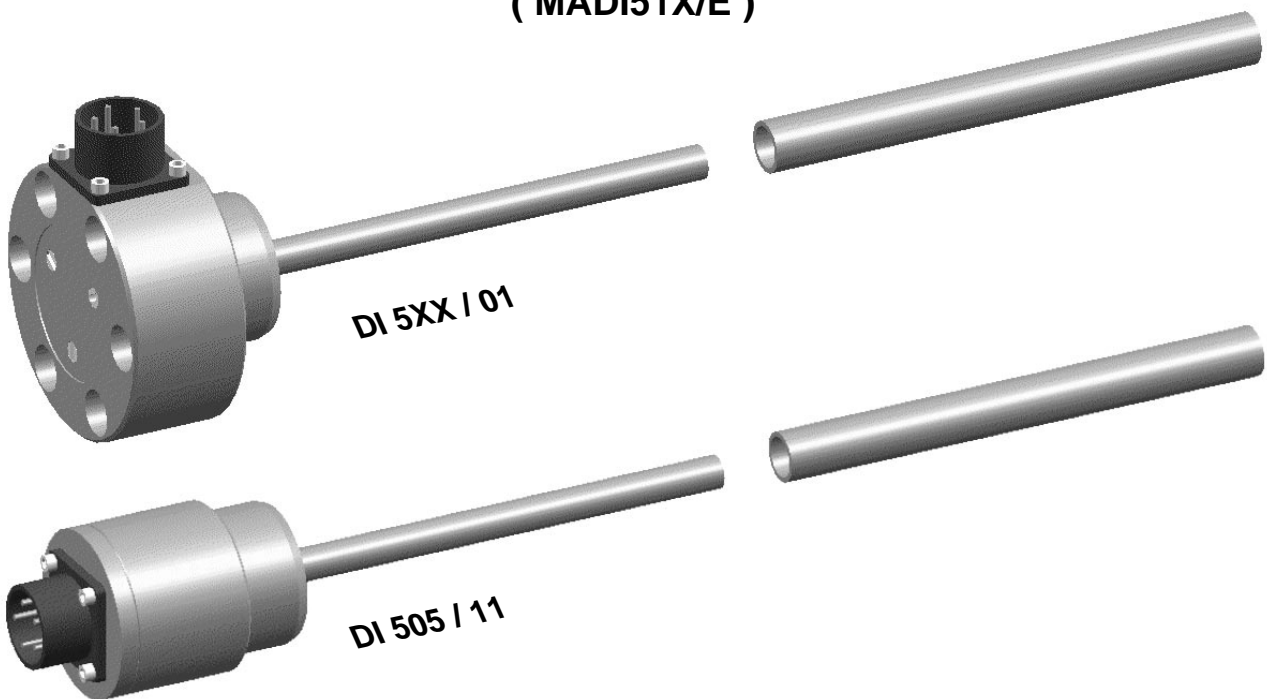


INSTRUCTION MANUAL

CONTACTLESS DISPLACEMENT TRANSDUCERS DI 505 ÷ 516

P/N 622.008 E

(MADI51X/E)



REVISION RECORD SHEET

Issue	Date	Written by / Modified by	PM No.	Description	Signature (Product Manager)
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	Department	Name	Date	Signature
Original issue approved by	Development / ID	J. Monot	23.07.96	<i>P.P. Monot</i>
	Product Manager / IC	J. Cattin	23.07.96	<i>J. Cattin</i>

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PRODUCT DEFECT REPORT

DOCUMENTATION EVALUATION FORM

PREFACE

Purpose and Scope of This Manual

This manual provides reference information concerning the mounting and connection of DI series displacement transducers.

Who Should Use This Manual ?

This manual is written for users wishing to install DI series displacement transducers in hydraulic or pneumatic cylinders and to connect these transducers to an electronic processing system.

The operator is assumed to have the necessary technical training in electronics and mechanical engineering (professional certificate/diploma, or equivalent) to enable him to install this type of transducer.

Manual Organization

This section gives an overview of the structure of the manual and the information contained within it. Some information has been deliberately repeated in different sections of the document to minimize cross-referencing and to facilitate understanding through reiteration.

The chapters of this manual are presented in a logical order. You should read those that are most relevant to you and then keep the manual at hand for future reference.

The structure of the manual is as follows :

Chapter 1 : **Safety** - Contains important information for your personal safety and the correct use of the DI series displacement transducers.

THIS CHAPTER SHOULD BE READ BEFORE ATTEMPTING TO INSTALL AND CONNECT THE DISPLACEMENT TRANSDUCERS.

Chapter 2 : **Introduction** - Contains the data sheet for the DI series displacement transducers. This data sheet provides a description of the transducers and their technical specifications.

Chapter 3 : **Mounting** - Provides mounting instructions for the DI series displacement transducers.

Chapter 4 : **Electrical Connection** - Instructions to connect the DI series displacement transducers to an electronic processing system.

Appendix A : **Mechanical Drawings** - Drawing of the DI series displacement transducers showing dimensions and ordering information.

Appendix B : **"CE" Declaration of Conformity** - Document certifying that the DI series displacement transducers comply to the EN-50081-2 and EN-50082-2 standards.

Product Defect Report - Allows the user to indicate problems observed on a module/system, thus enabling our After-Sales Service department to repair the unit as quickly as possible.


Documentation Evaluation Form - Allows the user to provide us with valuable feedback on our documentation.

1 SAFETY

1.1 Symbols Used in This Manual

The following symbols and type styles may be used in this manual to highlight certain parts of the text :



The **NOTE** symbol. 

*This is intended to draw the operator's attention to complementary information or advice relating to the subject being treated.
It introduces information enabling the correct and optimal functioning of the product to be obtained.*



The **CAUTION** safety symbol. 

This is used to draw the operator's attention to information, directives, procedures, etc. which, if ignored, may result in damage being caused to the material being used.

The associated text describes the necessary precautions to take and the consequences that may arise if the precautions are ignored.



THE WARNING SAFETY SYMBOL.



THIS INTRODUCES DIRECTIVES, PROCEDURES, PRECAUTIONARY MEASURES, ETC. WHICH MUST BE EXECUTED OR FOLLOWED WITH UTMOST CARE AND ATTENTION, OTHERWISE THE PERSONAL SAFETY OF THE OPERATOR OR THIRD PARTIES MAY BE PUT AT RISK.

THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

1.2 Important Remarks on Safety

CAUTION



This instruction manual should be read carefully and the safety instructions observed before installing, calibration or using the material described herein.

1.2.1 Location of Safety Symbols in This Manual

The operator should also take note of the safety-related information found elsewhere in this manual :



This symbol is found on the following pages :
1-2



This symbol does not appear in the manual.

1.3 Additional Remarks on Safety



For the correct and safe use of this instrument, it is essential that both operating and servicing personnel follow generally accepted safety procedures in addition to safety precautions specified in this manual. Specific warning and caution statements, where they apply, will be found throughout the manual. These are highlighted by the corresponding warning and caution symbols (described above).

The safety procedures should be communicated to all personnel who are liable to operate the equipment described in this manual.

No modifications, transformations or repairs should be made to the equipment without having first obtained the written permission of Vibro-Meter. Failure to observe this will invalidate the warranty.

2 INTRODUCTION

This chapter contains the data sheet for the DI series of displacement transducers. It contains a description of these transducers and their technical specifications.

Designation of Data Sheet

P/N

- Contactless Displacement Transducers, DI Series

222-006

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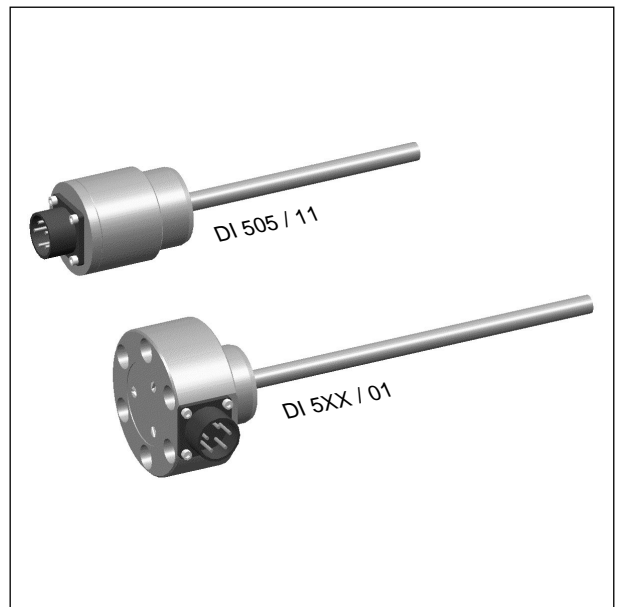
DI Series



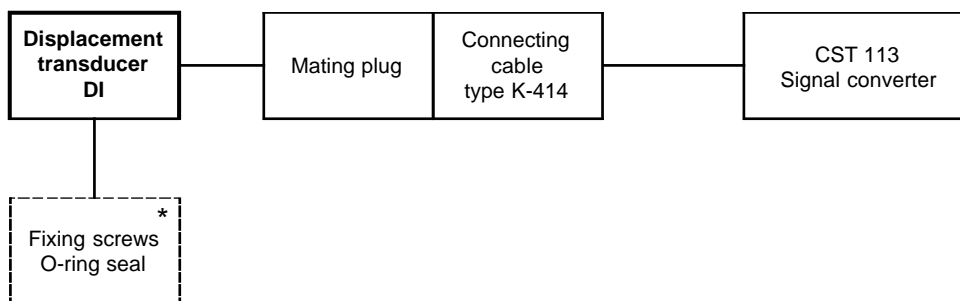
DI Series Contactless Displacement Transducers

FEATURES

- Contactless measurement of absolute piston position in hydraulic and pneumatic cylinders or other applications
- Large measuring range, piston displacements from 50 mm to 1000 mm
- Current-based output signal (4 to 20 mA) for displacement
- Built-in temperature measurement
- Very long life, no moving parts and therefore no wear of components (Eddy current principle)
- Slim measuring system allowing large measuring range
- Insensitive to metallic impurities in the working fluid
- Large insensitivity to shocks
- Capable of withstanding pressures up to 450 bars
- Robust construction, designed for permanent operation in hydraulic systems
- EMC compatible to CE standards



System configuration : _____



* Provided by the customer

The DI series of displacement transducers were developed principally for OEM applications in the hydraulic industry. They enable the direct and reliable measurement of the position of hydraulic cylinder pistons, control valves, servocontrols, etc. Their design is such that the installation cost is kept to a minimum.

This cost-effectiveness results from the limitation to one fixed standard signal of 4 to 20 mA with very precise determination of the measurement interval (from 0 to full-scale) on the sensing element.

The DI series is intended to replace the existing DE series. The two series are interchangeable, provided the maximum admissible pressure is respected.

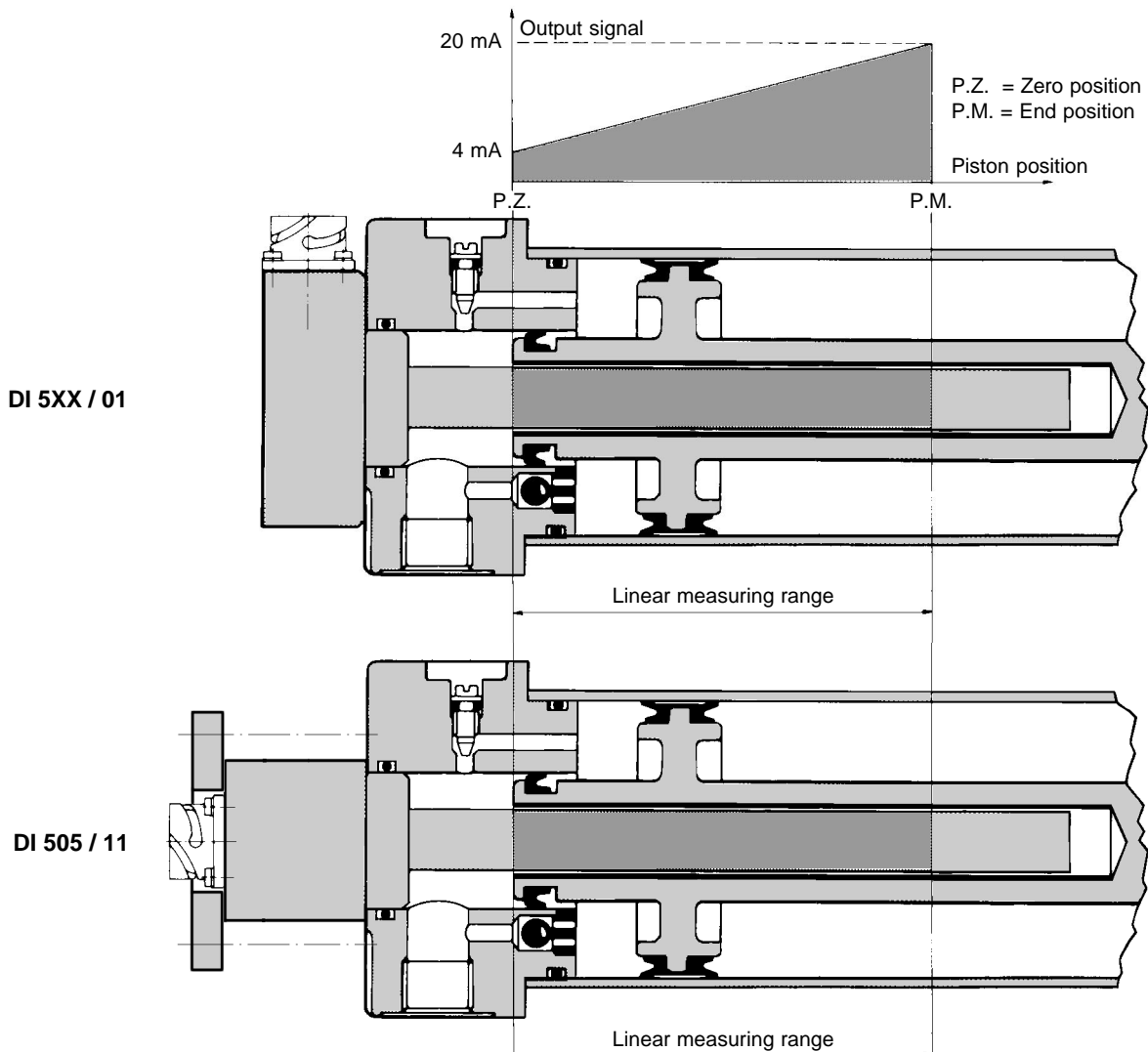
The displacement transducer contains a measuring element based on the Eddy current principle. This is a new-generation device whose technical performance has been considerably improved. The electronic circuitry housed in the head of the transducer uses the most modern SMD (surface-mounted device) technology, giving it robustness and reliability.

The DI series transducers have a voltage-based output that is proportional to the temperature of the measuring element. This output permanently provides an indication of the temperature within the hydraulic piston, information which can be very useful to the user.

In closed-loop systems, a specific piston position can be repeatedly achieved with a precision better than 0.05 ‰ of full-scale (i.e. better than 50 µm for a measuring range of 1 m).

Vibro-Meter supplies the DI displacement transducer with the appropriate measurement tube, which is manufactured from Anticorodal B (Al Mg Si 1). This ensemble constitutes the calibrated system (4 to 20 mA).

Typical mounting arrangement and characteristics of the output signal : _____



- MEAS. PRINCIPLE** : Displacement transducer having 3-wire configuration, providing a current source output of 4 to 20 mA. The measuring element consists of a long coil whose impedance varies as a function of the position of the measurement tube. A temperature output is also provided
- MEASUREMENT RANGES**
- Rated values** : 50, 100, 160, 250, 300, 400, 630, 1000 mm, according to dimension "D" on drawing (page 4)
- Zero position** : Defined by inserting the transducer probe into the measurement tube as far as X_{min} (refer to drawing on page 4)
- Full-scale position** : Defined by inserting the transducer probe into the measurement tube as far as X_{max} (refer to drawing on page 4)
- OUTPUT SIGNAL** : Calibrated standard signal. Transducer and measuring tube are calibrated in the factory for above-mentioned standard measuring ranges
- Displacement output** : Current source with imposed 4 to 20 mA signal. The output current is independent of the load resistance, provided it remains within limits
- Zero : Adjusted to 4 mA \pm 0.08 mA
 - Full scale : Adjusted to 20 mA \pm 0.15 mA
 - Admissible load : 0 to 500 Ω
 - Frequency response : 0 to 1000 Hz (-1 dB) with 4th-order Butterworth-type response
- Accuracy**
- Linearity error : < 0.3%, typically 0.15% of FSD
 - Resolution : < 0.05 ‰ of FSD
 - Repeatability : < 0.05 ‰ of FSD
- White noise on output current : < $0.2 \mu A_{eff} / \sqrt{Hz}$ (DC to 1 kHz)
- Temperature influence**
- On zero : < 150 ppm/°C of FSD
 - On sensitivity : < 150 ppm/°C of FSD
 - On drift (zero + sens.) : < 1.5% of FSD over the entire operating temperature range
- Supply voltage influence**
- On displacement measurement : < 10 ppm of FSD for 1V variation (DC to 100 Hz)
 - On temperature measurement : < 0,1°C over the range 20 to 32 V DC
- Temperature output**
- Offset voltage : 7.5 V DC \pm 80 mV at 20°C
 - Temperature signal : 30 mV/°C, accuracy \pm 5% typically (\pm 10% max.)
 - Output resistance : 1 k Ω
- POWER SUPPLY**
- Supply voltage** : 20 to 32 V DC
- Consumption** : \leq 70 mA
- Connection** : Watertight 5-pole bayonet connector. Watertight mating plug (straight or elbowed)
- Protection against polarity inversion** : No danger to the transducer in event of incorrect connection
- ENVIRONMENTAL**
- Operating temperature** : -40°C to +80°C
- Storage temperature** : -45°C to +100°C
- Max. admissible pressure** : 450 bars
- Admissible shock** : Half-sine, duration 3 ms, radial 100 g, axial 300 g
- Protection class** : IP 66, according to DIN 40050
- EMC** : Acc. to EN-50081-2 (Generic Emission Standard) & EN-50082-2 (Generic Immunity Standard)

Specification of measurement tube : _____

Material : Anticorodal B (material denomination Al Mg Si 1)

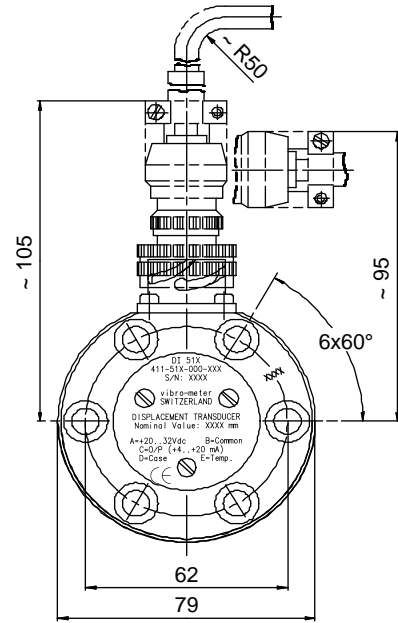
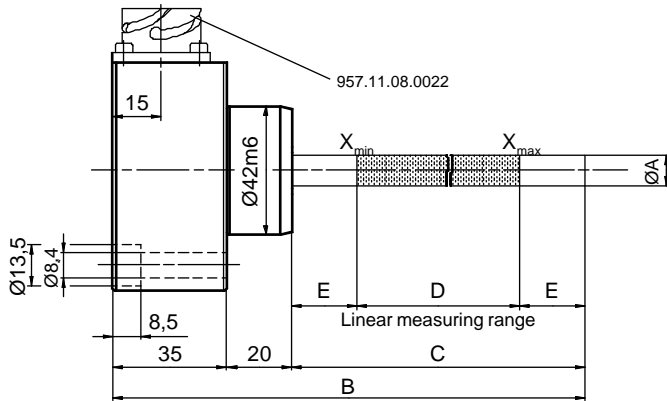
Type	P/N	For transducer type :	Outer diameter [mm]	Inside diameter [mm]	Length [mm]
13/11/100	411-505-021-011	DI 505	13 \pm 0,1	11	100
15/12/150	411-210-121-011	DI 510	15 \pm 0,1	12	150
15/12/210	411-211-121-011	DI 511	15 \pm 0,1	12	210
15/12/300	411-212-121-011	DI 512	15 \pm 0,1	12	300
26/22/460	411-213-122-011	DI 513	26 \pm 0,12	22	460
26/22/690	411-214-122-011	DI 514	26 \pm 0,12	22	690
28/24/1060	411-215-123-011	DI 515	28 \pm 0,2	24	1060
15/12/350	411-216-121-011	DI 516	15 \pm 0,1	12	350

DIMENSIONS

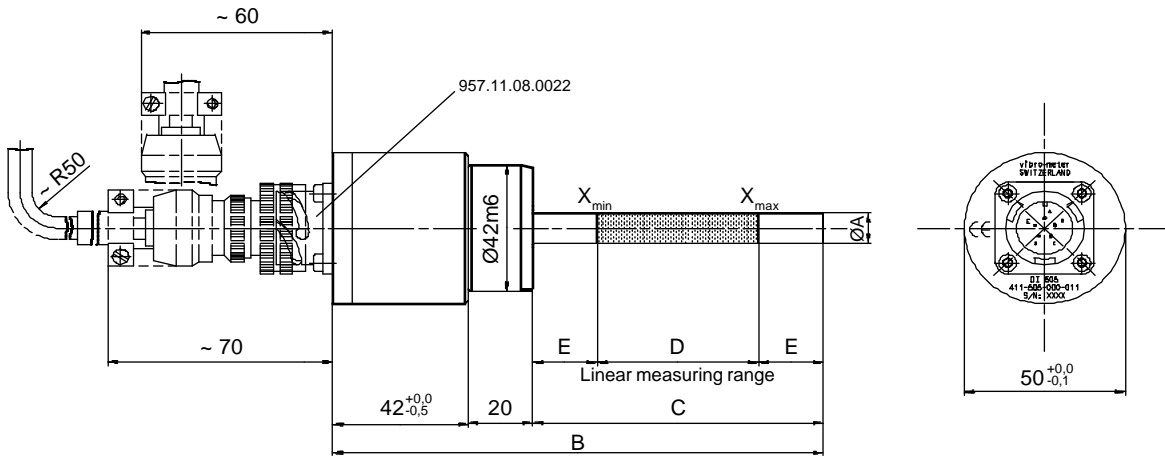
DI Series

DI 5XX / 01 :

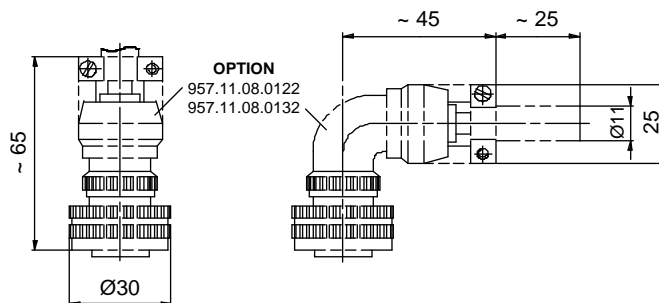
DI 505 and DI 510 ÷ 516		Supply (20 to 32 V DC)
		Common (0V)
		I _{OUTPUT} (X _{min} =4 mA, X _{max} =20 mA)
		Case
		Temperature output



DI 505 / 11 :



Mating plug :



Transducer type	Stroke D [mm]	Ø A [mm]	B [mm]	C [mm]	E [mm]	Weight [kg]	Ordering number
DI 505/11	50	10	152	90	20	< 1,10	411-505-000-111
DI 510/01 *	100	10	195	140	20	< 1,25	411-510-000-011
DI 511/01 *	160	10	255	200	20	< 1,30	411-511-000-011
DI 512/01 *	250	10	345	290	20	< 1,40	411-512-000-011
DI 513/01	400	20	505	450	25	< 1,85	411-513-000-011
DI 514/01	630	20	735	680	25	< 2,20	411-514-000-011
DI 515/01	1000	20	1105	1050	25	< 2,60	411-515-000-011
DI 516/01 *	300	10	395	340	20	< 1,70	411-516-000-011

* Providing that quantities are sufficient, these transducers are available on request with the same head as the DI 505

Accessory designation	Ordering number
CST 113 Signal converter I/V and I/I, with plastic housing	214-113-000-011
Signal converter I/V and I/I, with aluminium IP 65 housing	214-113-000-021
5-pole mating plug, straight	957.11.08.0122
5-pole mating plug, right-angle (90°)	957.11.08.0132
4-core cable, type K-414	957.37.22.2666
EH 144/01 K-414 cable type with 5-pole mating plug, straight, L = 3 m	943-144-000-011
EH 144/02 K-414 cable type with 5-pole mating plug, straight, L = 5 m	943-144-000-021
EH 144/03 K-414 cable type with 5-pole mating plug, straight, L = 10 m	943-144-000-031
EH 145/01 K-414 cable type with 5-pole mating plug, right-angle (90°), L = 3 m	943-145-000-011
EH 145/02 K-414 cable type with 5-pole mating plug, right-angle (90°), L = 5 m	943-145-000-021
EH 145/03 K-414 cable type with 5-pole mating plug, right-angle (90°), L = 10 m	943-145-000-031
Measurement tube for DI 505, type 13/11/100	411-505-021-011
Measurement tube for DI 510, type 15/12/150	411-210-121-011
Measurement tube for DI 511, type 15/12/210	411-211-121-011
Measurement tube for DI 512, type 15/12/300	411-212-121-011
Measurement tube for DI 513, type 26/22/460	411-213-122-011
Measurement tube for DI 514, type 26/22/690	411-214-122-011
Measurement tube for DI 515, type 28/24/1060	411-215-123-011
Measurement tube for DI 516, type 15/12/350	411-216-121-011



Due to the continual development of our products we reserve the right to modify the specifications without forewarning.

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3 MOUNTING

3.1 Schematic Diagram Showing Mounting of a DI 5XX/01 Transducer

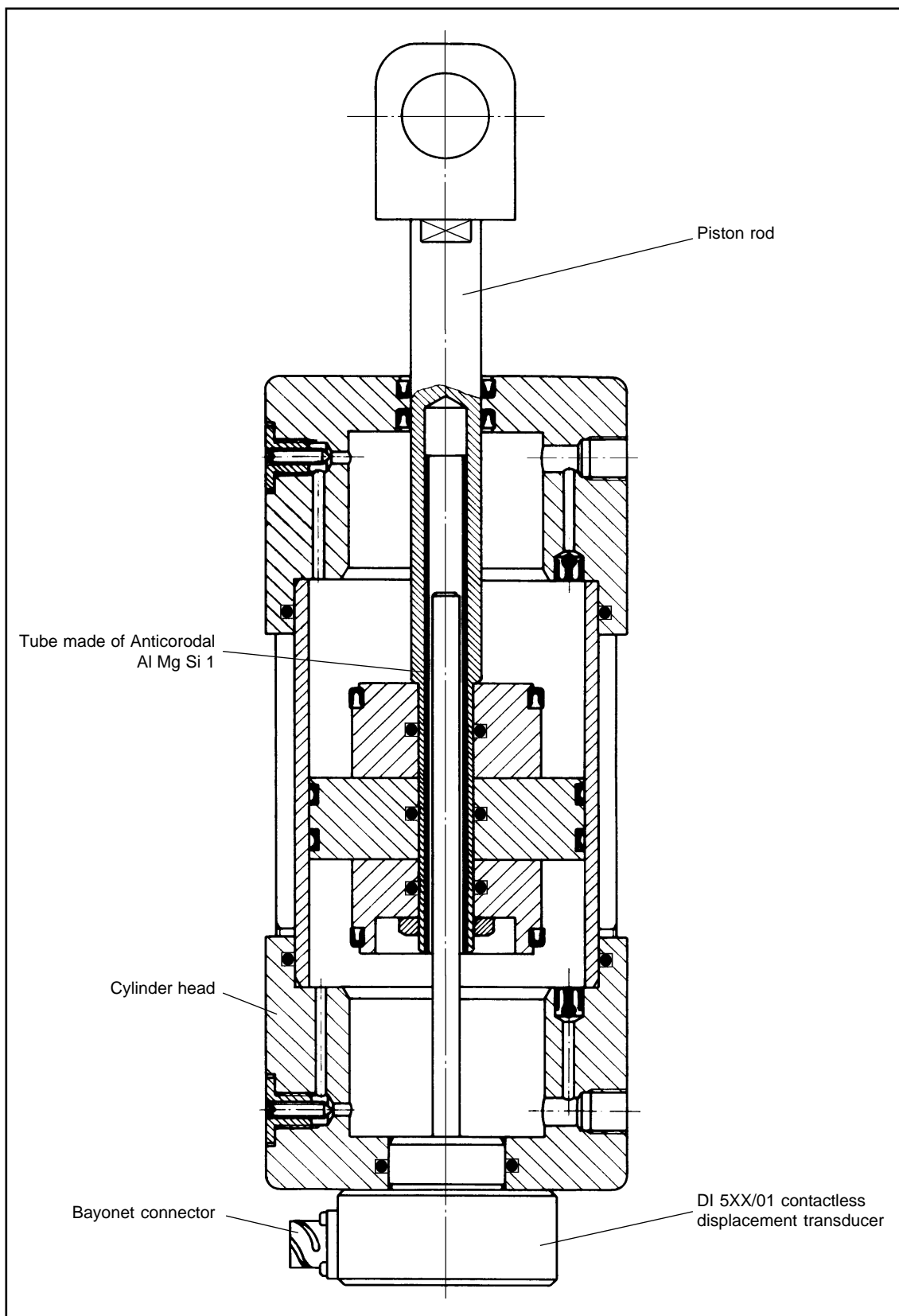


Fig. 3-1 : DI 5XX/01 transducer mounted on a cylinder.

3.2 Schematic Diagram Showing Mounting of a DI 505/11 Transducer

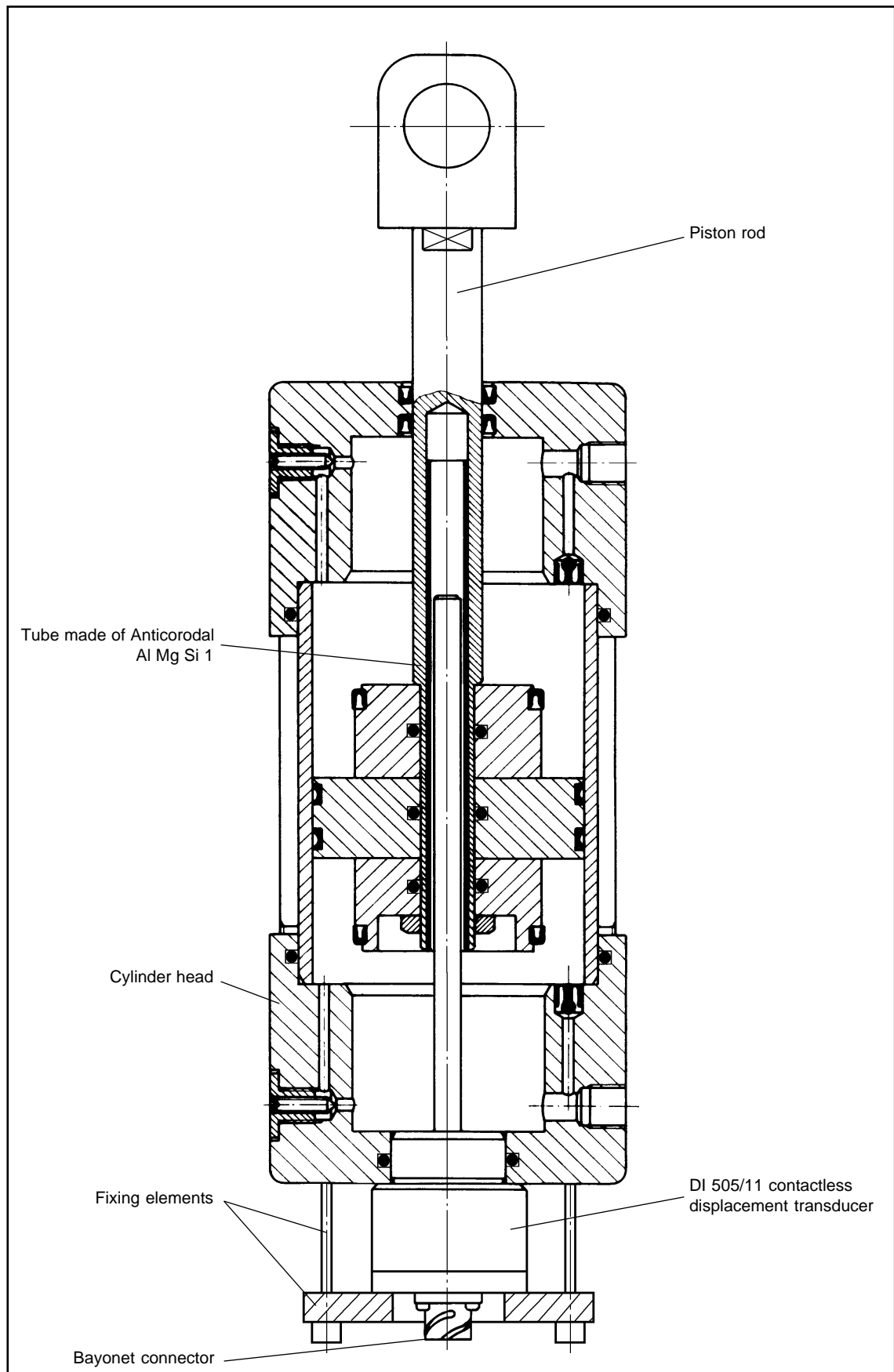


Fig. 3-2 : DI 505/11 transducer mounted on a cylinder.

3.3 Mounting Instructions

The DI 5XX/01 displacement transducer is fixed to the cylinder (flange, etc.) using six M8 hexagon socket head cap screws. The length of the screws depends on the thickness of the element onto which the displacement transducer will be mounted.

The DI 505/11 displacement transducer is mounted using a plate and at least 4 screws. The size of the fixing elements is determined by the type of application.

An O-ring type sealing ring mounted in a groove machined into the cylinder is used to provide the necessary impermeability between the cylinder and the transducer (refer to Fig. 3-3).

The choice of sealing ring and the exact dimensions of the groove are determined by the operating pressure inside the cylinder. The sealing ring manufacturer is qualified to advise the user of the correct choice

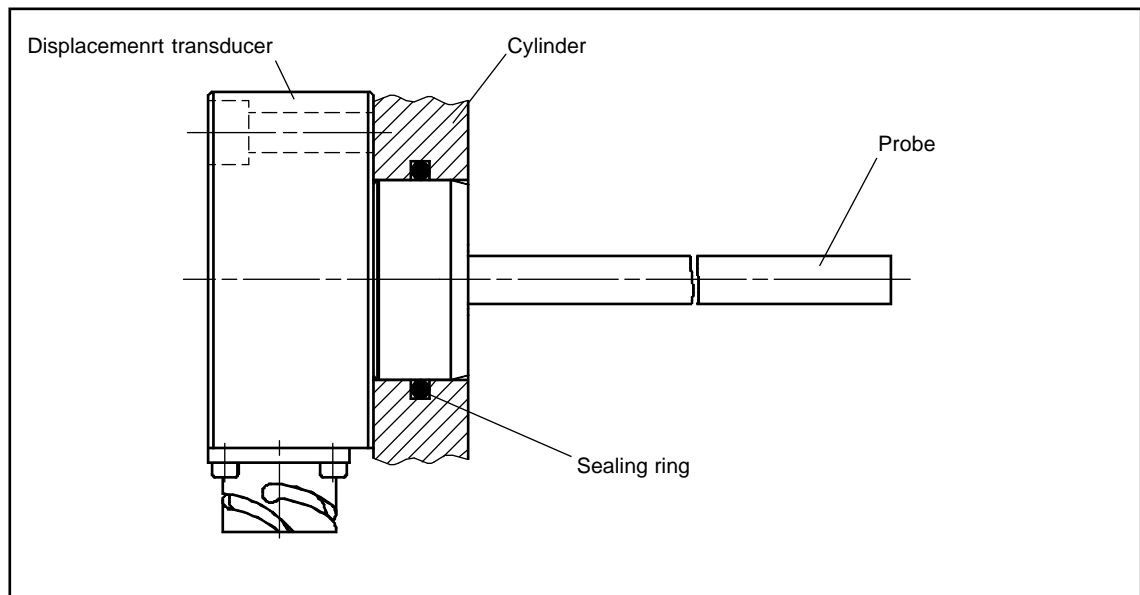


Fig. 3-3 : O-ring type sealing ring between the cylinder and the displacement transducer.

If the DI displacement transducer is mounted near strong magnetic fields or near another DI it may be necessary to provide shielding for the probe. If the transducer mounting is similar to that shown in Fig 3-1 and 3-2, the sides of the cylinder provide the shielding.

3.4 Mounting Suggestions for Anticorodal Tube

The Anticorodal tube, which is intended to be inserted into the measured object, can be knurled so as to allow it to be pressed into the hole. Alternatively, it may be glued or fixed by screws (refer to Figs 3-4 and 3-5).

If the Anticorodal tube is mounted slightly off-centre, this will not influence the measurement signal, but will increase the risk of friction on the probe.

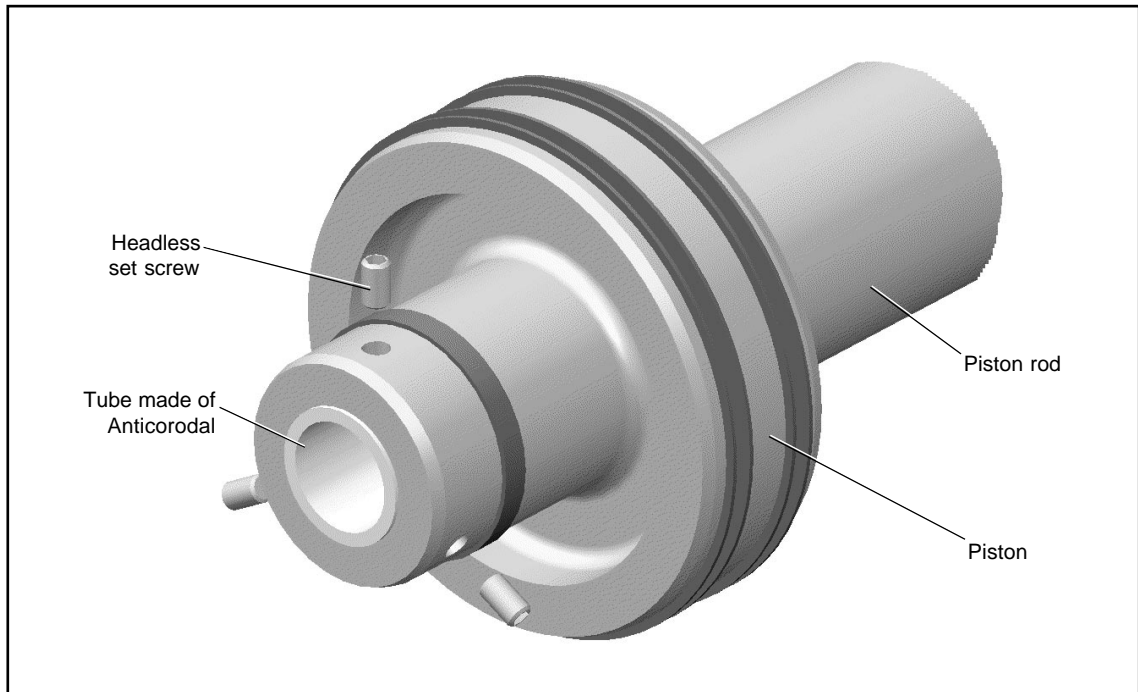


Fig. 3-4 : Example of fixing the tube using headless set screws.

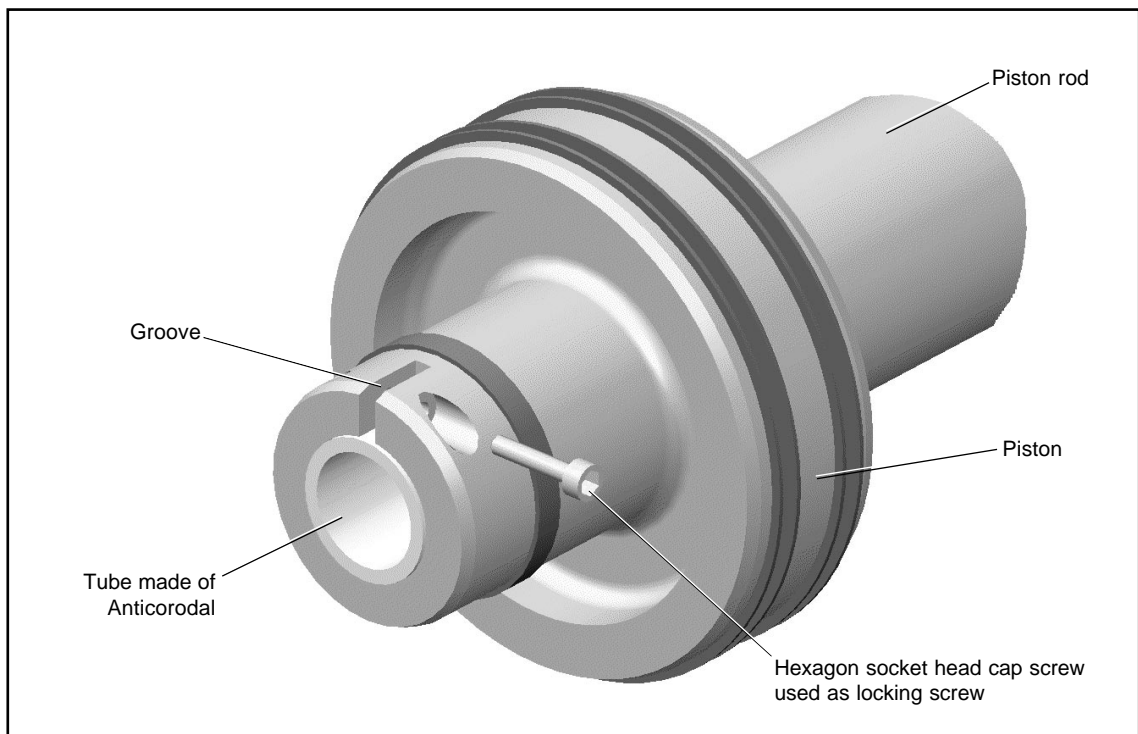


Fig. 3-5 : Example of fixing the tube using a groove and a locking screw.

3.4.1 Measurement Tube Made of Anticorodal 100 (Al Mg Si 1)

If the diameters " $D_{outside}$ " and " D_{inside} " (see Fig. 3-6) are not respected there will probably be a degradation in the linearity of the system, as well as in the sensitivity and temperature compensation. Additionally, this will have the effect of deregulating the calibration of the output signal (4 to 20 mA) that was performed in the factory.

For this reason we recommend mounting a system using the Anticorodal 100 (Al Mg Si 1) measurement tube that is delivered as a standard component with the displacement transducer. For future equipment orders, please quote the part numbers (P/N) mentioned in the table in Fig. 3-6.

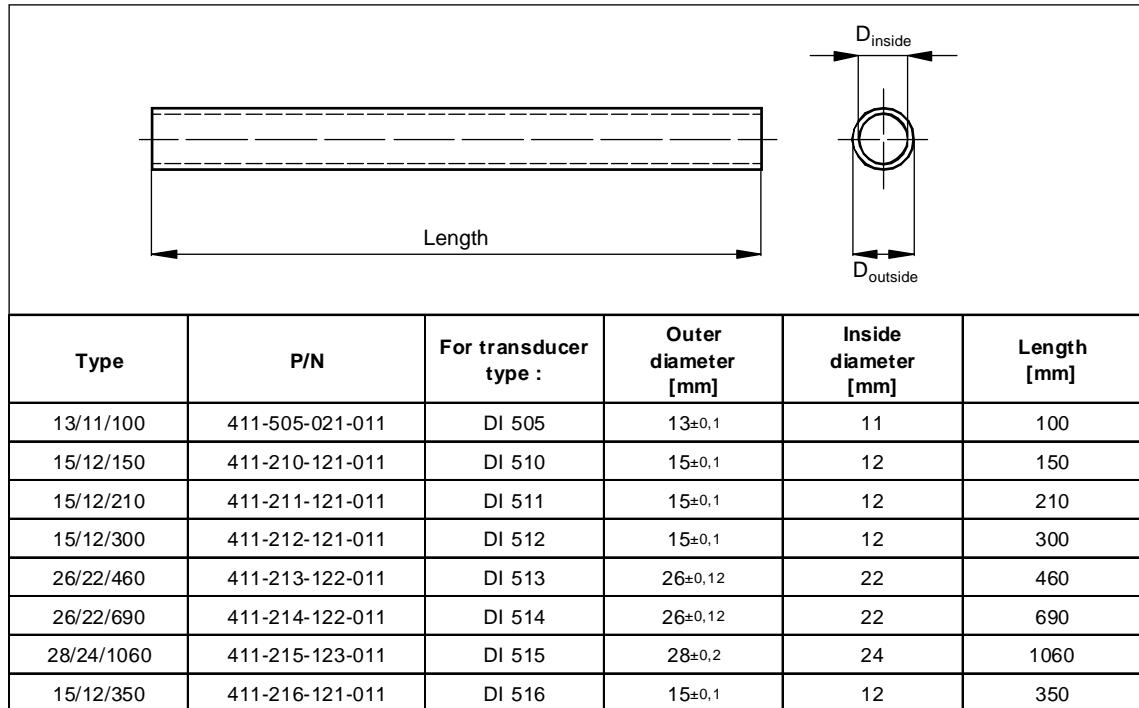


Fig. 3-6 : Specifications of measurement tubes made of Anticorodal 100 (Al Mg Si 1).

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4 ELECTRICAL CONNECTION

4.1 Transducer Connections

The DI transducer is fitted with a bayonet type connector. This connector is wired as shown in Fig. 4-1 and is protected against short-circuits and polarity inversion. The following counter-connectors may be supplied as optional accessories : a straight, watertight connector, P/N 957.11.08.0122; or a 90° angled connector, P/N 957.11.08.0132.

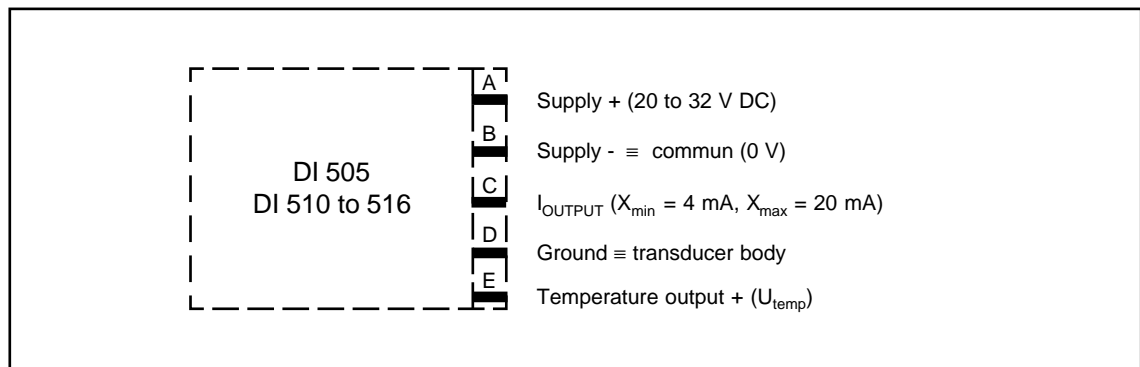


Fig. 4-1 : Connections to the DI displacement transducer.

4.2 Connecting Cable for Supply and Signal Transmission

The type of cable differs according to whether the temperature output is used or not :

a) K-414 connecting cable, temperature output used

- The temperature value is available as a voltage-based signal between terminal E (U_{temp}) and ground (0 V).
- This output can be used to make temperature measurements or to signal alarms.
- The voltage drop in the power supply return line produces a static error in the temperature measurement. This error is often neglected as it is $< +1,7\text{ }^{\circ}\text{C}$ for 10 m of K-414 cable.

For this type of application it is recommended to use a connecting cable that has 4 wires that are shielded in pairs (4 x 0,38 mm²) and that has a Radox sleeve (refer to Fig. 4-2).

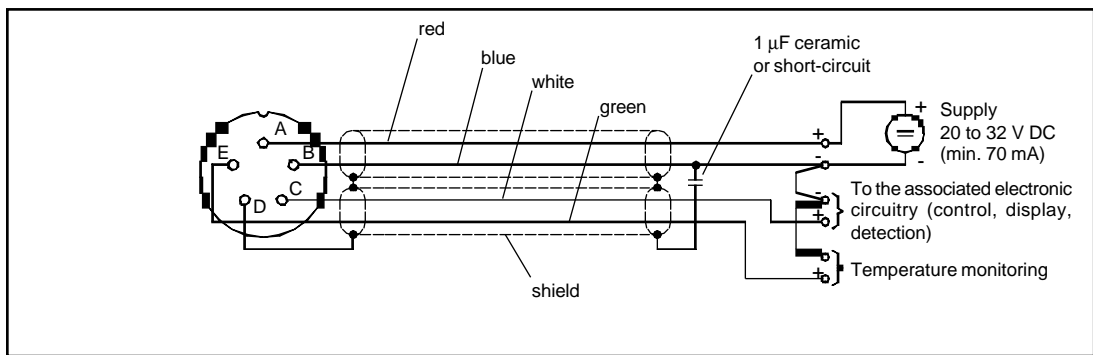


Fig. 4-2 : Connection using a K-414 cable.

b) K-414 connecting cable, temperature output unused

The K-414 connecting cable can also be used when the temperature output is not used. In this case, the green wire (terminal E) is not connected.

A MECHANICAL DRAWINGS

Designation

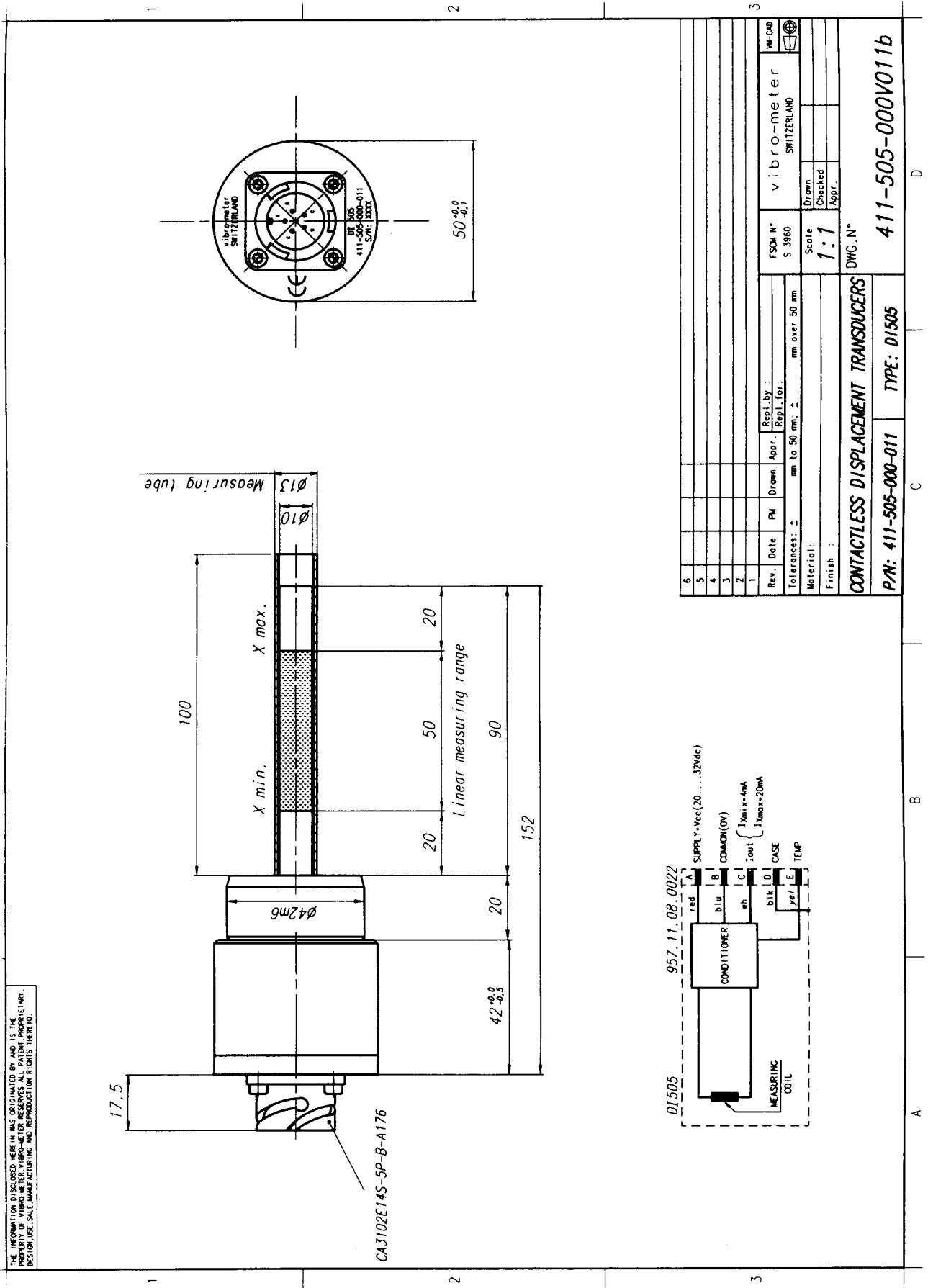
- Contactless Displacement Transducers, Type DI 510 ÷ 516
- Contactless Displacement Transducer, Type DI 505

Drawing No.

411-510-000 V 011
411-505-000 V 011b

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B "CE" DECLARATION OF CONFORMITY

Designation	No	Reference
Declaration of conformity (Only available in French)	DEC No 207	QHB-001/K12

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Vibro-Meter Fribourg Switzerland	Q-Form CE Conformity declaration	Form No :	QFO-067E/n
		Document Ref :	QHB-001/K12
		Emission date/Visa	95/11/28/W.K.

	Conformity declaration	DEC No 207	
---	------------------------	------------	---

We, **VIBRO-METER SA**
Rte de Moncor 4
CH-1752 Villars-sur-Glâne (Switzerland)

herewith declare that the following products :

Family Types

Contactless displacement transducers DI series

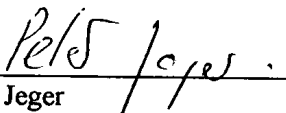
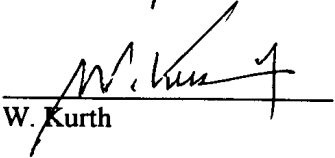
which are mentioned in this declaration, meet all requirements defined in :

89/336/EC Electromagnetic compatibility (EMC) / applicable for Vibro-Meter's products.
93/68/EC Instruction of marking of 89/336/EC (and the following).

Those products have been developed and manufactured according to the internal directives QHB001 conformity with the EN29001 / ISO 9001 norm.

For the evaluation of these products, following norms have been taken into account :

EN 50081-2 generic EMISSION Standard part 2 : industrial environment
EN 50082-2 generic IMMUNITY Standard part 2 : industrial environment.

	Place and date of emission	Name and signature
Duly allowed Vibro-Meter's Representative	Fribourg <u>19. 3. 96</u>	 P. Jeger
		 W. Kurth

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PRODUCT DEFECT REPORT

If you should observe any problems with this Vibro-Meter product would you please contact your **Vibro-Meter agent**.

Please fill in this form (in English), giving as much specific information as possible on the problems observed. This will enable us to decide the quickest way to solve the problem.

NB : If more than one unit is defective, photocopy this sheet and fill in one copy for each unit.



THIS REPORT OR A COPY OF IT SHOULD ACCOMPANY THE DEFECTIVE UNIT AT ALL TIMES !

NB : For plug-in modules this information can usually be found on the label stuck on its side.

Module type : _____

Part number (P/N) : _____

Serial number (S/N) : _____

Vibro-Meter order no. : _____

Date of purchase : _____

Site where used : _____

Problems observed : _____

(Please continue on back of sheet if necessary)

Is the problem :

Always evident ?

Intermittent ?

Temperature dependent ?

(Mark as appropriate)

In case we need any further information, please provide us with the name of an employee with whom we can make contact :

Name : _____

Department : _____

Company : _____

Address : _____

Country : _____ **Postal code :** _____

Tel. : _____ **Telex :** _____

Fax : _____

Signature : _____ **Date :** _____

Please cut out or copy and send to Vibro-Meter Sales agent



PRODUCT DEFECT REPORT

(cont.)

Please use this space for any additional information :

DOCUMENTATION EVALUATION FORM

Instruction Manual : DISPLACEMENT TRANSDUCER **P/N :** 622.008 E
DI 505 - 516

Vibro-Meter welcomes your evaluation of this instruction manual. Your comments and suggestions will help us to improve our documentation.

Please circle the following Yes or No :

- | | | |
|---|-----|----|
| • Is the document well organized ? | Yes | No |
| • Is the information technically accurate ? | Yes | No |
| • Would you like more technical detail ? | Yes | No |
| • Are the instructions clear and complete ? | Yes | No |
| • Are the descriptions easy to understand ? | Yes | No |
| • Are the examples and diagrams/photos helpful ? | Yes | No |
| • Are there enough examples and diagrams/photos ? | Yes | No |
| • Is the style/wording easy to read ? | Yes | No |
| • Are there any omissions ?
(If so, please list below) | Yes | No |

Comments : _____

Name : _____

Title : _____

Company : _____

Address : _____

Country : _____ **Postal code :** _____

Signature : _____ **Date :** _____

Please cut out and mail to Vibro-Meter



Thank you for your cooperation

Tape here

Please do not staple

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Fold here

Attn : Technical Documentation Dept. (I / M)

Vibro-Meter SA
Route de Moncor 4
CH-1701 Fribourg
Switzerland

Place
stamp
here