

## Operating manual

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# Multicomponent Transducer Series LVS

10 kN - 250 kN  
100 - 5000 N · m





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The content of these manual is intended solely for information purposes and can be changed at any time without prior notification.

With regard to the warranty and liability, we refer expressly to our 'General commercial terms and conditions' ([www.gtm-gmbh.com](http://www.gtm-gmbh.com)) and the instructions and regulations contained in these installation and operating instructions.

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# 1. Product description

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## 1.1 Designated use

The multicomponent transducer of the LVS series is to be used for measuring static and dynamic forces and torque vectors in test benches and test machines.

Any other use is not intended and is therefore prohibited. No claims may be made for damage resulting from inappropriate use.

The limit values for the total load and all other limits must be complied with.

## 1.2 Exempted use

The multicomponent transducer is not a safety component. You must not use it in a complete system in which its failure may lead to the life and well being of people being endangered.

The transducer is not suitable or approved for use in potentially explosive areas.

## 2. Safety instructions

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### Markings used

The following designations and symbols are used in the operating manual to identify hazards:



**DANGER!**

Denotes a possibly hazardous situation that can lead to physical injuries or death.



**DANGER!**

Denotes a hazardous situation due to electrical voltage that can lead to physical injuries or death.



**NOTE!**

Denotes usage tips, general information and other useful notes.



**DANGER OF BURSTING!**

Denotes a potentially hazardous situation that can cause physical injuries or death if ignored.

▶ Denotes handling instructions

● Denotes lists

## Additional regulations

This operating manual contains the most important notes for safe operation of the transducer. Consideration must also be given to the legal and safety regulations applicable at the operating location, the accident prevention regulations applicable at the operating location and the technical data in connection with the safety regulations listed here.

## Residual hazards

The transducer of series LVS is state-of-the-art technology and safe to operate. Residual hazards can arise during operation if the devices are used and operated improperly by unqualified personnel.

The scope of delivery for the transducer only covers a partial area of mechatronic metrology. The safety-related criteria for using the transducer within a complete system must be taken into account by the system design engineer, the equipment manufacturer and/or the operator so that residual hazards are minimised. Reference must be made to the remaining residual hazards in the complete system.



### **DANGER!**

In the case of a complete system, the safety-related criteria must be taken into account so that any failure of the transducer does not present a hazard to anyone.

## Transducer condition and modifications

You may only operate the transducer in a perfect condition while complying with the instructions given in the operating manual.

The transducer must not be modified either in its design or safety-related features, without our express, written permission.

## Overloading

All transducers of this series have already been subjected to an overload test at the manufacturer's. No additional overloads are permissible; always comply with the nominal loads of the transducer.



### **DANGER OF BURSTING!**

Do not overload the transducer!

The attached parts must also be designed to bear the maximum load. Only use attached parts in an appropriate condition.

In case of new, untested designs, you must provide additional protective measures against bursting parts.

## Personnel qualifications

The transducer and additional components must only be operated and assembled by qualified personnel. Qualified personnel are those persons who are acquainted with the assembly, commissioning and operation of the transducer and who have the appropriate qualifications for their job.



### **NOTE**

GTM offers training courses to qualify personnel.

## Ambient conditions

The transducer is intended for use in enclosed rooms while complying with the ambient conditions detailed in the technical specifications.

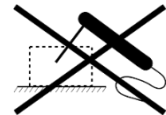
The transducer is not permitted for use in potentially explosive areas.



Protect the transducer against the influences of weather, such as rain and snow. Take appropriate measures on-site against power surges, e.g. from lightning strike.



No welding circuits may be introduced through the body of the transducer. If in doubt, you must dismantle the transducer.



### **DANGER!**

The transducer is not suitable for:

- Potentially explosive areas
- Power surges
- Welding circuits



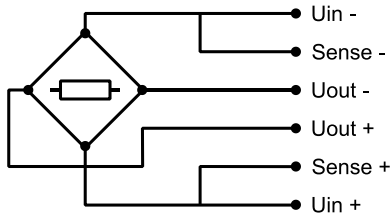
### 3. Storage and transport instructions

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The transducer series LVS is a precision measuring device and must be handled with appropriate caution.

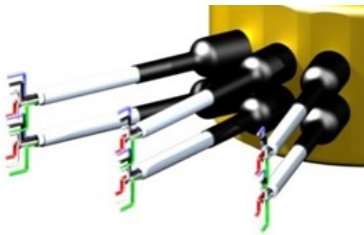
- ▶ If the transducer is dropped or jolted it can become damaged prohibiting any further use.
- ▶ During storage, secure rotationally symmetrical transducers and attachment parts from rolling away.
- ▶ Only use the original transport packaging and other appropriate cut-to-size packaging for storage and transport.

# 4. Cable connection



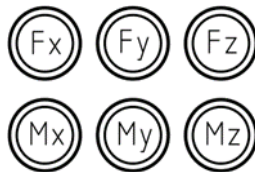
Permanent connection <sup>3)</sup> end not connected		Connection pluggable <sup>1)2)</sup>	
		Grey cable Ø 6,5 mm <sup>4)</sup>	
		7-pin LEMO Series 0 Female: - Male:	
Connection		Color	Pin
Supply voltage (+)	$U_{in+}$	blue	3
Supply voltage (-)	$U_{in-}$	black	2
Measurements signal (+)	$U_{out+}$	white	1
Measurements signal (-)	$U_{out-}$	red	4
Sense (+)	Sense+	green	5
Sense (-)	Sense-	grey	6
Shielding		yellow	Housing

- 1) View too weldingside
- 2) Female LEMO S.A. Typ: EGG.1B.307.CLL; Male: FGG.1B.307.CLA.D72
- 3) Gray cable with cable fitting PG7
- 4) twisted pairs, 3 x 2 x 0,25 mm<sup>2</sup>, temperature range: -35 °C to 90 °C



▶ permanent cable connection, end not connected

▶ pluggable cable connection

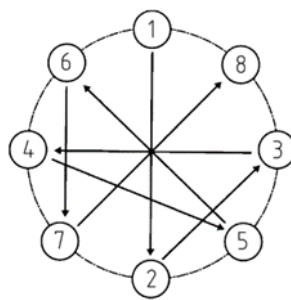


▶ pin assignment

## 5. Application instructions

### 5.1 Assembly instruction

- ▶ Lightly tighten all the bolts on the flange connection by hand.
- ▶ Perform torque-controlled tightening of the bolts in 3 to 4 uniform stages (e.g. stage 1: 30%, stage 2: 60%, stage 3: 100%) in accordance with (figure 2).
- ▶ Once the desired tightening torque has been reached for all the bolts, check them again in turn.



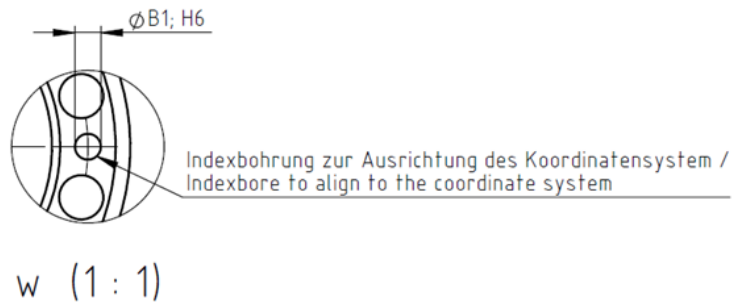
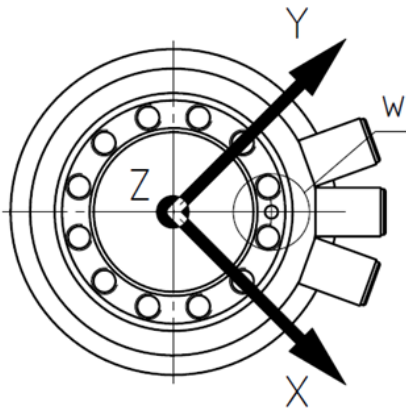
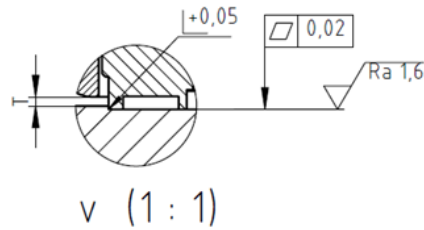
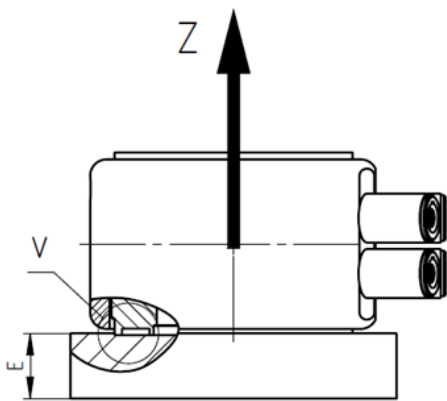
▶ Figure 2

- ▶ Avoid mechanical strain on the cable and the connector.
- ▶ Avoid a deformation of the assembly surfaces. This could affect the measurement.
- ▶ Pay attention to the cleanliness of the mounting surfaces and connections. They should be cleaned from dust and dirt before mounting and measuring, otherwise the measuring would be influenced.

Type	Screw size	Screw quality	Fastening torque	Surface pressure <sup>1)</sup>
-	-	-	N·m	N/mm <sup>2</sup>
10 - 50	M8	10.9	34	430
100	M12	10.9	117	460
250	M16	10.9	245	530

1) Surface pressure on the contact area as a result of the max. Fastening torque

► **Tightening torques of the screw connection**



► **Surface condition of the mounting area**

Size	$\varnothing B1$	T	E
-	mm	mm	mm
10 - 50	4 H7	1	20
100	4 H7	1	25
250	4 H7	1	30

► **Recommended plate thickness**

## 5.2 Definition of forces and moments

- ▶ Loads on the top of the transducer in a positive axial direction result in positive signals. Torques are positive in accordance with the “right-hand rule”.

The origin [N] of the coordinate system is in the geometric centre of the transducer. If force vectors pass through this point, they do not generate any torques  $M_x$ ,  $M_y$  or  $M_z$ . On the other hand, every vector that does not

pass through the origin generates a torque signal  $\vec{M} = \vec{a} \times \vec{F}$ , where  $a$  is the distance from the origin.

## 5.3 Calculation formula for load combinations

- ▶ Formula 5.3.1 can be used to evaluate a load collective that rises.

Note, for

- ▶ **Statically** combined loads:

When calculating the maximum value of the load score “P”, each component may not exceed the equivalent load ( $F_{\max}$ ;  $M_{\max}$ ) in question.

- ▶ **Dynamically** combined loads (varying):

When calculating the maximum value of the load score “P”, each component may not exceed  $1.6 \cdot F_{\text{dyn}}$  or  $1,6 \cdot M_{\text{dyn}}$  of the load in question.

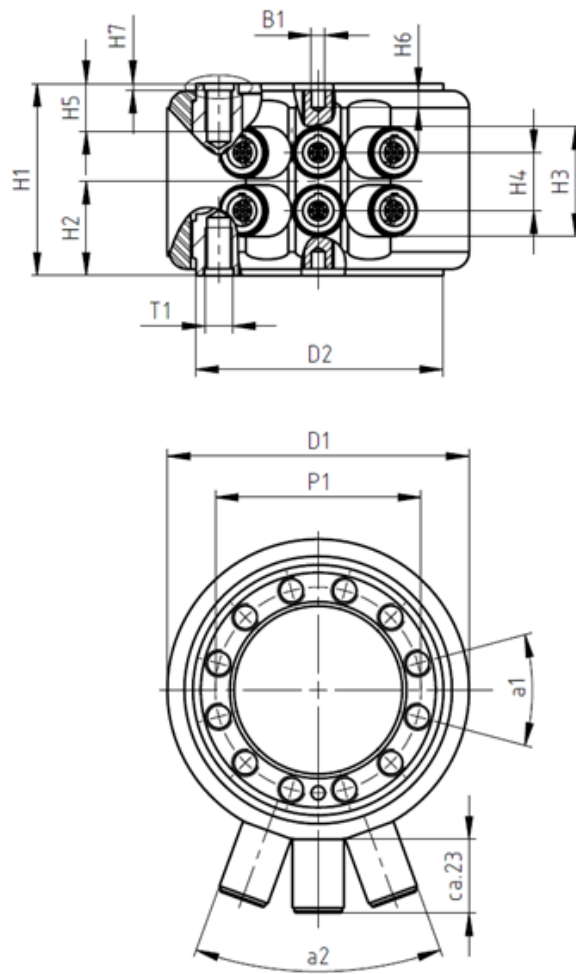
If a load component is omitted, the remaining loads may be designed to reach these limits.

$$P = \left( 1,48 * \frac{\sqrt{F_x^2 + F_y^2}}{F_{\max_{x;y}}} + \frac{|F_z|}{F_{\max_z}} + \frac{\sqrt{M_x^2 + M_y^2}}{M_{\max_{x;y}}} + 1,48 * \frac{|M_z|}{M_{\max_z}} \right) * 100 \quad (5.3.1)$$

Type		10	25	50	100	250
permitted dynamic	Points	241	241	241	241	241
permitted static	Points	386	386	241	368	290



- ▶ Load source „P“

## 6. Mating dimensions



Type			10 - 50	100	250
Bore	$\varnothing B_1$	mm	$\varnothing 4$ H7		
Diameter	$\varnothing D_1$	mm	$\varnothing 88$	$\varnothing 124$	$\varnothing 169$
Diameter	$\varnothing D_2$	mm	$\varnothing 73$	$\varnothing 110$	$\varnothing 154$
Pitch circle diameter	$\varnothing P_1$	mm	$\varnothing 60$	$\varnothing 90$	$\varnothing 130$
Thread	$T_1$		M8	M12	M16
Height	$H_1$	mm	56	70	92
Height	$H_2$	mm	27.5	33	46
Height	$H_3$	mm	32		
Height	$H_4$	mm	17		
Height	$H_5$	mm	14	18	22
Height	$H_6$	mm	7		
Height	$H_7$	mm	2		
Angle	$a_1$		30°		
Angle	$a_2$		40°		

# 7. Technical Data

Type			10	25	50	100	250
Accuracy class		%	0.1				
Basic forces <sup>4)</sup> (100% fatigue endurance all components simultaneously)	dynamic 	$F_{dyn\_x}$	2	5	10	20	50
		$F_{dyn\_y}$	2	5	10	20	50
		$F_{dyn\_z}$	10	25	50	100	250
Basic torques <sup>4)</sup> (100% fatigue endurance all components simultaneously)	dynamic 	$M_{dyn\_x}$	100	250	500	1500	5000
		$M_{dyn\_y}$	100	250	500	1500	5000
		$M_{dyn\_z}$	100	250	500	1500	5000
Sensitivity		$C_{Fnom\_i}$	mV/V				
Equivalence forces <sup>4)</sup> (single, static)	static ----	$F_{mbx\_x}$	4	10	20	40	100
		$F_{mbx\_y}$	4	10	20	40	100
		$F_{mbx\_z}$	20	50	100	200	500
Equivalence torques <sup>4)</sup> (single, static)	static ----	$M_{mbx\_x}$	200	500	1000	3000	10000
		$M_{mbx\_y}$	200	500	1000	3000	10000
		$M_{mbx\_z}$	200	500	1000	3000	10000
Linearity error		$d_{lin}$	%				
Hysteresis		$h$	%				
Repeatability (f.s.)			%				
Creep			%				
Cross talk <sup>3)</sup>			%				
Temperature effect on characteristic value per 10 K		$TK_C$	%/10 K				
Temperature effect on zero signal per 10 K		$TK_0$	%/10 K				

Metrological data

Type			10	25	50	100	250	
Electrical data	Input resistance	$R_e$	$\Omega$	400 – 800				
	Output resistance	$R_a$	$\Omega$	350 – 700				
	Insulation resistance	$R_{is}$	$\Omega$	$> 10^9$				
	Operating range of excitation voltage	$B_{U,G}$	V	5 – 12				
	IP-Protection (DIN EN 60529)			50				
Mechanical data	Spring stiffness crosswise	$c_{xy}$	kN/mm	80	150	230	480	800
	Spring stiffness axial	$c_z$	kN/mm	640	1230	1880	2690	4030
	Bending stiffness	$c_{b,xy}$	kN·m/rad	290	590	920	3280	6940
	Torsional rigidity	$c_{t,z}$	kN·m/rad	190	380	600	2430	7720
	Mass	$m$	kg	0.6	0.6	0.6	2.1	4.9
	Proportionate moving mass	$m_{mess}$	kg	0.3	0.3	0.3	1.1	2.6
	Fundamental resonant frequency	$f_G$	kHz	2.8	3.9	5	3.6	3
	Rated temperature range	$B_{T,nom}$	°C	10 – 60				
	Operating temperature range	$B_{T,G}$	°C	5 – 80				

1) Valid for pluggable

2) Valid for permanent cable connection

3) "Cross talk" is the percentage of a signal that a channel outputs when another component is loaded at 100% of its rated load

4) Other permissible load cases see calculation formula for load combinations



## 8. Technical support

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If problems arise while working with the product the following GTM services can be used:

### E-mail support

[contact@gtm-gmbh.com](mailto:contact@gtm-gmbh.com)

### Worldwide contact

GTM Testing and Metrology GmbH  
Philipp-Reis-Straße 4-6  
64404 Bickenbach  
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[www.gtm-gmbh.com](http://www.gtm-gmbh.com)

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19000 Praha 9  
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Tel. +420 286 891 392  
[info@gtm.cz](mailto:info@gtm.cz)  
[www.gtm.cz](http://www.gtm.cz)

## 9. Declaration of incorporation

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In accordance with EC Machinery Directive 2006/42/EC from May 17, 2006,  
Appendix II B

We,

**GTM Testing and Metrology GmbH  
Philipp-Reis-Straße 4-6  
64404 Bickenbach  
Deutschland**

hereby declare that the product

**Multicomponent Transducer Series LVS**

complies with the following basic requirement:

- ▶ 2006/42/EG, Appendix II B      EC Machinery Directive
- ▶ 2004/108/EC                      EMC Directive

The special technical documents were created in accordance with Appendix VII, Part B of the EC Machinery Directive 2006/42/EC. Upon reasoned request we shall undertake to submit them to the market supervision authority in electronic form within an appropriate period.

The product delivered by us may only be put into operation if it has been determined that the machine into which the product is to be incorporated likewise complies with the provisions of the Machinery Directive.



Daniel Schwind, Technical Manager

Bickenbach, 30.06.2022

# 10. Notes

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#precision wins

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Illustrations may differ from originals.

