMS} with banana connector)
Overvoltage protection	±500 V_{DC} or 300 V_{RMS}	±500 V_{DC} or 300 V_{RMS}
Output voltage	±5 V	±5 V
Output resistance	< 10 Ohm	< 10 Ohm
Output current	Max. 5 mA	Max. 5 mA
Output protection	Continuous short to ground	Continuous short to ground
RS-485 interface	Yes	Yes
Power supply voltage	±9 V (±10 %)	±9 V (±10 %)
Power consumption	typical 0.85 W	typical 0.85 W

LED state

The DAQx-V series module has a set of 6 LEDs showing the current input range (constant active) and filter range (flashing) setting.

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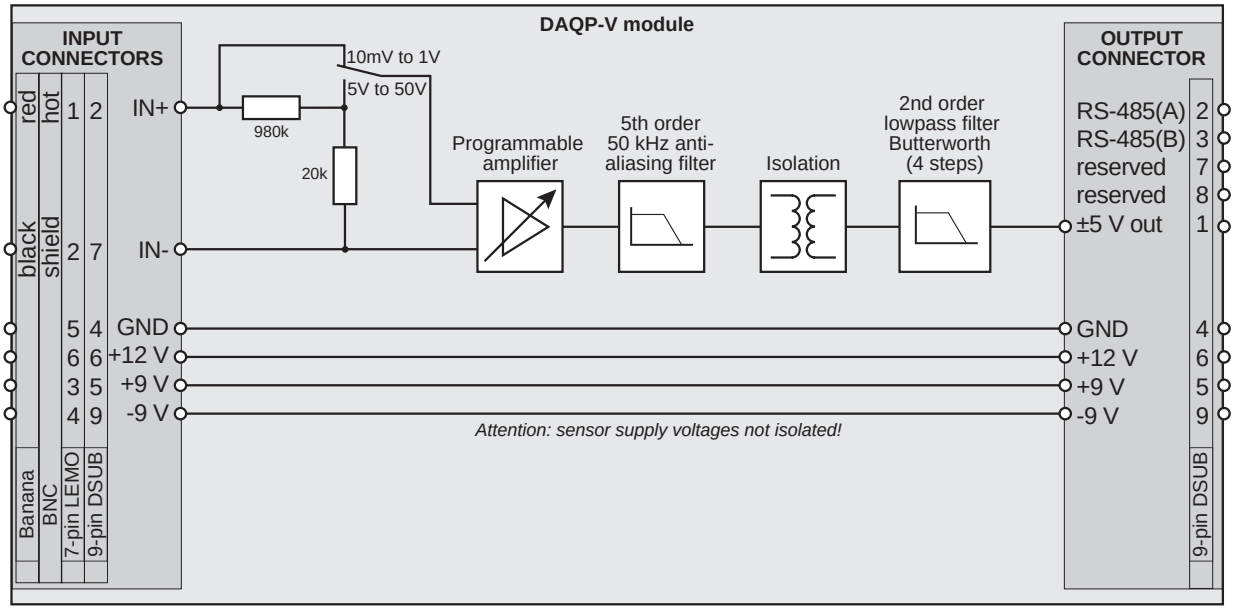
Input range and filter selection

The DAQx-V series module has two push buttons.

- Range button: Push the ***RANGE*** button several times until the LED displays the desired input range.
- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting.
  Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

Block diagram

The base block diagram of the DAQP-V module gives an idea of the internal structure.



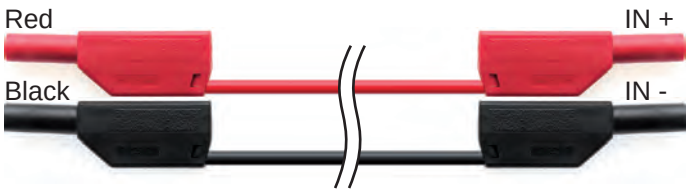
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Signal connection

DAQP-V-B module



Voltage measurement via banana plug cords



DAQP-V-BNC module



Voltage measurement via BNC cord



Hot: IN +

Shield: IN -

DAQP-V-D module



Voltage measurement via SUB-D cord



1 Not connected
2 IN +
3 Not connected
4 GND
5 Not connected (reserved for +9 V power supply)
6 +12 V (+15 V in conjunction with a DEWE-30-4)
7 IN -
8 Not connected
9 Not connected (reserved for -9 V power supply)

Pin 4, 5 and 9 are normally not connected. Use only as sensor supply (not isolated)!
If signals above 60 V may appear, don't use the metal housing of SUBD connector!

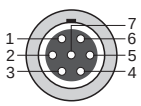
DAQP-V-LEMO module



Voltage measurement via LEMO cord



1 IN +
2 IN -
3 Not connected (reserved for +9 V)
4 Not connected (reserved for -9 V)
5 GND
6 +12 V (+15 V in conjunction with a DEWE-30-4)
7 Not connected



7-pin LEMO connector female
EGG.1B.307

DAQP-V-LEMO modules with 6-pin connector are fully pin compatible with the new 7-pin edition.

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Notes

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Isolated voltage amplifier



- Filter bandwidth: 300 kHz, 10 selectable lowpass filters
- Input ranges: 12 ranges (10 mV to 50 V)
- Input type: AC and DC coupling software selectable
- Isolation: 1 kV_{RMS} (with banana connector)
- TEDS: Supports electronic data sheet sensors
- Signal connection:
  - DAQP-LV-B: Banana plugs
  - DAQP-LV-BNC: BNC connector
  - DAQP-LV-D: 9-pin SUB-D connector
  - DAQP-LV-LEMO: 7-pin LEMO connector
  - DAQP-LV-SC: Screw terminals

Module specifications

	DAQP-LV
Input ranges unipolar and bipolar	10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2.5 V, 5 V, 10 V, 25 V, 50 V
Push button selectable ranges	10 mV, 50 mV, 200 mV, 1 V, 5 V, 10 V, 50 V
DC accuracy Bipolar Unipolar	Range — Accuracy 10 mV to 50 mV — ±0.02 % of reading ±40 µV 100 mV to 50 V — ±0.02 % of reading ±0.05 % of range 10 mV to 50 mV — ±0.04 % of reading ±40 µV 100 mV to 50 V — ±0.04 % of reading ±0.05 % of range
Input coupling	DC or AC software selectable (1.5 Hz standard, custom on request down to 0.01 Hz)
Gain linearity	0.01 % of full scale
Gain drift range	Typically 10 ppm/°K (max. 20 ppm/°K)
Offset drift 10 mV to 200 mV 500 mV to 50 V	Uni- and bipolar 3 µV/°K 10 ppm of Range/°K
Long term stability	100 ppm/sqrt (1000 hrs)
Input resistance	1 MOhm
Bandwidth (-3 dB)	300 kHz
Filter selection	Push button or software
Filters (low pass)	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz
Filter characteristics	10 Hz to 100 kHz: Butterworth or Bessel 40 dB/dec (2nd order; ±1.5 dB @ f0) 300 kHz: Bessel 60 dB/dec (3rd order; 0 to -3 dB @ 300kHz)
Typical SFDR and SNR: 20 mV 1 V 50 V	300 kHz bandwidth: SFDR / SNR — 100 kHz bandwidth: SFDR / SNR — 10 kHz bandwidth: SFDR / SNR 100 dB / 72 dB — 98 dB / 76 dB — 97 dB / 84 dB 102 dB / 82 dB — 99 dB / 93 dB — 97 dB / 96 dB 102 dB / 82 dB — 99 dB / 93 dB — 97 dB / 96 dB
Typical CMRR	10 mV to 1 V range: >100 dB @ 50 Hz, >100 dB @ 1 kHz, 83 dB @ 10 kHz 2.5 V to 50 V range: 90 dB @ 50 Hz, 65 dB @ 1 kHz, 55 dB @ 10 kHz
Input overvoltage protection	350 V_{DC}
Isolation voltage	350 V_{DC} (1 kV_{RMS} with banana connector)
Sensor supply	±9 V (±1 %), 12 V (±5 %), 200 mA resettable fuse protected(1)
Output voltage	±5 V
Output resistance	<10 Ohm
Maximum output current	5 mA
Output protection	Short to ground for 10 sec.
Power On default settings	Software programable
Power supply	±9 V_{DC} ±1 %
Power consumption	0.8 W without sensor supply
RS-485 interface	Yes
TEDS	Hardware support for TEDS (Transducer Electronic Data Sheet)
Supported TEDS chips	DS2406, DS2430A, DS2432, DS2433, DS2431
Supported MSI	MSI-V-ACC; MSI-V-RTD

(1) Overall current should not exceed DEWE-30-xx maximum power.

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LED state

The DAQP-LV modules have a set of 8 LEDs showing the current input range (constant active), the filter range (flashing) and the input mode setting. Seven of the different input ranges are indicated directly by the LEDs. The additional four input ranges (only software selectable) are indicated by lightening the two “neighbour” ranges. For example the 25 V input range is shown by the LEDs 50 V and 10 V.

Due to the large number of low pass filters, two LEDs are used to display the current frequency. The left LED indicates the multiplier, the right one shows the exponent with the base of 10. Example: for the 10 kHz frequency range, the lower left and the upper right LED are flashing (1x 10^4 Hz = 10 000 Hz).

The U/B LED shows the input mode: If this LED is off, the bipolar input range is selected, otherwise the unipolar mode is selected.

Input range and filter selection

The DAQP-LV module has two push buttons with multiple functions.

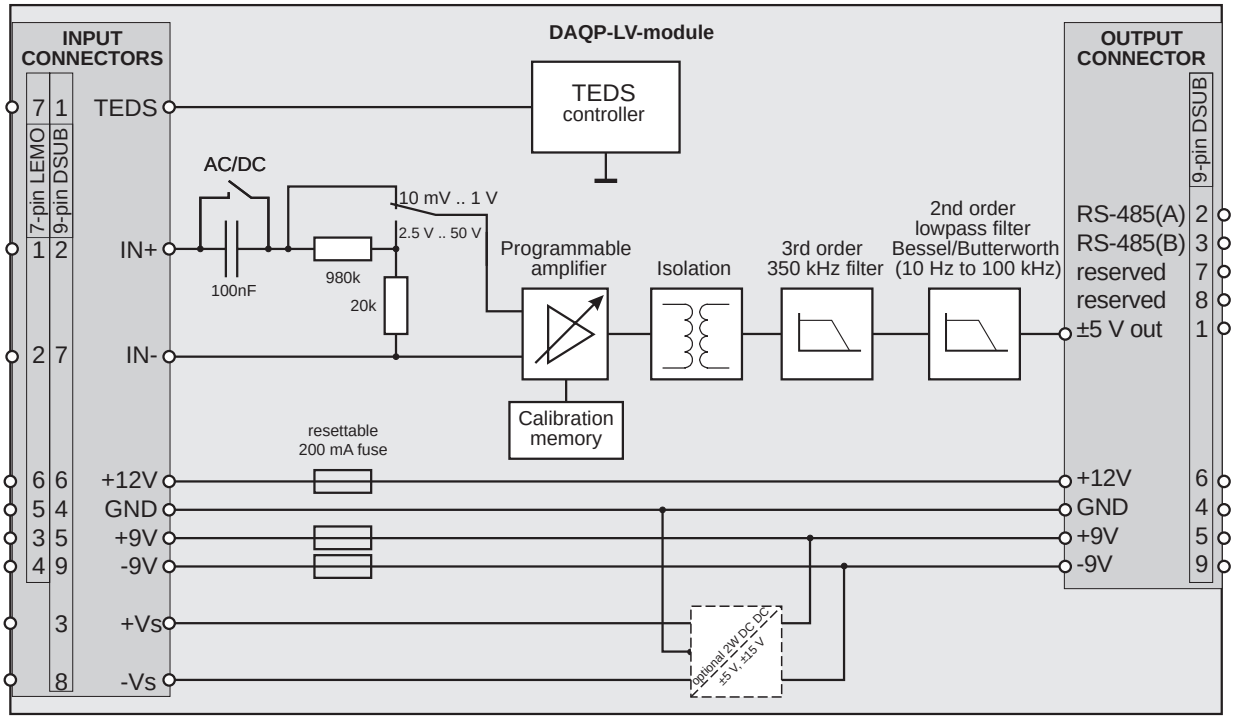
- Range button: Push the ***RANGE*** button several times until the LED displays the desired input range.

  Pressing the ***RANGE*** button for more than three seconds changes the input mode from bipolar to unipolar.

- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting. Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

Block diagram

The base block diagram of the DAQP-LV gives an idea of the internal structure.



CAUTION: TEDS terminal is not isolated!

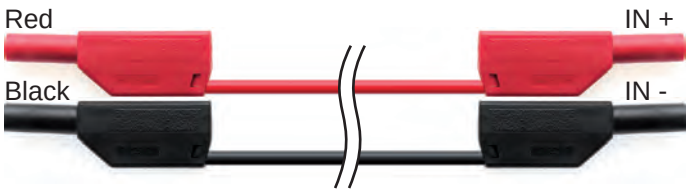
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Signal connection

DAQP-LV-B module



Voltage measurement via banana plug cords



DAQP-LV-BNC module



Voltage measurement via BNC cord



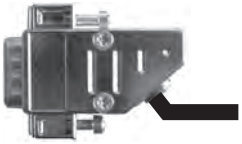
Hot: IN +

Shield: IN -

DAQP-LV-D module



Voltage measurement via SUB-D cord



1 TEDS
2 IN +
3 Reserved for custom sensor supplies
4 GND (not isolated)
5 +9 V (200 mA max.)
6 +12 V (200 mA max.; +15 V in conjunction with a DEWE-30-4)
7 IN -
8 Reserved for custom sensor supplies
9 -9 V (200 mA max.)



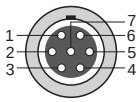
If signals above 60 V may appear, don't use the metal housing of SUBD connector!

DAQP-LV-LEMO module



Voltage measurement via LEMO cord





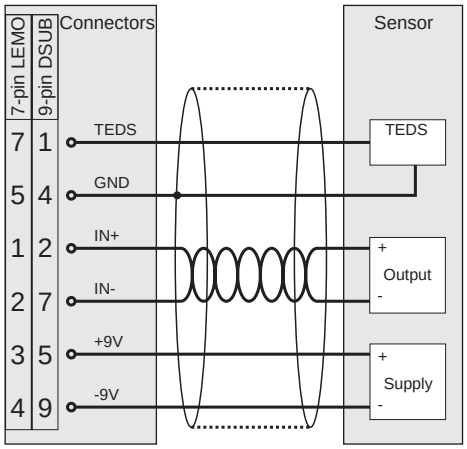
7-pin LEMO connector female
EGG.1B.307

1 IN +
2 IN -
3 +9 V (200 mA max.)
4 -9 V (200 mA max.)
5 GND
6 +12 V (200 mA max.; +15 V in conjunction with a DEWE-30-4)
7 TEDS

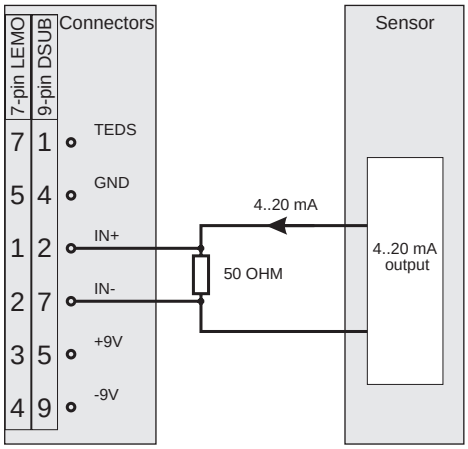
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Typical sensor connection

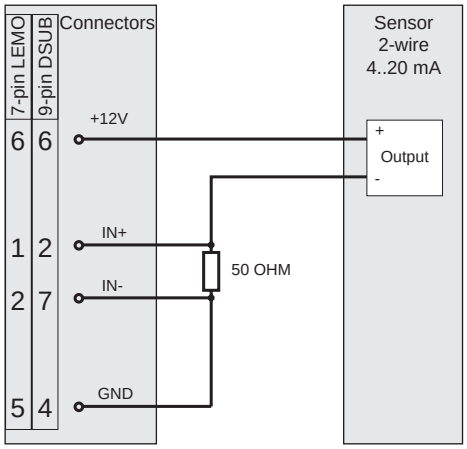
Sensor with differential output powered by the module



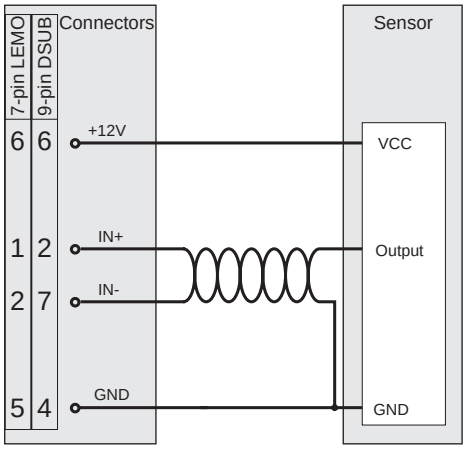
Current measurement



Loop powered sensor



Sensor with common ground



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Current measurement solutions

- Current measurement up to ±5 A
- Different designs available
- Fits to following modules:
  DAQx-DMM
  DAQx-V-B
  DAQP-V-A-B
  DAQP-V-B-B
  DAQN-V-AIN-B
  PAD-V8-P with CB8-B

Models

DAQ-SHUNT1



20 mA shunt adaptor (50 Ohm, 0.1 %, 25 ppm/°K, 1 W)

DAQ-SHUNT1-R



50 Ohm shunt resistor, 0.1 %, 25 ppm/°K, 0.25 W
for general purpose use

DAQ-SHUNT3

5 A shuntbox (100 mOhm, ±0.1%, < 10ppm/°K)
current input via 2x 2 m cable with banana plugs
output 2x 0.3 m cable with banana plugs

DAQ-SHUNT4

5 A shuntbox (100 mOhm, ±0.1%, < 10ppm/°K)
current input via 2 safety banana jacks
output 2x 0.3 m cable with banana plugs

DAQ-SHUNT5



5 A shunt box (100 mOhm, ±0.1%, < 10ppm/°K)
current input via 2 safety banana jacks
output via 2 safety banana jacks

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Notes

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High speed isolated voltage amplifier



- Bandwidth: 2 Mhz
- Input ranges: 12 ranges (10 mV to 50 V)
- Input type: AC and DC coupling software selectable
- Isolation: 1 kV_{RMS} (with banana connector)
- TEDS: Supports electronic data sheet sensors
- Signal connection:
  - HSI-LV-B: Banana plugs
  - HSI-LV-BNC: BNC connector
  - HSI-LV-D: 9-pin SUB-D connector
  - HSI-LV-LEMO: 7-pin LEMO connector

Module specifications

	HSI-LV							
Input ranges	10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2.5 V, 5 V, 10 V, 25 V, 50 V							
Button selectable ranges	10 mV, 50 mV, 200 mV, 1 V, 5 V, 10 V, 50 V							
1 year accuracy[1)]	Range	Signal frequency	Accuracy					
Bipolar	10 mV to 100 mV	DC	±0.02 % of reading ±60 µV					
	2.5 V	DC	±0.02 % of reading ±0.1 % of range					
	200 mV to 50 V	DC	±0.02 % of reading ±0.05 % of range					
	10 mV to 100 mV	0.1 Hz to 10 kHz >10 kHz to 50 kHz >50 kHz to 100 kHz >100 kHz to 1 MHz >1 MHz to 2 MHz	±0.1 % of reading ±30 µV ±0.4 % of reading ±30 µV ±(0.016*f) % of reading ±0.1 % of range ±(0.010*f) % of reading ±1 % of range ±(0.014*f) % of reading ±3 % of range					
	200 mV to 50 V	0.1 Hz to 1 kHz >1 kHz to 10 kHz >10 kHz to 50 kHz >50 kHz to 100 kHz >100 kHz to 1 MHz >1 MHz to 2 MHz	±0.05 % of reading ±0.01 % of range ±0.1 % of reading ±0.05 % of range ±0.4 % of reading ±0.05 % of range ±(0.016*f) % of reading ±0.1 % of range ±(0.010*f) % of reading ±1 % of range ±(0.014*f) % of reading ±3 % of range					
Unipolar	10 mV to 100 mV 200 mV to 50 V	DC DC	±0.02 % of reading ±60 µV ±0.02 % of reading ±0.08 % of range					
Input coupling	DC or AC software selectable (1.5 Hz standard, custom on request down to 0.01 Hz)							
Gain linearity	Typically 0.01 %; max. 0.04 % of full scale							
Gain drift range	Typically 10 ppm/°C (max. 30 ppm/°C)							
Offset drift	10 mV to 200 mV: 500 mV to 50 V:	Typically 3 µV/°C Typically 10 ppm of range/°C						
Long term stability	100 ppm/sqrt (1000 hrs)							
Input resistance	1 MOhm							
Bandwidth (-3 dB)	2 MHz							
Filter selection	Push button or software							
Filter	100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 2 MHz[2)]							
Filter type	Bessel or Butterworth 40 dB/dec							
Typical SFDR and SNR:	10 kHz bandwidth		100 kHz bandwidth		1 MHz bandwidth		2 MHz bandwidth	
	SFDR	SNR	SFDR	SNR	SFDR	SNR	SFDR	SNR
20 mV	88 dB	78 dB	88 dB	71 dB	77 dB	60 dB	76 dB	56 dB
1 V	110 dB	98 dB	110 dB	95 dB	93 dB	82 dB	84 dB	75 dB
50 V	110 dB	98 dB	110 dB	95 dB	94 dB	82 dB	85 dB	75 dB
Typical CMRR	10 mV to 1 V range:		2.5 V to 50 V range:					
50 Hz	130 dB		100 dB					
1 kHz	120 dB		75 dB					
10 kHz	95 dB		55 dB					
100 kHz	75 dB		25 dB					

continued on next page

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continued from previous page

Input overvoltage protection	350 V_{DC}
Isolation voltage	350 V_{DC} (1 kV_{RMS} with banana connector)
Sensor supply	±9 V (±1 %), 12 V (±5 %), 200 mA resettable fuse protected[3)]
Output voltage	±5 V
Output resistance	10 Ohm
Maximum output current	5 mA
Output protection	Short to ground for 10 sec.
Power On default settings	Software programable
Power supply	±9 V_{DC} ±1 %
Power consumption	1.1 W without sensor supply
Special functions	Integrated temperature sensor
RS-485 interface	Yes
TEDS	Hardware support for TEDS (Transducer Electronic Data Sheet)
Supported TEDS chips	DS2406, DS2430A, DS2432, DS2433, DS2431
Supported MSI	MSI-V-ACC, MSI-V-RTD

[1)] Conditions for accuracy: Module temperature is calibration temperature ±5 °C; humidity is 30 to 90 RH.
AC accuracy: the highest filter (2 MHz) has to be activated. f = signal frequency in kHz.
For the 2 year accuracy multiply all % of range and % of reading values by 1.5.

[2)] 2 MHz filter: exclusively for Butterworth 60 dB/decade - refer to filter specifications. Please consider possible bandwidth limitation of further components in the measuring chain, e.g. A/D card or signal conditioning mainframe.

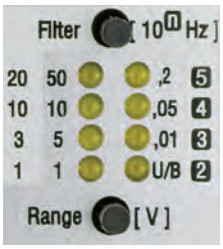
[3)] Overall current should not exceed DEWE-30-xx maximum power.

Front panel control

LED indication:

The HSI-LV series module has a set of 8 LEDs showing the current input range (constant active) and filter range (flashing) setting.

Filter	Range
20 Hz	50 V
10 Hz	10 V
3 Hz	5 V
1 Hz	1 V



Range	Filter
200 mV	10^5
50 mV	10^4
10 mV	10^3
U/B	10^2

The U/B LED shows the input mode: If this LED is off, the bipolar input range is selected, otherwise the unipolar mode is selected.

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. If the function is deactivated the module automatically remembers the last pushbutton selected range and filter.

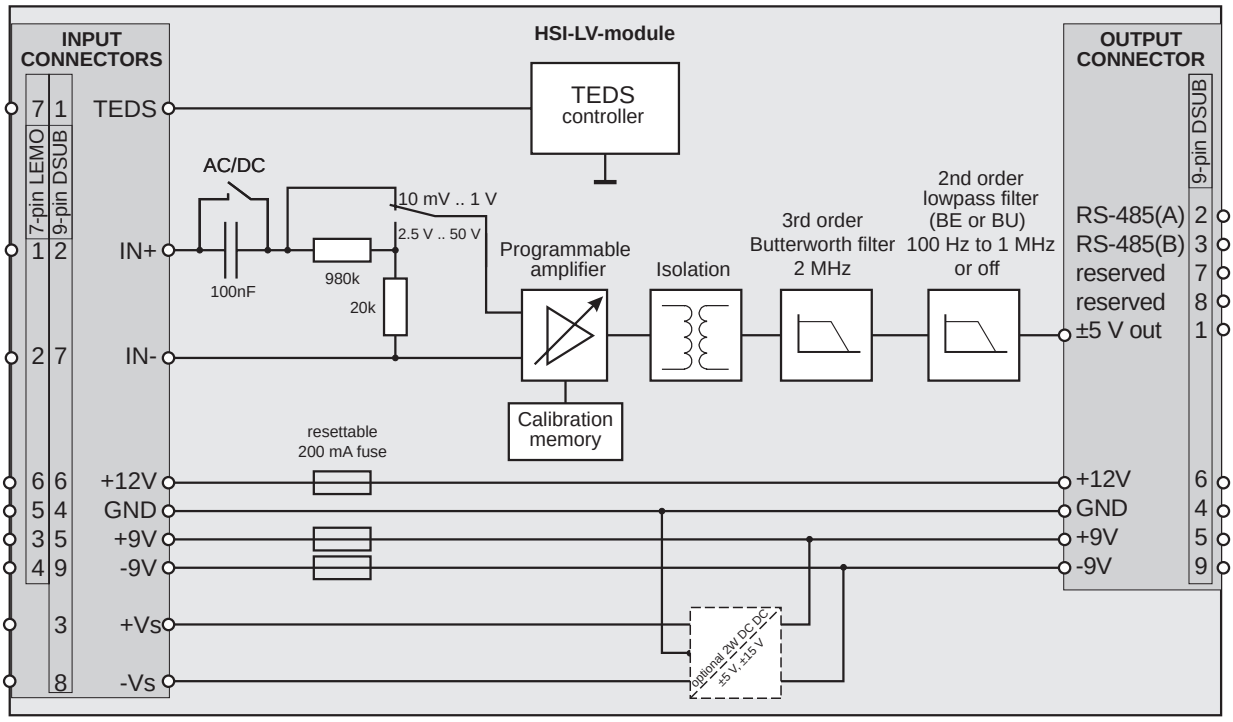
Push button operation:

- Select range: Push the ***RANGE*** button several times shortly until the LED displays the desired input range.
- Select filter: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting. Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.
- Change input mode: Keeping the ***RANGE*** button pressed for more than 3 seconds, the input mode changes from unipolar to bipolar or vice versa.

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Block diagram

The base block diagram of the HSI-LV gives an idea of the internal structure.



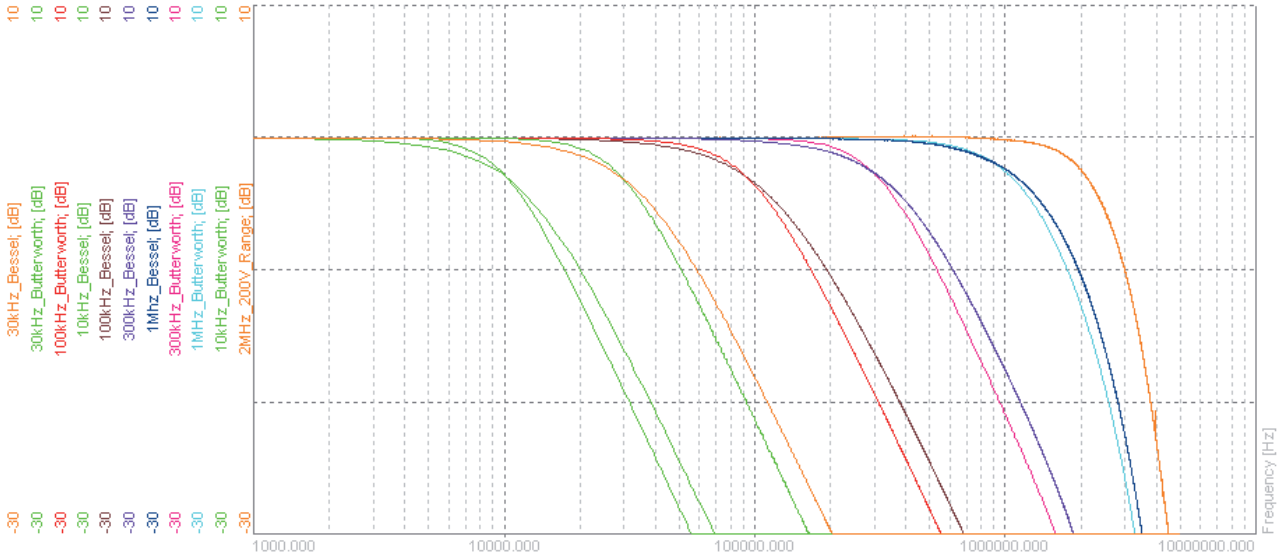
CAUTION: TEDS terminal is not isolated!

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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:



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

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.

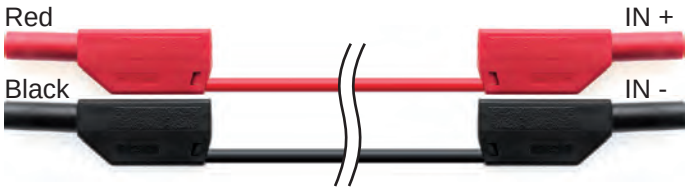
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Signal connection

HSI-LV-B module



Voltage measurement via banana plug cords



HSI-LV-BNC module



Voltage measurement via BNC cord



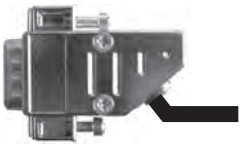
Hot: IN +

Shield: IN -

HSI-LV-D module



Voltage measurement via SUB-D cord



1 TEDS
2 IN +
3 Reserved for custom sensor supplies
4 GND (not isolated)
5 +9 V (200 mA max.)
6 +12 V (200 mA max.; +15 V in conjunction with a DEWE-30-4)
7 IN -
8 Reserved for custom sensor supplies
9 -9 V (200 mA max.)

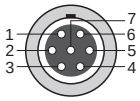
If signals above 60 V may appear, don't use the metal housing of SUBD connector!

HSI-LV-LEMO module



Voltage measurement via LEMO cord





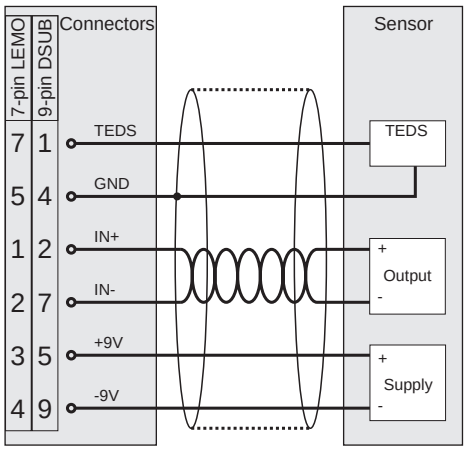
7-pin LEMO connector female
EGG.1B.307

1 IN +
2 IN -
3 +9 V (200 mA max.)
4 -9 V (200 mA max.)
5 GND
6 +12 V (200 mA max.; +15 V in conjunction with a DEWE-30-4)
7 TEDS

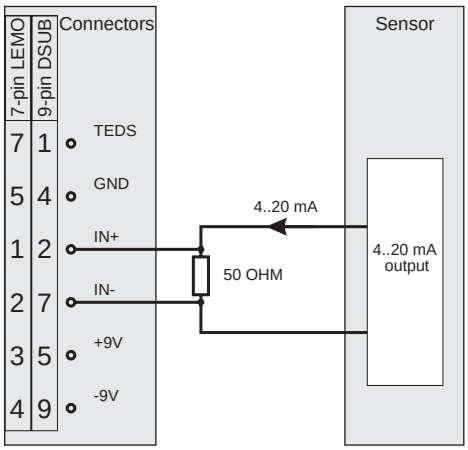
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Typical sensor connection

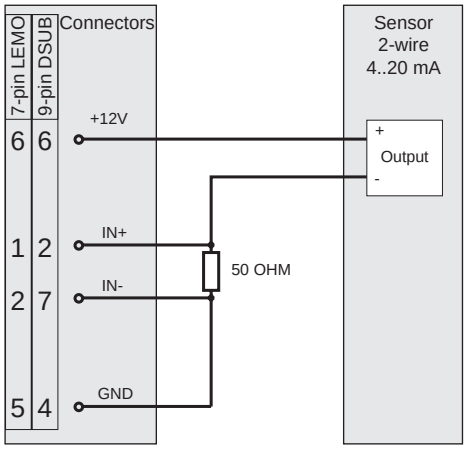
Sensor with differential output powered by the module



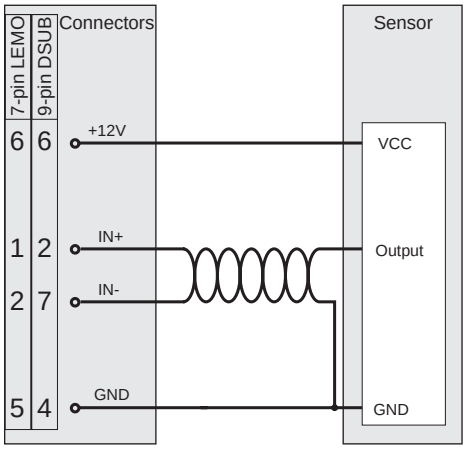
Current measurement



Loop powered sensor



Sensor with common ground



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Isolated current amplifier

- 30 A current peaks
- 5 A_{RMS} continuous
- 6 ranges
- 300 kHz bandwidth
- Signal connection
  DAQP-LA-B-S1: Banana plugs
  DAQP-LA-SC: Screw terminals



Module specifications

	DAQP-LA-SC	DAQP-LA-B-S1
Input resistance (Shunt)	0.1 Ohm	5 Ohm
Shunt inductance	<10 nH	<10 nH
Input ranges	0.1 A, 0.3 A, 1 A, 3 A, 10 A peak, 30 A peak	2 mA, 6 mA, 20 mA, 60 mA, 200 mA, 0.6 A
Continuous current	max. 5 A_{RMS}	max. 0.6 A
Peak current	30 A max. 10 ms; 10 A max. 100 ms	
DC accuracy 100 mA and 300 mA 1 A to 30 A 2 mA and 6 mA 20 mA and 600 mA	 ±0.05 % of reading ±300 µA ±0.05 % of reading ±0.05 % of range	 ±0.05 % of reading ±6 µA ±0.05 % of reading ±0.05 % of range
Offset drift 100 mA and 300 mA 1 A to 30 A 2 mA and 6 mA 20 mA to 600 mA	typ. max. 12 20 µA/°K 20 40 ppm of Range/°K	 typ. max. 0.24 0.4 µA/°K 20 40 ppm of Range/°K
Gain linearity	0.03 %	
Gain drift range	Typically 20 ppm/°K (max. 50 ppm/°K)	
Long term stability	100 ppm/sqrt (1000 hrs)	
Bandwidth (-3 dB)	300 kHz(1)	
Filter selection	Push button or software	
Filters (low pass)	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz	
Filter characterisitics	10 Hz to 100 kHz: Butterworth or Bessel 40 dB/dec (2nd order; ±1.5 dB @ f0) 300 kHz: Bessel 60 dB/dec (3rd order; 0 to -3 dB @ 300kHz)	
Typical SFDR and SNR 100 mA 1 A 30 A	300 kHz / 100 kHz / 10 kHz SFDR SNR SFDR SNR SFDR SNR 95 dB 64 dB 95 dB 67 dB 95 dB 77 dB 102 dB 82 dB 103 dB 85 dB 113 dB 90 dB 104 dB 89 dB 103 dB 89 dB 117 dB 91 dB	
Isolation voltage	Input to Ground 1.4 kV_{RMS}	
Protection	CAT III 150 V CAT IV 100 V	
Output voltage	±5 V	
Output resistance	<10 Ohm	
Output current	5 mA	
Power On default settings	Software programable	
Output protection	Short to ground for 10 sec.	
Power supply	±9 V_{DC} ± 1%	
Power consumption	0.7 W	
Interface	RS-485	

(1) 300 kHz exclusively for Bessel filter characteristic

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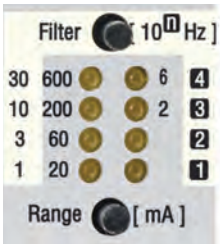
Operation with push buttons

LED state

The DAQP-LA series module has a set of 8 LEDs showing the current input range (constant active) and filter range (flashing) setting. Further functions are described below.

LED indication:

Filter	Range
30 Hz	600 mA
10 Hz	200 mA
3 Hz	60 mA
1 Hz	20 mA



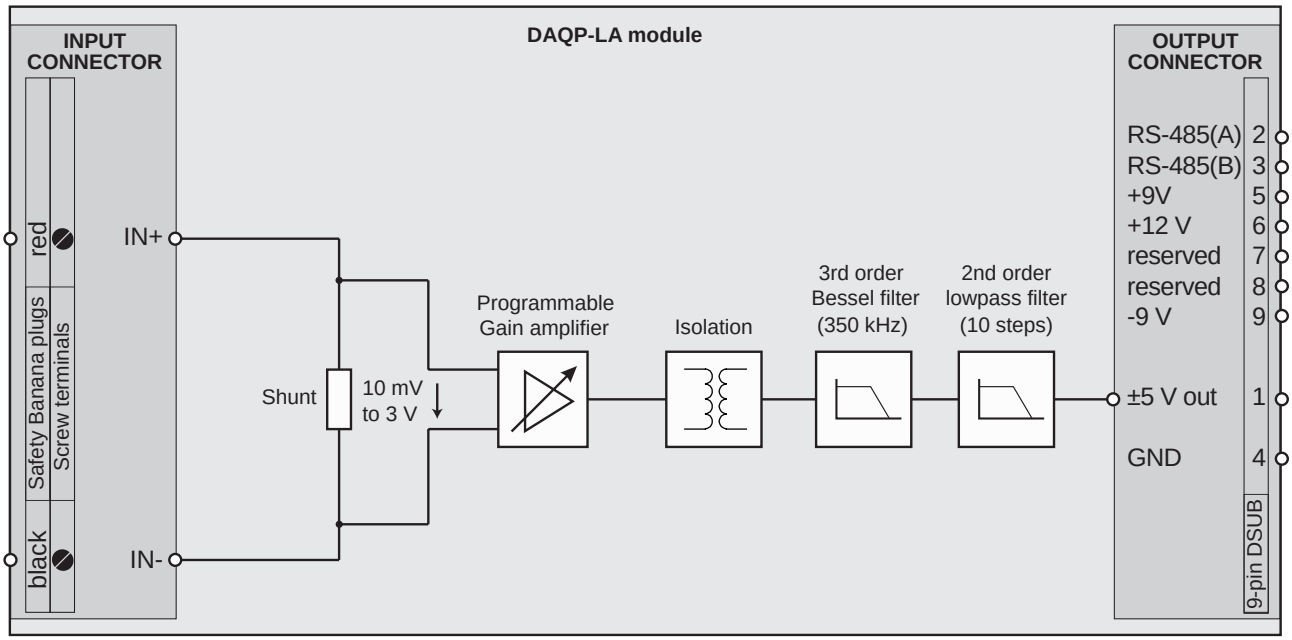
Range	Filter
6 mA	10^4
2 mA	10^3
	10^2
	10^1

Standard functions:

- Range button: Push the ***RANGE*** button several times shortly until the LED displays the desired input range.
- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting. Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

Block diagram

The base block diagram of the DAQP-LA gives an idea of the internal structure.

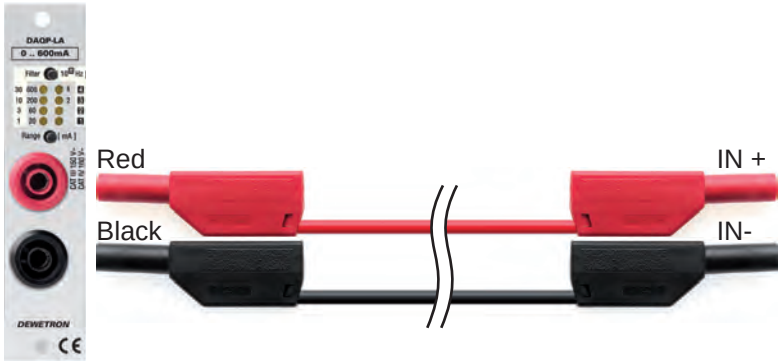


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Signal connection

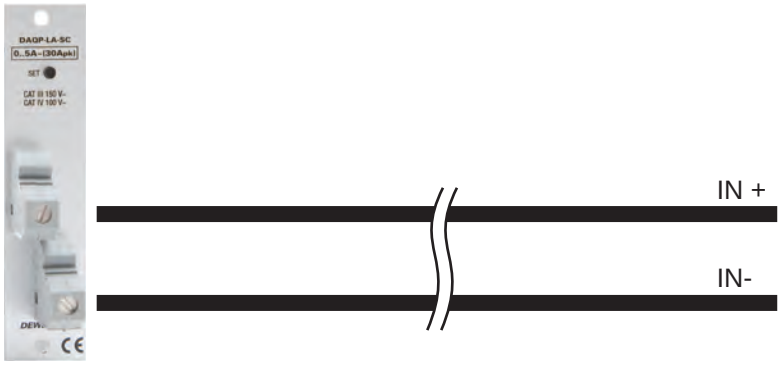
DAQP-LA-B-S1 module

Current measurement via banana plug cords



DAQP-LA-SC module

Current measurement via screw terminals



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Notes

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Isolated strain gage amplifier



- Input ranges: 0.05 mV/V to 1000 mV/V; 500 µV to 5 V; 25 mOhm to 100 kOhm
- Bandwidth: 300 kHz, 9 selectable low pass filter (10 Hz to100 kHz)
- Isolation: 350 V_{DC}
- 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 12V or 0 to 20mA 16 bit programmable
- TEDS: Support for TEDS sensors and DEWETRON MSI series

Module specifications

	DAQP-STG
Gain	0.5 to 10 000
Voltage input ranges Sensitivity @ 5 V_{DC} excitation	±0.5, ±1, ±2.5, ±5, ±10, ±25, ±50, ±100, ±250, ±500 mV, ±1 V, ±2V, ±5 V,±10 V ±0.1, ±0.2, ±0.5, ±1, ±2, ±5, ±10, ±20, ±50, ±100, ±200, ±400, ±1000 mV/V
Resistance	25 mOhm to 100 kOhm
Input impedance	>100 MOhm (power off: 50 kOhm)
Input noise	3.5 nV * √Hz
Voltage input accuracy 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/°C + 10 ppm of range/°C, max 2 µV/°C + 20 ppm of range/°C typical 0.02 %
Excitation voltage Accuracy 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 Accuracy Drift Compliance voltage Output impedance	0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 mA software programmable (16 Bit DAC) 0.05% ±2µA 15 ppm/K 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: Pt100, Pt200, Pt500, Pt1000, Pt2000
Bridge resistance	80 Ohm to 10 kOhm @ ≤ 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 1 V: ±200 % of Range 2.5 V to 5 V : ±20% of Range
Bandwidth (-3 dB)	300 kHz
Filters (low pass)	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz
Filter characteristics	10 Hz to 100 kHz: Butterworth or Bessel 40 dB/dec (2nd order; ±1.5 dB @ f0) 300 kHz: Bessel 60 dB/dec (3rd order; 0 to -3 dB @ 300kHz)
Typical SNR @ 100 kHz [1 kHz] and 5 V_{DC} excitation	66 dB [84 dB] @ 1 mV/V 82 dB [100 dB] @ 50 mV/V
Typical CMRR @ 0.1 mV/V [1 mV/V] and 5 V_{DC} excitation	160 dB [160 dB] @ DC 115 dB [110 dB] @ 400 Hz 110 dB [105 dB] @ 1 kHz
Isolation	±350 V_{DC} continuous (for input, excitation and TEDS interface)
Common mode voltage	±350 V_{DC} input to housing
Over voltage protection	±50 V_{DC} input (+) to input (-)
Output voltage	±5 V
Output resistance	< 1 Ohm
Output current	Max. 5 mA; short to ground protected for 10 seconds
RS-485 interface	Yes
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. 1.7 W @ 350 Ohm, 2.15 W @ 120 Ohm (both full bridge @ 5 V_{DC} excitation) Absolute max.: 3 W (maximum excitation @ maximum current)

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Front panel control

LED indication:



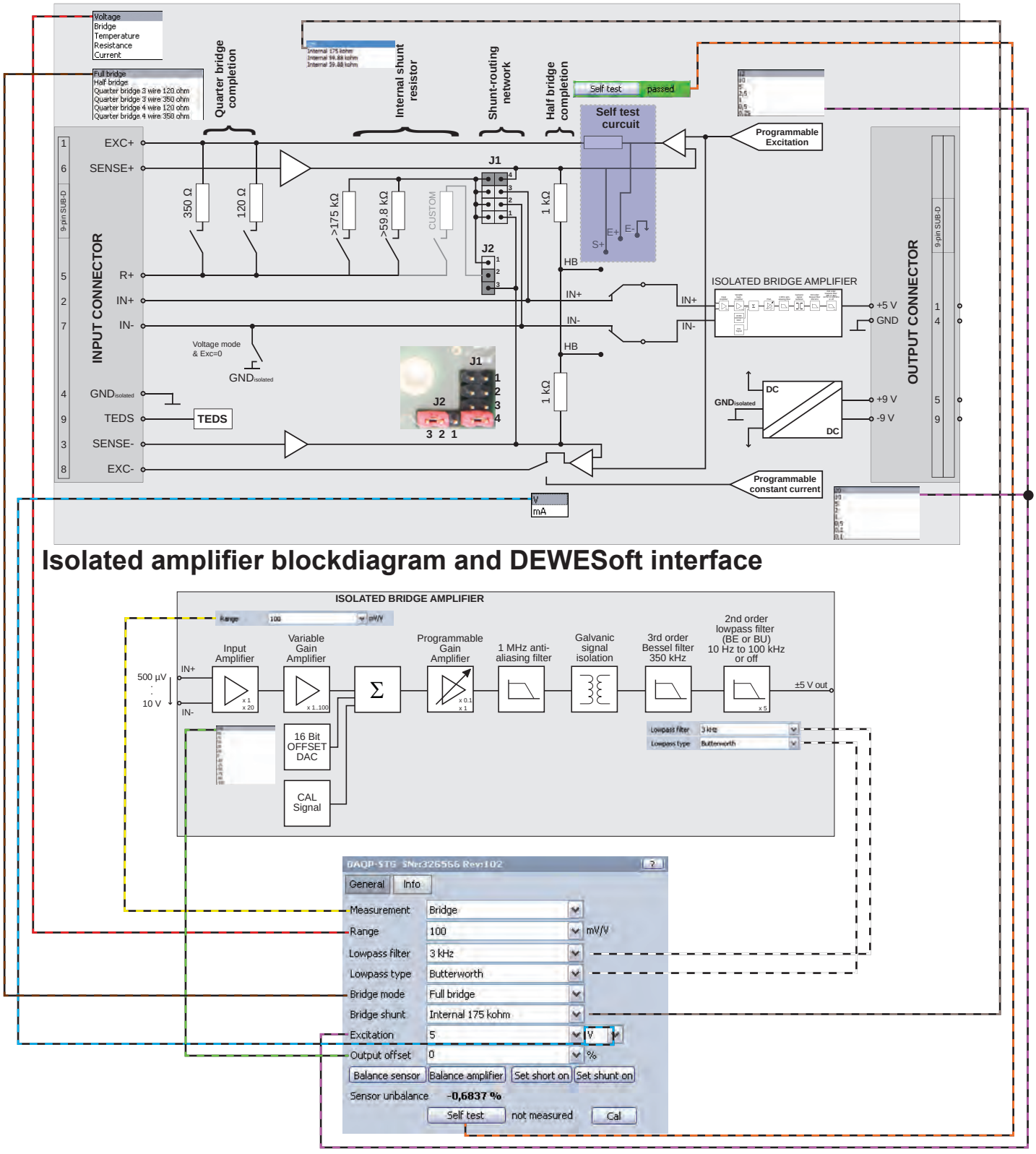
Power LED: This LED is always on when the module is supplied.
Status LED: This LED is flashing three times when the Module receives a valid command.

Push button operation

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

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Input blockdiagram



Isolated amplifier blockdiagram and DEWESoft interface

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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. ad-justable 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 except on the input ranges above 1V. Due to internal structure here the offset could be set from +20 % to – 20 %.
- **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 20 mA in 0.3 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 10 Hz to 100 kHz. The filter characteristic could chosen between Butterworth 2nd order or Bessel 2nd order. The highest filter is a 3rd order Bessel filter with a guaranteed -3 dB bandwidth of 300 kHz. This filter structure is the same for all new generation modules (DAQP-LV, DAQP-HV2) to have low phase shifts between the different module times over the frequency range.

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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 200 % of the actual range. This allows using the full dynamic of the AD-board instead of losing resolution because of digital offset shifting. Output offset and sensor balance may not exceed 200 % of range (20 % for ranges above 1 V).

Internal Completion Resistors

The DAQP-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 DAQP-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. For ranges above 1V the reference signal level is 20 % of range.

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.

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Signal connection

DAQP-STG-D module



Signal connection via SUB-D connector

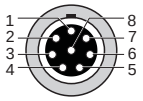


1 EXC+
2 IN+
3 Sense -
4 GND (isolated)
5 R+
6 Sense +
7 IN-
8 EXC-
9 TEDS

DAQP-STG-LEMO module



Signal connection via LEMO connector



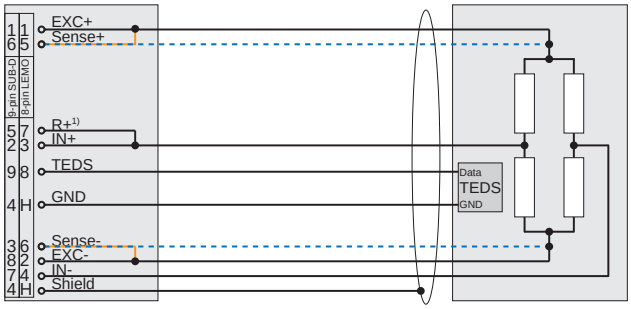
8-pin LEMO connector female
EGG.1B.308.CLL

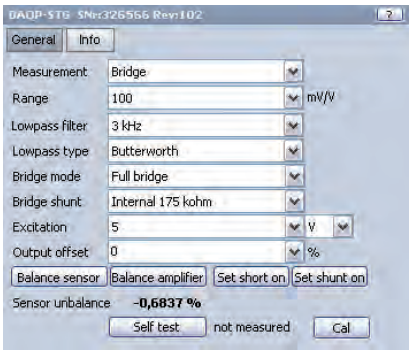


1 EXC+
2 EXC-
3 IN+
4 IN-
5 Sense +
6 Sense -
7 R+
8 TEDS
H GND (isolated)

Full bridge signal connection

6-wire and 4-wire sensor connection

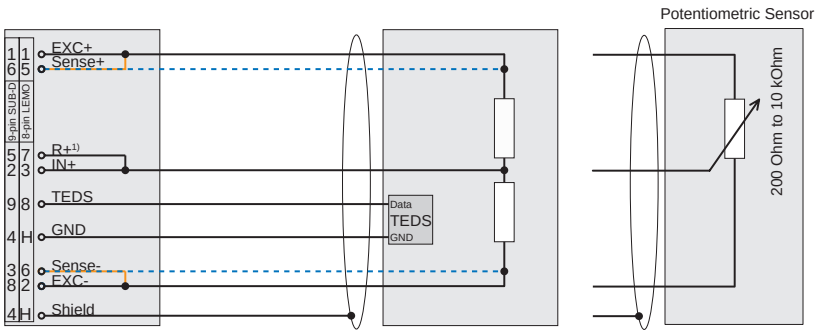


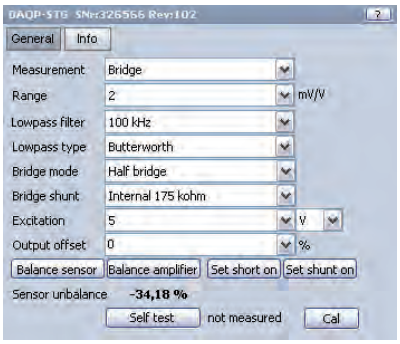


Voltage or Current excitation is allowed.
Senses terminals have to be connected to the excitation also when 4-wire connection is used.
6-wire sensor connection: Sense+ is connected to EXC+ at the sensor
4-wire sensor connection: Sense+ is connected to EXC+ at the connector

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. The advantages of using the DAQP-STG for potentiometric measurements is by adjusting the offset and range, you can focus on a certain potentiometer position with higher resolution. The scaling is ±500 mV/V equals ±50 % of potentiometer position.

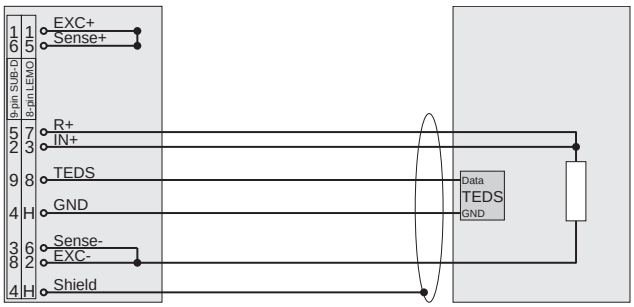
[1)] 'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.

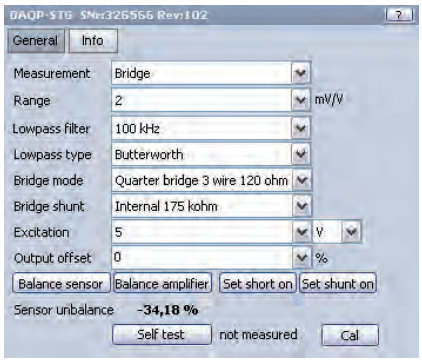
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Quarter bridge signal connection

3-wire sensor connection

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



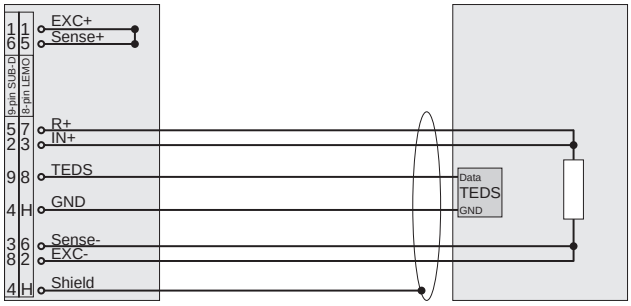


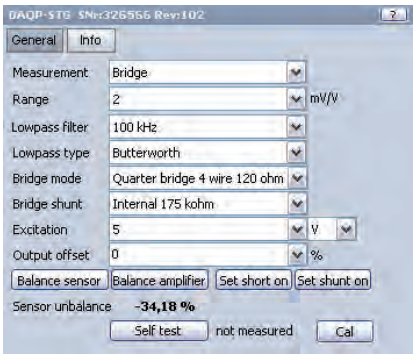
Sense leads (SUB-D: pin 3 and 6) have to be connected!

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

4-wire sensor connection

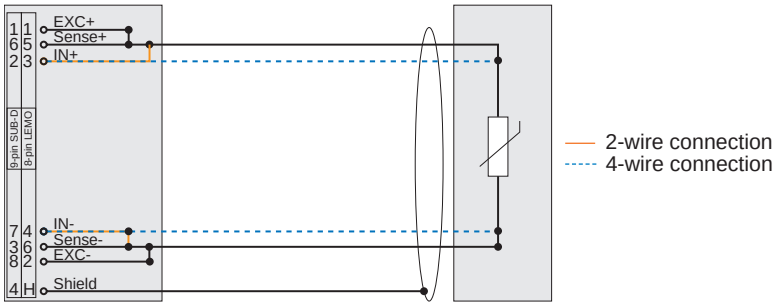
(Sense+ is connected to EXC+ at the sensor)

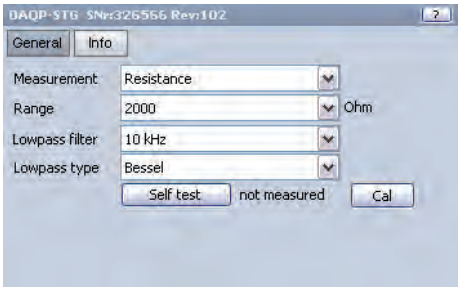




In the quarter bridge 4-wire mode the DAQP-STG internally adjusts its excitation in that way, that on the gage the resistor terminals exactly on the half of the excitation voltage. All wire resistances are compensated.

Resistance, RTD 2-wire and 4-wire



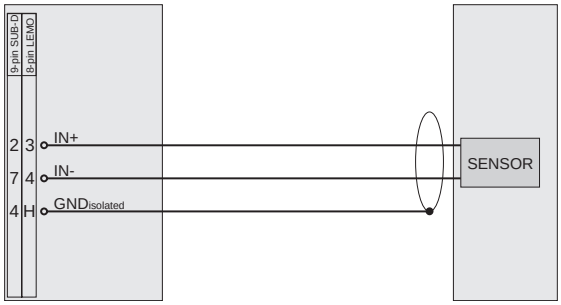


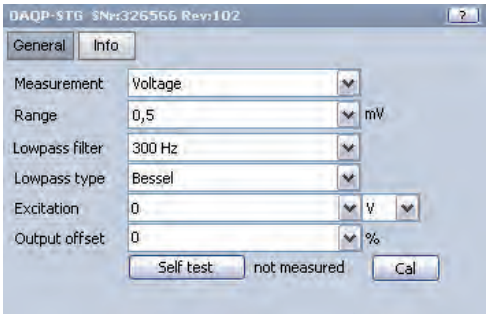
For resistance and RTD mode the 4-wire connection is recommended. The 2-wire connection will not compensate the wire resistance.

RTD	max. Resistor	Range	Accuracy
Type	Ω	Ω	
PT100	390.48	500	0.9 °C ±0.35 % of reading
PT200	780.96	1000	0.9 °C ±0.35 % of reading
PT500	1952.4	2000	0.85 °C ±0.35 % of reading
PT1000	3904.8	10000	1.6 °C ±0.6 % of reading
PT2000	7809.6	10000	1.4 °C ±0.6 % of reading

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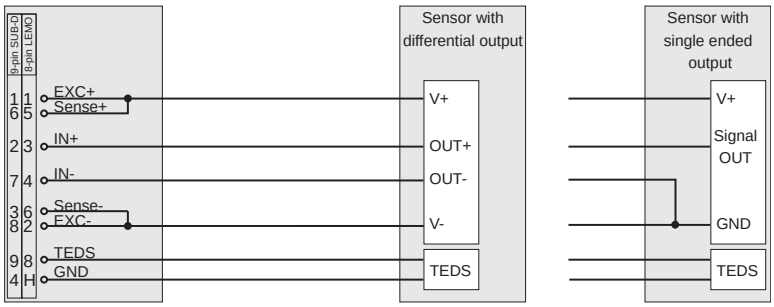
Voltage measurement and µV measurement

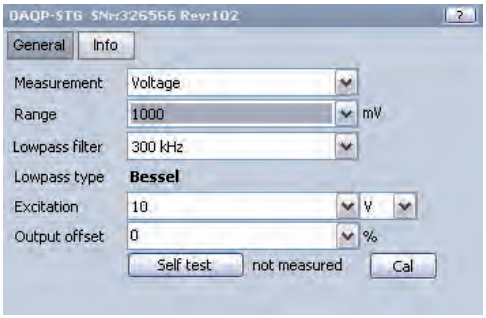




CAUTION: If the excitation is not used for sensor supply it has to be deactivated by setting it to 0 V. This will internally connect the IN- to the $GND_{isolated}$ to improve the common mode rejection.

Sensor with sensor supply and voltage output





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:

	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 %

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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:

EXC+	PIN1	and	EXC-	PIN8
Sense+	PIN6	and	Sense-	PIN3
IN+	PIN2	and	IN-	PIN7
R +	PIN5	and	$GND_{isolated}$	PIN4

If TEDS is used also the shield could be used as $GND_{isolated}$

For quarter bridge mode:

IN+	PIN2	and	Sense-	PIN3
R +	PIN5	and	EXC-	PIN8

Supported MSI

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

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Notes

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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	3.5 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, 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 300 kHz: Butterworth or Bessel 40 dB/dec 2 MHz: 3rd Butterworth characteristic, refere to transfer function							
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

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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.

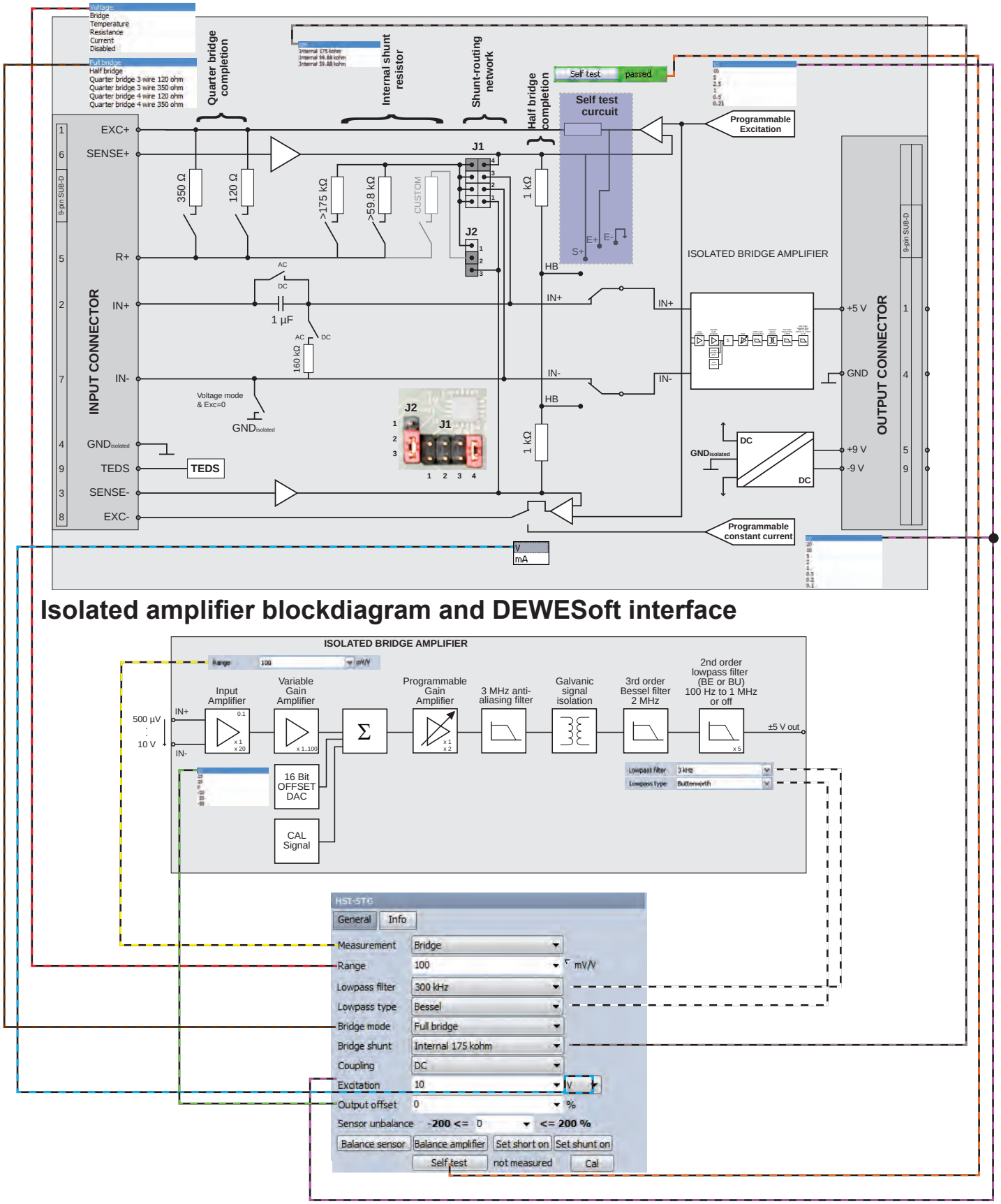
Isolation:

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

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Input blockdiagram



Isolated amplifier blockdiagram and DEWESoft interface

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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

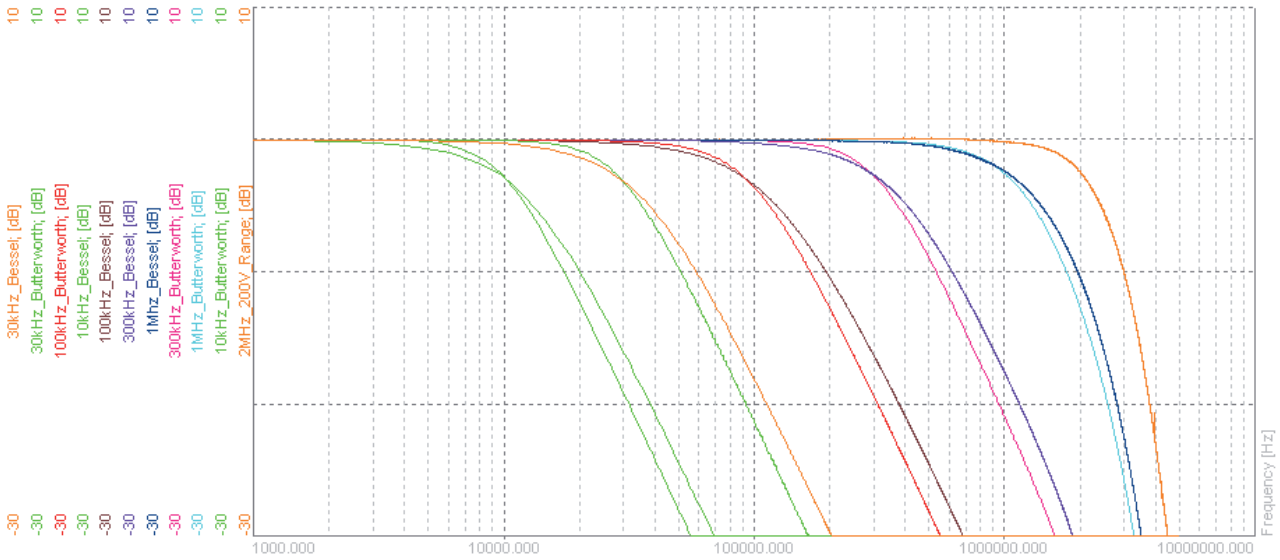
You can store the actual settings of the module in the internal EE-Prom memory. Once the module restarts, it comes up automatically with these setting. This is important for stand alone applications and for fail save reasons.

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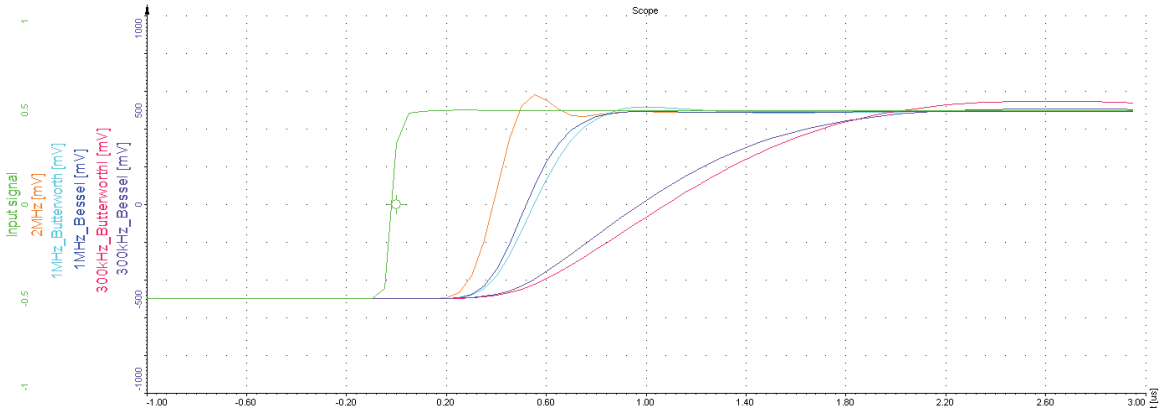
Filter

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

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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.

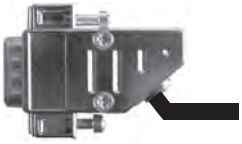
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Signal connection

HSI-STG-D module

Signal connection via SUB-D connector



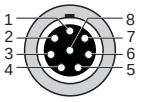


1 EXC+
2 IN+
3 Sense -
4 GND (isolated)
5 R+
6 Sense +
7 IN-
8 EXC-
9 TEDS

HSI-STG-LEMO module

Signal connection via LEMO connector





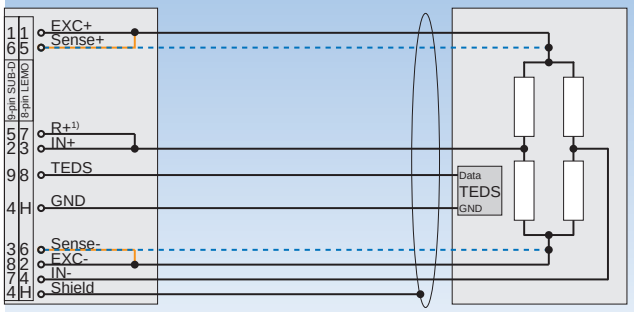
8-pin LEMO connector female
EGG.1B.308.CLL

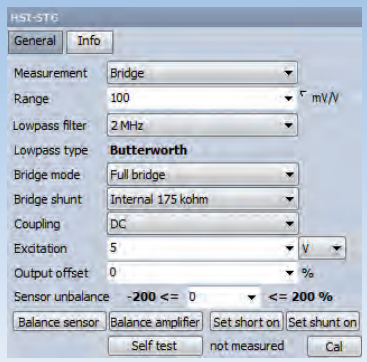


1 EXC+
2 EXC-
3 IN+
4 IN-
5 Sense +
6 Sense -
7 R+
8 TEDS
H GND (isolated)

Full bridge signal connection

6-wire and 4-wire sensor connection

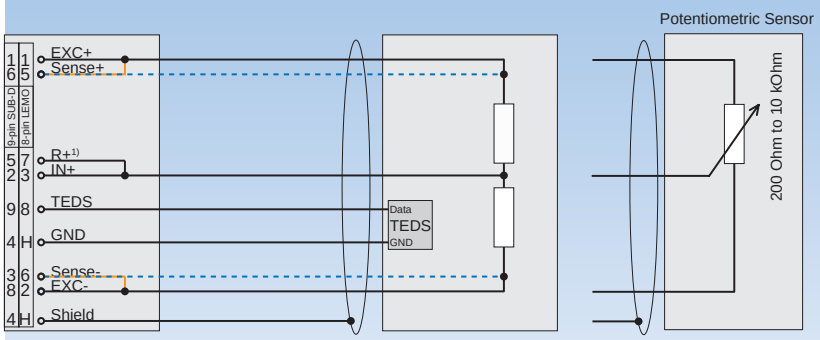


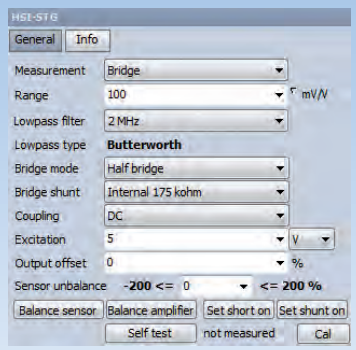


Voltage or Current excitation is allowed.
Senses terminals have to be connected to the excitation also when 4-wire connection is used.
6-wire sensor connection: Sense+ is connected to EXC+ at the sensor
4-wire sensor connection: Sense+ is connected to EXC+ at the connector

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.

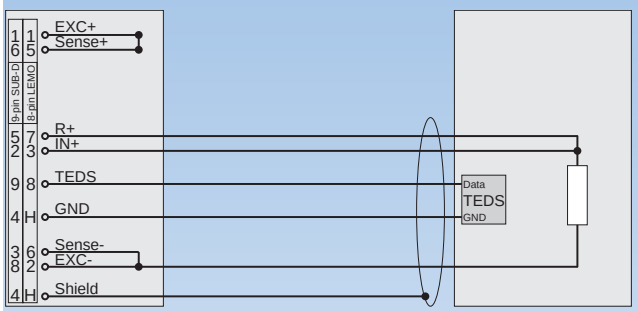
[1] 'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.

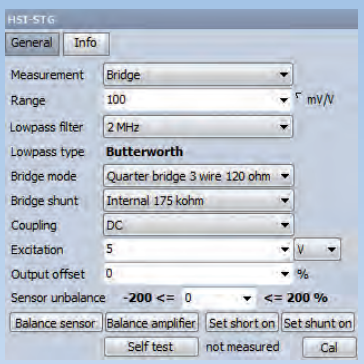
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Quarter bridge signal connection

3-wire sensor connection

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



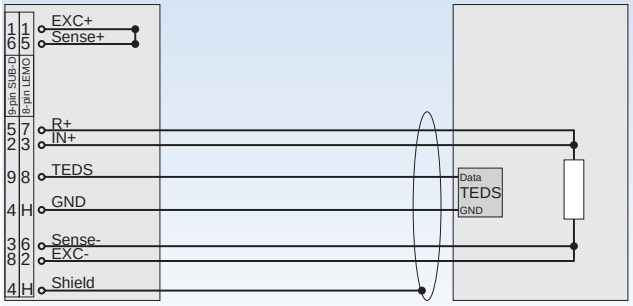


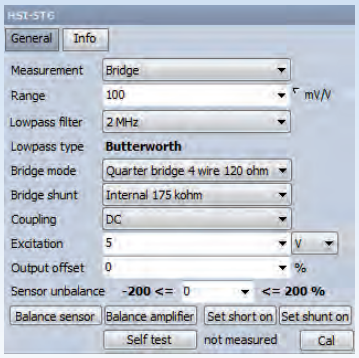
Sense leads (SUB-D: pin 3 and 6) have to be connected!

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

4-wire sensor connection

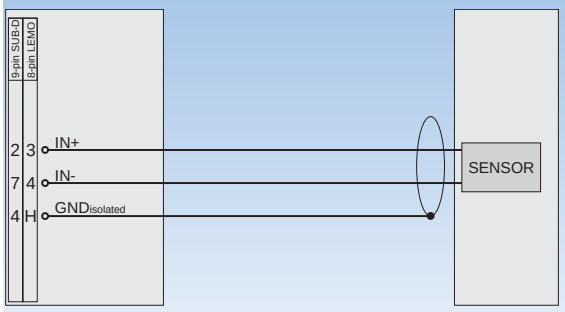
(Sense+ is connected to EXC+ at the sensor)

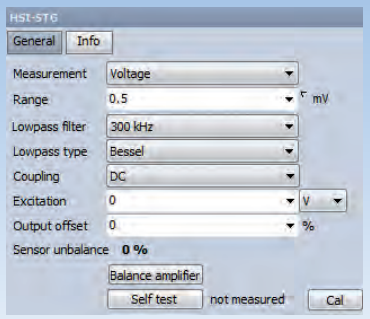




In the quarter bridge 4-wire mode the HSI-STG internally adjusts its excitation in that way, that on the gage the resistor terminals exactly on the half of the excitation voltage. All wire resistances are compensated.

Voltage measurement and µV measurement

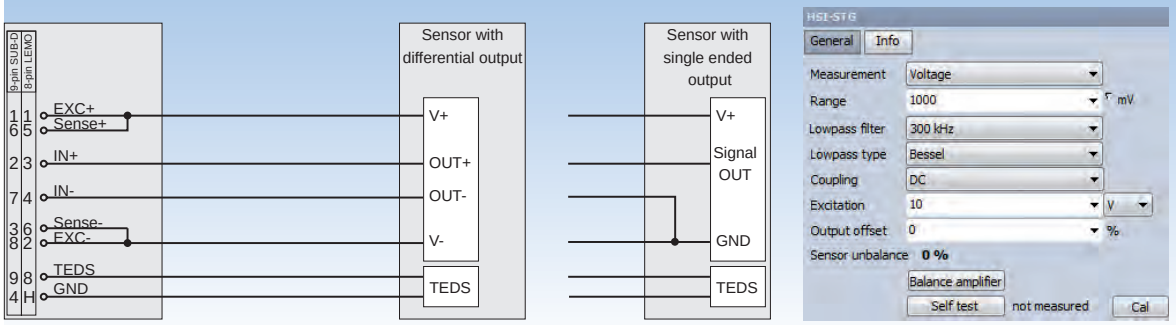




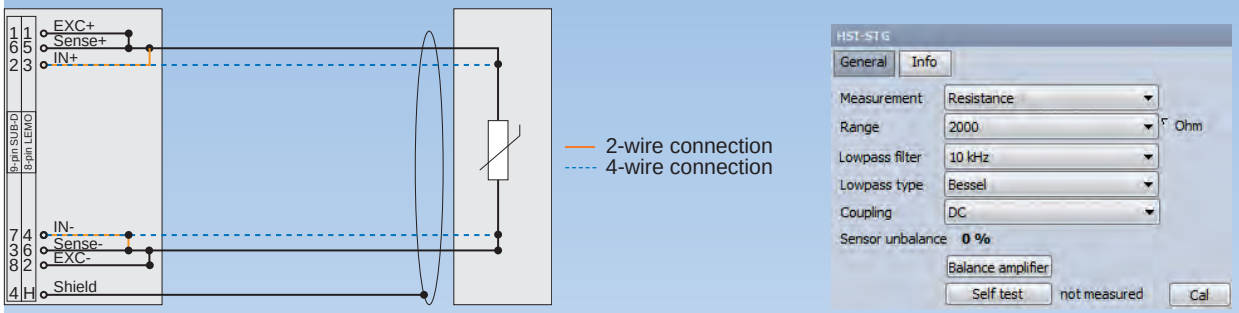
CAUTION: If the excitation is not used for sensor supply it has to be deactivated by setting it to 0 V. This will internally connect the IN- to the $GND_{isolated}$ to improve the common mode rejection.

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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

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Why to use more wire technology

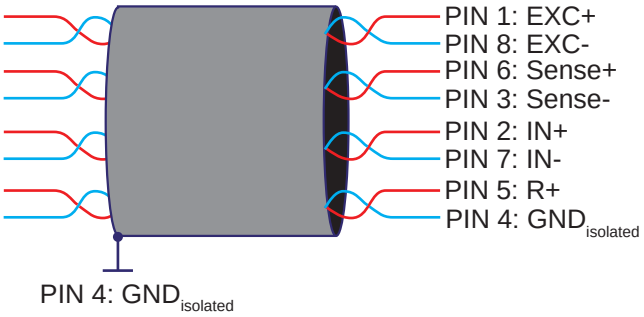
- **Sensitivity:** For sensor wiring typically copper cables are used. For example a 120 Ohm full bridge connected with a 4 x 0.14 mm² cable will have an sensitivity error of 2.1 % just because of the 1.27 Ohm wire resistance. With the 6 wire technology this could be completely compensated.
- **Temperature 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 %

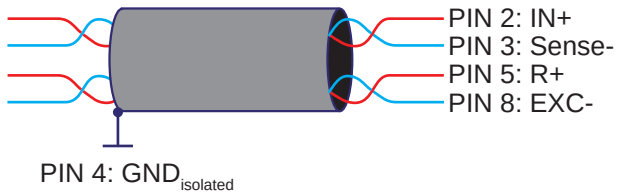
Cables and Shielding

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.

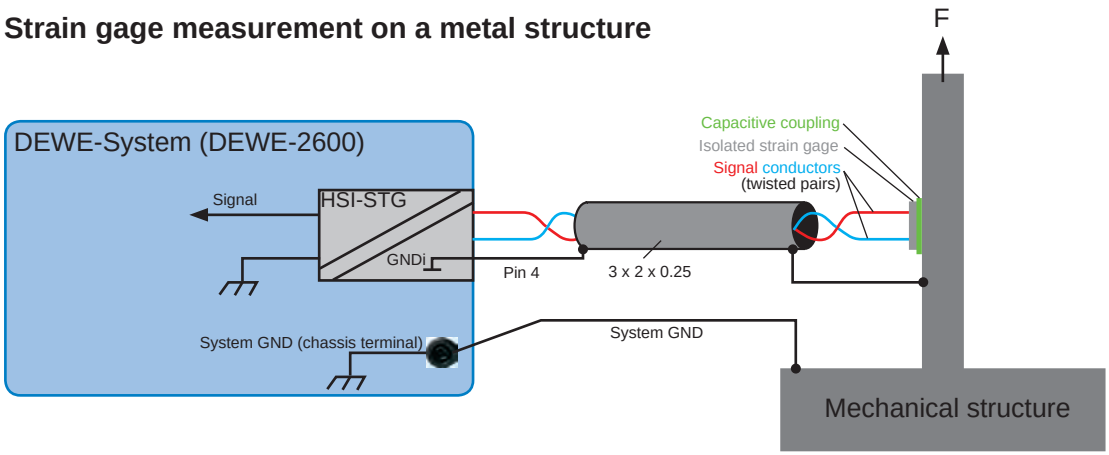
High-speed strain gage measurement (>100 kHz)

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.

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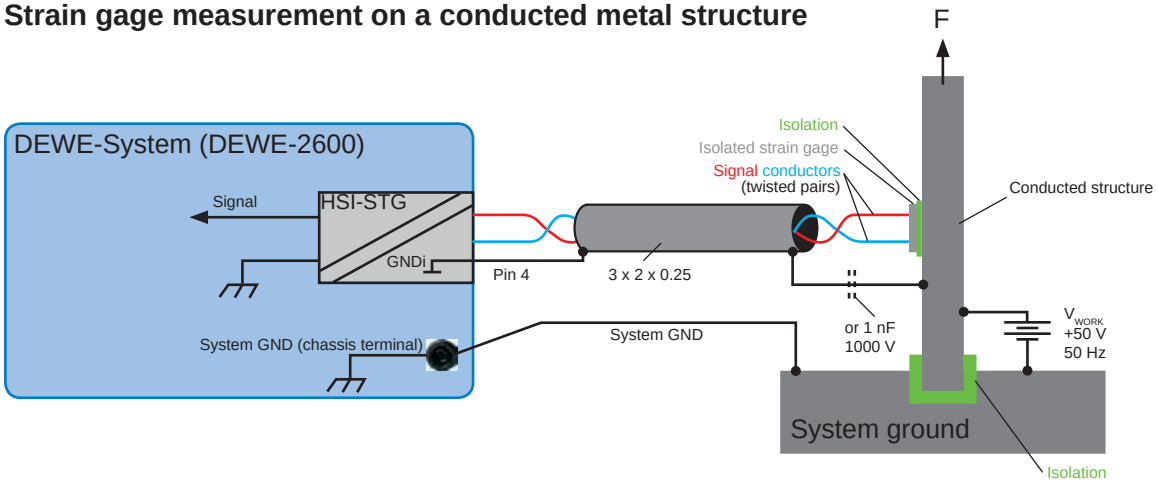
Shielding / Noise reduction

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.

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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

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Isolated strain gage amplifier



- Protection: Fully isolated (input and excitation)
- Input sensitivity: 0.5 mV/V to 1000 mV/V
- Ranges and filter: Button or software selection
- Bridge offset: Automatic bridge offset adjustment (approx. ±200 % of range)
- Bridge completion: Internal completion for ½ and ¼ bridge (120 and 350 Ohm)
- Shunt calibration: Two internal shunts or external shunt calibration possible
- Custom range: Programmable range for sensitivity, excitation and offset
- Signal connection: 9-pin SUB-D or 8-pin LEMO connector

Module specifications

	DAQP-BRIDGE-A
Gain	20 to 1000
Input ranges @ 5 V_{DC} excitation	±5, ±10, ±25, ±50, ±100, ±250 mV ±1, ±2, ±5, ±10, ±20, ±50 mV/V
Range selection	Push button or software
Input impedance	> 100 MOhm
DC accuracy	±0.1 %
Gain linearity	±0.05 %
Excitation voltage Accuracy Drift Protection	0.25, 0.5, 1, 2.5, 5 and 10 V_{DC} software programmable (5 V_{DC} = default setting) 0.05 % ±1 mV typ. 20 ppm (max. 40 ppm) Continuous short to ground
Bridge types	Full bridge ½ bridge with internal completion (software programmable) ¼ bridge with internal resistor for 120 and 350 Ohm (software programmable)
Bridge resistance	120 Ohm to 10 kOhm (down to 87 Ohm on request)
Shunt calibration	Two internal shunt resistors or external resistor for shunt calibration (175k & 59k88)
Zero adjust	Full automatic, ±200 % of F.S. (via push button or software)
Bandwidth (-3 dB)	20 kHz (±1.5 dB @ f0)
Filters (lowpass)	10 Hz, 100 Hz, 1 kHz, 5 kHz, 20 kHz (±1.5 dB @ f0)
Filter selection	Push button or software
Filter characteristics	Bessel or Butterworth (software programmable) 40 dB / decade (12 dB / octave)
Typ. SNR @ max. bandwidth	71 dB @ Gain 1000 79 dB @ Gain 20
Typical CMRR	73 dB @ 0 Hz 71 dB @ 400 Hz 70 dB @ 1 kHz
Overvoltage protection	±10 V_{DC}
Isolation	350 V_{DC} (for input and excitation)
Output voltage	±5 V
Output resistance	< 10 Ohm
Output current	Max. 5 mA
Output protection	Continuous short to ground
RS-485 interface	Yes
TEDS support	No
MSI support	Manually support of MSI-BR-TH-x adapter
Power supply voltage	±9 V_{DC} (±1 %)
Power consumption	Typ. 1.44 W @ 350 Ohm, 1.83 W @ 120 Ohm (both full bridge @ 5 V_{DC} excitation) Max: 3 W (depending on sensor)*

** WARNING: Older DEWE-RACK-16 systems supplies only 18 W!*

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LED state

The DAQP-BRIDGE-A series module has a set of 6 LEDs showing the current input range (constant active) and filter range (flashing) setting. Further functions are described below.

Input range and filter selection

The DAQP-BRIDGE-A series module has two push buttons with multiple functions.

- Range button: Push the ***RANGE*** button several times shortly until the LED displays the desired input range.
- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting.

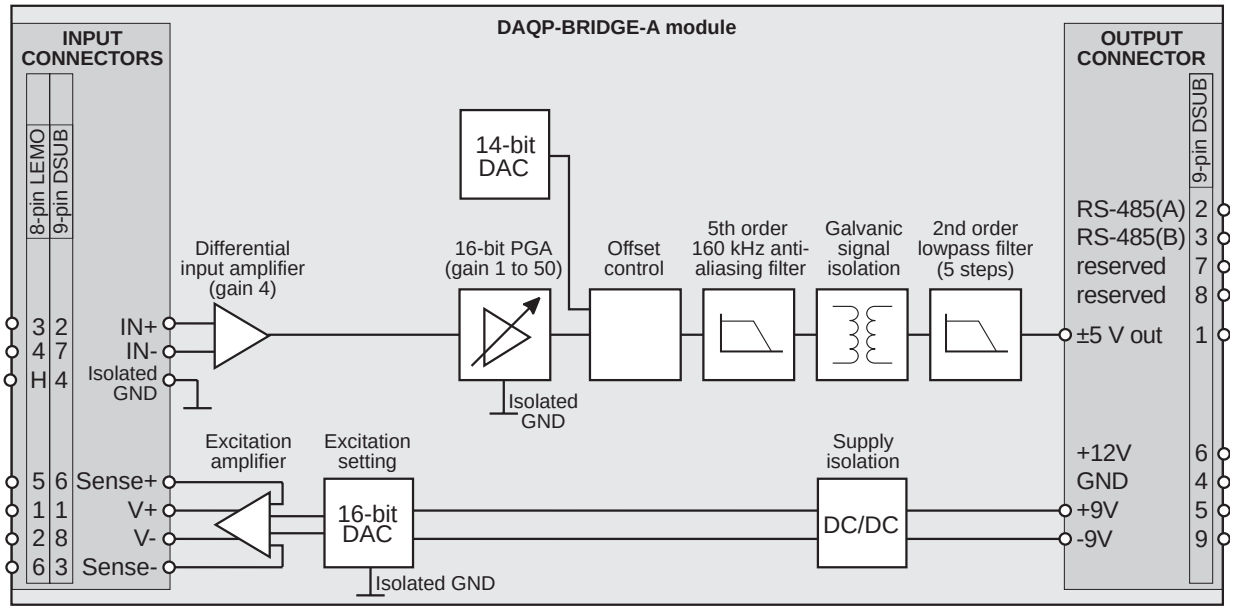
  Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

Both buttons have additional functionallity:

- Apply shunt resistor: Press the ***FILTER*** button for more than 3 seconds to apply the internal shunt resistor as long as you keep the button pressed.
- Zero reference: Press the ***RANGE*** button for more than 3 seconds to shortcut the module input as long as you keep the button pressed.
- Zero amplifier offset: Press the ***RANGE*** button for more than 3 seconds (Zero reference). Keep the ***RANGE*** button pressed and push in addition the ***FILTER*** button. This will set the module offset to zero. The calibration values will be stored in the module! This function is independend from the sensor and takes approx. 15 seconds!
- Zero sensor offset: Press both ***RANGE*** and ***FILTER*** button at together for more than 3 seconds. This will set the offset of a connected sensor to zero. The sensor offset correction is working within ±200 % of full scale range.

Block diagram

Base block diagram of the DAQP-BRIDGE-A module:

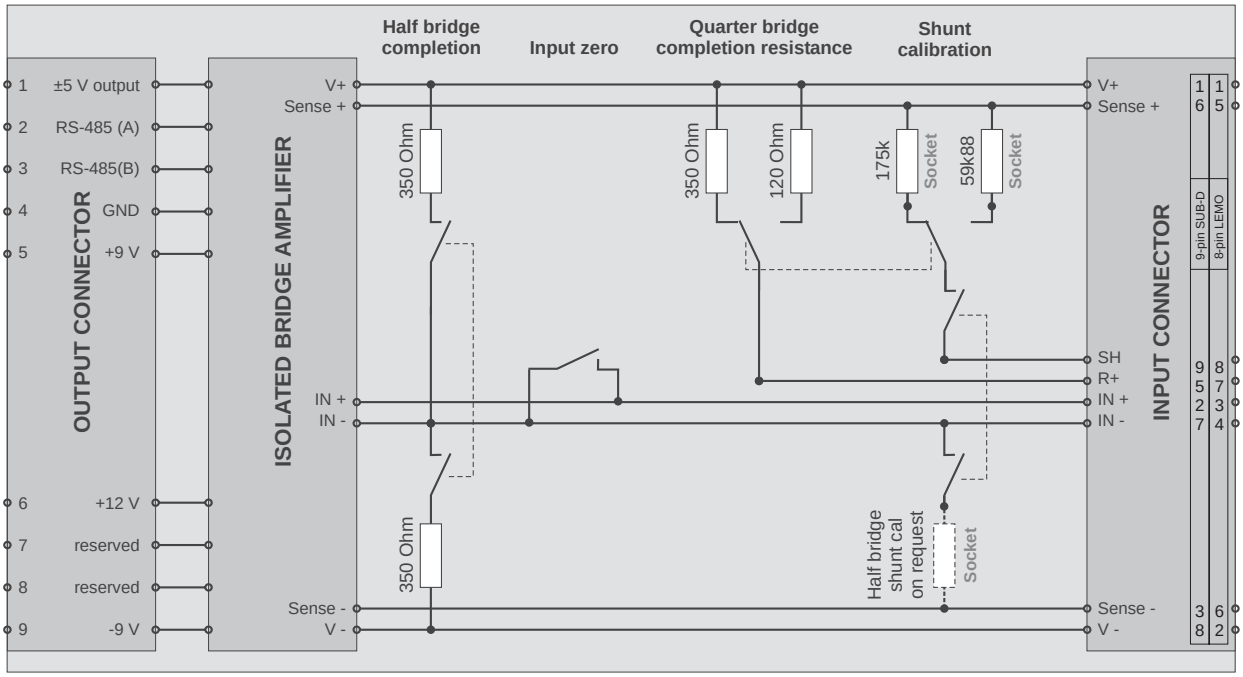


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Amplifier input

The DAQP-BRIDGE-A series module has an internal bridge completion and shunt calibration. The internal schematic diagram below should give an idea how the module operates and make the connection easier.

This schematic and the connection diagrams on the next pages are only valid for DAQP-BRIDGE-A modules revision 2.0 or newer!

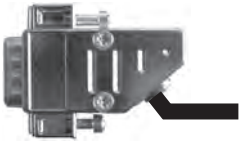


Signal connection

DAQP-BRIDGE-A module



Signal connection via SUB-D connector

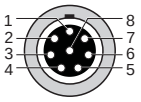


1 V+
2 IN+
3 Sense -
4 Isolated GND
5 R+
6 Sense +
7 IN-
8 V-
9 Shunt

DAQP-BRIDGE-A-LEMO module



Signal connection via LEMO connector



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



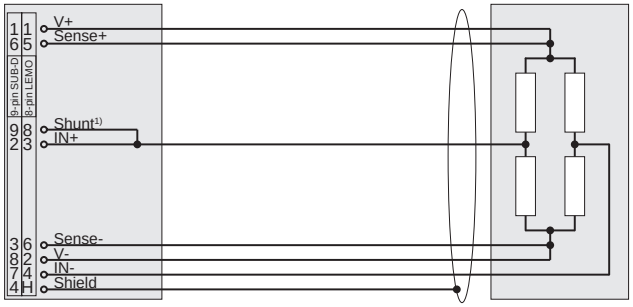
1 V+
2 V-
3 IN+
4 IN-
5 Sense +
6 Sense -
7 R+
8 Shunt
Housing Isolated GND

CAUTION: The sensor shield can be connected to either pin 4 (SUB-D version only) or the housing of the 9-pin SUB-D / 8-pin LEMO connector, depending on your application.

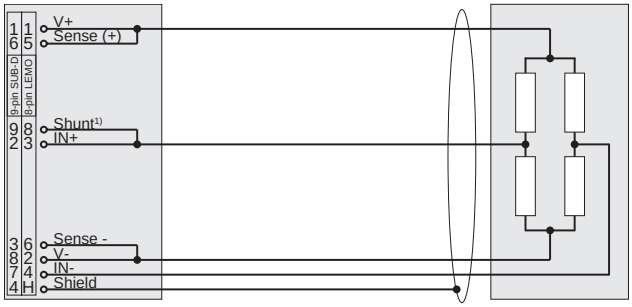
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Full bridge signal connection

6-wire sensor connection



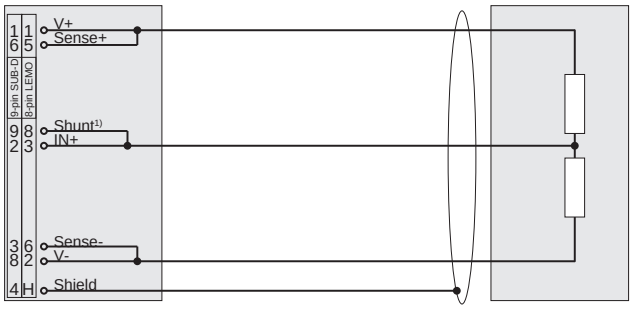
4-wire sensor connection



Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) have to be connected!

Half bridge signal connection

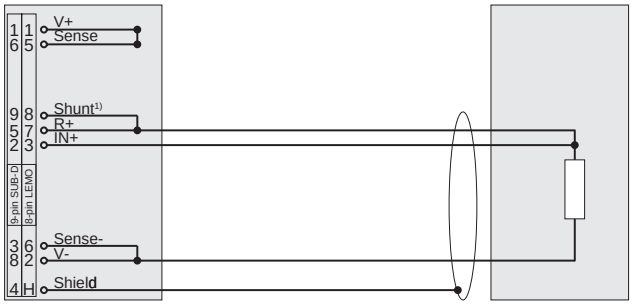
3-wire sensor connection



Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) have to be connected!

Quarter bridge signal connection

3-wire sensor connection



Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) have to be connected!

1) 'Shunt' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.

Potentiometric and µV measurements

For potentiometric and µV measurements with bridge amplifiers please refer to DAQP-BRIDGE-B description.

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Potentiometric measurements

using DAQP-BRIDGE-A and DAQP-BRIDGE-B modules

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.

The advantages of using bridge amplifiers for potentiometric measurements: only one multifunctional module with high bandwidth and a programmable offset (by adjusting the offset and range, you can focus on a certain potentiometer position with higher resolution).

Module configuration

DAQP-BRIDGE-A:	Excitation:	0.5 V
	Range:	500 mV/V
DAQP-BRIDGE-B:	Excitation:	1 V
	Range:	500 mV/V

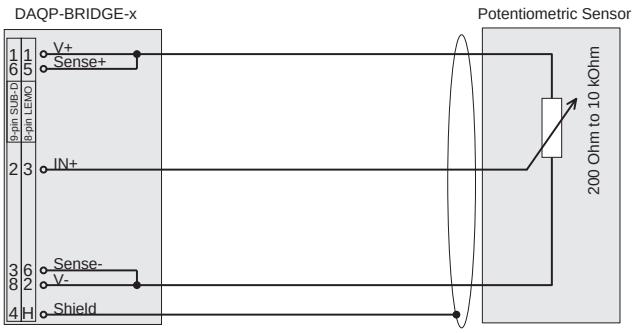
Always change the excitation voltage before changing the input range, otherwise you will not get the required 500 mV/V range.

The following table shows how the mV/V ranges are calculated. The ranges depend on the gain and the excitation voltage.

Excitation	0,25 V	0,50 V	1,00 V	2,50 V	5,00 V	10,00 V
Input Range	**Bridge module range [mV/V]**					
±500 mV	2000	1000	500	200	100	50
±250 mV	1000	500	250	100	50	25
±100 mV	400	200	100	40	20	10
±50 mV	200	100	50	20	10	5
±25 mV	100	50	25	10	5	2,5
±10 mV	40	20	10	4	2	1
±5 mV	20	10	5	2	1	0,5
±2.5 mV	10	5	2,5	1	0,5	0,25
±1 mV	4	2	1	0,4	0,2	0,1
±500 µV	2	1	0,5	0,2	0,1	0,05

(, = decimal point)

Sensor connection



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µV measurements

using DAQP-BRIDGE-B modules

The differential amplifier of the DAQP-BRIDGE-B module is designed to measure small voltages (with very low offset drift and high amplification). These are exactly the same requirements than for µV amplifiers.

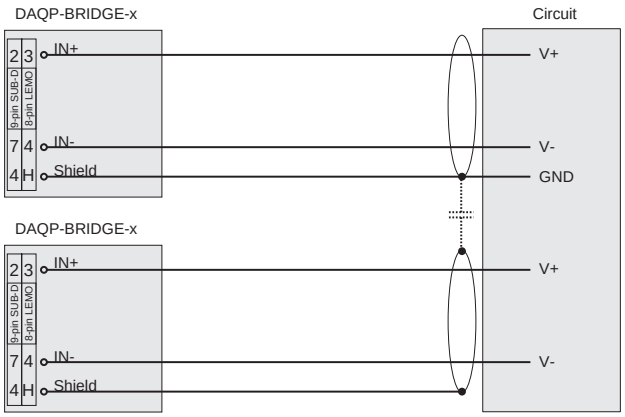
By setting the bridge input type to *Voltage* you can select input ranges from ±0.5 mV to ±500 mV.

The advantages of using bridge amplifiers for µV measurements: only one multifunctional module with high bandwidth, a lot of input and filter ranges and a programmable offset (Auto Zero).

Module configuration

DAQP-BRIDGE-B:	Input type:	Voltage
	Ranges:	±0.5 to 500 mV

Signal connection



For multi module measurement, the GND of one module should be connected to circuit GND, the other module GND connector(s) should be connected with 10 nF capacity for best results (high and low frequency shielding and sensing), but can be left open also.

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Carrier frequency amplifier



- Sensors: Strain gage, inductive full and half bridge, LVDT
- Input sensitivity: 0.1 mV/V to 1000 mV/V
- Bandwidth, filter: 2.3 kHz, 5 selectable lowpass filters (10 Hz to 1000 Hz)
- Bridge offset: Automatic balancing up to 400% of range
- Bridge completion: Internal completion for ½ and ¼ bridge (120 and 350 Ohm)
- Shunt calibration: Two internal shunts or external shunt calibration possible
- Gain linearity: 0.02 %

Module specifications

	DAQP-CFB
Input ranges	0.1 mV/V to 1000 mV/V
Inductive input ranges	5 mV/V to 1000 mV/V (inductive range is limited from 20 mV_{RMS} to 1000 mV_{RMS} input voltage)
Input voltage ranges	0.2 mV_{RMS} to 1000 mV_{RMS}
Bridge resistance	60 - 1,000 Ohm depending on excitation voltage
Excitation voltage level	1, 2, 5 V_{RMS}
Excitation voltage frequency	5 kHz sine wave ±20 Hz
Maximum excitation current	30 mA_{RMS} short circuit protected
Excitation voltage synchronisation	Internal or external
Excitation voltage accuracy	5 V_{RMS} ±5 mV_{RMS}; 2 V_{RMS} ±2.5 mV_{RMS}; 1 V_{RMS} ±2.5 mV_{RMS}
Excitation voltage drift	typically 50 ppm/°K
Excitation frequency drift	typically 20 ppm/°K
Nonlinearity	±0.02 % FS
Accuracy	±0.2 % of reading ±0.1 % of range
Offset drift	±0.003 µV/V/K ±40 ppm of Range/°K
Gain drift	within ±30 ppm/°K
Balance adjusting range	±400 % of Range (±200 % at 1 V excitation)
Capacitive imbalance compensation	approx. 1000 pF
Phase adjustment range	±40° (inductive mode only)
Balance adjusting accuracy	within ±0.1 % FS
Supported sensors	full bridge half bridge quarter bridge 120 Ohm quarter bridge 350 Ohm inductive full bridge inductive half bridge (typically LVTD Sensors)
Shunt calibration	internal 50 kOhm and 100 kOhm Shunt
Completion and shunt resistor accuracy	±0.05 %
-3 dB Bandwidth	DC - 2.3 kHz
Filters (lowpass)	10, 30, 100, 300, 1 kHz
Filter characteristics	2nd order Bessel, 2nd order Butterworth (40 dB/ decade)
Typ. SNR @ 1000 Hz [100 Hz] and 2 V_{RMS} excitation	78 dB [85 dB] @ 1 mV/V 80 dB [87 dB] @ 100 mV/V
Over voltage protection	±10 V
Output voltage	±5 V
Out current	±5 mA
Output protection	continuous short to ground
Power consumption	max. 1.5 W
Supported TEDS chips*	DS2406, DS2430, DS2432, DS2433, DS2431
Weight	within 250 (±30) g

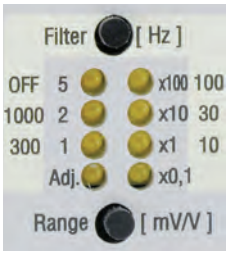
*) TEDS support only with revision 2.0 or higher

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Front panel control

LED indication:

Filter	Range		Range	Filter
OFF	5mV/V		x100	100Hz
1000Hz	2mV/V		x10	30Hz
300Hz	1mV/V		x1	10Hz
	Cust.		x0.1	



The DAQP-CFB series module has a set of 8 LEDs showing the current input range (constant active) and filter range (flashing) setting. Further functions are described below.

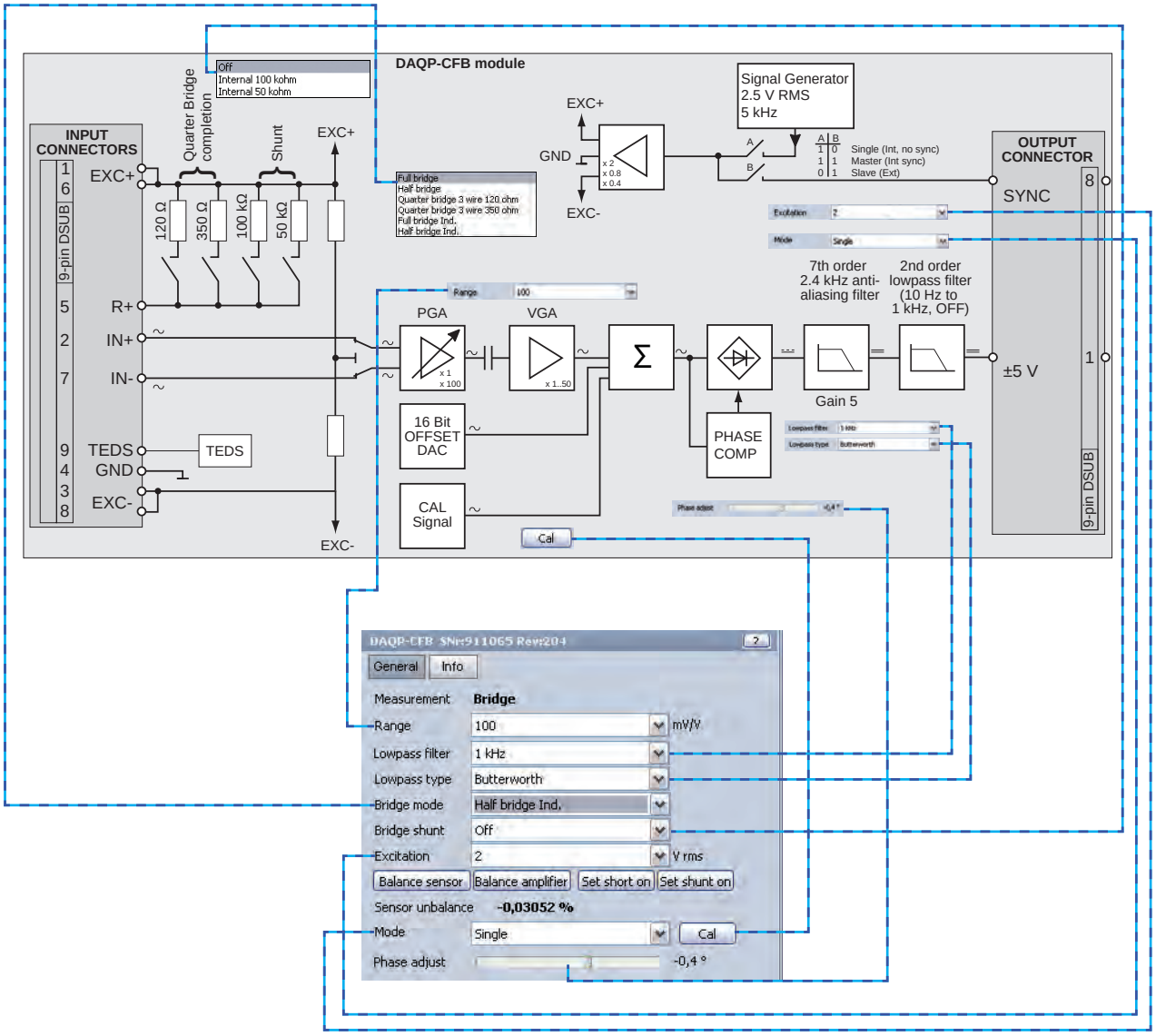
Push button operation:

- Select range : Push the ***RANGE*** button several times shortly until the LED displays the desired input range.
- Select Filter: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting. Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.
- Apply shunt: Press the ***FILTER*** button for more than 3 seconds to apply the internal shunt resistor as long as you keep the button pressed.
- Apply Zero ref.: Press the ***RANGE*** button for more than 3 seconds to shortcurcuit the module input as long as you keep the button pressed.
- Amplifier ballance: Press the ***RANGE*** button for more than 3 seconds (Zero reference). Keep the ***RANGE*** button pressed and push in addition the ***FILTER*** button. This will set the module offset to zero. The calibration values will be stored in the module! This function is independent from the sensor and takes approx. 2 seconds!
- Sensor ballance: Press both ***RANGE*** and ***FILTER*** button at together for more than 2 seconds. This will set the offset of a connected sensor to zero. The sensor offset correction is working within ±400 % of full scale range.
- Factory default: Press both ***RANGE*** and ***FILTER*** button at power up for approx. 3 seconds to set the amplifier to factory default settings (full bridge, 100 mV/V, 5 VDC, Bessel, module address 0x00, 100 kOhm shunt, power-on-default off, man. control).

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Blockdiagram

The blockdiagram below shows the basic function of the DAQP-CFB and the setup window for the amplifier configuration. The programmable gain amplifier (PGA) combined with the variable gain amplifier (VGA) allows the wide input gain selection from 0.1 mV/V to 1000 mV/V. Due the switch at the input and the possibility to connect a 120R and 350R resistor to pin R+, this signal conditioning module supports several modes from full bridge over quarter bridge but also inductive sensor support.



Before the amplified signal is demodulated, the free programmable offset DAC allows to balance automatically the amplifier but also the sensor offset. The sensor offset adjustment range for 1Vrms excitation is ±200 %, for 2 and 5 Vrms ±400% of the actual measurement range. Beside this three different excitation voltage levels, the excitation mode allows to output the excitation level from one amplifier over the module backplane. An additionally installed DAQP-CFB can receive this signal for synchronized operation.

Amplifier balance

The amplifier balance allows to eliminate automatically the amplifier offset. In that operation the input is shorted and all ranges are balanced by the module. Automatically previous stored sensor offset values are cleared.

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Sensor balance

The sensor balance is similar to the amplifier balance. Because the input is not shorted the sensor offset is automatically adjusted to zero.

Short

For measuring the absolute strain it is possible to “disconnect” the sensor by software and short the input.

Shunt

Two different internal shunts resistors (50kΩ and 100kΩ) can be connected for easy function or calibration check. With this technique the whole measurement chain (sensor, amplifier and analog to digital conversation) can be checked. The table below shows the shunt calibration result for typical strain gage resistor values.

Strain gage Resistor	Shunt resistor	Result
120Ω	50k□	0.6 mV/V
120Ω	100k□	0.3 mV/V
350Ω	50k	1.74 mV/V
350Ω	100k□	0.87 mV/V

The shunt resistor check is not possible in inductive bridge operation mode.

Cal

Independent of the value of the input signal this function set the output to 80% of the actual range. The base of this calibration signal is the excitation voltage. Therefore this is an easy check of the excitation voltage. Typical reason why the excitation is not working are short curcuit of the excitation at the cabling or sensor defects, too high load for the excitation amplifier (please decrease the excitation level) or wrong settings of the synchronisation mode (no master assigned).

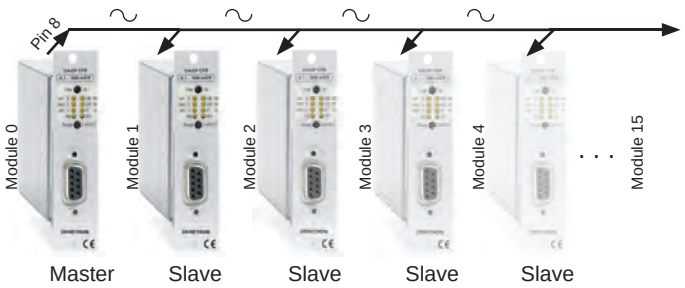
Synchronizing multiple amplifiers

Due the high amplification of strain gage amplifiers it is needed to synchronize the excitation voltage if multiple channels are used. This is done with Pin 8 of the back plane connector.

The DAQP-CFB offers three possibilities of synchronisation settings:

- Single: DAQP-CFB uses internal oscillator and outputs no synchronisation signal.
- Master: DAQP-CFB uses internal oscillator and serves synchronisation signal.
- Slave: DAQP-CFB generates the excitation voltage from the synchronisation signal.

Sync of up to 16 channels:



Sync of more than 16 channels:

For more than 16 channels, an additional SYNC-Signal amplifier is required.
One master module can only drive 15 slaves.

The synchronisation of the carrier frequency is required when:

- Sensor cables of different CFBs are nearby
- Sensors are mounted on the same metal structure (capacitive signal coupling)

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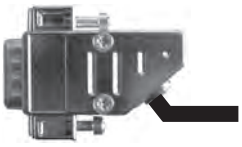
No synchronisation required when:

- Isolated sensors are on non-conductive structures
- For ranges above 100 mV/V because of the low amplification and therefore less influence of cross talking over the cables.

In some special DEWETRON racks Pin 8 is already in use for customized sensor supply voltage level. If so, only single mode operation is possible!

Signal connection





1 EXC +
2 IN +
3 EXC -
4 GND
5 R +
6 EXC +
7 IN -
8 EXC -
9 TEDS*

Pin 6 and 8 can be left unconnected

Inductive bridge operation

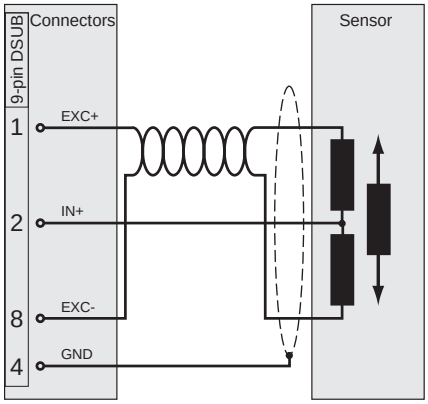
Especially LVDT sensor may have phase shift between supply voltage and output signal. This will cause a gain error with the factor of the cosine of phase shift. Therefore the phase shift between demodulator and excitation needs to be adjusted.

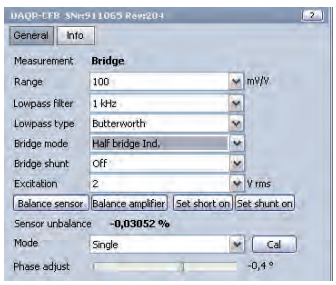
How to adjust the phase level:

- Connect the sensor to the DAQP-CFB module
- The sensor output voltage should be at least 20% of the full scale value
- Press the left/right arrow button until you get the maximum output voltage (can be easy checked with checking the data shown below the amplifier configuration setup). 

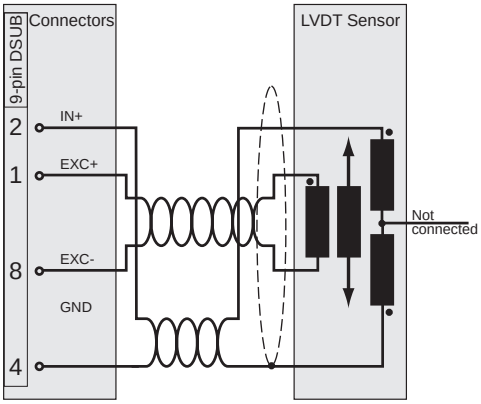
This adjustment is needed for getting the correct amplifier sensitivity and linearity values.

Inductive half bridge sensors





LVDT sensors

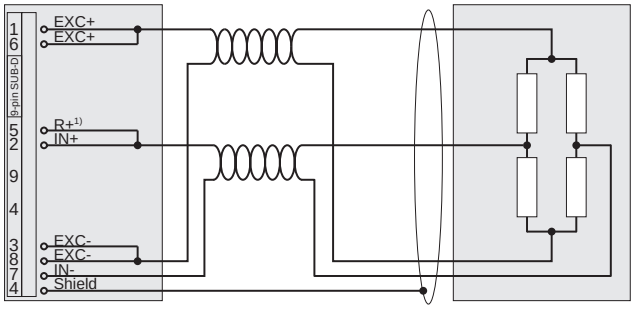


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Full bridge signal connection

4-wire sensor connection for standard bridge & inductive bridge

(Sense wired at the connector)

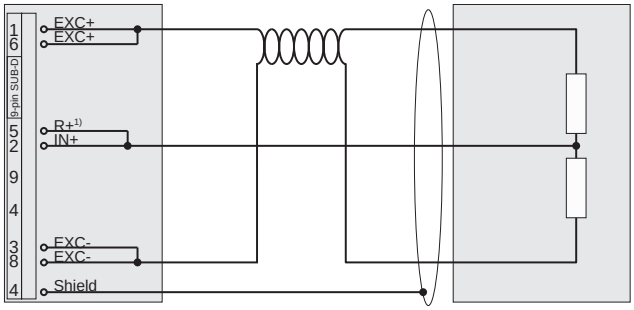


Sense leads (SUB-D: pin 3 and 6) could be connected to be compatible to other modules.

Half bridge signal connection

3-wire sensor connection for standard bridge

(Sense wired at the sensor)

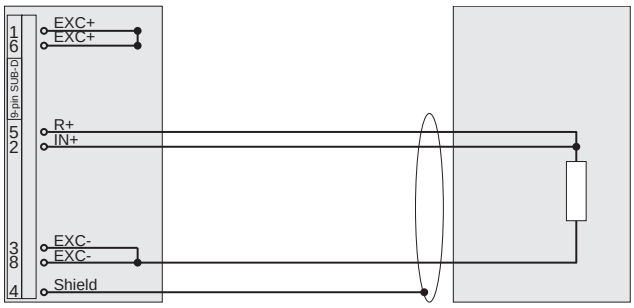


Sense leads (SUB-D: pin 3 and 6) could be connected to be compatible to other modules.

Quarter bridge signal connection

3-wire sensor connection

(Sense wired at the connector)



Sense leads (SUB-D: pin 3 and 6) could be connected to be compatible to other DEWE-BRIDGE amplifier.

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

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High dynamic signal amplifier

- Supported sensors: IEPE® sensors
- Input sensitivity: ±5 V, ±1.66 V, ±500 mV, ±166 mV, ±50 mV (Gain 1, 3, 10, 30 and 100), push button or software selection
- Bandwidth: 300 kHz
- Sensor connection: BNC connector



Module specifications

	DAQP-ACC-A
Ranges	±5 V, ±1.66 V, ±500 mV, ±166 mV, ±50 mV
Gain	1, 3, 10, 30, 100
Range / gain selection	Push button or software
Gain error	0.5 %
Sensor types	IEPE® sensors only
Sensor excitation	4 or 8 mA (software selection), 10 %, up to 28 V_{DC}
Input impedance	5 or 7 MOhm (depending on time constant), in parallel with 1.2 nF
Input voltage range Voltage < 4 V Voltage > 19 V	4 to 19 V ‚Shortcut' detection ‚No sensor' detection
Input protection IN+ IN- (shield)	 max. -10 to 28 V max. 20 mA
Bandwidth (-3 dB)	From selected highpass filter to 300 kHz (+2 to -5 dB @ fg)
Filters (highpass) 0.5 Hz filter 5 Hz filter	0.5 Hz and 5 Hz (software selection) 0.32 s time constant 0.032 s time constant
Filters (lowpass)	1 kHz, 10 kHz, 100 kHz, 300 kHz other filter steps available as an option on request
Filter selection	Push button or software
Filter characteristics up to 100 kHz 300 kHz	Butterworth 100 dB / decade (30 dB / octave) 80 dB / decade (24 dB / octave)
Typ. SNR @ max. bandwidth Gain 1 and 3 Gain 10 Gain 30 Gain 100	 94 dB 91 dB 80 dB 73 dB
Output voltage	±5 V
Output resistance	< 10 Ohm
Output current	Max. 5 mA
Output protection	Continuous short to ground
RS-485 interface	Yes
Power supply voltage	±9 V_{DC} (±10 %)
Power consumption	Typical 0.8 to 1.0 W (depending on sensor)

LED state

The DAQP-ACC-A series module has a set of 6 LEDs showing the current input range (constant active) and filter range (flashing) setting. The ERR LED will displays shortcut and no sensor connected.

IEPE® is a trademark of PCB Piezotronics, Inc.

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Input gain and filter selection

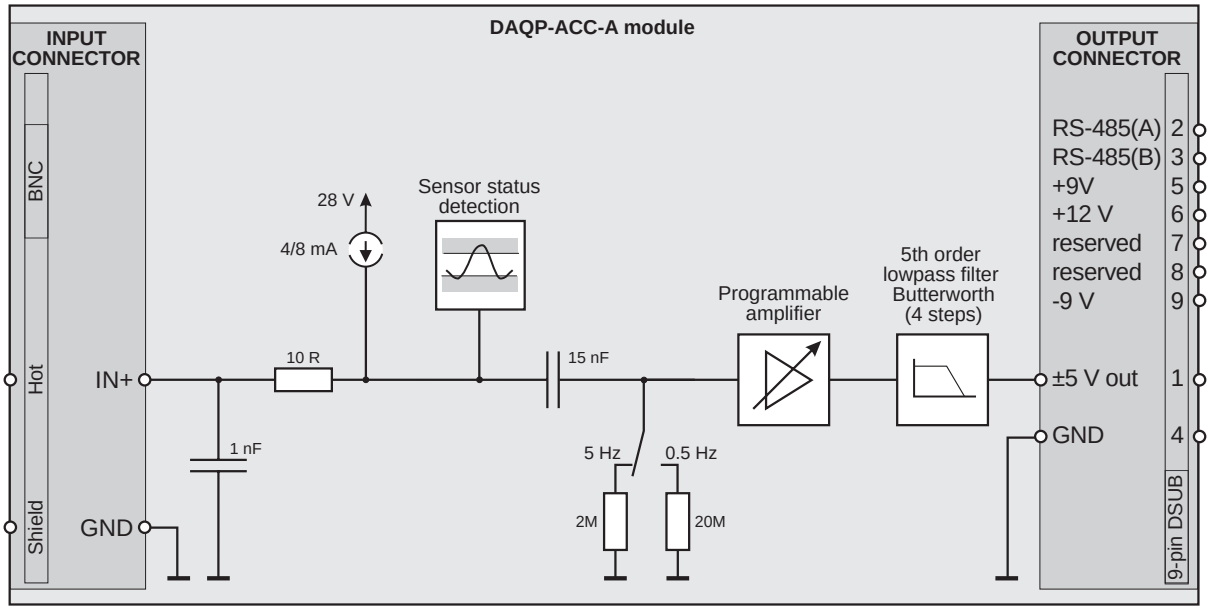
The DAQP-ACC-A series module has two push buttons.

- Gain button: Push the ***GAIN*** button several times until the LED displays the desired input range.
- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current filter setting.

  Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

Block diagram

The base block diagram of the DAQP-ACC-A gives an idea of the internal structure.



Sensor connection

IEPE® sensor connection



Connect IEPE® sensor to BNC connector





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Dynamic signal amplifier

- Supported sensors: IEPE® and charge sensors (selection via push button)
- Input sensitivity: Push button or software selection
  - IEPE® input: 0, 20, 40 and 60 dB (±5 V, ±500 mV, ±50 mV, ±5 mV)
  - Charge input: 5, 50, 500, 5000 and 50000 pC
- Output: Acceleration, velocity and displacement
- Sensor connection: BNC connector



Module specifications

	DAQP-CHARGE-A
Supported sensors	IEPE® and charge sensors
Sensor type selection	Push button or software
Input ranges IEPE® input Charge input	 0, 20, 40, 60 dB (±5 V, ±500 mV, ±50 mV, ±5 mV) 5, 50, 500, 5000, 50000 pC
Gain accuracy	1 % F.S.
Input range finetuning	programmable
Range selection	Push button (fixed) or software (all)
Integration	Single (velocity) or double (displacement), 0 dB at 15.9 Hz
LED indicators Range and filter ICP LED OVL LED A, V and D LED	 5 LEDs Active with connected IEPE® sensor, inactive for charge input Overload control (output voltage > 5 V) Indicator for acceleration, velocity and displacement output
Constant current source	3.2 to 5.6 mA, > 24 V
Filters (highpass)	0.1 Hz, 1 Hz, 10 Hz (±2 dB @ f0)
Filters (lowpass)	100 Hz, 1, 3, 10, 50 kHz (±2 dB @ f0)
Filter selection	Push button or software
Filter characteristics	Butterworth 80 dB / decade (24 dB / octave)
Bandwidth (-3 dB)	0.1 Hz to 50 kHz (±2 dB @ f0)
Typ. SNR @ max. bandwidth 5000 pC 500 pC 50 PC 5 pC 5 pC	 90 dB 87 dB 73 dB 54 dB 60 dB @ 10 kHz
Output voltage	±5 V (±6 V peak voltage)
Output noise	< 8 mV (all ranges with 50 kHz filter)
RS-485 interface	Yes
Power supply voltage	±9 V_{DC} (±10 %)
Power consumption	0.6 W to 1.2 W (depending on sensor)*

*) **CAUTION:** The following systems only support 10 DAQP-CHARGE-A modules at once, due to high start-up current.
DEWE-2010 series, DEWE-2500 series, DEWE-5000 series, DEWE-30-16 with DC option, DEWE-50-USB2 with DC option

LED state

The DAQP-CHARGE-A series module has a set of 6 LEDs showing the current input range (constant active), the filter range (flashing) and the input overload (OVL). Another 4 LEDs display the current output state acceleration, velocity or displacement output and the input type (IEPE® or charge) and the highpass filter setting.

IEPE® is a trademark of PCB Piezotronics, Inc.

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Input range and filter selection

The DAQP-CHARGE-A series module has three push buttons with multiple functions.

- Range button: Push the ***RANGE*** button several times shortly until the LED displays the desired input range.
- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current lowpass filter setting.

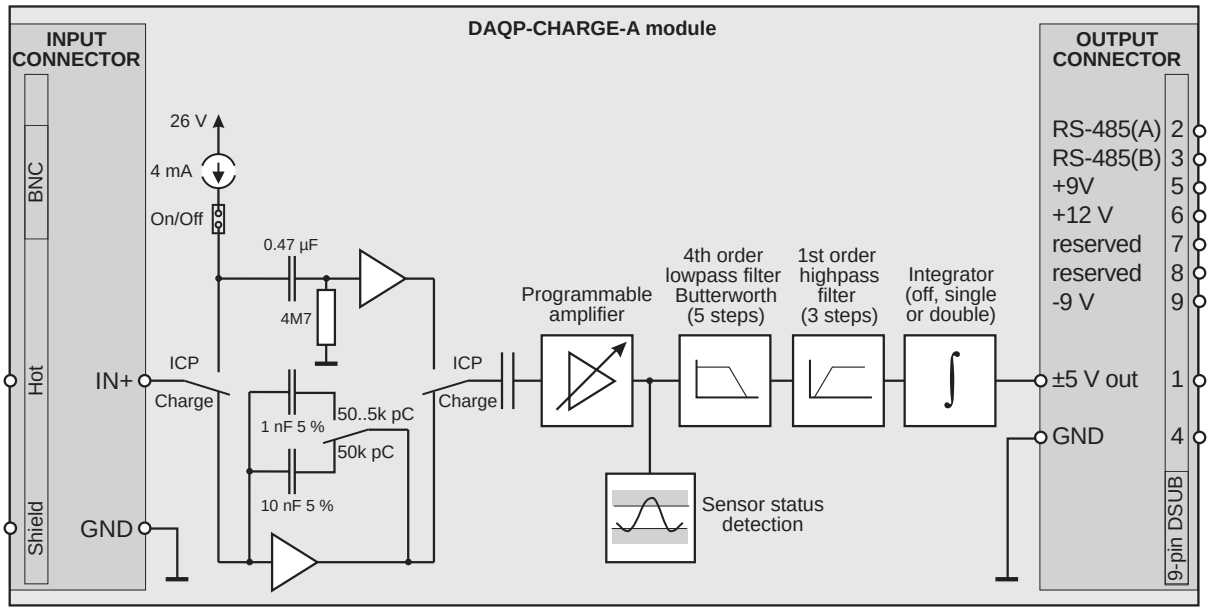
  Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.
- Shift button: Press the ***SHIFT*** button for more than 5 seconds to change between IEPE® and charge input. If IEPE® input is selected, the **C/I** LED is active after sensor connection. If charge input is selected, the **C/I** LED is inactive.

The buttons have additional functionallity:

- Output type: Press the ***SHIFT*** button, keep it pressed and push the ***RANGE*** button to change between acceleration, velocity and displacement. The current state is displayed by the LEDs **A**(cceleration), **V**(elocity) and **D**(isplacement).
- Output filter: Press the ***SHIFT*** button, keep it pressed and push the ***FILTER*** button to change the highpass filter. The highpass filter state is displayed by the 4 LEDs.

Block diagram

The base block diagram of the DAQP-CHARGE-A gives an idea of the internal structure.



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Sensor connection

IEPE® or charge sensor connection



Press ***SHIFT*** button for more than 5 seconds to select IEPE® input (C/I LED is active after sensor connection) or charge input (C/I LED is inactive).





BNC to Microdot adapter



One adapter is included in the shipment
as standard for each DAQP-CHARGE-A module.

CAUTION

- *Using an IEPE® sensor with charge input selected (or a Charge sensor with IEPE® input selected) will not destroy the module or the sensor, but the measured values will be incorrect.*
- *When using the fine tuning option of the input range (3686 steps per decade), the module is no longer in a calibrated state. In this case the input range LED's are not active!*

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Dynamic signal amplifier



- Input protection: Isolated input (1 kV ESD)
- Input sensitivity: 8 ranges from 100 pC to 1 000 000 pC
- Dynamic: Up to 93 dB
- Charge drift: < 0.03 pC/sec
- Bandwidth, filter: 100 kHz, 9 selectable low pass filters (10 Hz to 100 kHz)
- Custom range: Completely free programmable sensitivity and offset

Module specifications

	DAQP-CHARGE-B	
Input ranges	±100, ±500, ±2 000, ±10 000, ±40 000, ±200 000, ±1 000 000 pC	
Range selection	Push button or software	
Gain accuracy	0.5 % of range (1 % of range for 100 and 500 pC)	
Gain linearity	±0.05 %	
Bandwidth (-3 dB)	100 kHz (±1.5 dB @ f0)	
Filters (lowpass)	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz (±2 dB @ f0)	
Filter selection	Push button or software	
Filter characteristics	Bessel or Butterworth (software programmable) 40 dB / decade (12 dB / octave)	
Coupling	AC or DC software selectable	
Time constant / Highpass filter 100 pC to 2000 pC 2001 pC to 40000 pC 40001 pC to 200 kpC	AC coupled 2 sec / 0.7 Hz 40 sec / 3.9 mHz 1000 sec / 0.16 mHz	DC coupled @ 25°C; max. 60 % relative humidity >20000 sec >50000 sec >70000 sec
Drift input current @ 25 °C	< ±0.03 pC/s	
Offset drift	50 ppm of Range/°K	
Amplifier reset	Push button or software	
Offset after reset	±2 mV or ±1 pC (greater value is valid)	
Typ. SNR @ max. bandwidth Range 100 pC Range > 2000 pC	 76 dB (82 dB @ 30 kHz / 85 dB @ 10 kHz) 81 dB (89 dB @ 30 kHz / 93 dB @ 10 kHz)	
Ouput noise @ 100 kHz @ 30 kHz	 0.3 mV_{RMS} + 0.01 pC_{RMS} 0.12 mV_{RMS} + 0.008 pC_{RMS}	
Cable noise	< 10^{-5} pC_{RMS}/pF	
CMR	< 0.02 pC/V (difference between input and output ground)	
Isolation	350 V_{DC}	
Input overvoltage protection	1 kV ESD	
Output voltage	±5 V	
RS-485 interface	Yes	
Power supply voltage	±9 V_{DC} (±1 %)	
Power consumption	1.5 W to 3.5 W (depending on signal range and frequency)	

LED state

The DAQP-CHARGE-B series module has a set of 7 LEDs showing the current input range (constant active), the filter range (flashing). A selected custom range is displayed with constant lightening of the highest both range LEDs. The LED labeled with HP displays the state of the high pass filter: if the LED is active, the high pass filter is used, if the LED is flashing, the module is in reset mode.

Due to the large number of low pass filters, two LEDs are used to display the current frequency. The left LED indicates the multiplier, the right one shows the exponent with the base of 10. Example: for the 10 kHz frequency, the LED 1 and 4 are flashing (1x 10^4 Hz = 10 000 Hz).

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Input range and filter selection

The DAQP-CHARGE-B series module has two push buttons with multiple functions.

- Range button:

  Push the ***RANGE*** button several times shortly until the LED displays the desired input range. If a special custom range is defined in the module, it can be selected before the highest range (1x 10^6 pC = 1 000 000 pC) is activated.

  Pressing the ***RANGE*** button for more than one second will activate the reset function.

- Filter button:

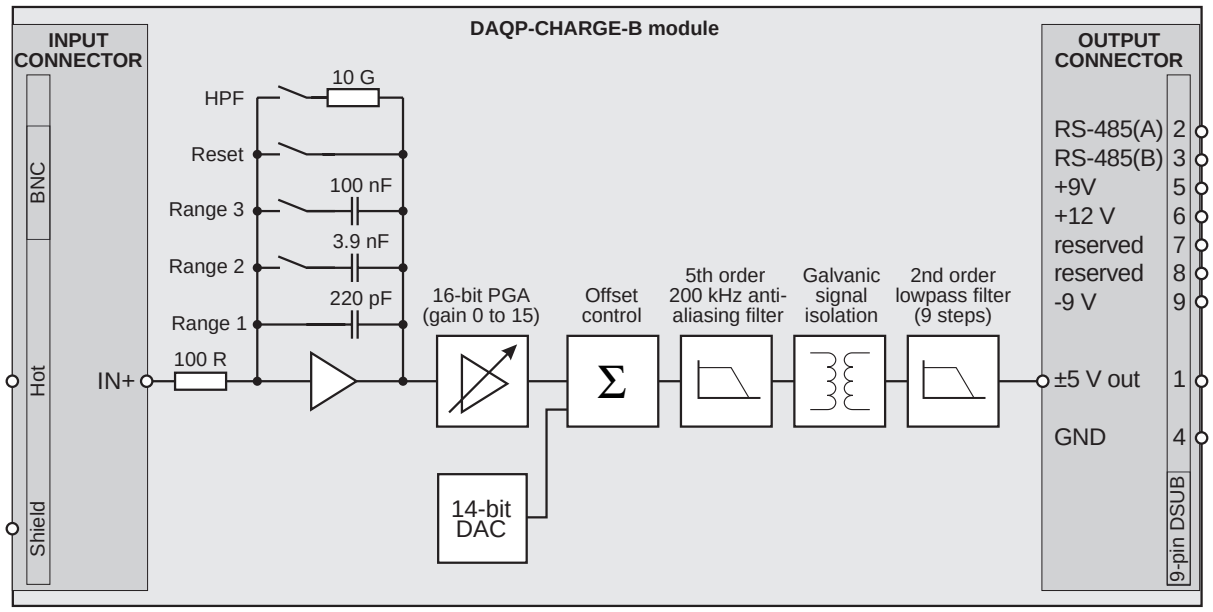
  Push the ***FILTER*** button once - the LEDs will flash for approx. 3 seconds and display the current lowpass filter setting.

  Push the ***FILTER*** button within the three seconds several times until the flashing LED displays the desired filter range.

  Pressing the ***FILTER*** button for more than one second will activate the highpass filter.

Block diagram

Base block diagram of the DAQP-CHARGE-B module:



High pass filter

As shown in the schematic of the DAQP-CHARGE-B the time constant of the internal highpass filter depends on the used input range. For Range 1 (100 pC, 500 pC and 2 000 pC) the time constant is 2 seconds (or 0.07 Hz), for Range 2 (10 000 pC and 40 000 pC) the time constant is 40 seconds (or 3.9 mHz). For the highest both ranges (200 000 pC and 1 000 000 pC) the time constant is 1000 seconds or 0.16 mHz).

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Sensor connection



A BNC to Microdot adapter is available as an option.

Power consumption

Charge is defined by current multiplied with time (Q = I x t). That means that every charge amplifier (or better: charge to voltage converter) requires more power if the charge amplitude or the frequency increases. The relation between power, charge and frequency is definend by:

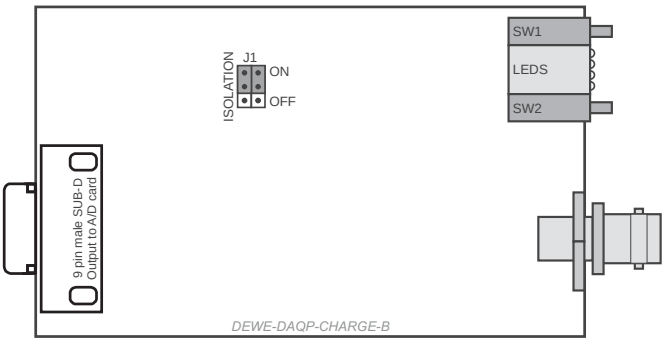
$$P\,[W] = Q\,[pC] \times f\,[Hz] \times 6.28 \times 10^{-11}$$

That means that the DAQP-CHARGE-B requires 6.28 W at 100 kHz and 1 000 000 pC of additional power (or 0.628 W @ 10 kHz and 1 000 000 pC). But the internal amplifier (and also the DEWE-RACK) is limited to 2 W for additional power.

Although this limitation the DAQP-CHARGE-B can also used with a 100 kHz and 1 000 000 pC signal for a short time. Up to 50 cycles with that high frequency can be handled without any limitation. After this 50 cycles it is necessary to have a break of at least 100 cycles to be within the maximum average power consumption.

Isolation

The DAQP-CHARGE-B series module offers an isolation between input and output (= factory default). This will eliminate nearly all errors which occur if the input GND (= sensor GND) has not exactly the same potential than the GND of the data acquisition system.



Different locations have different potential. Therefore errors may occur if many sensors are mounted on different locations.

But if the ground of the charge sensor is isolated or the potential where the sensor is mounted is floating better results can be achieved if the module input GND is connected to the module output GND. These can be done externally, but also with two internal jumpers. Set both jumpers to the lower position to connect the input and output GND and disable the isolation.

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Pulse isolation amplifier



- Input ranges: 100 Hz to 200 kHz
- Ranges and filter: Button or software selection
- Trigger level: Autotrigger or software programmable
- Excitation: Sensor supply available
- Signal connection: 9-pin SUB-D connector

Module specifications

	DAQP-FREQ-A
Input ranges	100 Hz, 1 kHz, 5 kHz, 20 kHz, 100 kHz, 200 kHz
Minimum input	2 % of selected range
Range selection	Push button or software
Accuracy	±0.05 % (from 4 % to 100 % of range)
Input signal	10 mV to 300 V Be aware that the DSUB connector is only specified up to 250 V! For signals above 60 V you are not allowed to use the metal housing of the DSUB connector, which is included with shipment.
Input resistance	1 MOhm
Input filters	100 Hz, 1 kHz, 5 kHz, 20 kHz, 100 kHz, 200 kHz
Filter selection	Push button or software
Coupling	DC or AC (software programmable)
Trigger level	10 mV to 130 V (software programmable)
Sensor supply	+12 V_{DC}, ±9 V_{DC} (not isolated)
Isolation	350 V_{DC}
Overvoltage protection	±500 V_{PEAK} / 350 V_{RMS}
Output filter Filter characteristics Selection	3 ranges with 1.5, 30 and 500 ms (10 - 90 %) Butterworth, 60 dB / decade (18 dB / octave) Automatically according to input range slow (default) or fast output filter selectable within the input range
Output signals	±5 V according to input frequency TTL level trigger output signal
Output resistance	< 10 Ohm
Output current	Max. 5 mA
Output protection	Continuous short to ground
RS-485 interface	Yes
Power supply voltage	±9 V_{DC} (±5 %)
Power consumption	Typical 1.0 W

LED state

The DAQP-FREQ-A series module has a set of 6 LEDs showing the current input range (constant active) and filter range (flashing) setting. Two additional LEDs display trigger events and the fast output filter:

- Trigger LED: To find a signal, just press the ***FILTER*** button for approx. 3 sec. to activate the autotrigger function. As soon as the module is able to trigger, the trigger indicator LED will be active.
- Output filter: This LED indicates fast (active) or slow (inactive) output filter. The output filter setting can be selected via software.

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Input range and filter selection

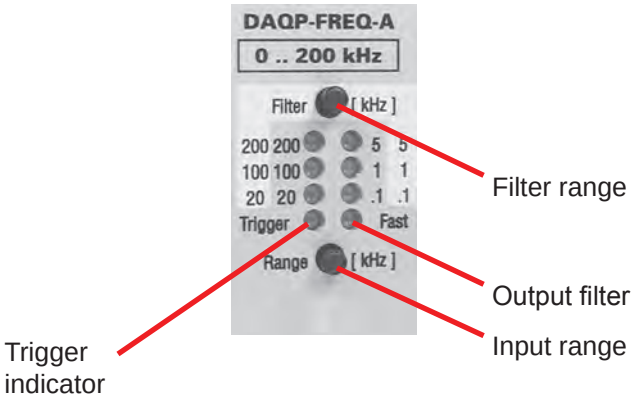
The DAQP-FREQ-A series module has two push buttons with multiple functions.

- Range button: Push the ***RANGE*** button several times until the LED displays the desired input range.
- Filter button: Push the ***FILTER*** button once - the LEDs will flash for approx. 2 seconds and display the current filter setting.

  Push the ***FILTER*** button again as long as the LEDs are flashing to change the filter range.
  The input filter will be set automatically to the same value.

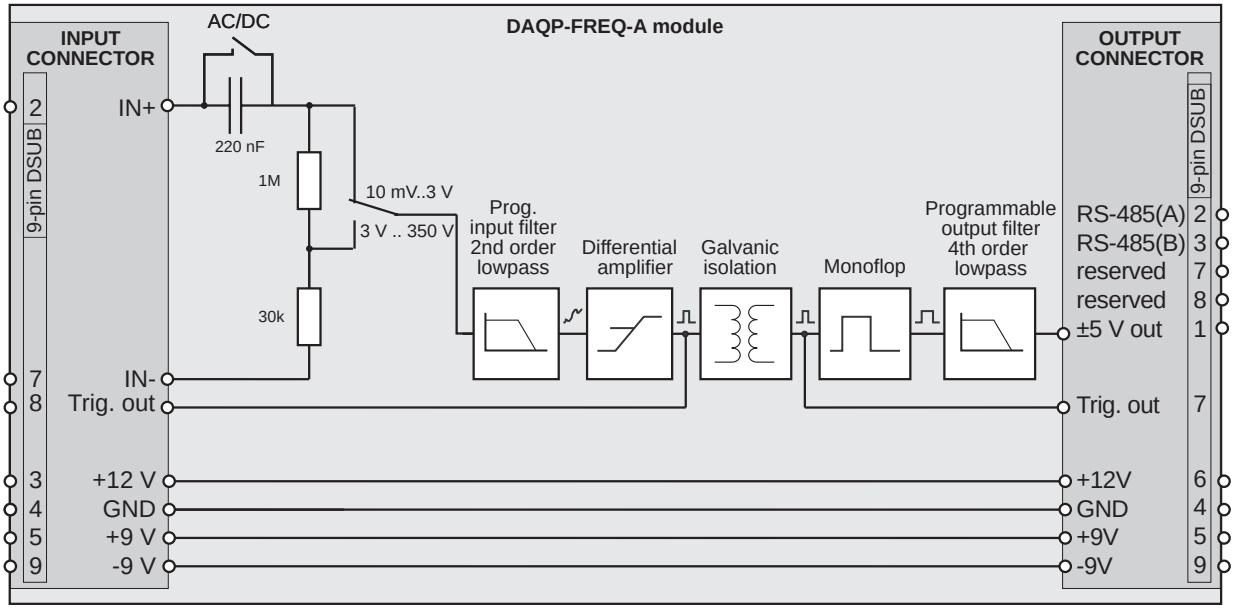
Additional function for the ***FILTER*** button:

- Autotrigger: Press the ***FILTER*** button for more than 3 seconds to activate the autotrigger function. As soon as a signal has been detected, the trigger LED is active.



Block diagram

The base block diagram of the DAQP-FREQ-A gives an idea of the internal structure.



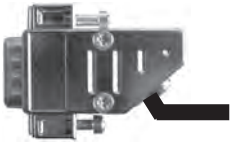
The sensor supply voltages are not isolated!

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Signal connection

Input connection

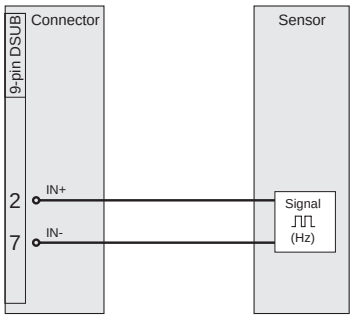




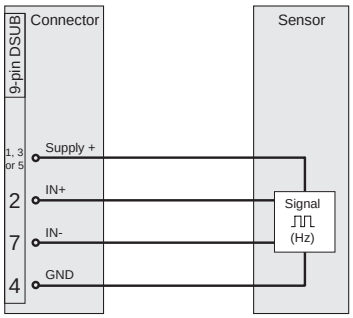
1 Reserved for custom sensor supply
2 IN +
3 +12 V (sensor supply)
4 GND (shield)
5 +9 V (sensor supply)
6 Not connected
7 IN -
8 Trigger output (TTL)
9 -9 V (sensor supply)

Sensor supply voltages are not isolated - only the input (pin 2 and 7)!
For signals above 60 V don't use the metal housing of SUBD connector!

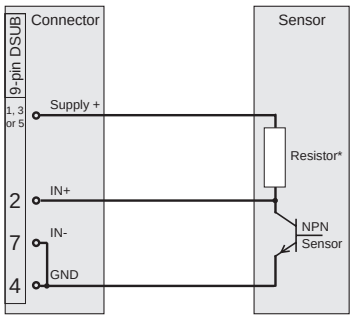
Sensors without sensor supply:



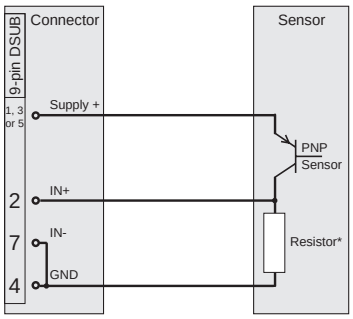
Sensors with sensor supply:



Open collector sensors (NPN):



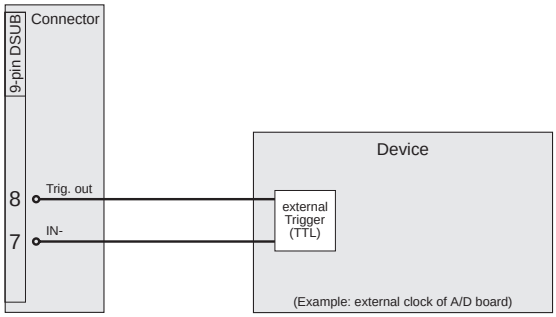
Open collector sensors (PNP):



* The value of the resistor depends on the sensor supply voltage and the open collector sensor.

Output connection

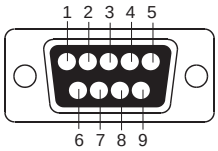
Trigger output connection:



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Rear connector

Due to the special functions of the DAQP-FREQ-A module, the pin assignment of the rear connector differs from the standard modules: The isolated trigger output is also available on pin 7 on the rear connector of the module.



9-pin male SUB-D connector

Pin assignment:

1 Module output (±5 V)
2 RS-485 (A)
3 RS-485 (B)
4 GND
5 +9 V power supply
6 reserved (+12 V sensor supply)
7 Trigger output (isolated)
8 reserved
9 -9 V power supply

Output filter ranges

The following table shows output filter response time (10-90 %), depending on input range.

Input range	Fast	Slow
200 kHz	1.5 ms	30 ms
100 kHz	1.5 ms	30 ms
20 kHz	1.5 ms	30 ms
5 kHz	30 ms	500 ms
1 kHz	30 ms	500 ms
100 Hz	500 ms	500 ms

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Isolated multifunctional amplifier

- Input ranges: Thermocouple, RTD, Resistance, Voltage, Constant current supplied Bridge
- Bandwidth: 3 kHz
- Filter: 6 programmable low pass filter (3 Hz to 3 kHz) and Programmable filter order (2nd, 4th, 6th, 8th)
- Isolation: 1000 V_{RMS}
- Output: Free programmable linearized voltage output



DAQP-MULTI *DAQP-THERM*

Module specifications

	DAQP-MULTI / DAQP-THERM
Input types	High speed thermocouple (TC)
	High speed Resistance Temperature Detector (RTD); voltage; resistance; bridge with constant current excitation
Thermocouple	
Type	K, J, T, R, S, N, E, B, L, C, U, others on request
Range	Min. to max. of the input range is free programmable within the full thermocouple input span
CJC absolute accuracy	±0.3 °C
CJC stability	0.03 °C/°C ambient temperature change
CJC equilibrium time	5 minutes
Accuracy	Typical 0.4 °C for type K including CJC error; details see table „Input ranges and detailed specifications“.
Linearization	DSP based linearization
Nonlinearity	> 0.01°C
Open thermocouple detection	100 MΩ pull up; software selectable
Connector	Mini thermocouple connector with integrated cold junction compensation sensor
RTD	
Type	Pt100, Pt200, Pt500, Pt1000, Pt2000, others on request
Range	Min. and max. of the input range is free programmable within the full RTD input span
Constant current	Pt100: 1 mA; Pt200, Pt500: 0.5 mA; Pt1000, Pt2000: 0.2 mA
Accuracy	Typical accuracy 0.2 °C for Pt100, details see table „Input ranges and detailed specification“.
Linearization	DSP based linearization
Nonlinearity	> 0.01 °C
Voltage	
Input range	±5 mV, ±10 mV, ±20 mV, ±50 mV, ±100 mV, ±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, free programmable within ±5V
Accuracy	±5 mV to ±100 mV Range: 0.02 % of reading ±0.02 % of Range ±5 µV ±0.1 V to ±5V Range: 0.02 % of reading ±0.02 % of Range ±200 µV
Offset drift	Typical ±0.3 µV/°K ±10 ppm of range/°K
Gain drift	Typical 15 ppm/°K
Input impedance	> 100 MΩ (power off: 50 kΩ)
Input noise	8 nV * √Hz
Resistance	
Range	1, 3, 10, 30, 100, 300, 1k, 3k, 10k, 30k, 100k, 1M, free programmable between 1 Ω and 1 MΩ
Accuracy	According to table „Input ranges and detailed specifications“.
Drift	Typical 15 ppm/°K
Constant current	From 5 µA to 5 mA depending on range
Bridge	
Range	0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000 mV/mA
Accuracy	0.02 % of reading ±0.01 % of Range ±5 µV
Offset drift	typical ±0.3 µV/°K ±10 ppm of range/°K
Gain drift	typical 15ppm/°K
Input impedance	> 100 MΩ (power off: 50 kΩ)

= DAQP-MULTI support only

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continued from page 77

Input noise	8 nV * √Hz
Automatic bridge balance	±200 % of range
Supported sensors	4 wire full bridge
Connector	DSUB9; DEWETRON bridge type pinout
Excitation current	
Excitation current	1, 2, 4 mA; software programmable
Accuracy	0 to 200 µA: 0.02 % ±50 nA
	200 µA to 5 mA: 0.02 % ±1 µA
Drift	15 ppm/°K
Compliance voltage	15 V
Source resistance	>150 kΩ

Bandwidth (-3dB)	3 kHz		
Filters	3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz		
Filter characteristics	Butterworth or Bessel, 2nd, 4th, 6th, 8th order programmable		
Group delay	300 µs with highest filter		
Typ. CMRR	0 to 100 mV range	100 mV to 5 V range	Thermocouple input
50 Hz	125	105	160
1 kHz	120	100	135
3 kHz	115	95	130
Isolation	±1000 V_{RMS} continuous (for input excitation and TEDS interface)		
Over voltage protection	±100 V between inputs (clamping voltage: 5 V @ TC input; 11 V @ Voltage input)		
Output voltage	±5 V; 0 to 5V; (±10 V and 0 to 10 V with special DEWE-30)		
Output resistance	22 Ω		
Output current	Max. 5 mA		
Output protection	Continuous short to ground		
RS485 interface	Yes		
RS485 data output	Yes		
Supported TEDS chips	DS2406, DS2430A, DS2431, DS2432, DS2433,DS28EC20		
MSI support	No		
DEWESoft support:	Version 7.01 and higher		
Power supply voltage	±9 V_{DC} (±5 %)		
Power consumption	1 W typical		

= DAQP-MULTI support only

Front panel control

LED indication:

Power LED: This LED is always on when the module is supplied.
Status LED: This LED has three functions:



- It is flashing three times when the module receives a valid command.
- It displays an input overflow if it flashes with the duty cycle 800 ms on / 200 ms off. In thermocouple mode this will indicate an open thermocouple detection.
- It displays an internal error if it flashes with the duty cycle 200 ms on / 800 ms off.

Push button operation:

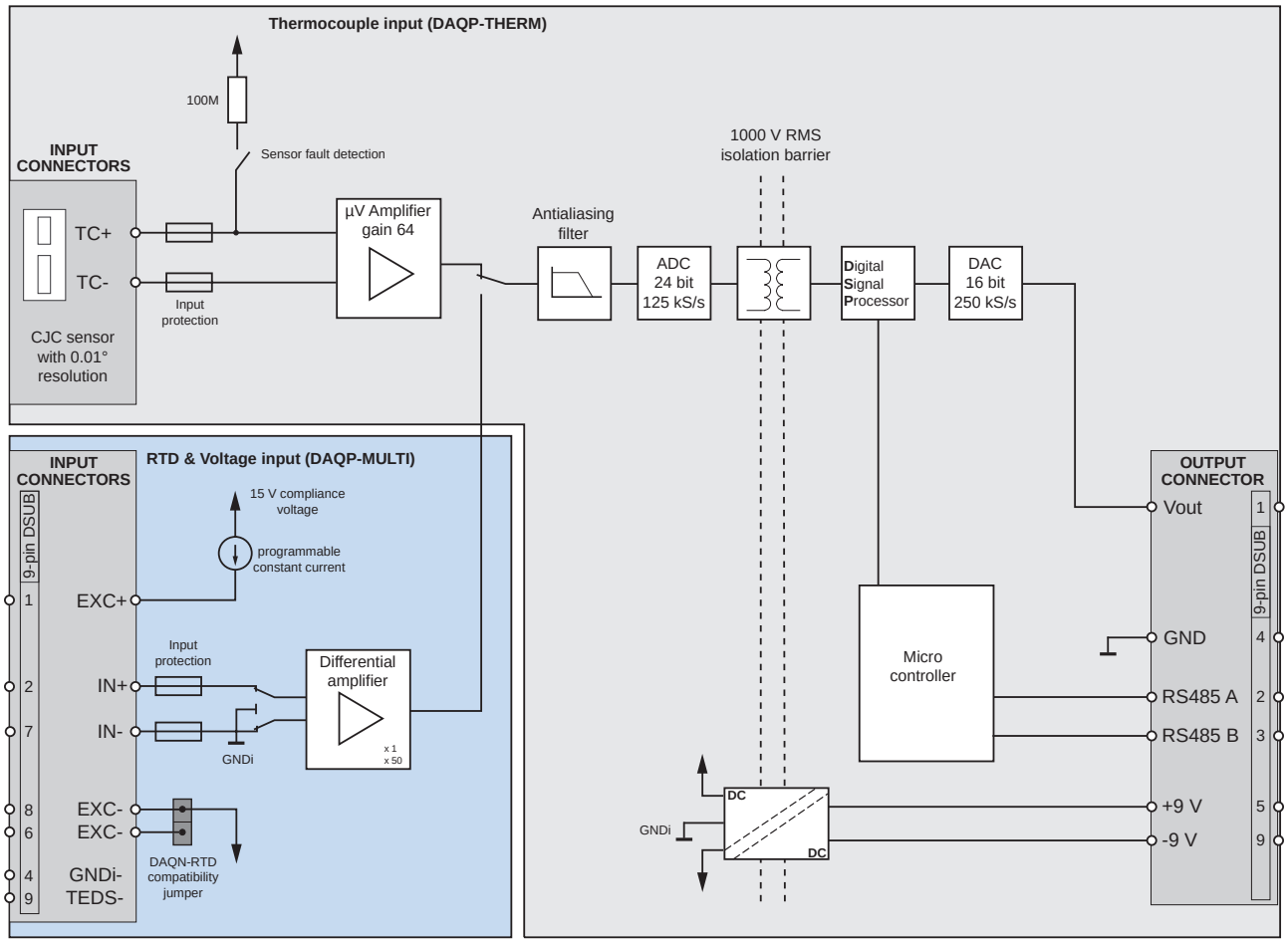
- Module readressing: Push the ***ID*** button for allowing the software to change the address.
- Module reset: Press the ***ID*** button during power on, and keep it pressed for at least 5 seconds. The module will reset to default settings.

Address: 0
Baud rate: 9600 bps
Module setup: Load backup setup and calibration data (last setup will be overwritten)

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Block diagram

The base block diagram of the DAQP-MULTI and the DAQP-THERM gives an idea of the internal structure.



Amplifier description

The DAQP-MULTI consists of two separate input amplifiers. The first one is optimized for thermocouple measurement. Its main properties are extremely low offset drift and noise. The sensor is connected to a mini thermocouple connector with copper contacts. A precision temperature sensor with a resolution of 0.01 °C measures the temperature directly on the junction between the copper contact and the TC material of the sensor connector. This minimizes the error due to the CJC and allows the connection of all TC types.

The second input combines a programmable constant current source and a differential input amplifier on a standard DSUB9 connector. It allows all kind of resistance measurement as well as voltage measurement. Bridge sensors using current excitation are also supported. The small input offset drift could be eliminated by using the internal short circuit function.

The conditioned analog signal passes a low pass filter and then comes to an aliasing free analog to digital converter. The digital data stream is isolated before getting into a high speed **D**igital **S**ignal **P**rocessor. It allows the complete linearization and filtering with a very low signal delay. Linearization tables are stored with up to 512 points which minimizes the nonlinearity error for thermocouples and RTD to less than 0.01°C. The complete data processing internally runs at 125 kS/sec. The output digital to analog converter runs at the double speed, 250 kS/sec. That improves the signal quality on the analog output. The measured value is also available on the RS485 as an ASCII value. That allows using the module also as a full measurement instrument without AD-Card or analog wiring.

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Input ranges and detailed specifications[1)]

Thermocouple accuracy including CJC error										
Type	Standard	Input range		Accuracy						
		min	max	-270 to -200 °C -454 to -328 °F	-200 to -100 °C -328 to -148 °F	-100 to 0 °C -148 to 32 °F	0 to 100 °C 32 to 212 °F	100 to 400 °C 212 to 752 °F	400 to 1000 °C 752 to 1832 °F	>1000 °C > 1832 °F
		[°F] °C	[°F] °C	[°F] °C	[°F] °C	[°F] °C	[°F] °C	[°F] °C	[°F] °C	[°F] °C
K	DIN EN 60584-1	[-454] -270	[2501] 1372	[49.41] 9.67	[33.82] 1.01	[33.92] 0.51	[32.70] 0.39	[32.79] 0.44	[33.08] 0.6	[33.39] 0.77
J	DIN EN 60584-1	[-346] -210	[2192] 1200	[33.76] 0.98	[33.57] 0.87	[32.85] 0.47	[32.67] 0.37	[32.76] 0.42	[32.92] 0.51	[33.01] 0.56
T	DIN EN 60584-1	[-454] -270	[752] 400	[43.38] 6.32	[33.78] 0.99	[32.99] 0.55	[32.70] 0.39	[32.61] 0.34	-	-
R	DIN EN 60584-1	[-58] -50	[3200] 1760	-	-	[34.30] 1.28	[33.60] 0.89	[33.17] 0.65	[32.95] 0.53	[33.28] 0.71
S	DIN EN 60584-1	[-58] -50	[3200] 1760	-	-	[34.07] 1.15	[33.57] 0.87	[33.21] 0.67	[33.04] 0.58	[33.39] 0.77
N	DIN EN 60584-1	[-454] -270	[2372] 1300	[55.81] 13.23	[34.02] 1.12	[32.97] 0.54	[32.67] 0.42	[32.70] 0.39	[32.86] 0.48	[33.03] 0.57
E	DIN EN 60584-1	[-454] -270	[1832] 1000	[43.00] 6.11	[33.057] 0.87	[32.88] 0.49	[32.65] 0.36	[32.61] 0.34	[32.86] 0.48	-
L	DIN 43710	[32] 0	[1652] 900	-	-	-	[32.65] 0.36	[32.74] 0.41	[32.77] 0.43	-
C	ASTM E988-96	[32] 0	[4190] 2310	-	-	-	[32.88] 0.49	[32.86] 0.48	[33.06] 0.59	[33.69] 0.94
U	DIN 43710	[-328] -200	[1112] 600	[33.67] 0.93	[33.67] 0.93	[32.99] 0.55	[32.70] 0.39	[32.63] 0.35	[32.56] 0.31	-
B	DIN EN 60584-1	[32] 0	[3308] 1820	-	-	-	[86.56] 30.31	[37.47] 3.04	[33.40] 0.78	[32.92] 0.51

= calculated specifications, not veryfied.

RTD								
Type	Standard	Input range		Current	Accuracy			
		min	max		-200 to -100 °C -328 to -148 °F	-100 to 0 °C -148 to 32 °F	0 °C to fullscale 32 °F to fullscale	
		[°F] °C	[°F] °C	mA	[°F] °C	[°F] °C	(% of reading + [°F] °C)	
Pt100 (385)	DIN EN 60751	[-328] -200	[1562] 850	0.2	[32.25] 0.14	[32.37] 0.21	0.07	[32.37] 0.21
Pt200 (385)	DIN EN 60751	[-328] -200	[1562] 850	0.1	[32.32] 0.18	[32.48] 0.27	0.10	[32.48] 0.27
Pt500 (385)	DIN EN 60751	[-328] -200	[1562] 850	0.2	[32.61] 0.34	[32.75] 0.42	0.09	[32.75] 0.42
Pt1000 (385)	DIN EN 60751	[-328] -200	[1562] 850	0.2	[32.39] 0.22	[32.52] 0.29	0.09	[32.52] 0.29
Pt2000 (385)	DIN EN 60751	[-328] -200	[1562] 850	0.2	[32.45] 0.25	[32.63] 0.35	0.12	[32.64] 0.36
Pt100 (3926)		[-328] -200	[1562] 850	0.2	[32.25] 0.14	[32.37] 0.21	0.07	[32.37] 0.21

Resistance			
Range	Current	Accuracy	
[Ω]	[mA]	[% of reading]	[% of range]
1000000	0.005	0.04	1.02
300000	0.015	0.04	0.35
100000	0.05	0.04	0.11
30000	0.1	0.04	0.07
10000	0.1	0.04	0.08
3000	0.2	0.04	0.07
1000	0.5	0.04	0.25
300	1	0.04	0.18
100	1	0.04	0.12
30	2	0.04	0.08
10	4	0.04	0.06
3	5	0.04	0.10
1	5	0.04	0.23

Excitation		
	[% of reading]	[µA]
0 to 200 µA	0,02	0,05
>0.2 to 5 mA	0,02	1

[1)] All accuracy specifications mentioned on this page are 1-year specifications.
They are valid for module calibration temperature ±5 °C and 30 to 90 % relative humidity.

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Amplifier function

Free programmable module range

Regardless which input mode is selected, the module measurement range is completely free programmable. Simply by entering the lower and upper limit the amplifier adjusts its gain and offset factors automatically. The amplifier output is scaled to either ±5 V or 0 to 5 V.With the 16-OUT-10 option which is available on all DEWETRON signals conditioning systems also ±10 V or 0 to 10 V output signals are possible. This is especially designed for test rig applications. Converting a nonlinear temperature signal from an RTD or a TC to a linear 0 to 10 V analog output is one of the key features of this amplifier.

Filter

The module has 6 selectable low pass filters from 3 Hz to 1 kHz. The filter characteristic could be chosen between Butterworth and Bessel. Also the filter order could be selected between 2^{nd} ,4^{th} ,6^{th} and 8^{th} order. The 2^{nd} order filter up to 1 kHz is fully compatible to any other DAQP series filter.

Amplifier balance

The amplifier balance function allows automatic elimination of 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. All previously stored sensor offset values are cleared.

Sensor balance

The DAQP-Multi can automatically balance any sensor offset up to 200 % of range. Depending on the input range, also higher offsets can be balanced (e.g. input range is 100 mV/mA, excitation is 1 mA, offset can be balanced up to 5000 %).

Short

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

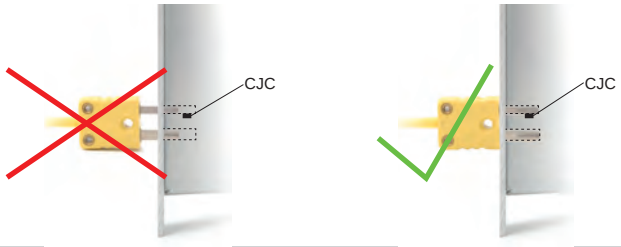
Applies a high precision internal reference signal with 80% of the full scale value (4.0000 V) to the module output. This function allows compensating the actual error of the AD-Board, to get the full accuracy of the DAQP-MULTI.

Open thermocouple detection

The open thermocouple detection of the DAQP-MULTI consists of an 100 MΩ pull-up resistor. That typically drives a 50 nA current through the sensor which normally does not take effect on the measurement, but is enough to generate an input overflow if the sensor breaks. Despite of that small current, there are sensors available where this current generates a big error. Those sensors are typically non-contact infrared thermocouples and fast response thermocouples. In that case the open thermocouple detection can simply be deactivated in the software. Sensors with up to 50 kΩ output impedance could be measured in that way.

CJC

The DAQP-MULTI as well as the DAQP-THERM comes with an integrated cold junction compensation sensor with an absolute accuracy of ±0.2 °C. In order to archieve this accuracy the sensor has to be connected for at least 5 minutes to the thermocouple connector (CJC equilibrium time).



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Signal connection

DAQP-MULTI



Signal connection via SUB-D connector



1 EXC +
2 IN +
3 n.c.
4 $GND_{isolated}$
5 n.c.
6 reserved for EXC -
7 IN -
8 EXC -
9 TEDS

Signal connection via mini TC connector

TC+



TC -

Signal connection

DAQP-THERM



Signal connection via mini TC connector

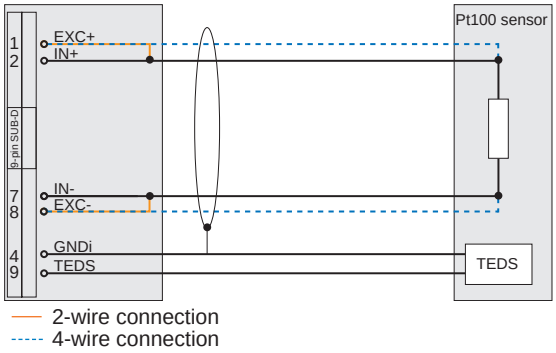
Connector

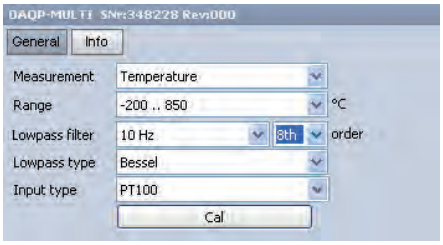
TC+



TC -

Resistance, RTD 2-wire and 4-wire



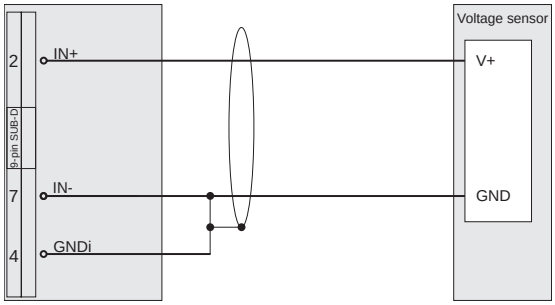


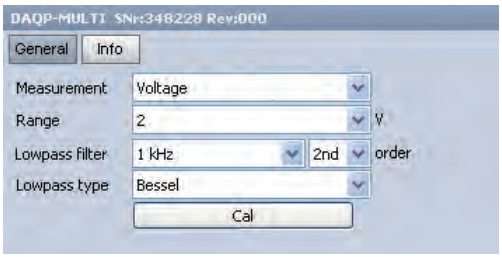


For resistance and RDT mode the 4-wire connection is recommended. The 2-wire connection will not compensate the wire resistance.

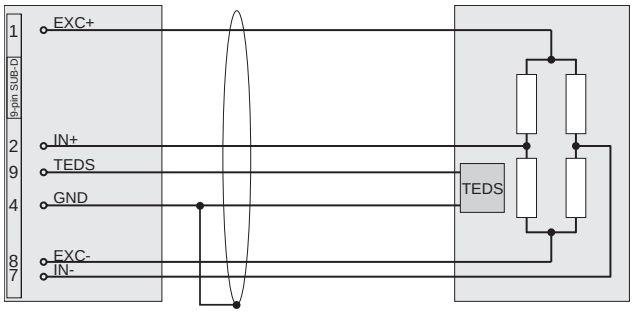
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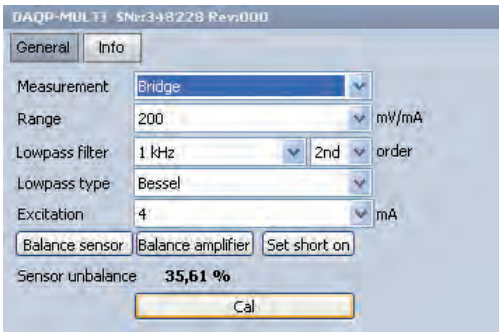
Voltage measurement



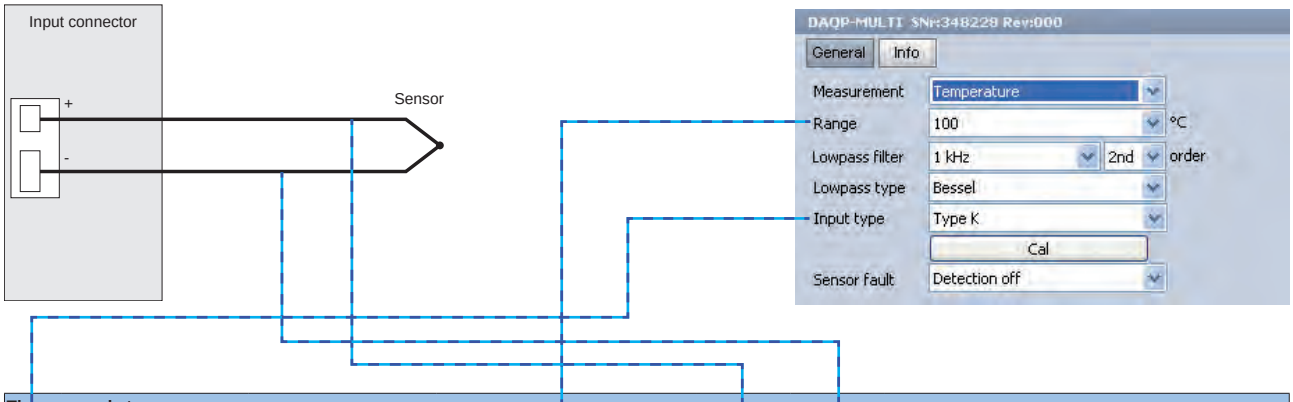


Bridge I sensor





Thermocouple sensor



Thermocouple types

Type	IEC color code	ANSI color code	Temperature range °C [°F]	Alloy combination +	-	Comments
K	green	yellow	-270 to 1372 [-454 to 2501]	Ni	CrNi	Wide temperature range, most popular calibration
J	black	black	-210 to 1200 [-346 to 2193]	Fe	CuNi	Used in vacuum, reduced and inert atmosphere
T	brown	blue	-270 to 400 [-454 to 752]	Cu	CuNi	Low temperature & cryogenic applications
R	orange	green	-50 to 1760 [-58 to 3214]	Pt13Rh	Pt	High temperature
S	orange	green	-50 to 1760 [-58 to 3214]	Pt10Rh	Pt	High temperature
U	orange	green	-200 to 600 [-328 to 1112]	Cu	CuNi	Also known as RX & SX extension wire.
N	rose	orange	-270 to 1300 [-450 to 2372]	NiCrSi	NiSi	Alternative to type K. More stable at high temp.
E	purple	purple	-270 to 1000 [-454 to 1832]	NiCr	CuNi	Highest EMF change per degree
B	grey	grey	0 to 1820 [32 to 3308]	Pt30Rh	Pt6Rh	High temperature. Common use in glass industry
L	blue		-200 to 900 [-328 to 1652]	Fe	CuNi	Similar to type J
C*	no standard IEC color	red*	0 to 2310 [32 to 4208]	W5Re	W26Re	Highest temperature range

*) no official symbol or standard designation

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Notes

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1:1 analog input module

- Input signal: Voltage signals up to ±10 V with overvoltage protection
- Signal connection:
  - DAQN-AIN-B: Banana plugs
  - DAQN-AIN-BNC: BNC connector
  - DAQN-AIN-D: 9-pin SUB-D connector



Module specifications

	DAQN-AIN
Input signal	1:1 voltage input to A/D board
Accuracy	According to A/D board
High input protection	
Max. input voltage	±10 V, higher voltages up to ±500 V will be cut off
Max. output voltage	±10 V
Accuracy	Typ. better than ±0.25 %
Bandwidth (-3 dB)	Typ. 35 kHz (±1.2 dB @ f0)
Low input protection	
Max. input voltage	±10 V, higher voltages will destroy the protection resistor
Max. output voltage	±10 V
Accuracy	Typ. better than ±0.02 %
Bandwidth (-3 dB)	Full system bandwidth
Protection resistor	10 Ohm
RS-485 interface	No
Power supply	±9 V

Input protection

The DAQN-AIN module allows two stages of overvoltage protection. As a standard, the module is set to low protection.

1. Low protection (factory default)

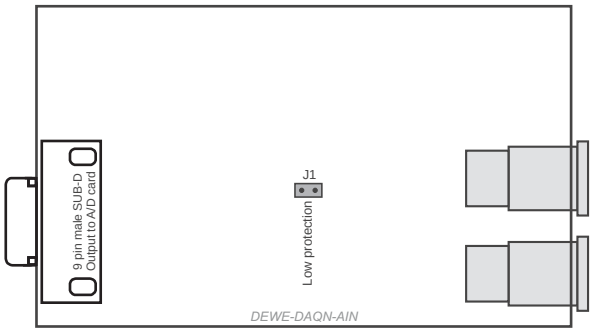
Transient voltages above approx. ±10 V will be cut off, continuous overvoltage will destroy the internal protection resistor (10 Ohm)! This setting offers full system bandwidth.

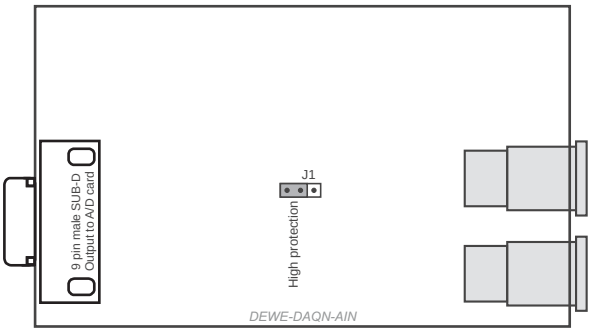
To activate the low overvoltage protection set the jumper inside the module.

2. High protection

Voltages between approx. ±10 V up to ±500 V will be cut off at approx. ±10 V. The bandwidth is approx. 35 kHz.

To activate the high overvoltage protection remove the jumper inside the module.





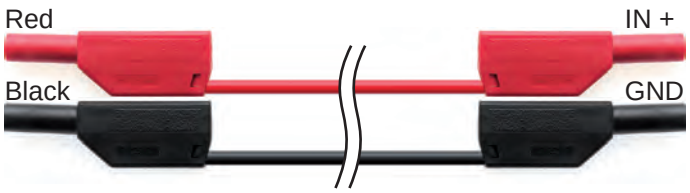
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Signal connection

DAQN-AIN-B module



Voltage measurement via banana plug cords



DAQN-AIN-BNC module



Voltage measurement via BNC cord



Hot: IN +

Shield: GND

DAQN-AIN-D module



Voltage measurement via SUB-D cord



1 Input (+)
2 RS-485 A (if available within the system)
3 RS-485 B (if available within the system)
4 GND
5 +9 V power supply
6 +12 V power supply (+15 V in conjunction with a DEWE-30-4)
7 Reserved for special applications
8 Reserved for additional sensor supply
9 -9 V power supply

Use pin 4, 5 and 9 only as sensor supply (not isolated)!
For signals above 60 V don't use the metal housing of SUB-D connector!

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Developing module

- Prototype board: For free use
- Signal connection: Via banana plug,
  BNC connector or
  9-pin SUB-D connector
  (depending on module)



Module specifications

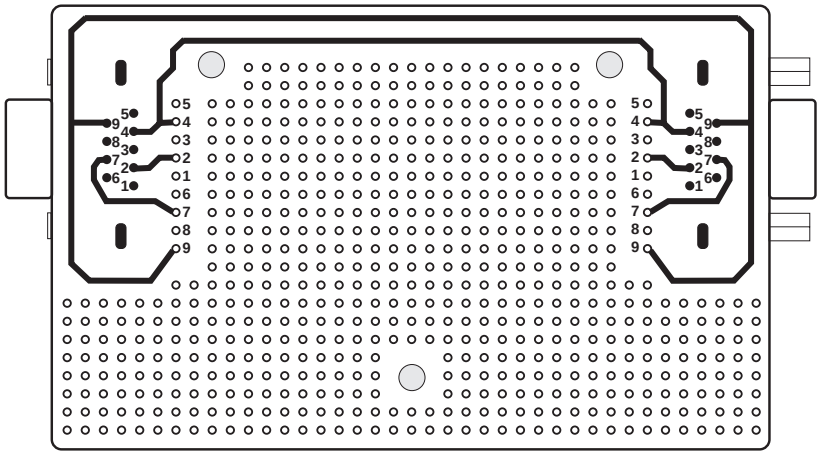
	DAQN-CUSTOM
Supply voltage:	±9 V_{DC} available from main system, no isolation other voltages available on request according appendix B: Internal Wiring
Output voltage:	Has to be within ±5 V for most A/D boards (otherwise system damages possible)
Output resistance:	As low as possible (typ. < 10 Ohm)
RS-485 interface:	No
Power consumption:	Depending on circuit

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Prototype board - Example

Solder side

Interface to main system:
9-pin DSUB connector (male)



User interface:
9-pin DSUB connector (female),
4 mm banana plug
or BNC connector

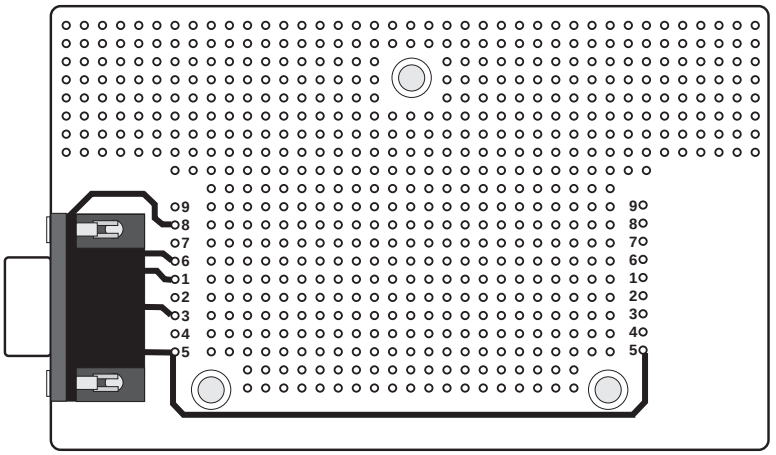
1 Analog input (to A/D converter)
2 RS-485 A (optional, reserved)
3 RS-485 B (optional, reserved)
4 GND (from main system)
5 +9 V (from main system)
6 +12 V (from main system)
(+15 V in conjunction with a DEWE-30-4)
7 Analog output (from D/A converter)
8 Vcc (optional, reserved)
9 -9 V (from main system)

All PIN's refer to system ground!

1 Not connected
2 Not connected
3 Not connected
4 GND (from main system)
5 +9 V (from main system)
6 Not connected
7 Not connected
8 Not connected
9 -9 V (from main system)

Pin 4, 5 and 9 refer to system ground!

Component side



Connector according
module type!

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Isolated voltage output amplifier

- Voltage output: ±10 V
- Signal connection:
  DAQN-V-OUT-B: Banana plugs
  DAQN-V-OUT-BNC: BNC connector
  DAQN-V-OUT-D: 9-pin SUB-D connector



Module specifications

	DAQN-V-OUT
Input voltage ranges	±10 V
Input voltage maximum	±36 V (no damage)
Input resistance	50 MOhm
Output voltage range up to	up to ±10 V (depending on DAC output of DAQ card)
Over range capability	5 % @ 10 V output
Output drive	50 mA max.
Output resistance	0.5 Ohm
Output current under fault, max	75 mA
Output protection transient	ANSI/IEEE C37.90.1-1989
CMV, output to input, continuous Transient CMRR (50 / 60 Hz)	1500 V_{RMS} max. ANSI/IEEE C37.90.1-1989 110 dB
Accuracy	±0.05 % span (0 to 5 mA load)
NMR (-3 dB @ 400 Hz)	100 dB per decade above 400 Hz
Nonlinearity	0.02 % span
Stability Offset Span	 ±25 ppm/°C ±20 ppm/°C
Noise Output ripple, 1 kHz bandwidth	 2 mV_{pp}
Bandwidth (-3 dB)	400 Hz
Power supply voltage	9 V_{DC} ±5 %
Power supply current	350 mA full load, 135 mA no load
Power supply sensitivity	±12.5 ppm/%

Description

The DAQN-V-OUT module provides an isolated voltage output from -10 to +10 V (depending on the DAC-output voltage of the DAQ board).

Note: Analog outputs are normally wired to the last 2 slots of the DAQ-RACK.

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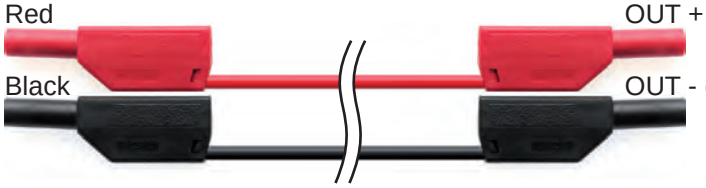
DAQN-V-OUT

Signal connection

DAQN-V-OUT-B module



Voltage output via banana plug cords



Red — OUT + (-10 to +10 V, isolated)

Black — OUT - (-10 to +10 V, isolated)

DAQN-V-OUT-BNC module



Voltage output via BNC cord



Hot: OUT + (-10 to +10 V, isolated)

Shield: OUT - (-10 to +10 V, isolated)

DAQN-V-OUT-D module



Voltage output via SUB-D cord



1 Not connected
2 Not connected
3 Not connected
4 GND (not isolated)
5 +9 V (not isolated)
6 Not connected
7 OUT + (-10 to +10 V, isolated)
8 OUT - (-10 to +10 V, isolated)
9 -9 V (not isolated)

Use pin 4, 5 and 9 only as sensor supply (not isolated)!
For signals above 60 V don't use the metal housing of SUB-D connector!

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8 channel voltage amplifier

- Intelligent amplifier with integrated 24-bit A/D conversion
- 8 differential voltage input channels
- Signal connection via 25-pin SUB-D connector



Module specifications

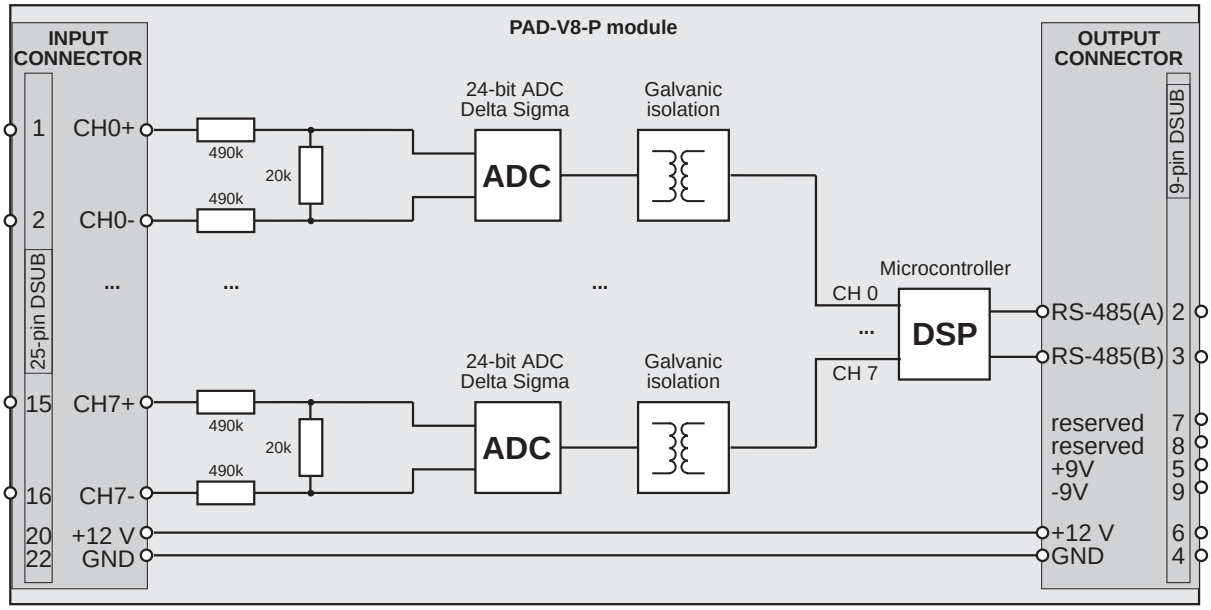
	PAD-V8-P	
	Revision 5.04 and lower	**Revision 6.00 and higher**
Input channels:	8 differential input channels	
Input signals: Voltage: Current:	±100 mV, ±150 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±10 V, ±50 V, -0.15 to +1.5 V With external shunt resistor	
Resolution:	10 µV for all ranges	
Sampling rate:	Max. 6 Hz per channel	Max. 12 Hz per channel
Readout speed:	Typ. 50 ch/sec.*	Typ. 80 ch/sec.*
DC accuracy:	±0.03 % of reading ±900 µV	
Bandwidth (-3 dB):	3 Hz (±1.5 dB @ f_0)	6 Hz (±1.5 dB @ f0)
Isolation voltage:	350 V_{DC} (channel to channel and input to output)	
Overvoltage protection:	150 V_{DC}	
Common mode voltage:	350 V_{DC} / 250 V_{AC} @ 50 Hz	
NMR:	120 dB @ 50/60 Hz	
CMRR:	140 dB @ DC, 120 dB @ 50 Hz	
RS-485 interface:	Yes	
Interface speed:	9600 bps (2400 to 115200)	
Power supply voltage:	±9 V_{DC} (±10 %)	
Power consumption:	Typical 0.6 W	

*) Depending on system and number of channels

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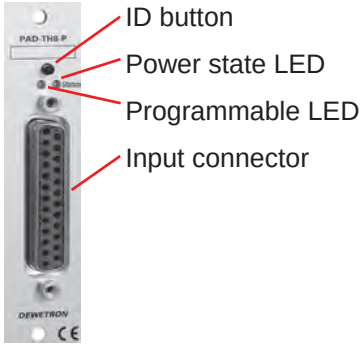
Block diagram

The base block diagram of the PAD-V8-P gives an idea of the internal structure.



Signal connection

PAD-V8-P module



Input connector:

1	Channel 0	(+)	13	Channel 6	(+)
2	Channel 0	(-)	14	Channel 6	(-)
3	Channel 1	(+)	15	Channel 7	(+)
4	Channel 1	(-)	16	Channel 7	(-)
5	Channel 2	(+)	17	Digital input 1*	
6	Channel 2	(-)	18	Digital input 2*	
7	Channel 3	(+)	19	Digital input 3*	
8	Channel 3	(-)	20	+12 V_{DC}	
9	Channel 4	(+)	21	Reset / Digital input 4*	
10	Channel 4	(-)	22	GND	
11	Channel 5	(+)	23	Reserved	
12	Channel 5	(-)	24	Reserved	
			25	Reserved	

ID button:	Used to define module address via software
Power state LED:	Flashing when data transfer is active
Programmable LED:	Free programmable state LED (on = standard; off or 1 Hz flashing programmable)

Reset procedure for firmware 1.14 and lower:

- Connect Pin 21 (Reset) to pin 22 (GND) on the DSUB-25 connector.
- Press the ID button during powering on the module.

Reset procedure for firmware 2.00 and higher:

- Press the ID button during powering on the module and keep it pressed for at least 3 more seconds.

Default values:

- Baud rate: 9600 Bps
- Address: 00h (equals a cleared module in DEWESoft)
- Data Format: engineering unit, no checksum

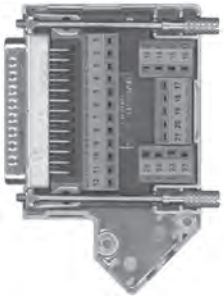
*) no DEWESoft support.

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Connection options for PAD-V8-P module

PAD-OPT2

25-pin SUB-D connector with screw terminal
(not included as a standard with module).

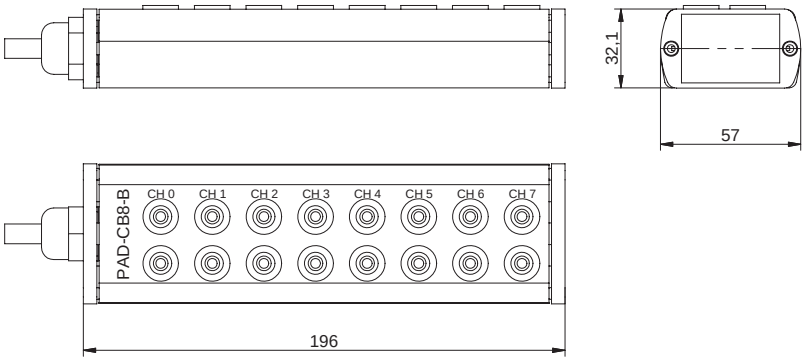


PAD-CB8-xx

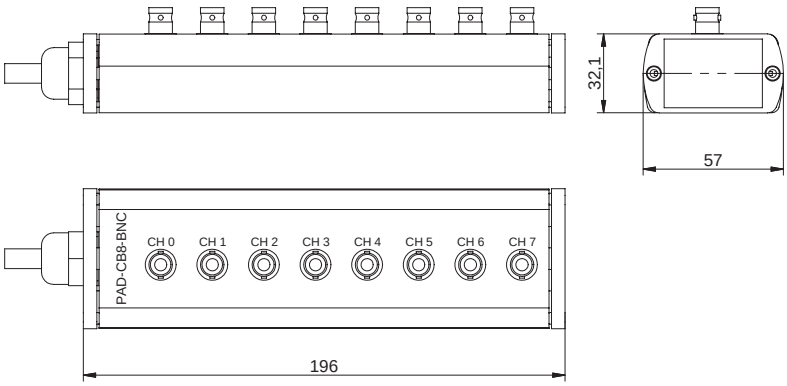
Connection box with banana connectors or
BNC for all 8 channels, cable length approx. 1 m
(not included as a standard with module).



Dimensions CB8-B



Dimensions CB8-BNC



(Dimensions in mm; 1 inch = 25.4 mm)

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Notes

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8 channel thermocouple and RTD amplifier



- Intelligent amplifier with integrated 24-bit A/D conversion
- 8 galvanic isolated input channels
- External CJC
- Automatic sensor block detection
- Signal connection via 25-pin SUB-D connector
  Direct thermocouple and RTD connection via
  PAD-CB8-xx connection block

Module specifications

PAD-TH8-P		
	Revision 5.04 and lower	Revision 6.00 and higher
Input channels:	8 differential input channels	
Input voltage:	±1.5 V	
Input resistance:	1.4 MΩ	
Gain linearity:	0.001%	
Bandwidth:	3 Hz	6 Hz
Resolution:	1 µV (24-bit)	
Temperature drift:	30 ppm/°K	
Typical noise:	2 µV	
DC accuracy:	Better ±0.05 % ±200 µV (typ. ±0.03 % F.S. ±20 µV)	
Sampling rate:	Max. 6 Hz per channel	Max. 12 Hz per channel
Readout speed:	typ. 50 ch/sec.*	Typ. 80 ch/sec.*
Isolation voltage:	350 V_{DC} channel to chassis ground 100 V_{DC} channel to channel	
Overvoltage protection:	15 V_{DC}	
NMR (50/60 Hz):	120 dB	
CMRR (50/60 Hz):	130 dB	
RS-485 interface:	Yes	
Interface speed:	9600 bps (2400 to 115200)	
Power supply voltage:	±9 V_{DC} (±10 %)	
Power consumption:	Typical 0.6 W	

*) Depenging on system an number of channels

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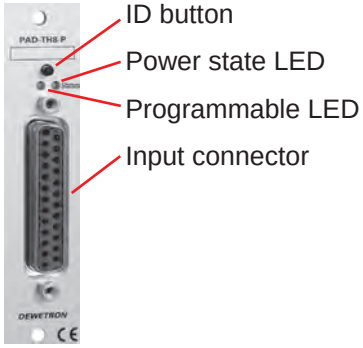
PAD-TH8-P

Signal connection

General

To use the full power of the PAD-TH8-P module, a connection block should be ordered together with the module (CB8-x-P2 or CB8-x-M for thermocouples type K, J or T or CB-8-RTD für RTD sensors). The thermocouple type has to be specified at time of order. The thermocouple types on each CB-8-x-P2 connector block can be also mixed (e.g. 4 pcs. type K, 4 pcs. type J).

PAD-TH8-P module



1	Channel 0	(+)	13	Channel 6	(+)
2	Channel 0	(-)	14	Channel 6	(-)
3	Channel 1	(+)	15	Channel 7	(+)
4	Channel 1	(-)	16	Channel 7	(-)
5	Channel 2	(+)	17	Sensor identification (SI1)	
6	Channel 2	(-)	18	Sensor identification (SI2)	
7	Channel 3	(+)	19	Sensor identification (SI3)	
8	Channel 3	(-)	20	+12 V_{DC}	
9	Channel 4	(+)	21	Reset (SI4)	
10	Channel 4	(-)	22	GND	
11	Channel 5	(+)	23	CJC	
12	Channel 5	(-)	24	CJC	
			25	CJC	

ID button:	Used to define module address via software
Power state LED:	Flashing when data transfer is active
Programmable LED:	Free programmable state LED (on = standard; off or 1 Hz flashing programmable)

Reset procedure for firmware 5.04 and lower:

- Connect Pin 21 (Reset) to pin 22 (GND) on the DSUB-25 connector.
- Press the ID button during powering on the module.

Reset procedure for firmware 6.00 and higher:

- Press the ID button during powering on the module and keep it pressed for at least 3 more seconds.

Default values:

- Baud rate: 9600 Bps
- Address: 00h (equals a cleared module in DEWESoft)
- Data Format: engineering unit, no checksum

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Connection options for PAD-TH8-P modules

PAD-CB8-x-P2 and PAD-CB8-x-M

Be aware that PAD-CB8-x-P2 and PAD-CB8-x-M are only supported by PAD-TH8-P modules with firmware version 5 or later (delivered october 2002 or later).

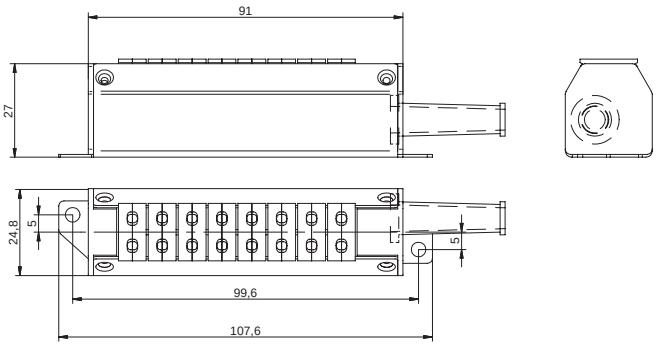
Modules with older firmware supports only the PAD-CB8-x-P block, but can be upgraded.
Please contact your local distributor for upgrade information.



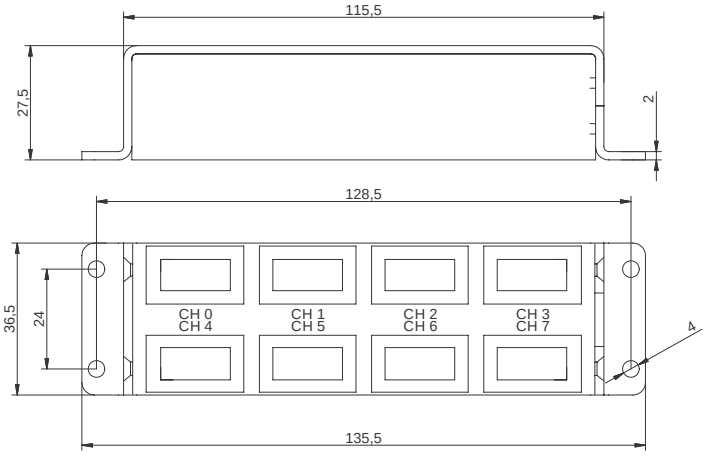
Connector block specifications

	PAD-CB8-x-P2 and PAD-CB8-x-M			
Input channels:	8 isolated thermocouple input channels			
Accuracy:	Thermocouple type J: ±1.0 °C @ -200 to -100 °C ±0.3 °C @ -100 to 150 °C ±0.4 °C @ 150 to 400 °C ±1 °C @ 400 to 1200 °C	Thermocouple type K: ±1.0 °C @ -200 to -25 °C ±0.4 °C @ -25 to 120 °C ±0.6 °C @ 120 to 400 °C ±1 °C @ 400 to 1372 °C	Thermocouple type T: ±1.0 °C @ -200 to -150 °C ±0.4 °C @ -150 to 400 °C	Thermocouple type U: ±0.7 °C @ -200 to -100 °C ±0.4 °C @ -100 to 0 °C ±0.3 °C @ 0 to 100 °C ±0.3 °C @ 100 to 600 °C
	Thermocouple type E, R, S, N, C or other types on request			
Typical noise:	±0.1 °C @ 6 Hz sampling; no average			
CJC:	Internal			
Operating temperature:	-25 to +80 °C (better on request)			
Cable length:	2 m (up to 12 m on request)			

Dimensions PAD-CB8-x-M



Dimensions PAD-CB8-x-P2



(Dimensions in mm; 1 inch = 25.4 mm)

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PAD-TH8-P

PAD-CB8-RTD

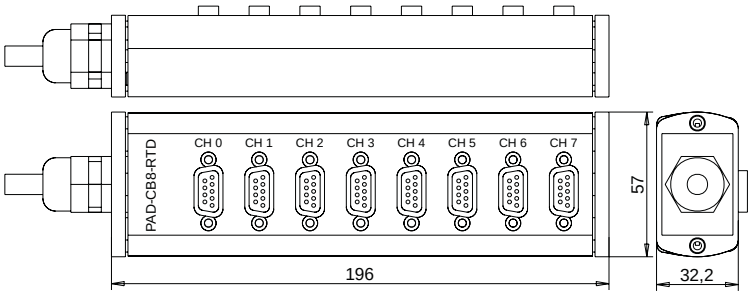
Connector block for up to 8 RTDs type Pt100, Pt200, Pt500, Ni120, ... The sensor supply is galvanic isolated to the PAD-TH8-P.



Connector block specifications

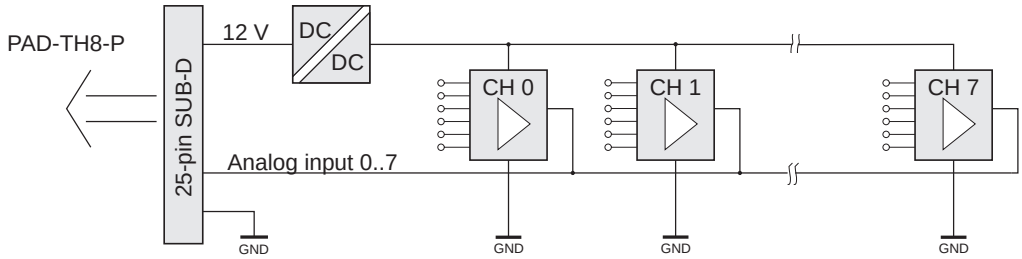
	PAD-CB8-RTD			
Input channels:	8 RTDs			
Constant current:	1250 µA (CB8-RTD-S3: 250 µA)			
Constant current drift:	5 ppm/°K			
Connection types:	2-, 3- or 4-wire			
Standard input ranges:	Resistor 0 to 999,99 Ohm, Pt100 a = 0.00385; Pt100 a = 0.003916; Pt200; Pt500; Ni120			
CB8-RTD-S3:	Resistor 0 to 999,99 Ohm, Pt100 a = 0.00385; Pt100 a = 0.003916; Pt200; Pt500; Pt1000; Pt2000			
Accuracy:	Pt100 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 800 °C	Pt100 a = 0.003916 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 800 °C	Pt200 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.5 °C @ 400 to 630 °C	Pt500 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 250 °C
	Pt1000 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 600 °C	Pt2000 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 600 °C	Ni120 ±0.3 °C @ -80 to 100 °C ±0.6 °C @ 100 to 260 °C	
Typical noise:	0.01 °C			
Operating temperature:	-25 to +80 °C			
Cabel length:	2m (up to 12 m on request)			
Dimensions (WxDxH):	approx. 196 x 57 x 32.2 mm (7.7 x 2.2 x 1.3 in.)			

Dimensions PAD-CB8-RTD



(Dimensions in mm; 1 inch = 25.4 mm)

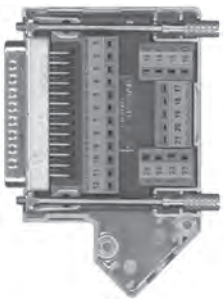
PAD-CB8-RTD block diagram



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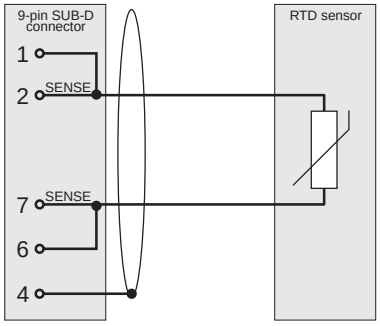
PAD-OPT1

25-pin SUB-D connector with screw terminal
and integrated CJC.
(not included as a standard with module).

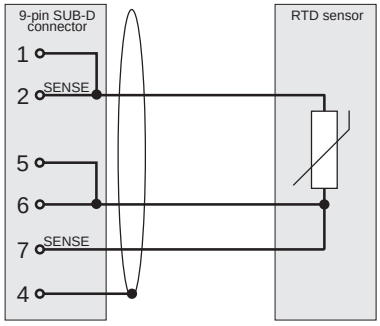


Sensor connection

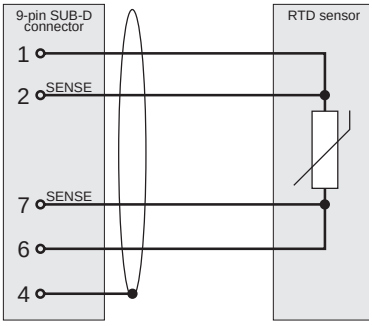
2-wire connection



3-wire connection



4-wire connection



Measuring temperature with Pt100 or similar sensors is based on simple resistor measurements. Keep in mind that the resistance of the lead will influence the measurement result. The resistance changes with the temperature, the length and the diameter of the lead.

The 4-wire connection will completely remove all the measurement errors caused by lead resistance.

Using 2-wire connection the lead resistance will be within the measurement result. Especially using long and thin wires from the PAD-CB8-RTD to the temperature sensors will distort the measurement result.

The 3-wire connection will also compensate the lead resistance completely if all three wires have the same diameter and length. In that case it is safe to assume that the lead resistance of all three wires is the same. Therefore the resistance of only one wire has to be measured for eliminating the lead resistance influence.

Be aware that the PAD-CB8-RTD is only supported by PAD-TH8-P modules with firmware version 5 or later (delivered October 2002 or later).

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Notes

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1 channel analog output module

- Voltage or current output selectable
- 12-bit D/A converter
- Power-on startup value and safe value programmable
- Signal connection via 25-pin SUB-D connector



Module specifications

	PAD-AO1
Number of channels:	1 output channel
Output signals:	
Voltage:	0 to 10 V
Current:	0 to 20 mA or 4 to 20 mA
Resolution:	12-bit
Accuracy:	±0.1 % of FSR
Readback accuracy:	±1 % of FSR
Resolution:	±0.02 % of FSR
Zero drift:	
Voltage output:	±30 µV/°C
Current output:	±0.2 µA/°C
Span temp. coefficient:	±25 ppm/°C
Programmable output slope:	0.125 to 1024 mA/sec or 0.0625 to 512 V/sec
Current load resistor:	500 Ohm
Isolation:	300 V_{DC}
RS-485 interface:	Yes
Interface speed:	9600 bps
Power supply voltage:	+12 V_{DC} (±10 %)
Power consumption:	Typical 1.2 W

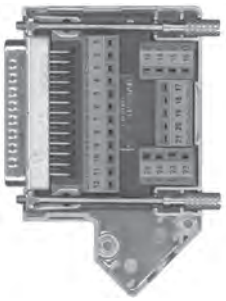
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Signal connection

PAD-AO1 module



The current module address is labeled in the address field.



1	Not connected	13	Not connected
2	Not connected	14	Not connected
3	Not connected	15	reserved
4	Not connected	16	reserved
5	Not connected	17	IOUT (+)
6	Not connected	18	IOUT (-)
7	Not connected	19	VOUT (+)
8	Not connected	20	VOUT (-)
9	Not connected	21	Init *1
10	Not connected	22	GND / Init *1
11	Not connected	23	Not connected
12	Not connected	24	Not connected
		25	Not connected

*1 A temporary shortcut between pin 21 and 22 (GND) offers the possibility to change the baud rate.

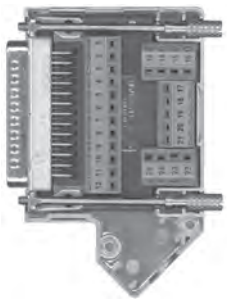
If the module settings are not known, a short power off - power on procedure has to be done after doing the shortcut. This resets the module to default address 0x00, baud rate 9600, checksum disable and watchdog timer disable.

Remove the shortcut after changing the baud rate.

Connection option for PAD-AO1 module

PAD-OPT2

25-pin SUB-D connector with screw terminal
(not included as a standard)



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2 counter / frequency module

- Two independent 32-bit counter or two frequency measurement channels
- Frequency measurement up to 100 kHz
- Programmable digital noise filter
- Signal connection via 25-pin SUB-D connector



Module specifications

	PAD-CNT2
Number of channels:	2 input channels (isolated or non-isolated programmable)
Input level:	
Isolated input:	low: +1 V max high: +3.5 V to +30 V
Non-isolated input:	low: 0 to +5 V programmable (default: 0.8 V) high: 0 to +5 V programmable (default: 2.4 V)
Isolation voltage:	300 V_{RMS} (when selected)
Noise filter:	Programmable, 2 µs to 65 ms
Counter measurement:	2 independend 32 bit counter (up to 4.294.967.295)
Frequency measurement:	
Input frequency:	1 Hz to 100 kHz
Built-in gate timer:	1.0 or 0.1 sec programmable
Alarm:	Alarm on counter on request
Digital output:	2 channels, open collector up to 30 V, 30 mA max. load
RS-485 interface:	Yes
Interface speed:	9600 bps
Power supply voltage:	+12 V_{DC} (±10 %)
Power consumption:	Typical 1.2 W

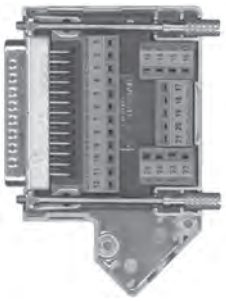
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Signal connection

PAD-CNT2 module



The current module address is labeled in the address field.



1	IN0	(+)	14	DO0 / low
2	IN0	(-)	15	DO1 / high
3	GATE0	(+)	16	Not connected
4	GATE0	(-)	17	Not connected
5	IN1	(+)	18	Not connected
6	IN1	(-)	19	Not connected
7	GATE1	(+)	20	+12 V_{DC} sensor supply
8	GATE1	(-)	21	Init *1
9	IN0	(non isolated)	22	GND / Init *1
10	GATE0	(non isolated)	23	Not connected
11	DGND	(non isolated)	24	Not connected
12	IN1	(non isolated)	25	Not connected
13	GATE1	(non isolated)		

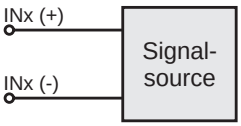
*1 A temporary shortcut between pin 21 and 22 (GND) offers the possibility to change the baud rate.

If the module settings are not known, a short power off - power on procedure has to be done after doing the shortcut. This resets the module to default address 0x00, baud rate 9600, checksum disable and watchdog timer disable.

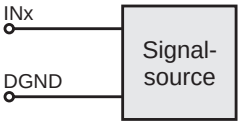
Remove the shortcut after changing the baud rate.

PAD-CNT2 wiring examples

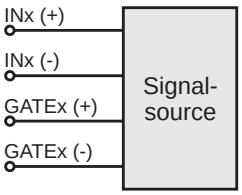
Each channel can be configured as isolated or non isolated input (see command table *set input mode*). The correct pin assignment for this measurements is also mentioned in this table. To activate gated measurement see table *set gate control.*



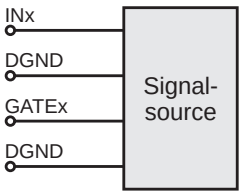
Isolated measurement channel x



Non-isolated measurement channel x



Isolated, gated measurement channel x

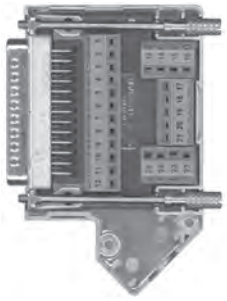


Non-isolated, gated measurement channel x

Connection option for PAD-CNT2 module

PAD-OPT2

25-pin SUB-D connector with screw terminal
(not included as a standard)



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8 channel isolated digital input module

- 8 input channels (6 isolated channels, 2 channels with common ground)
- High isolation voltage
- Input signal up to 30 V
- Signal connection via 25-pin SUB-D connector



Module specifications

	PAD-DI8
Number of channels:	6 independent isolated channels 2 channels with common ground
Input level: low: high:	 +1.0 V max. +3.0 to +30 V
Isolation voltage:	300 V_{RMS}
Input impedance:	3 kOhm, 0.5 W
RS-485 interface:	Yes
Interface speed:	9600 bps
Power supply voltage:	+12 V_{DC} (±10 %)
Power consumption:	Typical 0.6 W

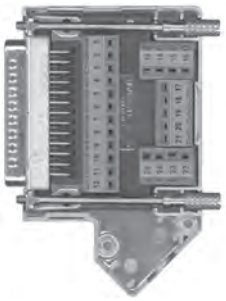
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Signal connection

PAD-DI8 module



The current module address is labeled in the address field.



1	IN0	(+)
2	IN0	(-)
3	IN1	(+)
4	IN1	(-)
5	IN2	(+)
6	IN2	(-)
7	IN3	(+)
8	IN3	(-)
9	IN4	(+)
10	IN4	(-)
11	IN5	(+)
12	IN5	(-)

13	IN6 (+)
14	IN6/IN7 GND
15	IN7 (+)
16	Not connected
17	Not connected
18	Not connected
19	Not connected
20	+12 V_{DC} sensor supply
21	Init *1
22	GND / Init *1
23	Not connected
24	Not connected
25	Not connected

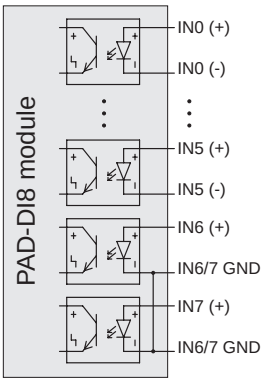
*1 A temporary shortcut between pin 21 and 22 (GND) offers the possibility to change the baud rate.

If the module settings are not known, a short power off - power on procedure has to be done after doing the shortcut. This resets the module to default address 00, baud rate 9600, checksum disable and watchdog timer disable.

Remove the shortcut after changing the baud rate.

PAD-DI8 wiring

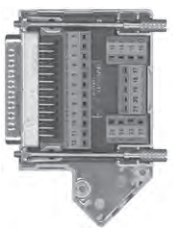
Channel 0 to 5 are differential inputs, channel 6 and 7 single ended (common ground).



Connection option for PAD-DI8 module

PAD-OPT2

25-pin SUB-D connector with screw terminal
(not included as a standard)



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7 channel relay output module

- 7 relay output channels
- High isolation voltage
- Signal connection via 25-pin SUB-D connector



Module specifications

	PAD-DO7
Number of channels:	7 relay output channels
Relay type:	Form 'A' relay SPST N.O. with dry contacts
Max. load:	0.5 A (60 V_{AC}) 1 A (24 V_{DC})
Isolation voltage:	300 V_{RMS}
Relay on time	Typical 5 ms
RS-485 interface:	Yes
Interface speed:	9600 bps
Power supply voltage:	+12 V_{DC} (±10 %)
Power consumption:	Typical 1.0 W

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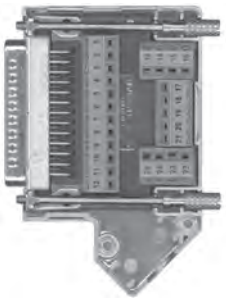
PAD-DO7

Signal connection

PAD-DO7 module



The current module address is labeled in the address field.



1	R1 NO	13	R7 NO
2	R1 COM	14	R7 COM
3	R2 NO	15	Not connected
4	R2 COM	16	Not connected
5	R3 NO	17	Not connected
6	R3 COM	18	Not connected
7	R4 NO	19	Not connected
8	R4 COM	20	+12 V_{DC} sensor supply
9	R5 NO	21	Init *1
10	R5 COM	22	GND / Init *1
11	R6 NO	23	Not connected
12	R6 COM	24	Not connected
		25	Not connected

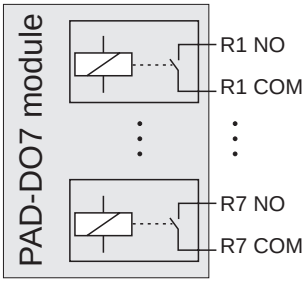
*1 A temporary shortcut between pin 21 and 22 (GND) offers the possibility to change the baud rate.

If the module settings are not known, a short power off - power on procedure has to be done after doing the shortcut. This resets the module to default address 00, baud rate 9600, checksum disable and watchdog timer disable.

Remove the shortcut after changing the baud rate.

PAD-DO7 wiring

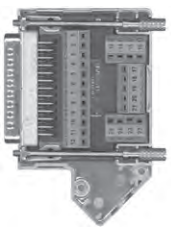
Each output channel has own common (COM) and normal open (NO) contacts.



Connection option for PAD-DO7 module

PAD-OPT2

25-pin SUB-D connector with screw terminal
(not included as a standard)



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CE-Certificate of conformity

CE

Manufacturer:

DEWETRON Elektronische Messgeraete Ges.m.b.H.

Address:

Parkring 4
A-8074 Graz-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 amplifier

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

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Notes

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