DEWESoft®
measurement innovation

DS-16xLVDTr

TECHNICAL REFERENCE MANUAL

Table of contents

1. About this document

This is the Technical Reference Manual for DS-16xLVDTr Version **1.0.0**.

1.1. Legend

The following symbols and formats will be used throughout the document.

Important
Gives you an important information about a subject.
Please read carefully!

Hint
Gives you a hint or provides additional information about a subject.

Example
Gives you an example to a specific subject.

Safety symbols in the manual:

Warning
Calls attention to a procedure, practice, or condition that could cause the body injury or death

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

1.2. Online versions

1.2.1. DS-16xLVDTr technical reference manual

The most recent version of this manual can be downloaded from our homepage:
https://download.dewesoft.com/list/manuals-brochures/hardware-manuals
In the *Hardware Manuals* section click the download link for the *DS-16xLVDTr technical reference manual*.

1.2.2. DEWESoft® tutorials

The DEWESoft® tutorials document, provides basics and additional information and examples for working with DEWESoft® and certain parts of the program.
The latest version of the DEWESoft® tutorials can be found here:
https://download.dewesoft.com/list/manuals-brochures/software-manuals
In the *Software Manuals* section click the download link of the DEWESoft X3 tutorials entry.

Important
Read safety instructions first in chapter 8. Safety instructions.

2. System Overview

DS-16xLVDTr

Combines 16 channels of LVDT signal conditioners in a 19”-rack housing with 1U height.

LVDT

LVDT

Strain / Stress

Full Bridge

1/2

Half Bridge

DSI Compatible

TEDS

TEDS Compatible

IP20

IP20

+50°
-20°

-20 °C to +50 °C

2.1. Main features

- **LVDT SENSOR INTERFACING:** DS-16xLVDTr uses a unique ratiometric architecture to eliminate several of the disadvantages associated with traditional approaches to LVDT interfacing. DS-16xLVDTr combines 16 channels of DSI-LVDT adapters in a 19”-rack housing with 1U height.

- **SYNCHRONISATION:** Main advantage of new design is a synchronous excitation signal provided from external function generator to a BNC front connector (IN connector). When using multiple DS-LVDTr devices the EXC signal can be daisy-chained from the BNC OUT connector to the BNC IN connector on the other device.

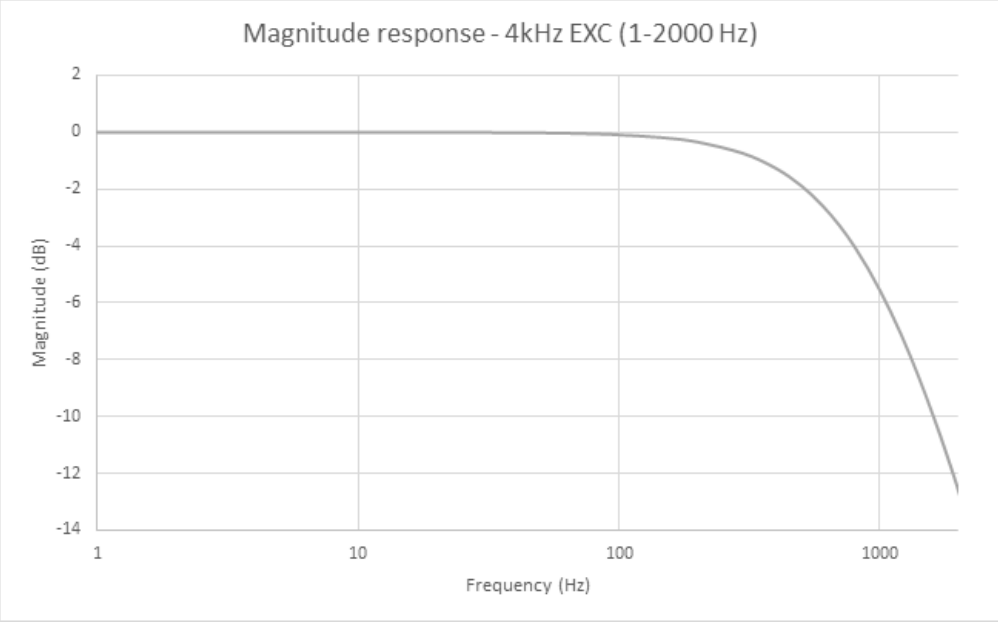
- **CONNECTIVITY:** Additionally, there are 16 DSUB-9M (male) connectors on the front panel of DS-16xLVDTr for the connection to the Dewesoft host amplifier. By each connector is a trimmer used for phase adjustment. On the back panel are 16 DSUB-9F (female) connectors for the sensor connection. DS-16xLVDTr supports measurements with full-bridge and half-bridge LVDT sensor types.

3. Specifications

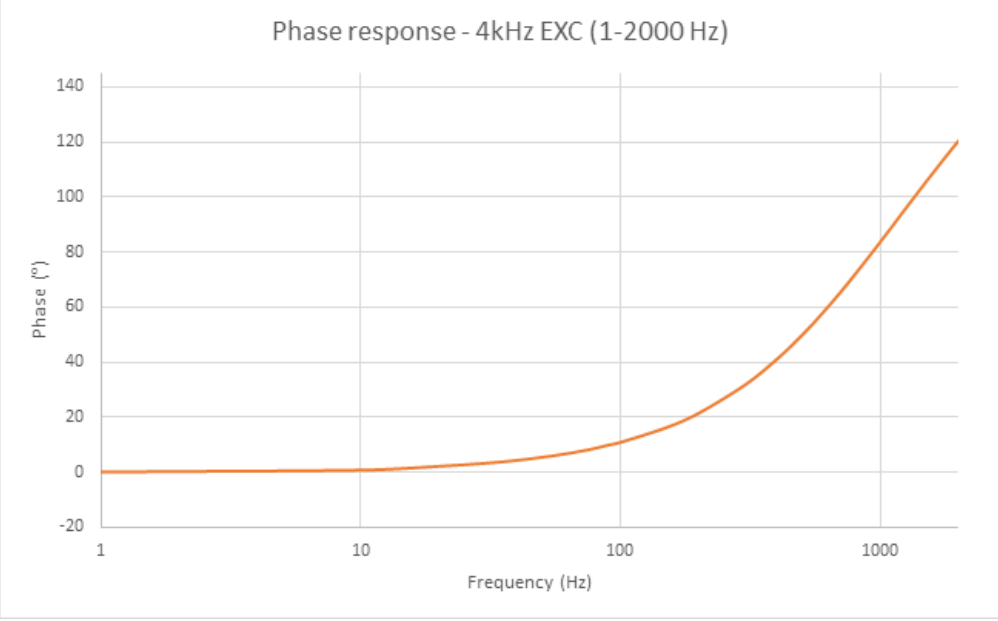
3.1. General

Parameter	Description
Power supply Exc. Voltage	10V – 15V, from EXC+ to EXC- outputs (SIRIUS STGv2 = 15V supply)
Power consumption per channel	320mW (15V supply, no load) 800mW (15V supply, 100R load on 3Vrms)
Output voltage max.	500mV for 1000mV/V HB LVDT
Output bandwidth	1kHz (-6dB, 90deg phase)
Gain error	1% of Full Scale
Output TCR	55ppm/K of Full Scale
Sensor supported type	Full Bridge / Half-Bridge LVDT impedance min. 120R.
SYNC Input Voltage	500mVrms typical recommended 1700mVrms max recommended
Sensor Exc. voltage	3Vrms max (15V supply) set on SYNC Inputs: 1.76 * Sync Input (Vrms) @ 4kHz 1.70 * Sync Input (Vrms) @ 10kHz
Sensor Exc. frequency	4kHz to 10kHz typical, set on SYNC Inputs
Phase compensation	-50° to +85° @ 4kHz -75° to +70° @ 10kHz
TEDS	1024-Bit, 1-Wire EEPROM
Operating temperature	-20°C to +50°C
Ingress protection	IP20
Humidity	5% to 85% RH non condensing @ 50°C
Dimensions	444 x 221 x 44 mm (W x D x H)
Weight	2300g

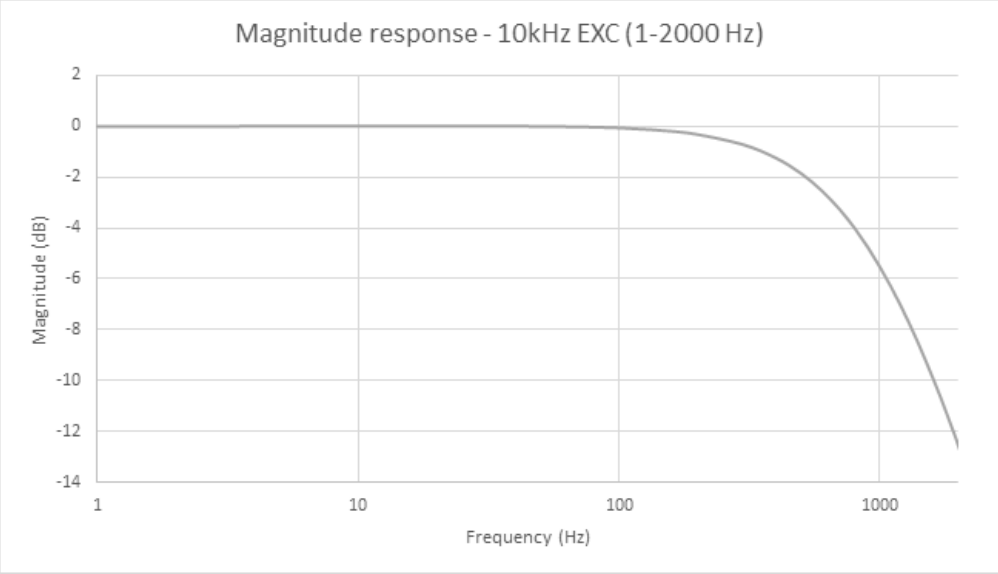
3.2. Output bandwidth - Magnitude and Phase response



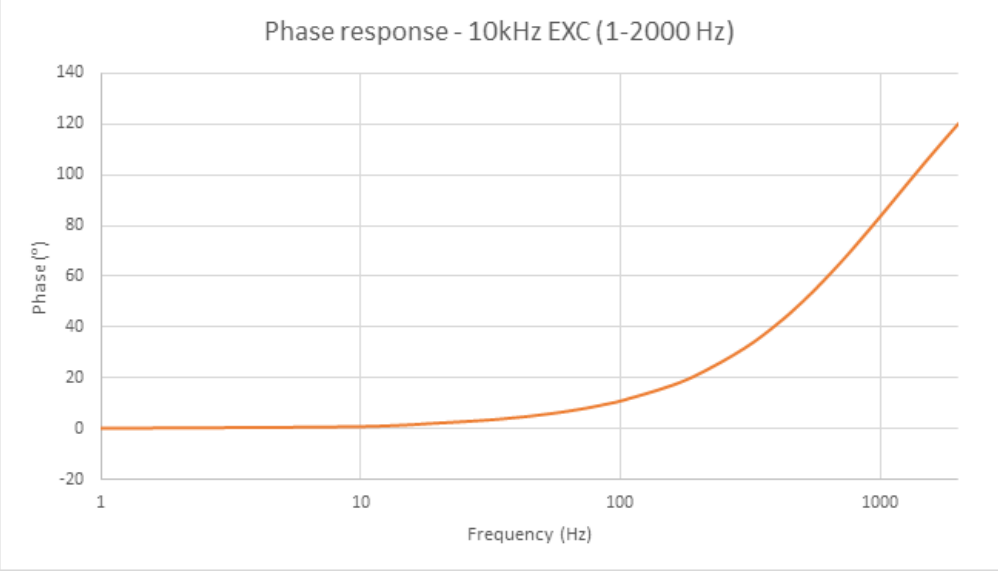
Typical magnitude response for 4kHz EXC



Typical phase response for 4kHz EXC



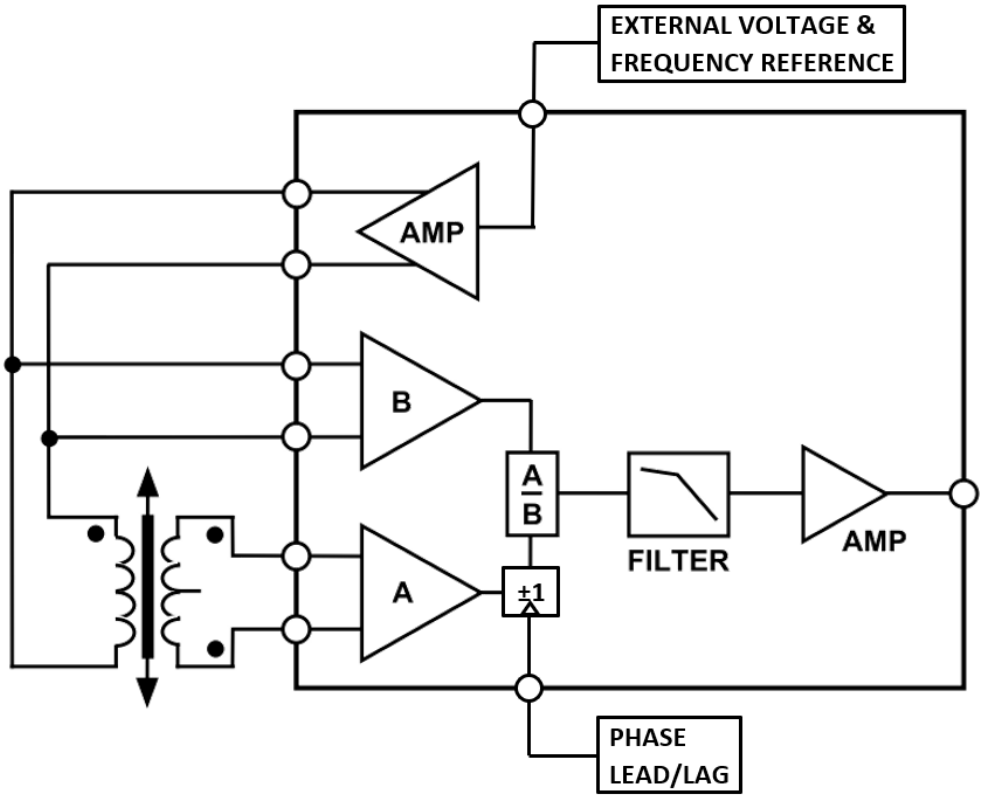
Typical magnitude response for 10kHz EXC



Typical phase response for 10kHz EXC

4. Theory of operation

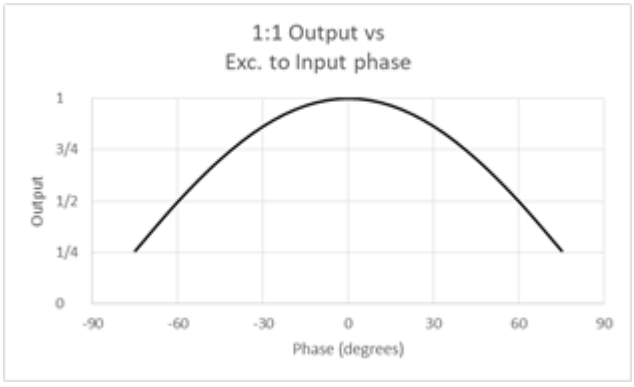
DS-16xLVDTr Adapter uses a unique ratiometric architecture to eliminate several of the disadvantages associated with traditional approaches to LVDT interfacing. The benefits of this new circuit are: minimal adjustments are required; temperature stability is improved; and transducer interchangeability is improved.



Functional block diagram of a single shannel of DS-16xLVDTr adapter

DS-16xLVDTr adapter SENSE inputs are connected as B-Inputs and adapters IN are connected as A-Inputs. Phase Lead / Lag circuit will compensate difference of the sensor output in reference to Exc. and Sense inputs.

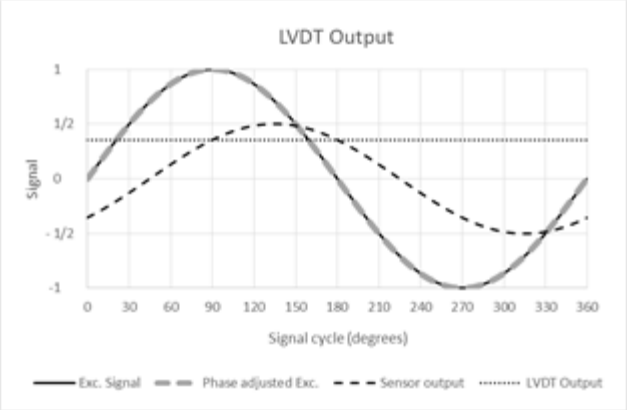
Output signal level will depend on the phase difference between the sensor output and Sense inputs.



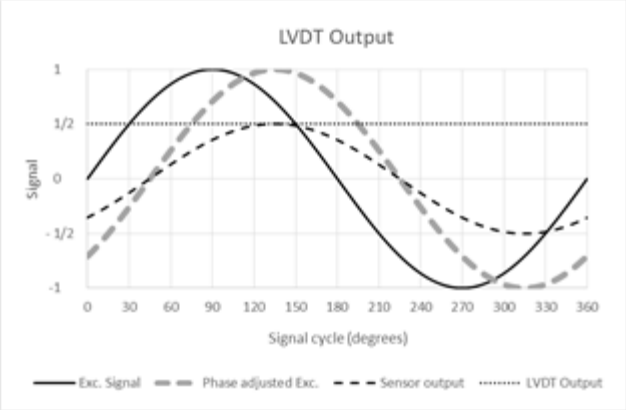
LVDT adapter output sensitivity to input signal phase lead/lag, 1:1 sensor

Two examples are shown for sensor with sensitivity = 0,5. Output signal level is of the Exc. Signal. Sensor output phase lag is 45⁰. LVDT adapter output is ≈0,35 (≈1Vexc · sensitivity · 0,70).

When phase compensation matches phase lead / lag of sensor output LVDT adapter output will be at its maximum = 0,5 (=1Vexc · sensitivity · 1,00).



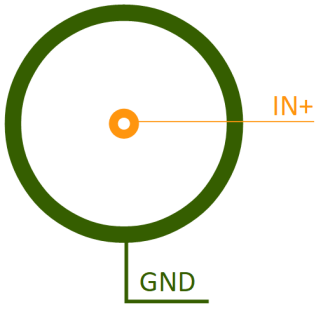
Example: 45⁰ sensor output, no compensation



Example: 45⁰ sensor output, 45⁰ compensation

5. SYNC inputs

2x BNC SYNC input connectors



BNC SYNC input pinout

Parameter	Description	Comment
Input connectors	2 x BNC	Parallel, Not isolated
Coupling	AC - High pass	-3dB @ 16Hz (1st order)
Input impedance	1MR	
Overvoltage Protection / ESD	36V	Bidirectional TVS
Overcurrent Protection	2.4mA typical	Resettable
Input Bandwidth	4kHz 10kHz 20kHz	Att: 0% 17deg phase relative to input Att: <2% 45deg phase relative to input -3dB @ 20kHz (2nd order)

5.1. Sync input to LVDT-EXC transfer function

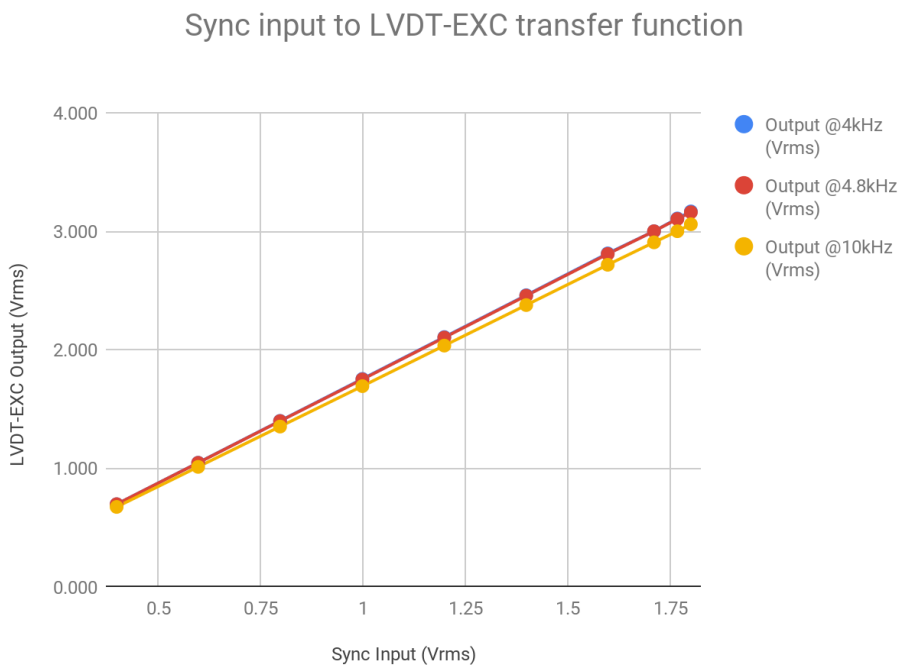


Table of Transfer Coefficients:

Parameter	Output @4kHz (Vrms)	Output @4.8kHz (Vrms)	Output @10kHz (Vrms)
Transfer-K	1.76	1.76	1.7

Sensor LVDT-EXC Output equation:

$$LVDT - EXC\ Output\ (V\,rms) = Transfer - K * Sync\ Input\ (V\,rms)$$

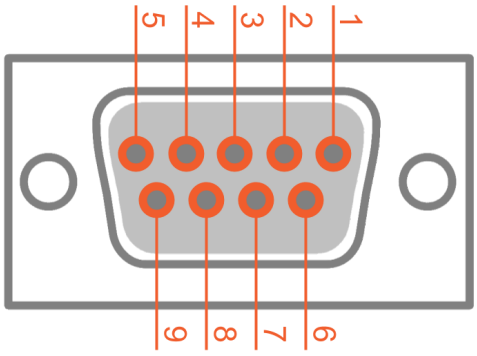
Influence on Noise floor
Noise floor may differ with Sync Input Voltage level. Adjust if required.

6. Sensor inputs

LVDT sensor inputs are located on the back side

Parameter	Description	Comment
Connectors	16 x DSUB-9 female	Not isolated
Sensor Probe type	Half Bridge / Full Bridge	Optional: Internal HB termination on In-

6.1. Pinout



Pin Assignment DSUB9-female

1: Sensor supply, excitation +

2: Sensor Output +

3: Sense -

4: Ground

5: Not Connected

6: Sense +

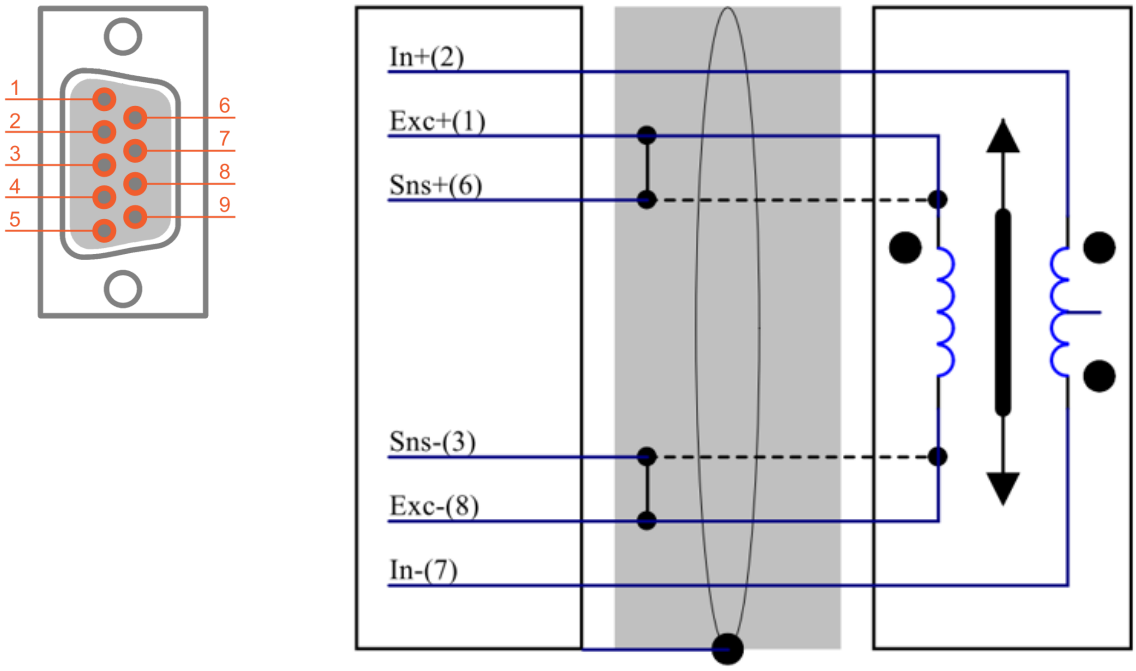
7: Sensor Output - [1.]

8: Sensor supply, excitation -

9: Reserved

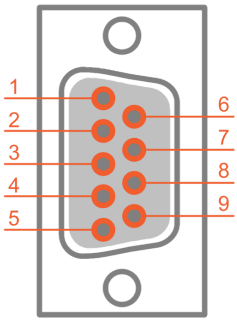
Important
Optional **internal** HB completion: Do not connect Sensor Output-. Pin-7 internally terminated as Half-Bridge. Must specify when ordered!

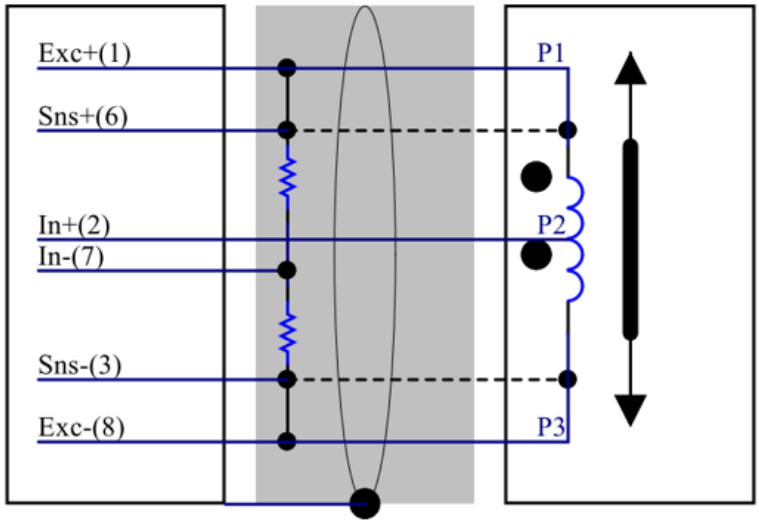
6.2. Typical Full Bridge sensor connection



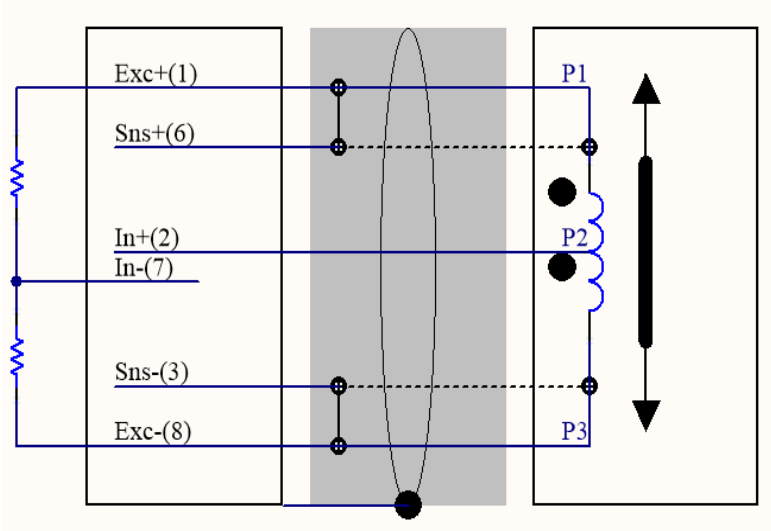
Note
6-wire connection only shown. 4-wire also possible, connect Sns and Exc signals on adapter side of connector.

6.3. Typical Half Bridge sensor connection





External Half Bridge completion

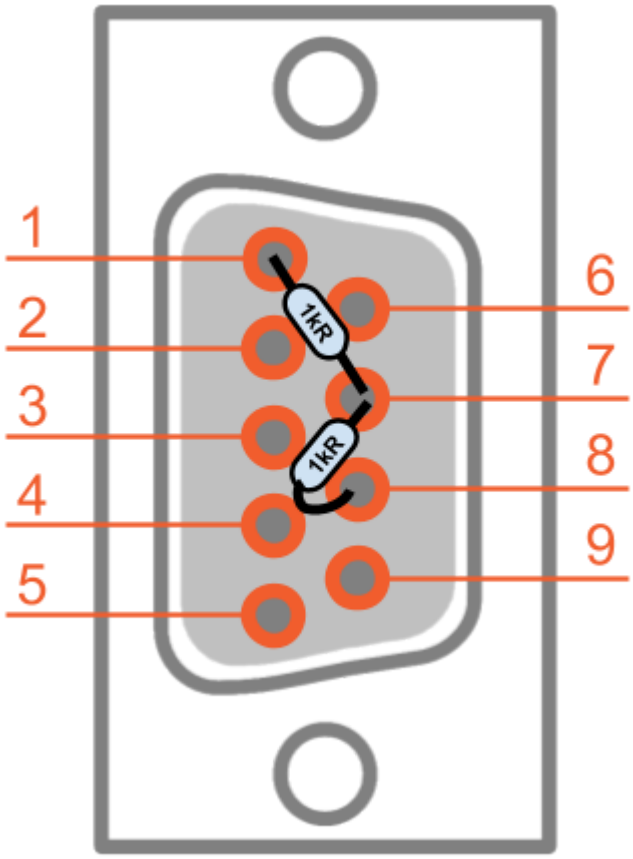


Optional internal Half Bridge completion

Important
Input - (pin7) shall be connected to half bridge completion resistor divider assembled with discrete resistors with the following recommended specifications:

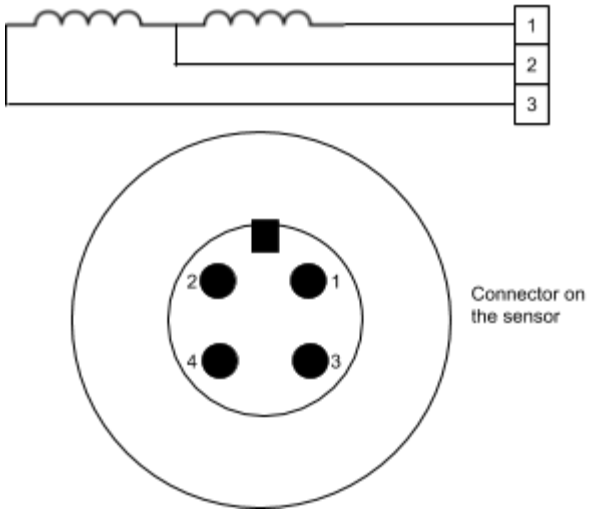
- Resistance 1kΩ,
- Tolerance 0.1%,
- Temperature coefficient 15ppm,
- Power 0,125W.

This connection is preferred over the connection IN- to GND (so called “noisy GND”).



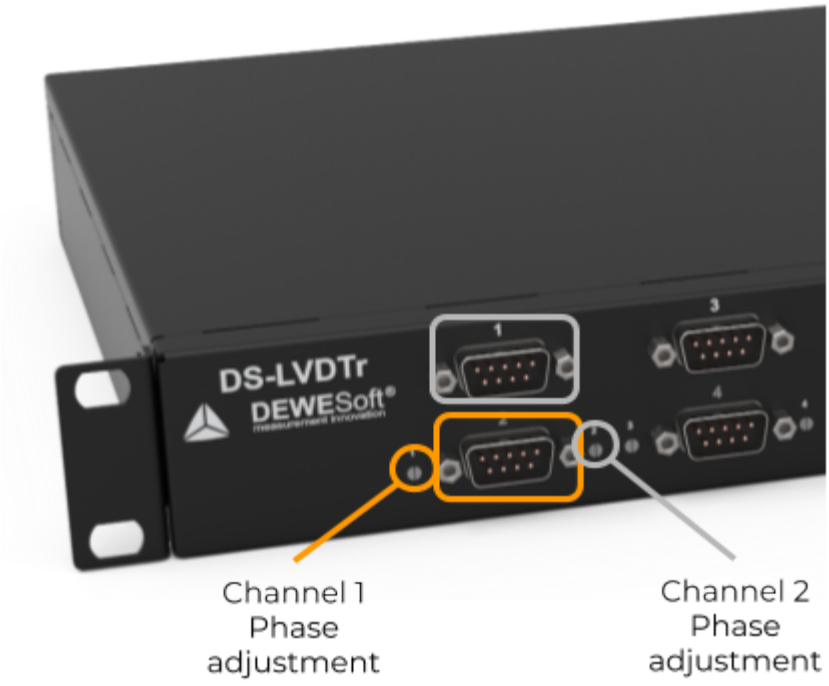
External Half Bridge completion, DSUB9 solder side view

Example
Example sensor pinout.



7. Adapter outputs

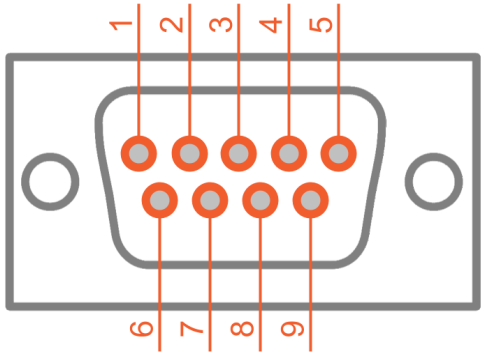
DS-16LVDTr adapter outputs are located on the front side



Channels Phase adjustment positions on front side

Parameter	Description	Comment
Connectors	16 x DSUB-9 male	Not isolated
Phase adjustment	18 turn trimmer	2.5mm slotted shaft

7.1. Pinout



Pin Assignment DSUB9-male

1: Power supply +

2: Output +

3: Power supply (sns) +

4: Ground

5: Not Connected

6: Power supply (sns) -

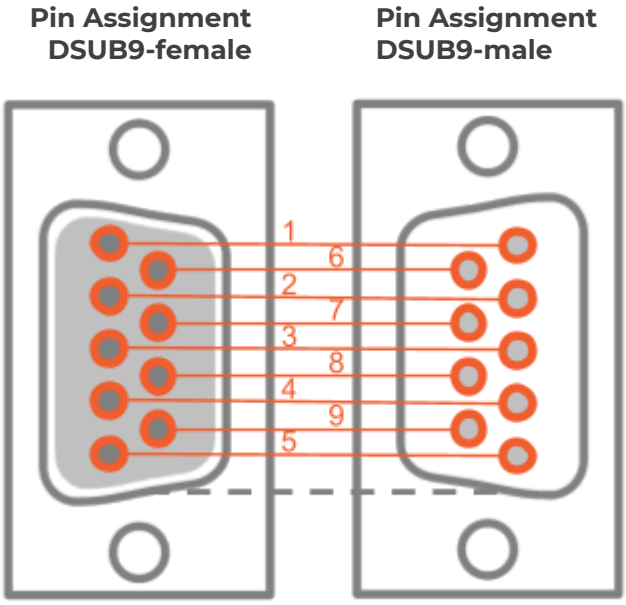
7: Ground

8: Power supply -

9: TEDS

7.2. Typical connection to DEWESoft amplifier w. DSUB-9 connector

Use shielded DSUB9-male to DSUB9-female extension cable.



8. Safety instructions

Your safety is our primary concern! Please be safe!

8.1. General Safety Instructions

Warning

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. Dewesoft d.o.o. assumes no liability for the customer's failure to comply with these requirements.

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

8.1.1. Environmental Considerations

Information about the environmental impact of the product.

8.1.2. Product End-of-Life Handling

Observe the following guidelines when recycling a Dewesoft system:

System and Components Recycling
Production of these components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at its end of life! Please recycle this product in an appropriate way to avoid an unnecessary pollution of the environment and to keep natural resources.

This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further information about recycling on the Dewesoft web site www.dewesoft.com

Restriction of Hazardous Substances
This product has been classified as Monitoring and Control equipment and is outside the scope of the 2002/95/EC RoHS Directive. However, we take care of our environment and the product is lead-free.

8.1.3. General safety and hazard warnings for all Dewesoft systems

Safety of the operator and the unit depend on following these rules.

- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- You may not connect higher voltages than rated to any connectors.
- The power cable and connector serve as Power-Breaker. The cable must not exceed 3 meters, the disconnect function must be possible without tools.
- Maintenance must be executed by qualified staff only.
- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advice for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- 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.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.
- The inputs must not unless otherwise noted (CATx identification), be connected to the mains circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorized personnel only.
- Adverse environmental conditions are Moisture or high humidity Dust, flammable gases, fumes or dissolver Thunderstorm or thunderstorm conditions (except assembly PNA) Electrostatic fields, etc.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuiting, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened.
- 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 the safe operation can be verified by service-trained personnel. If necessary, return the product to Dewesoft sales and service office for service and repair to ensure that safety features are maintained.
- If you assume a more riskless use is not provided anymore, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more riskless operation is not possible anymore if the system is damaged obviously or causes strange

noises. the system does not work anymore. the system has been exposed to long storage in adverse environmental. the system has been exposed to heavy shipment strain.

- Warranty void if damages caused by disregarding this manual. For consequential damages, NO liability will be assumed!
- Warranty void if damage to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details, please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of high magnetic or electromagnetic fields, transmitting antennas or high-frequency generators, for exact values please refer to the enclosed specifications.
- Use measurement leads or measurement accessories aligned with the specification of the system only. Fire hazard in case of overload!
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipment in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use in humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already- lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advice of the connected systems.
- This product has left the factory in safety-related flawless and in proper condition. In order to maintain this condition and guarantee safety use, the user has to consider the security advice and warnings in this manual.

9. Notice

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

Note:
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9.1. Warranty Information

The copy of the specific warranty terms applicable to your Dewesoft product and replacement parts can be obtained from your local sales and service office. To find a local dealer for your country, please visit https://dewesoft.com/support/distributers.

9.2. Calibration

Every instrument needs to be calibrated at regular intervals. We recommend annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

9.3. Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

E-mail: support@dewesoft.com

Address:
Dewesoft d.o.o.
Gabrsko 11a
1420 Trbovlje Slovenia

Europe Tel.: +386 356 25 300
Web: http://www.dewesoft.com
The telephone hotline is available Monday to Friday from 07:00 to 16:00 CET (GMT +1:00)

9.4. Service/repair

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly on https://dewesoft.com/support/rma-service.

9.5. Restricted Rights

Use Slovenian law for duplication or disclosure. Dewesoft d.o.o. Gabrsko 11a, 1420 Trbovlje, Slovenia / Europe.

9.6. Printing History

Version 1.0.0
Released 2019
Last changed: 06/12/2019 at 11:00.

9.7. Copyright

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9.8. Trademarks

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The Dewesoft name is a registered trademark.
Product families (KRYPTON, SIRIUS, DSI, DS-NET, IOLITE) and technologies (DualCoreADC, SuperCounter, GrandView) are registered trademarks as well.
When used as the logo or as part of any graphic material, the registered trademark sign is used as a part of the logo.
When used in text representing the company, product or technology name, the ® sign is not used. The Dewesoft triangle logo is a registered trademark but the ® sign is not used in the visual representation of the triangle logo.

9.9. Documentation version

Doc-Version	Date [dd.mm.yyyy]	Notes
1.0.0	06.12.2019	Initial version