DEWETRON

HSI-LV Module

TECHNICAL REFERENCE MANUAL

WELCOME TO THE WORLD OF DEWETRON!

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

ISO9001

EN ISO 14001

THE MEASURABLE DIFFERENCE.

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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.

Safety instructions for DEWETRON amplifiers

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

Support

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

For Asia and Europe, please contact:

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

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

For the Americas, please contact:

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

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

Calibration information

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

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

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

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

General module specifications

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

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

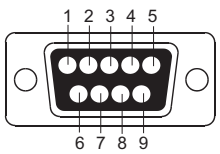
All modules are produced according ISO9001 and ISO14001.

Module connectors

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

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

HSI/DAQx and PAD module rear view



9-pin male SUB-D connector

Interface pin assignment:

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

[1)] Triggerout at DAQP-FREQ-A

General Module Information

RS-232/485 interface

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

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

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

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

HSI/DAQP module configuration

1. Push button selection

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

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

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

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

2. RS-232/485 programming

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

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

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

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

PAD module communication

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

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

High speed isolated voltage amplifier

- Bandwidth: 2 Mhz
- Input ranges: 12 ranges (10 mV to 50 V)
- Input type: AC and DC coupling software selectable
- TEDS: Supports electronic data sheet sensors
- Signal connection:
  - HSI-LV-B: Banana plugs
  - HSI-LV-BNC: BNC connector
  - HSI-LV-D: 9-pin D-SUB 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							
Rated input voltage	33 V_{RMS}, 46.7 V_{PEAK}, 70 V_{DC} according to EN-61010-1 and EN-61010-2-30							
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 5 kHz >5 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 500 Hz >500 Hz to 5 kHz >5 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							
Signal delay @ full bandwidth	approx. 405 ns							
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							
Filter characteristics 100 Hz to 1 MHz 2 MHz	 Butterworth or Bessel 40 dB/dec (2^{nd} order; ±1.5 dB @ f_0) Butterworth 60 dB/dec (3^{rd} order; 0 to -3 dB @ 2 MHz)							
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		60 dB					
10 kHz	95 dB		40 dB					
100 kHz	75 dB		20 dB					

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Input overvoltage protection	350 V_{DC}
Isolation voltage	1 kV_{RMS} [3]
Sensor supply	±9 V (±1 %), 12 V (±5 %), 200 mA resettable fuse protected[4]
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] Although the rated input voltage is 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} according to EN-61010-1 and EN-61010-2-30, the galvanic isolation has been tested with 1 kV_{RMS} for 1 min.

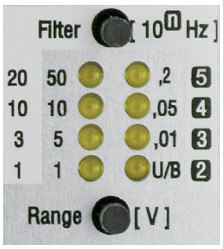
[4] Overall current should not exceed DEWE-30-xx maximum power.

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

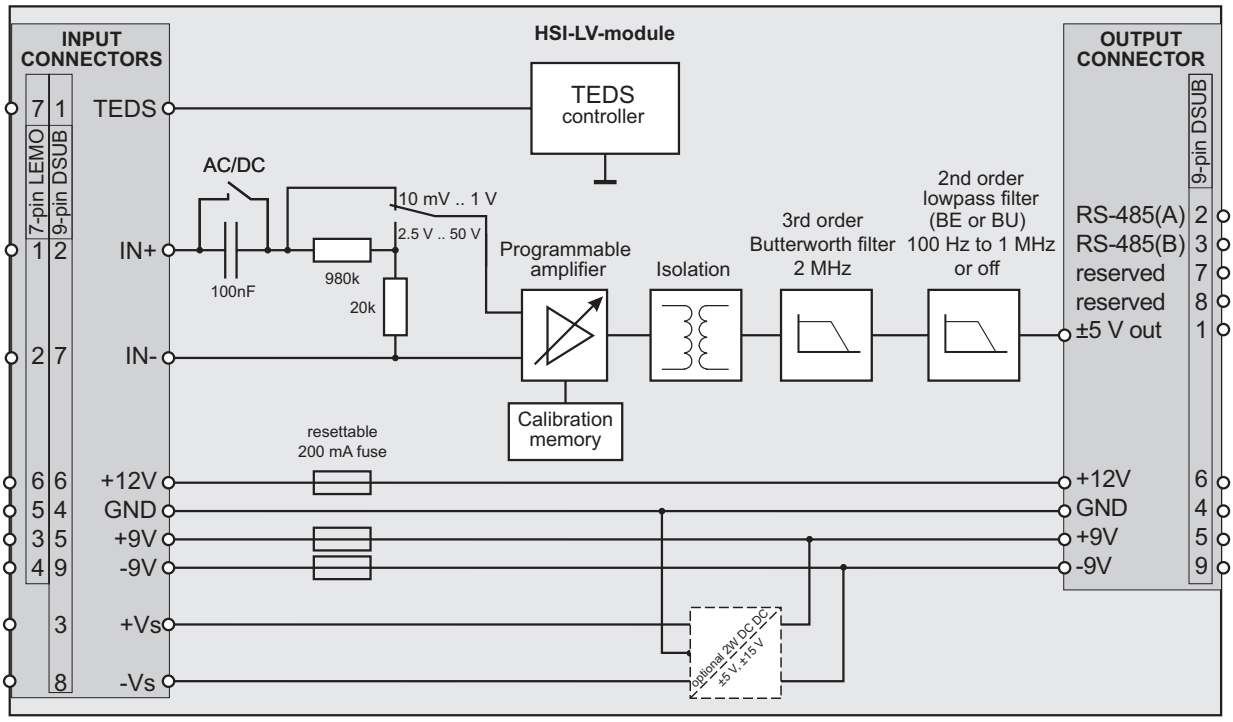
You can store the actual settings of the module in the internal EE-Prom memory. Once the module restarts, it comes up automatically with these setting. This is important for stand alone applications and for fail save reasons. If the function is deactivated the module automatically remembers the last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

Block diagram

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

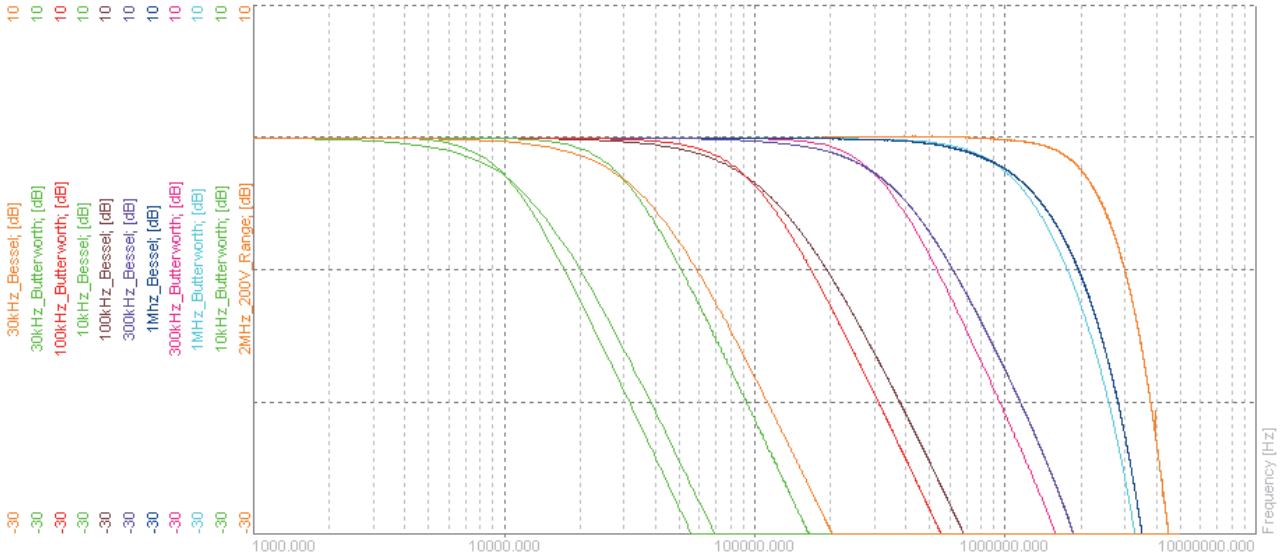


CAUTION: TEDS terminal is not isolated!

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

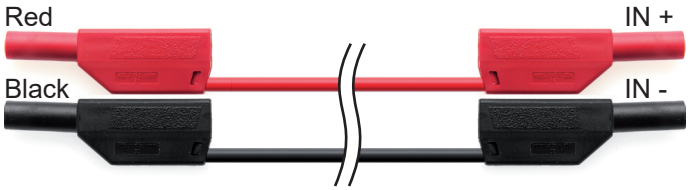
Please ensure that also the Hardware that carries the HSI Module is not limiting the 2 MHz bandwidth.

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.

Signal connection

HSI-LV-B module

Voltage measurement via banana plug cords



HSI-LV-BNC module

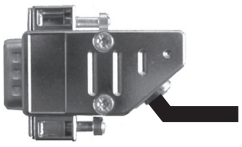
Voltage measurement via BNC cord

Hot: IN +

Shield: IN -

HSI-LV-D module

Voltage measurement via D-SUB cord

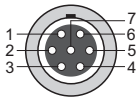


1 TEDS
2 IN +
3 Reserved for custom sensor supplies
4 GND (not isolated)
5 +9 V (200 mA max.)
6 +12 V (200 mA max.; +15 V in conjunction with a DEWE-30-4)
7 IN -
8 Reserved for custom sensor supplies
9 -9 V (200 mA max.)

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

HSI-LV-LEMO module

Voltage measurement via LEMO cord

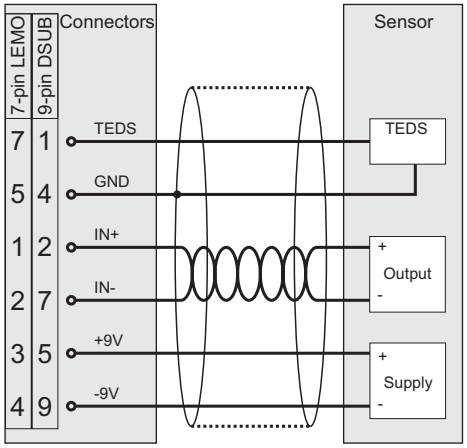


7-pin LEMO connector female
EGG.1B.307

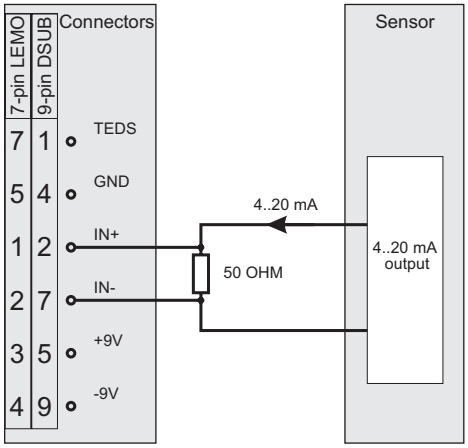
1 IN +
2 IN -
3 +9 V (200 mA max.)
4 -9 V (200 mA max.)
5 GND
6 +12 V (200 mA max.; +15 V in conjunction with a DEWE-30-4)
7 TEDS

Typical sensor connection

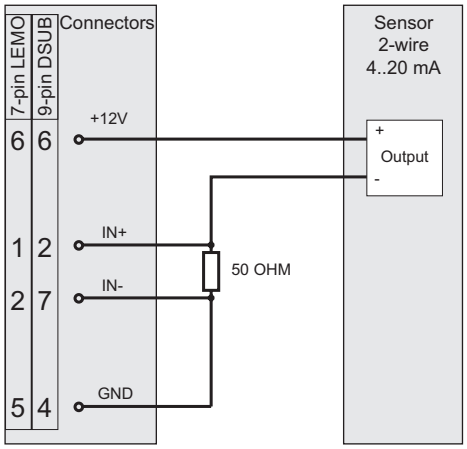
Sensor with differential output powered by the module



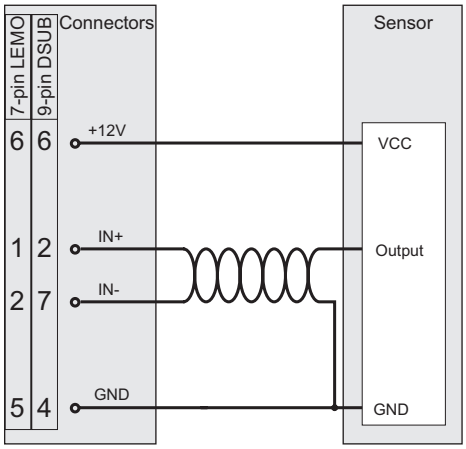
Current measurement



Loop powered sensor



Sensor with common ground



CE-Certificate of conformity

Manufacturer:

Address:

DEWETRON GmbH

Parkring 4
8074 Grambach, Austria

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

Name of product: **DEWE-MODULES**

Kind of product: *Signal conditioning modules*

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

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

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

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

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

Graz, April 28, 2010

Place / Date of the CE-marking

Dipl.-Ing. Roland Jeutter / Managing director

Notes