

Technical documentation

LDT-401

Module for reading in up to two LVDT sensors



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1 General information

1.1 Product Name

LDT-401 Module for reading up to two LVDT sensors with 4-wire connection

1.2 Scope of supply

The scope of supply includes the module incl. the terminal blocks belonging to the housing as well as two back-plane bus connectors for connection to control modules from W.E.St. that support a connection via this digital interface.

Cables and other parts that may be required must be ordered separately.

This documentation is also available as a PDF file on the Internet at www.w-e-st.de.

1.3 Symbols used



General note



Safety relevant note

1.4 Legal notice

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Date: 20.06.2022

The data and characteristics described herein serve only to describe the product. The user is required to evaluate this data and to check suitability for the particular application. General suitability cannot be inferred from this document. We reserve the right to make technical modifications due to further development of the product described in this manual. The technical information and dimensions are non-binding. No claims may be made based on them.

This document is protected by copyright.

1.5 Safety instructions

Please read this documentation and safety instructions carefully. This document will help you to define the area of application of the product and to carry out the commissioning. Additional documentation (WPC-300 for commissioning software) and knowledge about the application should be taken into account or be available. General rules and laws (depending on the country: e.g. accident prevention and environmental protection) must be taken into account.



These modules are designed for hydraulic applications in open or closed loop. Equipment faults (in the module or on the hydraulic components), application errors and electrical faults can cause uncontrolled movements. Work on the drive or the electronics may only be carried out when it is switched off and depressurised.



This manual describes only the functions and electrical connections of this electronic assembly. For commissioning, all technical documents concerning the system must be taken into account.



Connection and commissioning may only be carried out by trained specialists. The operating instructions must be read carefully. The installation instructions and the instructions for commissioning must be observed. In the event of non-observance of the instructions, faulty installation and/or improper handling, the warranty and liability claims become invalid.



ATTENTION!

All electronic modules are manufactured to a high quality. However, it cannot be ruled out that malfunctions may occur due to component failure. The same applies, despite extensive testing, to the software. If these units are used in safety-relevant applications, suitable measures must be taken outside the unit to ensure the necessary safety. The same applies to malfunctions that impair safety. No liability can be accepted for any damage that may occur.



Further notes

- Operation of the module is only permitted in compliance with the national EMC regulations. Compliance with the regulations is the responsibility of the user.
- The appliance is intended for commercial use only.
- When not in use, the module must be protected from the weather, dirt and mechanical damage.
- The module must not be used in an explosive environment.
- The ventilation slots must not be covered for sufficient cooling.
- Disposal must be carried out in accordance with national legal requirements.

2 Properties

Module for reading two LVDT sensors with 4-wire connection.

The unit comprises two completely independent channels that do not influence each other. It can also be used for one channel only.

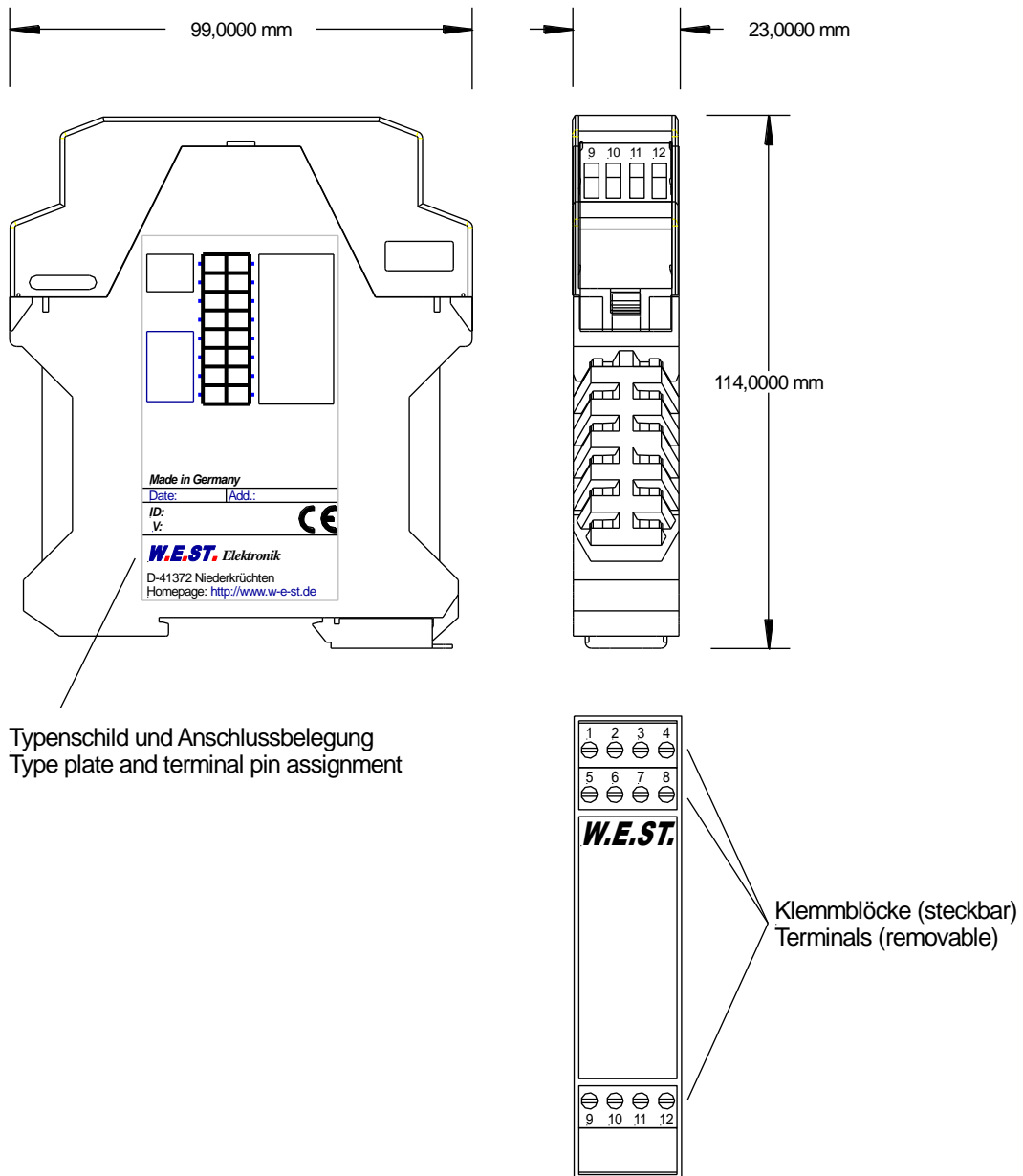
Preferably, the unit is used in combination with a control module with backplane bus connection so that the high resolution of the integrated ADC is utilised.

In addition, the measured values are output via two Analog outputs 0 to 10V (not scalable) if the application does not support digital coupling via the backplane bus.

Features

- **Reading of two LVDT sensors with 4-wire connection**
- **I2C (backplane bus) ADC converter for two channels, 16 bit (with oversampling)**
- **Additionally two Analog outputs for measured value output from 0 to 10V (not scalable)**

2.1 Device description



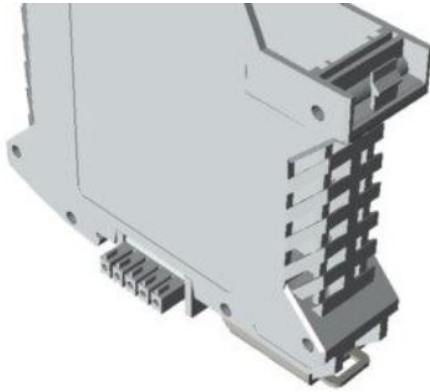
2.2 Application and use

2.2.1 Installation instructions

- This module is intended for installation in a shielded EMC housing (control cabinet). All cables leading to the outside must be shielded, whereby a complete shielding is required. When using our control modules, it is also assumed that no strong sources of electromagnetic interference are installed in the vicinity of the module.
- **Typical installation location:** 24 V control signal area (near PLC).
By arranging the units in the control cabinet, separation between the power section and the signal section must be ensured. Experience shows that the installation space close to the PLC (24 V range) is most suitable. All digital and Analog inputs and outputs are provided with filters and overvoltage protection in the unit.
- The module must be installed and wired according to the documentation and under EMC aspects. If other loads are operated on the same power supply unit, star grounding is recommended. The following points must be observed when wiring:
 - The signal lines must be laid separately from power-carrying lines.
 - Analog signal lines **must be** shielded.
 - All other cables must be shielded in case of strong sources of interference (frequency converters, power contactors) and cable lengths > 3 m. In the case of high-frequency radiation, inexpensive folding ferrites can also be used.
 - The shielding must be connected to PE (PE terminal) as close to the module as possible. The local requirements for the shielding must always be taken into account. The shielding must be connected to PE on both sides. In case of potential differences, equipotential bonding must be provided.
 - For longer cable lengths (>10 m), the respective cross-sections and shielding measures must be evaluated by qualified personnel (e.g. for possible interference and sources of interference as well as with regard to voltage drop). For cable lengths over 40 m, special care must be taken and, if necessary, the manufacturer must be consulted.
- A low-impedance connection between PE and the mounting rail must be provided. Transient interference voltages are conducted from the module directly to the mounting rail and thus to the local earthing.
- The power supply should be a regulated (typically: PELV system according to IEC 60364-4-41 / VDE 0100-410 , safe extra-low voltage). The low internal resistance of regulated power supplies enables better interference voltage dissipation, which improves the signal quality, especially of high-resolution sensors. Switched inductances (relays and valve coils) on the same power supply must always be wired with appropriate overvoltage protection directly on the coil.

2.2.2 Handling the DIN Rail - Bus connectors

The scope of delivery of the unit includes two bus connectors for clipping into the mounting rail. They are used for data communication to a control module that supports this connection, such as the PQP-179. The bus connectors are first plugged together and then clipped into the mounting rail. The LDT-401 assembly is plugged onto the left of the two connectors:



Then the control module is mounted on the right of it on the mounting rail so that its left slot also makes contact with the bus connector.

3 Commissioning

3.1 Procedure for commissioning

Step	Activity
Installation	Install the unit according to the block diagram. Make sure that the wiring is correct and that the signals are well shielded. The unit must be installed in a protected housing (control cabinet or similar).
First switch on	Ensure that no unwanted movements can occur at the drive (e.g. switching off the hydraulics). Connect an ammeter and check the current consumption of the unit. If it is higher than indicated, there are wiring faults. Switch off the unit immediately and check the wiring.
Check or adjust the gain	See chapter 5.
Scaling of the Measured value	In the connected controller module, the supplied raw value is scaled to the physical range of the measurand or %. See the documentation of the corresponding module.

4 Technical description

4.1 Input and output signals

Connection	Analog outputs
PIN 1	Analog output LVDT 1 sensor 0 to 10V (actual range adjustable with dip switches)
PIN 2	Analog output LVDT 2 sensor 0 to 10V (actual range adjustable with dip switches)
Connection	Supply
PIN 3	Power supply (see technical data)
PIN 4	0 V (GND) Supply connection
Connection	LVDT sensors
PIN 5	LVDT1 +AIN (measuring signal)
PIN 6	LVDT1 -AIN (measuring signal)
PIN 7	LVDT1 EXC1 (supply -)
PIN 8	LVDT1 EXC2 (supply +)
PIN 12	LVDT2 +AIN (measuring signal)
PIN 11	LVDT2 -AIN (measuring signal)
PIN 10	LVDT2 EXC1 (supply -)
PIN 9	LVDT2 EXC2 (supply +)

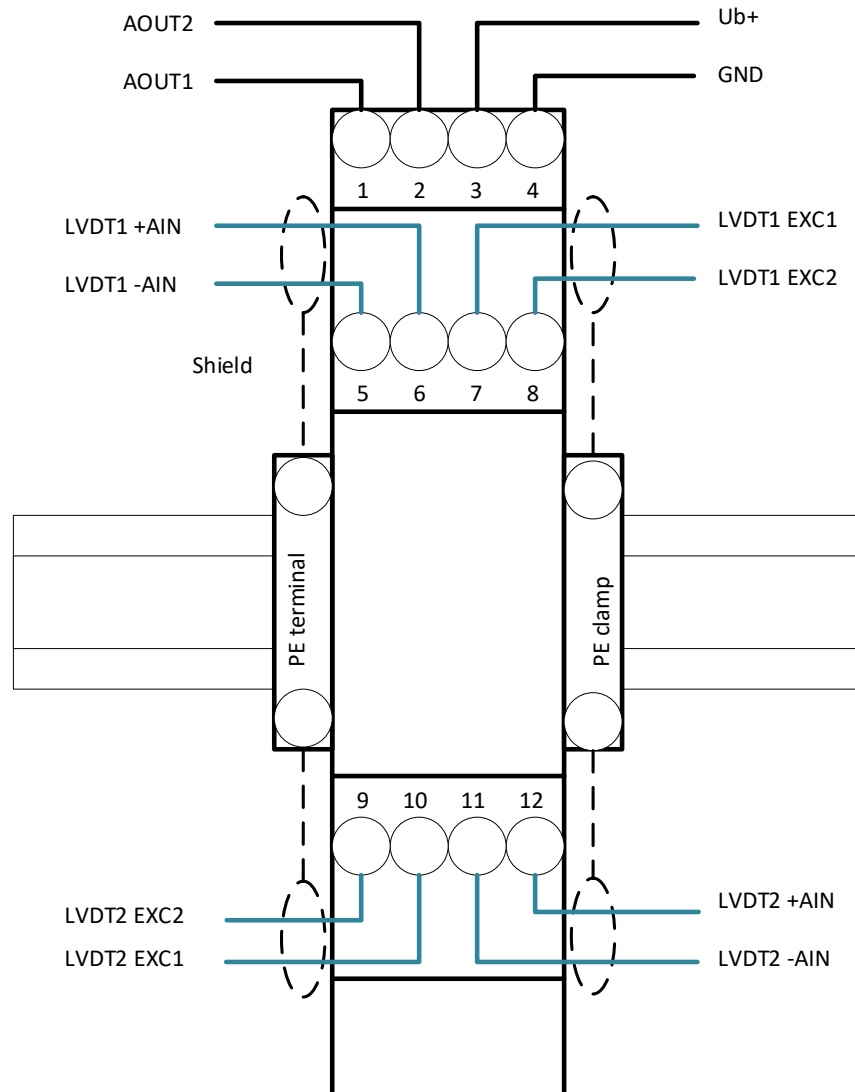
Polarity of the LVDT signals:

Since these are AC voltage signals, the polarity can also be swapped. During evaluation, the phase is detected so that a swapped polarity leads to a reversal of the direction of the output signal (rising or falling signal over the stroke).

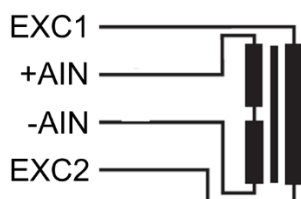
In further signal processing, this can be compensated again by scaling the measured value accordingly. Therefore, it is only important to clearly define the connection.

If the direction of the output signal is relevant when it is fed out via the Analog outputs, it can be reversed by swapping the connections on the side of the supply or the measuring signal. Swapping on both sides at the same time has no effect.

4.2 Typical wiring



4.3 Connection example



4.4 Technical data

Supply voltage (U _b)	[VDC]	21.5... 30 (incl. ripple)
Power consumption	[mA]	36 + Current for LVDT sensor
Analog outputs		
Voltage	[V]	0... 10
Maximum load	[mA]	10
Min. resistance LVDT primary side	[Ohm]	42
Output EXC	[Vrms]	3.15
Measuring frequency	[kHz]	5.2
LVDT sensitivity:		
Amplifier stage 1	[Vrms]	0.24
Amplifier stage 2	[Vrms]	0.44
Amplifier stage 3	[Vrms]	0.8
Amplifier stage 4	[Vrms]	1.03
Cut-off frequency	[Hz]	530
Housing		Snap-on module according to EN 50022
Material	-	Polyamide PA 6.6
Flammability class	-	V0 (UL94)
Weight	[kg]	0.14
Protection class	[°C]	IP20
Temperature range	[C°]	-20... 60
Storage temperature	[C°]	-20... 70
Humidity	[%]	< 95 (non-condensing)
Connections		
Connector	-	4 x 4-pole terminal blocks with screw terminals
PE		via the DIN mounting rail
EMC	-	EN IEC 61000-6-2:2019 EN IEC 61000-6-4:2019

5 Gain setting

The LDT-401 module is connected to one or two inductive position transducers (LVDT/differential transformers) in a 4-wire circuit via terminals 5 to 8 and 9 to 12.

The setting of a suitable amplification is very important to ensure the optimal resolution of the measurement, but to be able to capture the measuring range without overdriving.

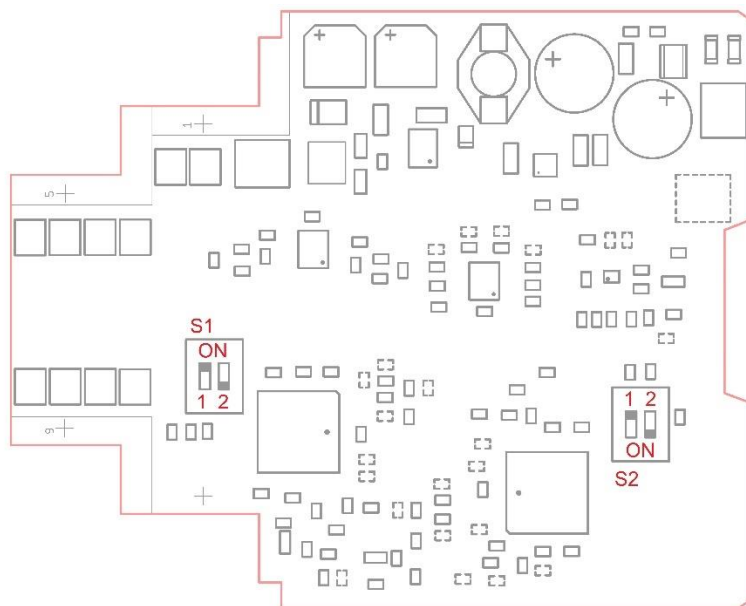
The picture below shows the dip switch blocks S1 and S2. They are respectively responsible for the amplifier setting of the connections LVDT1 and LVDT2.

To adjust the switches, pull the circuit board out of the lower part of the housing.

To do this, two latching lugs (top and bottom) must be pushed back:



View of the circuit board:



It is possible to set four amplification values using the dip switches.

Amplifier stage	Dip switch	
1	1 - OFF 2 - OFF	highest amplification
2	1 - ON 2 - OFF	Default setting for channel 1 (S1)
3	1 - OFF 2 - ON	Default setting for channel 2 (S2)
4	1 - ON 2 - ON	lowest amplification

In the delivery state, the dip switches are preset according to the table.

Based on the data sheet information of the LVDT used and the information on sensitivity (see chapter 4.3), one can make a theoretical presetting.

In practice, it is now necessary to check that the following intervals of the output signals are not left at the ends of the mechanical stroke to be detected:

- Use of the digital interface (backplane bus):
The raw value display of the LVDT measurement in the controller should remain in the range of 5% to 100%.
- Use of the analog outputs on terminals 1 and 2:
The measured voltage should remain in the range of 0.5 V to 10 V.

Depending on the application, only the associated criterion is decisive.

If the above limits are violated, reduce the gain of the corresponding channel by one level and repeat the check.

In this way, even without knowing the theoretical value, the setting can be made without any problems.

6 Notes