INSTRUCTION MANUAL

LB 210 AND LB 230 SERIES
LOAD MEASURING PINS

P/N 632.005 E

(MALB2XX/E)

LB 210

LB 230

REVISION RECORD SHEET

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PREFACE

Purpose and Scope of This Manual

This manual provides reference information for the LB 210 and LB 230 load measuring pins. It offers information concerning the installation, connection and use of these pins.

Who Should Use This Manual ?

This manual is written for users who wish to mount the LB 210 and LB 230 load measuring pins on hoisting, weighing or other installations, to connect them to electronic processing units and to use them with the aim of performing measurements.

The operator is assumed to have the necessary technical training in mechanical engineering and electronics to enable him to install these load measuring pins.

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 load measuring pins.

THIS CHAPTER SHOULD BE READ BEFORE ATTEMPTING TO INSTALL OR USE THE LOAD MEASURING PINS.

Chapter 2 : **Introduction** - Definition of the types of load measuring pins and their application.

Chapter 3 : **Measurement principle** - Explanation of the measurement principle of the load measuring pins.

Chapter 4 : **Mounting and connection** - Instructions concerning the mounting and cabling of the load measuring pins.

Chapter 5 : **Influence factors** - Explanations concerning the influence of the mounting position of the load measuring pins on the measured signals.

Chapter 6 : **Maintenance** - Instructions concerning the maintenance of the load measuring pins and a flow chart allowing detection of possible faults.

Chapter 7 : **Specifications** - Data sheets presenting the principal technical characteristics of the load measuring pins.

Appendix A : **Mechanical drawings** - Mechanical design drawings of the load measuring pins mentioned in this instruction manual.

Appendix B : **OIML certificate** - OIML conformity certificate for the LB 230 series load measuring pins.

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.

Related Publications

For additional information relating to the load measuring pins the reader is referred to the following documents :

- SDC 107 Data Sheet (Vibro-Meter P/N 124-001)
- SDC 109 Data Sheet (Vibro-Meter P/N 238-008)
- AN 2401 Data Sheet (Vibro-Meter P/N 238-010)
- Co-Pilot II Data Sheet (Vibro-Meter P/N 240-003)
- SDC 107 Instruction Manual (Vibro-Meter P/N 633.006)
- SDC 109 Instruction Manual (Vibro-Meter P/N 633.008)
- AN 2401 Instruction Manual (Vibro-Meter P/N 604.021)
- Co-Pilot II Instruction Manual (Vibro-Meter P/N 633.010)

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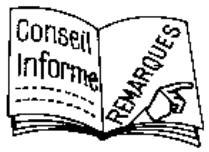
1 SAFETY

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. STOP

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

Ths 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 ; 4-4; 4-6; 4-10

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

When forces applied to mechanical structures have to be measured, often expensive modifications have to be effected on the structures. Load measuring pins present considerable advantages, since they replace conventional force transducers and at the same time are easily integrated into a measurement system. They are used in replacement of non-instrumented load-carrying pins. As a solution to load measuring problems, Vibro-Meter propose the LB 210 to LB 221 series for overload protection and the LB 231 to LB 241 series for measurement as well as protection.

The LB 210 series load measuring pins (see figure 2-1)

These pins are full bridge strain gauge force transducers available in 10 standard types for the measurement of forces from 2.5 to 1250 kN. They are suitable, for example, for :

- load measurement and overload protection on cranes, hoists, winches.
- acquisition of the traction force in the cable of ski-lifts, cableways and chairlifts.
- force measurement for regulation processes in industrial installations.

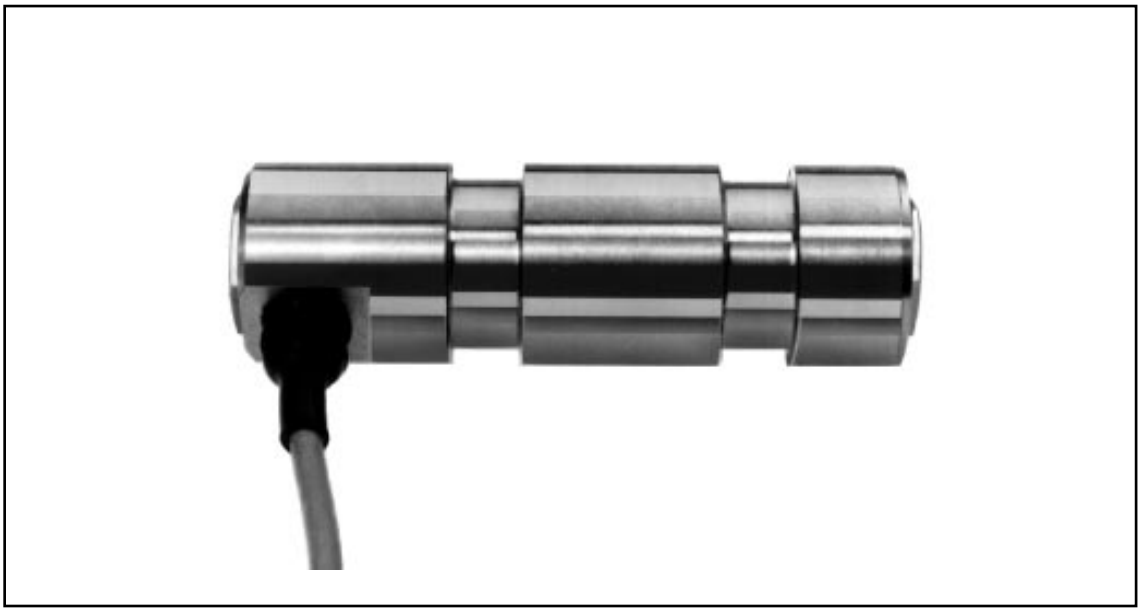


Fig. 2-1 : LB 210 series load measuring pin.

The LB 210 series comprises the following types :

Type	Rated load [kN]
LB 210	2.5
LB 211	5
LB 212	10
LB 213	20
LB 214	50

Type	Rated load [kN]
LB 216	100
LB 217	200
LB 218	500
LB 220	1000
LB 221	1250

The LB 230 series load measuring pins (see figure 2-2)

These pins are double full bridge strain gauge force transducers available in 10 standard types for the measurement of forces from 5 to 1250 kN. They are suitable, for example, for :

- static weighing on platforms, containers, silos.
- acquisition of the static load on mobile superstructures, such as lorries, skips, dumpers and wagons.
- weighing of the load on cranes, hoists, elevators and fork trucks.

The LB 230 load measuring pins are hermetically welded (IP 67) and consequently may be used in extremely harsh environmental conditions. The pins from 50 to 200 kN have been certified according to OIML R60 D0.1 (for class IIII scales) so that they may be used in any application entailing customer invoice (e.g. : recycling of household refuse).

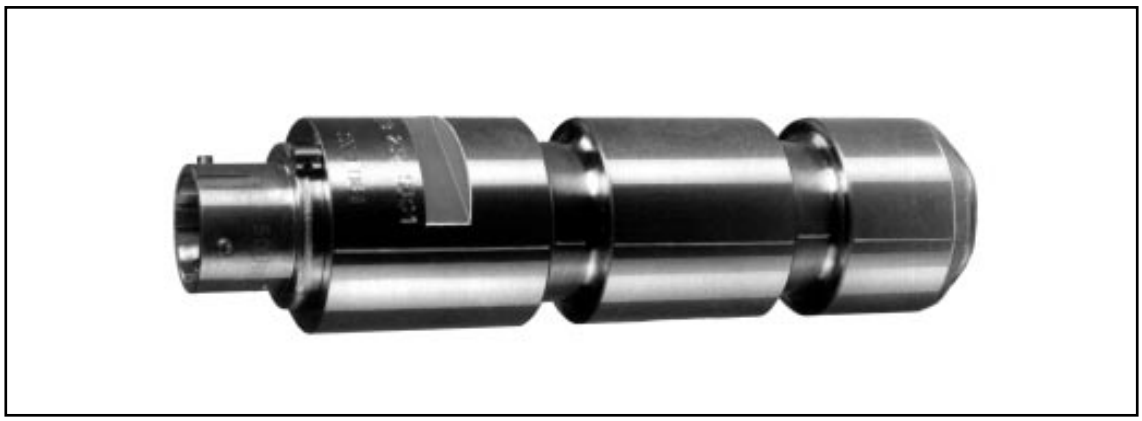


Fig. 2-2 : LB 230 series load measuring pin.

The LB 230 series comprises the following types :

Type	Rated load [kN]
LB 231	5
LB 232	10
LB 233	20
LB 234*	50
LB 235*	70

Type	Rated load [kN]
LB 236*	100
LB 237*	200
LB 238	500
LB 240	1000
LB 241	1250

* OIML-certified pins

3 MEASUREMENT PRINCIPLE

A pin of the LB 210 or LB 230 series has the shape of a hollow cylinder. The outside diameter A features two circular grooves with a reduced diameter X (see figure 3-1). When a force F is applied to the central portion of the pin, deformations occur within the pin's body. These concentrate to the portions where the diameter is reduced, i.e. the two grooves.

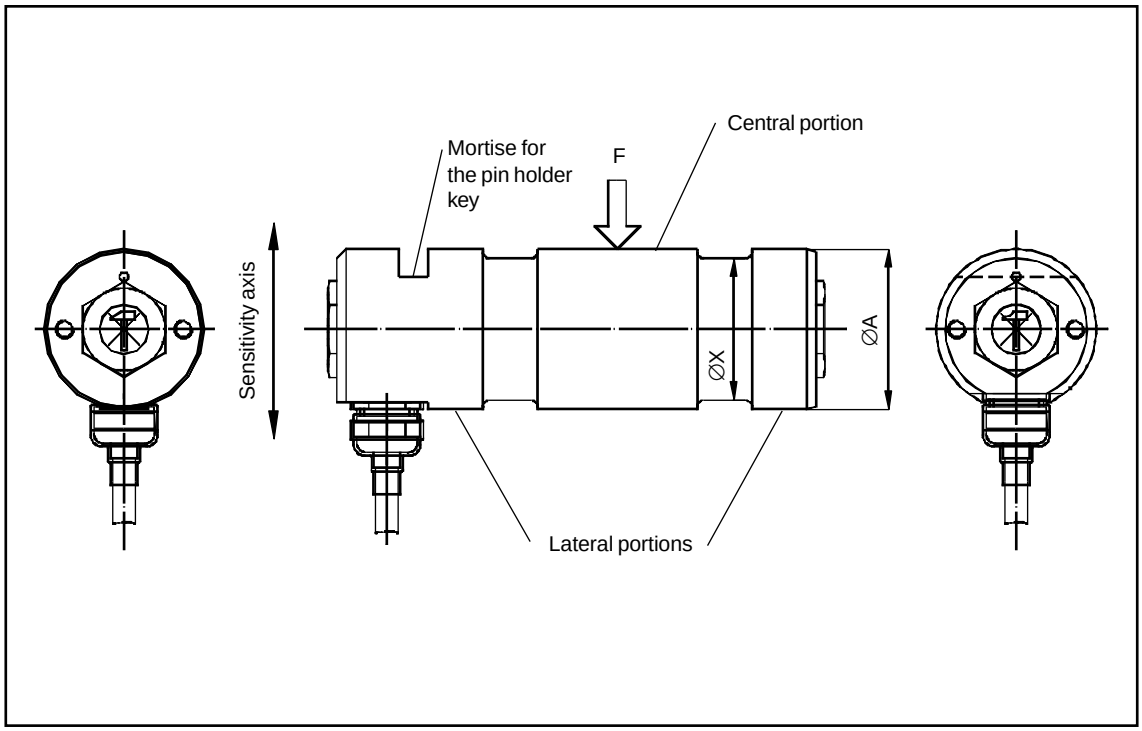


Fig. 3-1 : Body of the load measuring pin.

☞ *The direction of the sensitivity axis can be found by means of the mortise for the pin holder key. The latter is perpendicular to the sensitivity axis and should be facing the force applied to the central portion.*

The strain gauges are placed in the inside of the load measuring pin, together with several printed circuits supporting elements for the electrical trimming. The strain gauges are situated symmetrically in the bore, their situation coinciding with that of the grooves visible outside.

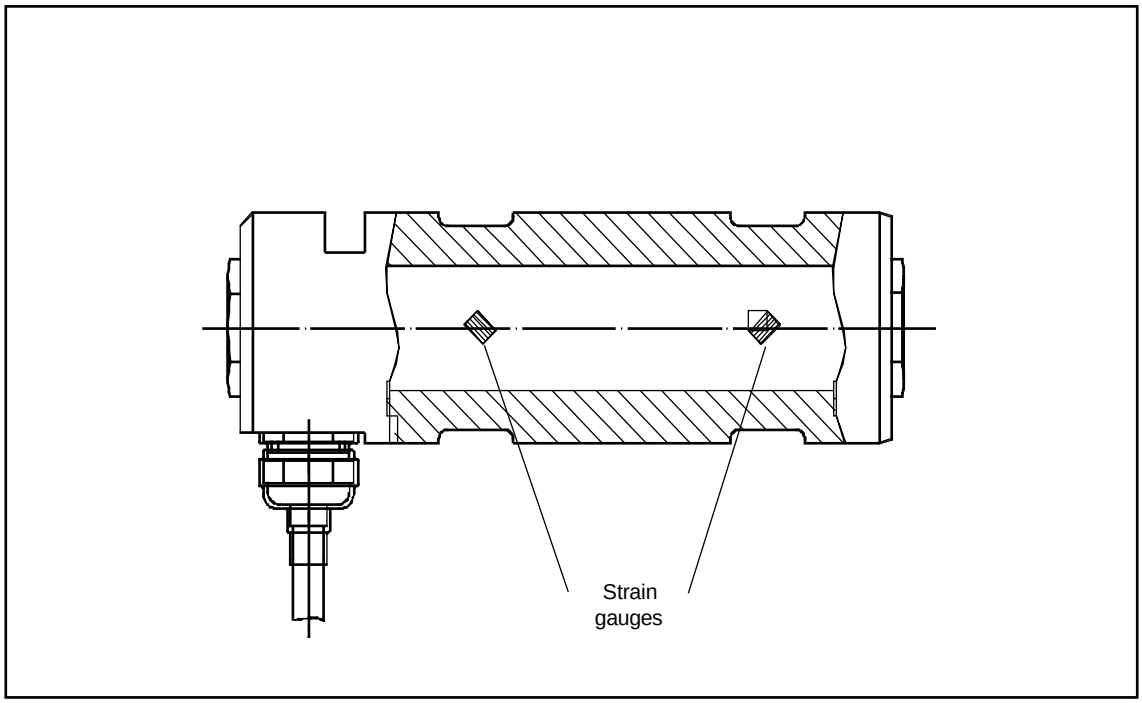


Fig. 3-2 : LB 210 series load measuring pin; unloaded.

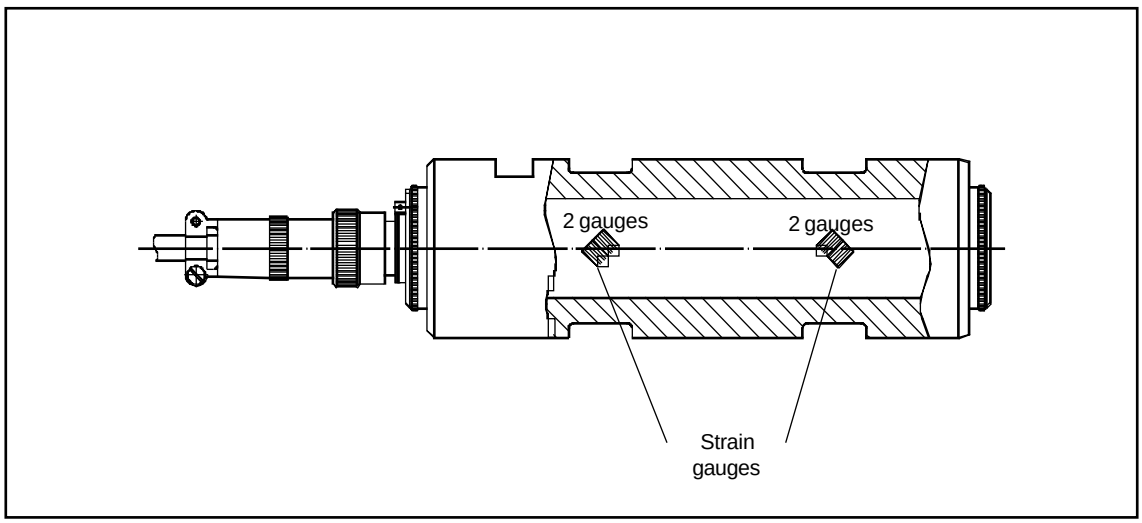


Fig. 3-3 : LB 230 series load measuring pin; unloaded.

When a load is applied to the load measuring pin in the direction of its sensitivity axis (see figures 3-4 and 3-5), the strain gauge full bridge produces a signal which is proportional to the load applied. The strain gauge power supply as well as the processing of the measurement signal (voltage) are performed by means of an external amplifier.

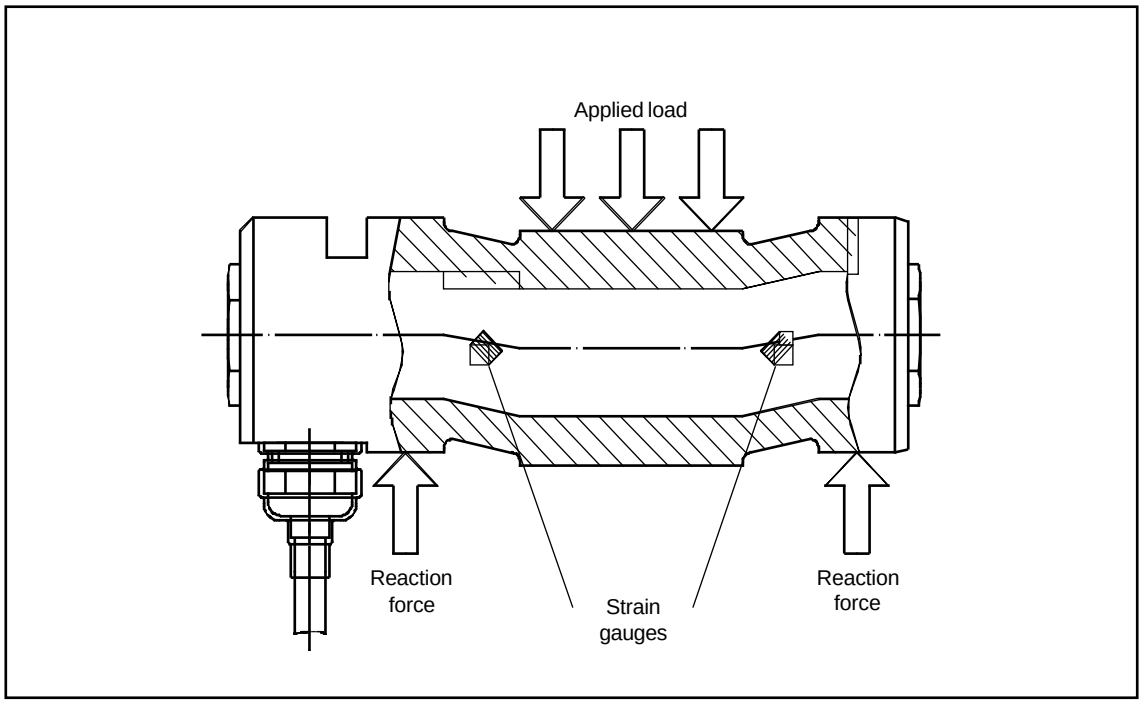


Fig. 3-4 : LB 210 series load measuring pin; loaded.

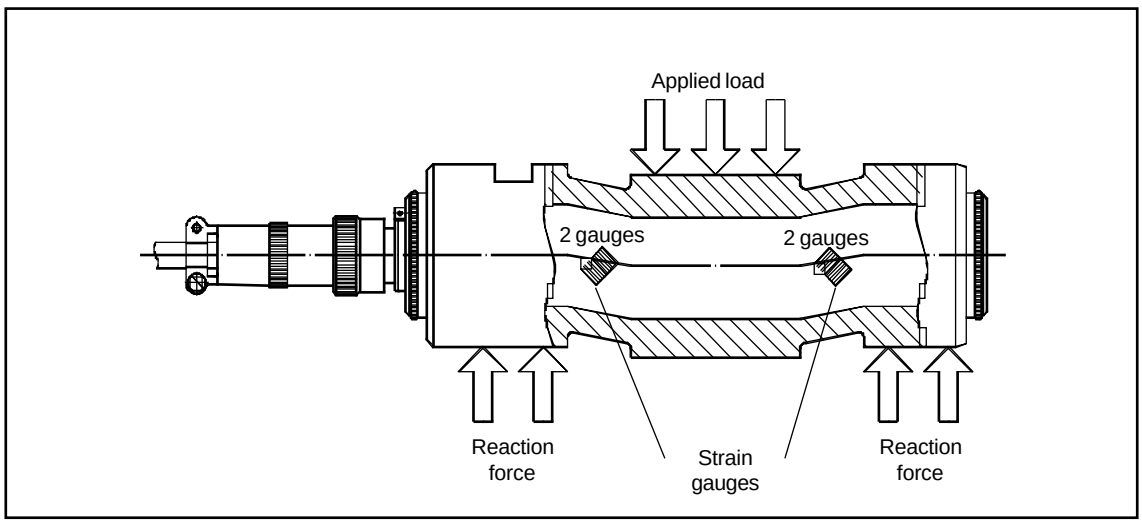


Fig. 3-5 : LB 230 series load measuring pin; loaded.

☞ *Owing to the double full bridge of the LB 230 load measuring pins, the measurement signal of these remains practically unaffected by possible transverse forces, even if the load is not applied exactly in the direction of the sensitivity axis.*

Checking of the applied load

In order to determine or to check the load applied to the load measuring pin, proceed as follows :

- Determine the load measuring pin's sensitivity. This features in the measurement protocol supplied with the pin under the point "Rated output" (e.g. 0.998 mV/V).
- By means of a digital voltmeter measure the voltage supplied to the pin by the external amplifier (e.g. 10.00 VDC).
- At rated load the signal output by the load measuring pin corresponds to the sensitivity value multiplied by the supply voltage (e.g. 0.998 mV/V x 10.00 VDC = 9.98 mV).
- For any measured signal the applied load can be easily calculated by means of the rule of three.

Checking example :

Type of load measuring pin : _____

Serial number : _____

Rated signal :

SUPPLY VOLTAGE x SENSITIVITY

☐☐ . ☐☐ V x ☐ . ☐☐☐ mV/V = ☐ . ☐☐☐ mV

Calculated signal :

$$\frac{\text{RATED SIGNAL} \times \text{APPLIED LOAD}}{\text{RATED LOAD}} =$$

$$\frac{\square . \square\square\square \text{ mV} \times \square\square . \square\square \text{ kN}}{\square\square . \square\square \text{ kN}} = \square . \square\square\square \text{ mV}$$

Measured signal : ☐ . ☐☐☐ mV

☞ *This photocopiable sheet ought to simplify the checking of the load measuring system. In the case of measurement problems it can also be sent to the After-Sales department of Vibro-Meter.*

4 MOUNTING AND CONNECTION

In order to correctly proceed with the mounting and connecting of the load measuring pins, and to thus avoid the measurement signals being perturbed, it is indispensable to follow the procedures described in the following sections.

☞ *The procedures contained in this instruction manual do not cover all the existing mounting and connection possibilities. Rather, the instruction manual provides the user with illustrated examples, intended to help in finding the appropriate solution for his specific application.*
Furthermore, the general manufacturer's instructions as well as security standards and recommendations should be respected by the user for special constructions.

4.1 Mounting of the load measuring pins

1) Bore the lateral supports and linking element in which the load measuring pin will be placed according to the dimensions and tolerances given in the figure 4-1 below.

Type of load measuring pin	P/N	Rated load [kN]	Rated diameter [mm]	Load measuring pin tolerances h6 [um]	Bore tolerances G7 [um]
LB 210	122-210-000-011/XXX	2.5	25	0 / -13	+28 / +7
LB 211	122-211-000-011/XXX	5			
LB 231	122-231-000-021				
LB 212	122-212-000-011/XXX	10	25	0 / -13	+28 / +7
LB 232	122-232-000-021				
LB 213	122-213-000-011/XXX	20	25	0 / -13	+28 / +7
LB 233	122-233-000-021				
LB 214	122-214-000-011/XXX	50	35	0 / -16	+34 / +9
	122-214-000-111/XXX				
LB 234	122-234-000-021				
LB 235	122-235-000-021	70	45	0 / -16	+34 / +9
LB 216	122-216-000-011/XXX	100	50	0 / -16	+34 / +9
	122-216-000-111/XXX				
LB 236	122-236-000-021				
LB 217	122-217-000-011/XXX	200	65	0 / -19	+40 / +10
	122-217-000-111/XXX				
LB 237	122-237-000-021				
LB 218	122-218-000-011/XXX	500	85	0 / -22	+47 / +12
	122-218-000-111/XXX				
LB 238	122-238-000-021				
LB 220	122-220-000-011/XXX	1000	100	0 / -22	+47 / +12
	122-220-000-111/XXX				
LB 240	122-240-000-021				
LB 221	122-221-000-011/XXX	1250	120	0 / -22	+47 / 12
	122-221-000-111/XXX				
LB 241	122-241-000-021				

Fig. 4-1 : Machining dimensions and tolerances according to DIN 7161.

☞ *When bushings are used for adaptation to the load measuring pins, tolerances G7 - N7 (depending on the application type) should be applied.*

Ensure a rigid mounting. The lateral supports should not move with respect to each other when load is applied (see figure 4-2). Elastic mounting, entailing parasitic forces on the load measuring pin, should be avoided by all means.

The play between the lateral supports and the linking element (see figure 4-2) should be limited to values between 0.5 mm and 1 mm. If these parts are pressed against each other, the induced strong lateral contact pressure produces too strong friction on the gliding surface, thus impeding optimal force transmission to the load measuring pin.

Use slide (see figure 4-2) or roller bearings.
If the load measuring pin is subject to lateral forces, use thrust bearings and spacing or gliding washers between the lateral supports and the linking element to eliminate friction.
To improve the linearity and hysteresis of the measurement, place antifriction elements into the bores of the lateral supports and linking element.

The bores in the lateral supports must be cylindrical and concentric to each another. The tolerances indicated in figure 4-1 leave sufficient play for the load measuring pin to slide in place without effort (light-push fit).
On welded constructions the bores of the lateral supports must be remachined after the welding.

2) Machine the pin holder key to the dimensions given in figure 4-3.
Bore and thread the fastening screw holes according to the specified dimensions (respect both bore and thread depth).
The mortise on the load measuring pin is by 0.5 mm wider than the pin holder key. Thus no strain can be transmitted through the key to the pin itself.

3) Prepare 2 screws and 2 single-coil spring-lock washers for the fixing of the pin holder key following the information in figure 4-3.

4) Clean the load measuring pin as well as the bores in which it will be placed to ensure clean contact surfaces.

5) Lubrificate the load measuring pin as well as the bores in which it will be placed by means of grease or oil.

☞ *When mounting roller bearings heat them to about 80°C to slide them more easily on the load measuring pin. Ensure that this operation does not generate a too great pre-stress on the load measuring pin when the bearing is in position and cooled down.*

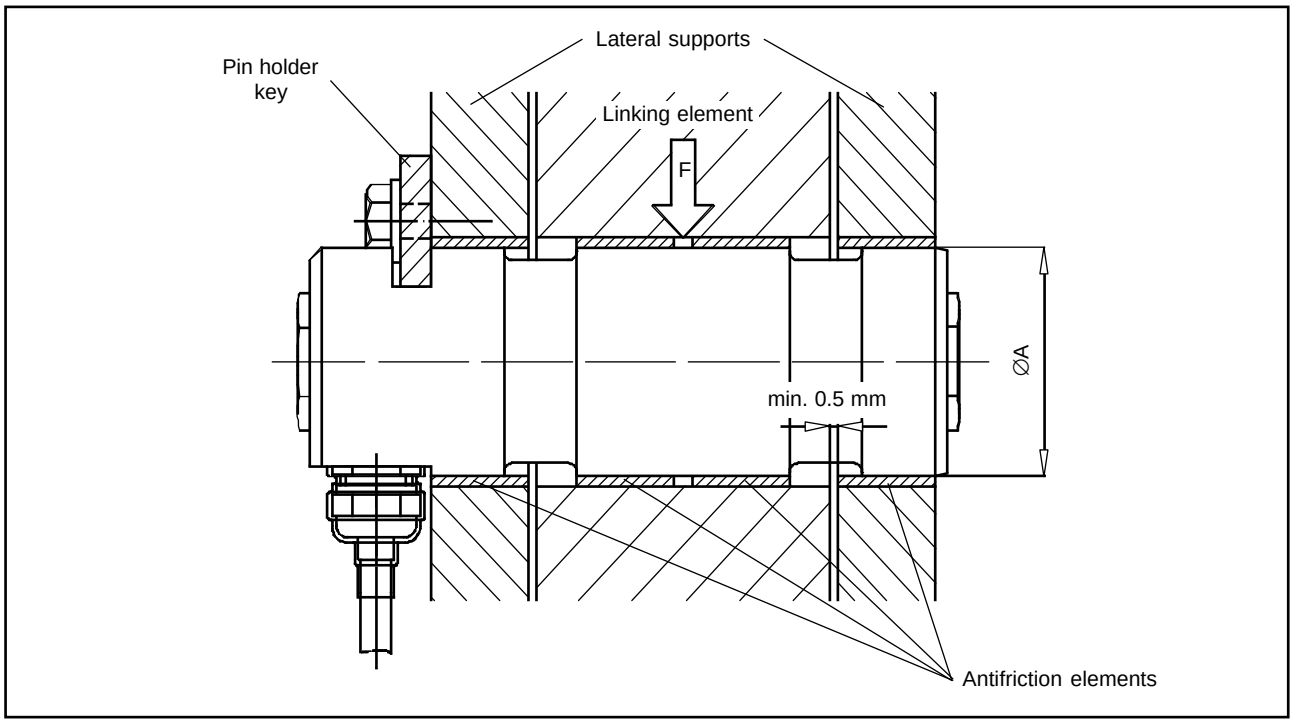
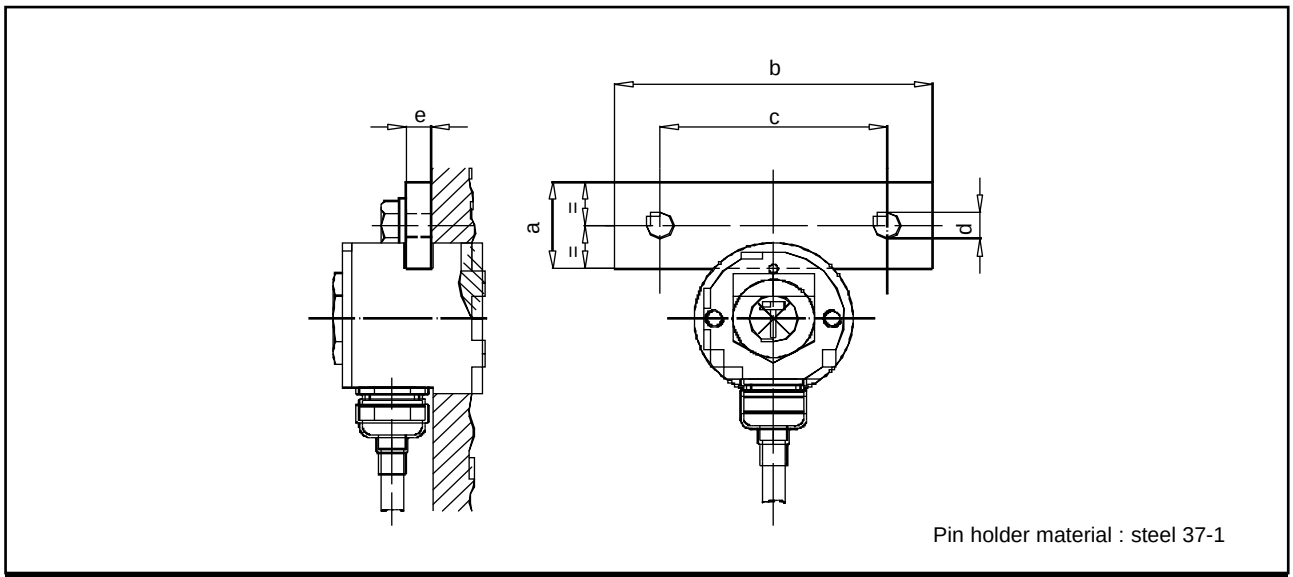


Fig. 4-2 : Load measuring pin mounted in its seat.



Load measuring pin	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	Fastening screw	Screwing torque [Nm]	Spring-lock washer
LB 210	20	60	36	9	5	M8	24	M8
LB 211 / LB 231	20	60	36	9	5	M8	24	M8
LB 212 / LB 232	20	60	36	9	5	M8	24	M8
LB 213 / LB 233	20	60	36	9	5	M8	24	M8
LB 214 / LB 234	25	80	50	11	6	M10	48	M10
LB 235	30	100	70	13	8	M12	83	M12
LB 216 / LB 236	30	100	70	13	8	M12	83	M12
LB 217 / LB 237	40	140	100	17	10	M16	200	M16
LB 218 / LB 238	40	140	100	17	1	M16	200	M16
LB 220 / LB 240	40	140	100	17	10	M16	200	M16
LB 221 / LB 241	50	190	140	21	12	M20	390	M20

Fig. 4-3 : Dimensioning of the pin holder key.

6) Position the load measuring pin facing the bores in which it will be seated (see figure 4-4). Turn it so that the mortise for receiving the pin holder key is facing upward and perpendicular to the applied force.

☞ *The direction of the sensitivity axis can be found by means of the mortise for the pin holder key. The latter is perpendicular to the sensitivity axis and is normally facing the force applied to the central portion.*

7) Slide manually the load measuring pin into its seat (see figure 4-5), until the mortise for receiving the pin holder key reaches the lateral support. This inserting of the load measuring pin should be done without the use of any tool. If it is impossible to slide the pin in, check the alignment (concentricity and axiality) of the elements and machine again, if necessary.
Insert the pin holder key into the mortise and align the key to coincide with the threaded holes for the fastening screws.

⚠ **Never hit the load measuring pin with a hammer or any other tool to insert it in its seat.**
Mechanical damage entailing measurement errors may occur if this prescription is not respected.
The violation of this prescription will cancel the guarantee.

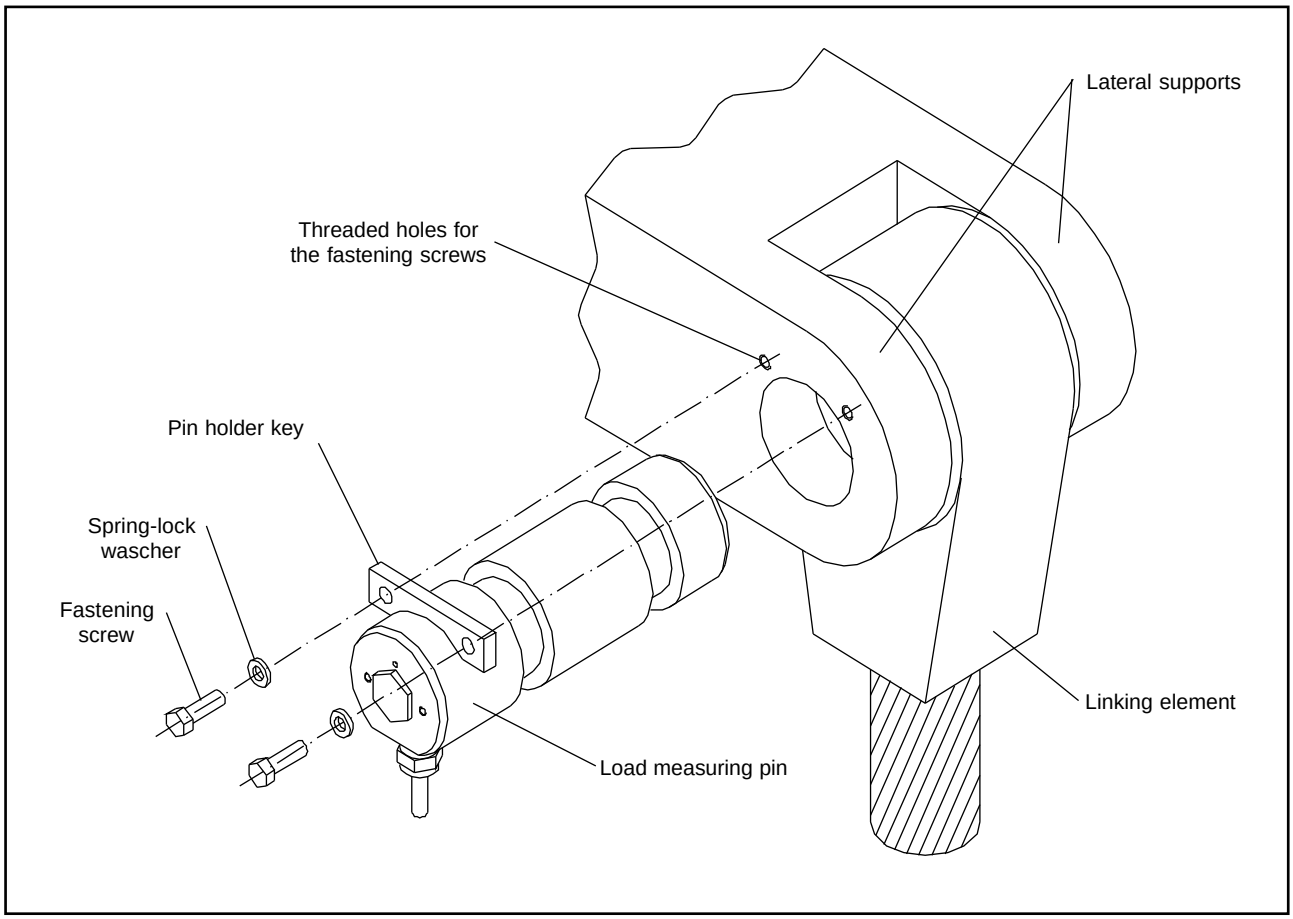


Fig. 4-4 : Positioning of the load measuring pin.

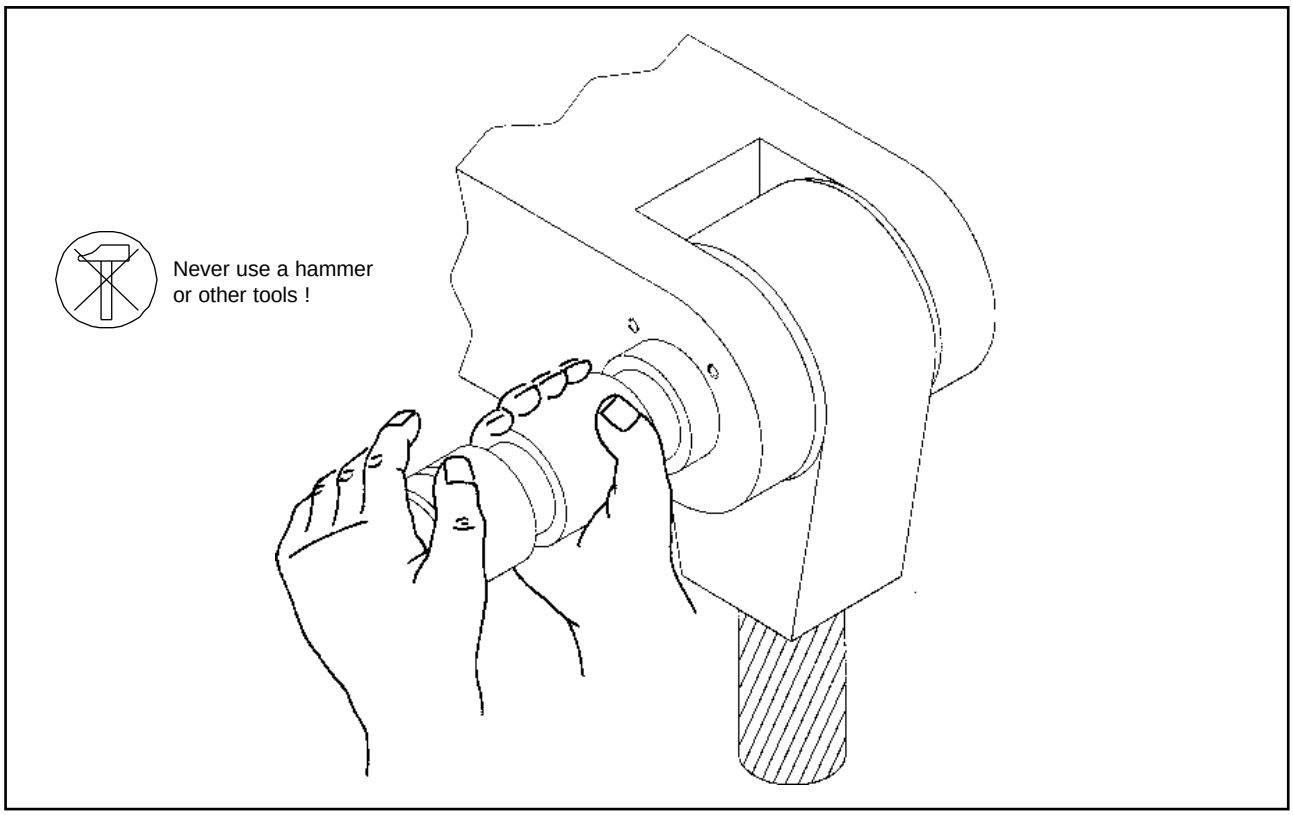


Fig. 4-5 : Inserting the load measuring pin.

8) Place the two fastening screws, fitted with their washers, into the holes of the pin holder key (see figure 4-6), and screw them into the previously threaded holes, applying the screwing torque specified in figure 4-3.

9) For pins equipped with lubricators (optional for LB 216 to LB 221) inject lubricant (grease or oil) by means of a grease gun or oil pump.

4.2 Extraction of the load measuring pins

- Before any attempt to extract, unload the load measuring pin (remove tare). This should allow its easy extraction.

- Load measuring pins LB 218 to LB 221 and LB 238 to LB 241 are fitted with two extraction screw threads at each end (see figure 4-6) which ought to be used to fix the extraction device (not provided by Vibro-Meter). We recommend fixing it on the same side as the stuffing gland (series LB 210) or the electrical connector (series 230) to avoid their damage if the pin is pulled out on the opposite end (see figure 4-7).
  For the load measuring pins with an electrical connector it is possible to disconnect the cable in order to facilitate the extraction.

Never unscrew the stuffing gland of a load measuring pin.
Never hit the stuffing gland or the electrical connector with any tool. Never extract the load measuring pin by pulling at its cable, stuffing gland or electrical connector.
The waterproofness of the load measuring pin is no longer guaranteed if this prescription is not respected.

If the load measuring pin is bonded in its seat, first rotate it about its axis by means of screws screwed into the extraction screw threads. It is also possible to apply a derusting agent, which can prove effective in some cases.

Never use the hexagonal covers at the ends of the load measuring pins to rotate or to pull them.
The covers may unscrew. In that case the waterproofness of the load measuring pin is no longer guaranteed and the electronic circuits within the load measuring pin can be damaged.

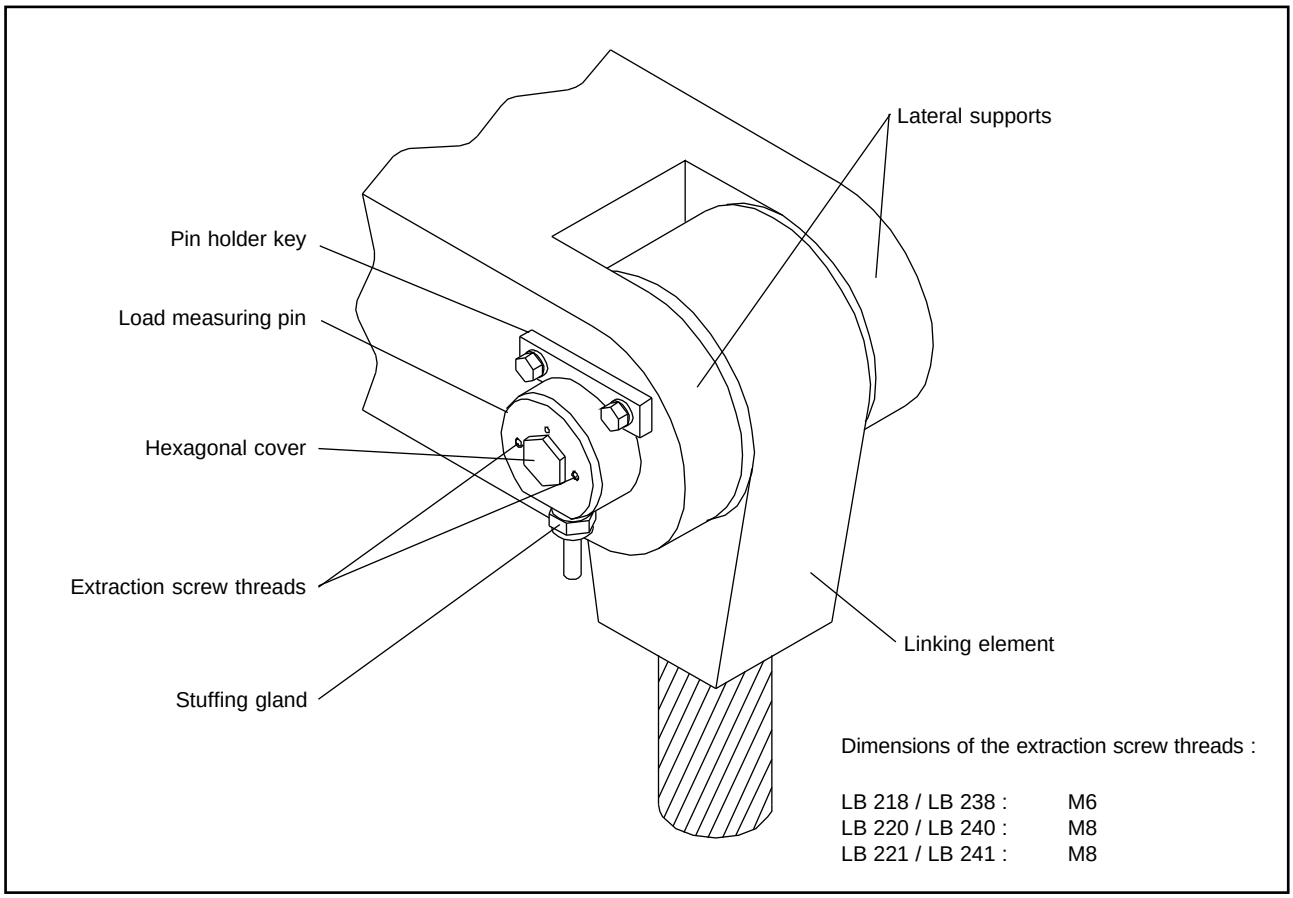


Fig. 4-6 : Mounted load measuring pin.

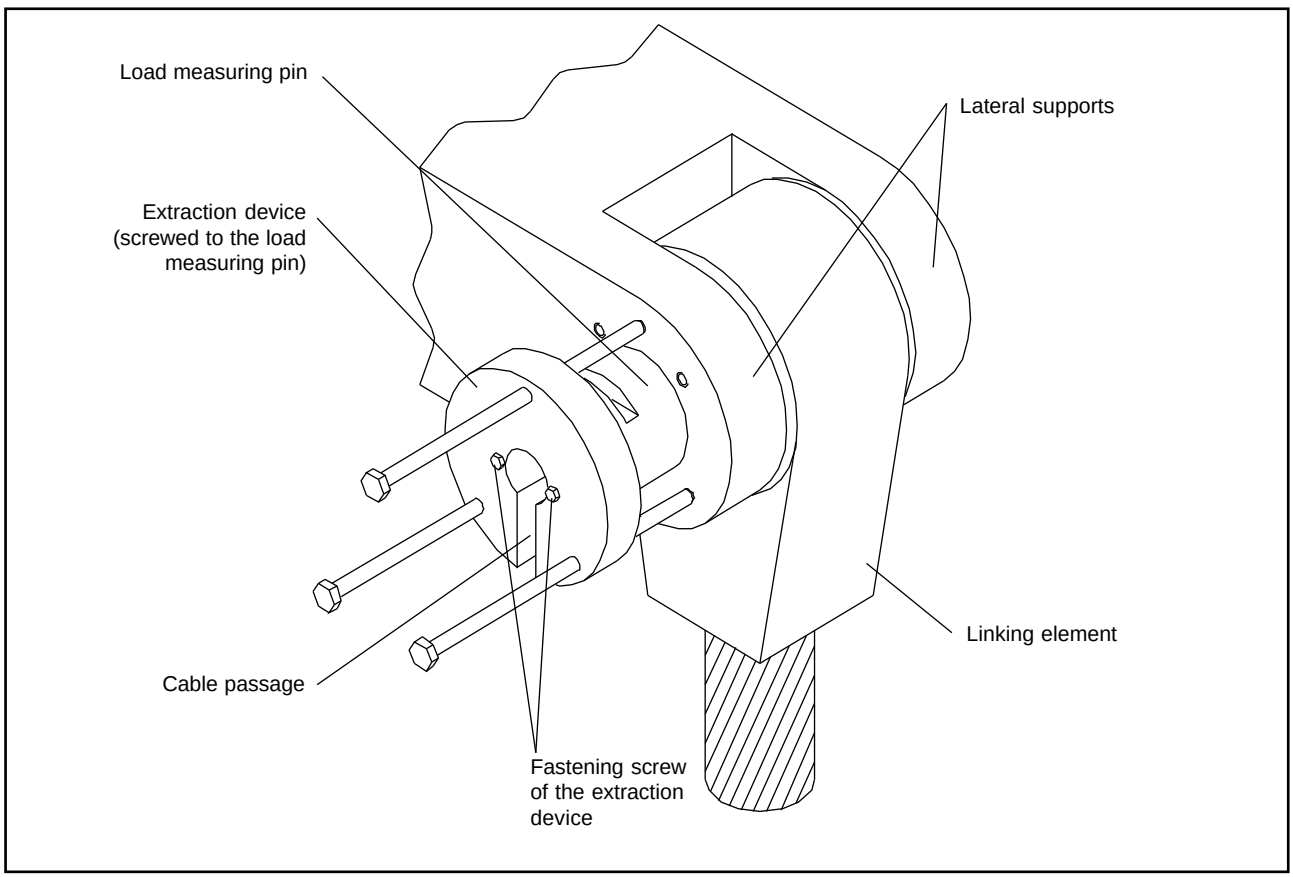
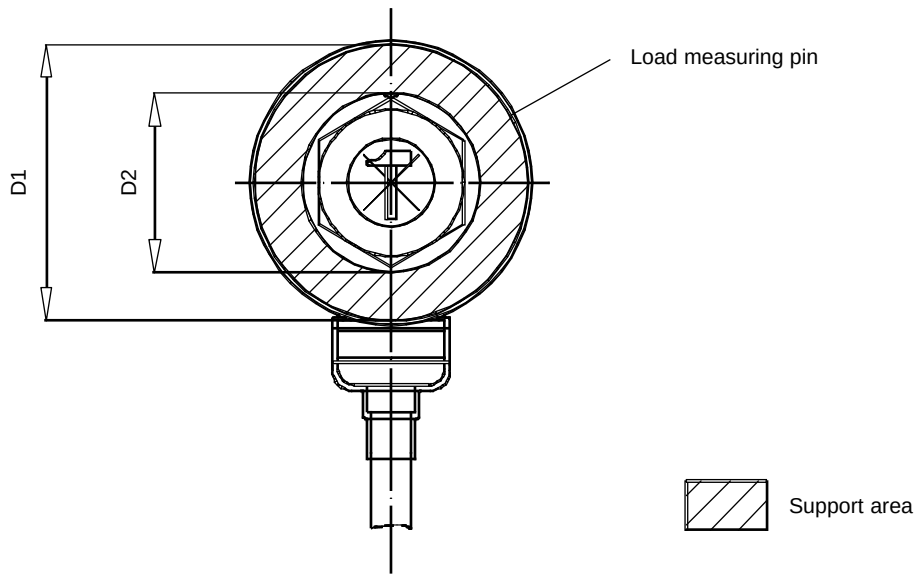


Fig. 4-7 : Pulling out the load measuring pin by means of an extraction device (principle).

- For small size load measuring pins without extraction screw threads use a sleeve tube or a muff made in a metal of lesser stiffness than that of the pin (e.g. bronze, brass). Place the tube against the pin end opposite the stuffing gland or electrical connector, taking care not to touch the hexagonal cover (see figure 4-8). Now hit the tube with a plasticized hammer (shock absorption) to push the load measuring pin out of its seat. It is also possible to use a wooden cylinder for this operation.

- For the extraction of roller bearings use an extracting device, taking care not to exert any pressure on the cover of the load measuring pin.



Load measuring pins	D1 [mm]	D2 [mm]
LB 214 / LB 234	30	26
LB 235	40	35
LB 216 / LB 236	46	40
LB 217 / LB 237	60	40
LB 218 / LB 238	80	40
LB 220 / LB 240	90	40
LB 221 / LB 241	110	40

Fig. 4-8 : Support area on the end of the load measuring pin for a sleeve tube or a muff.

☞ *On the load measuring pins LB 210 to LB 213 and LB 231 to LB 233 the area of support is not sufficient. Use a wooden cylinder for the extraction of the load measuring pin.*

4.3 Connection of the load measuring pins

Methods of connecting load measuring pins to electronic conditioning instruments supplied by Vibro-Meter are described in this chapter. The load measuring pins can, however, also be connected to instruments from other suppliers.

A measuring and monitoring chain is composed of a transducer and of electronic signal conditioning modules, represented in figure 4-9.

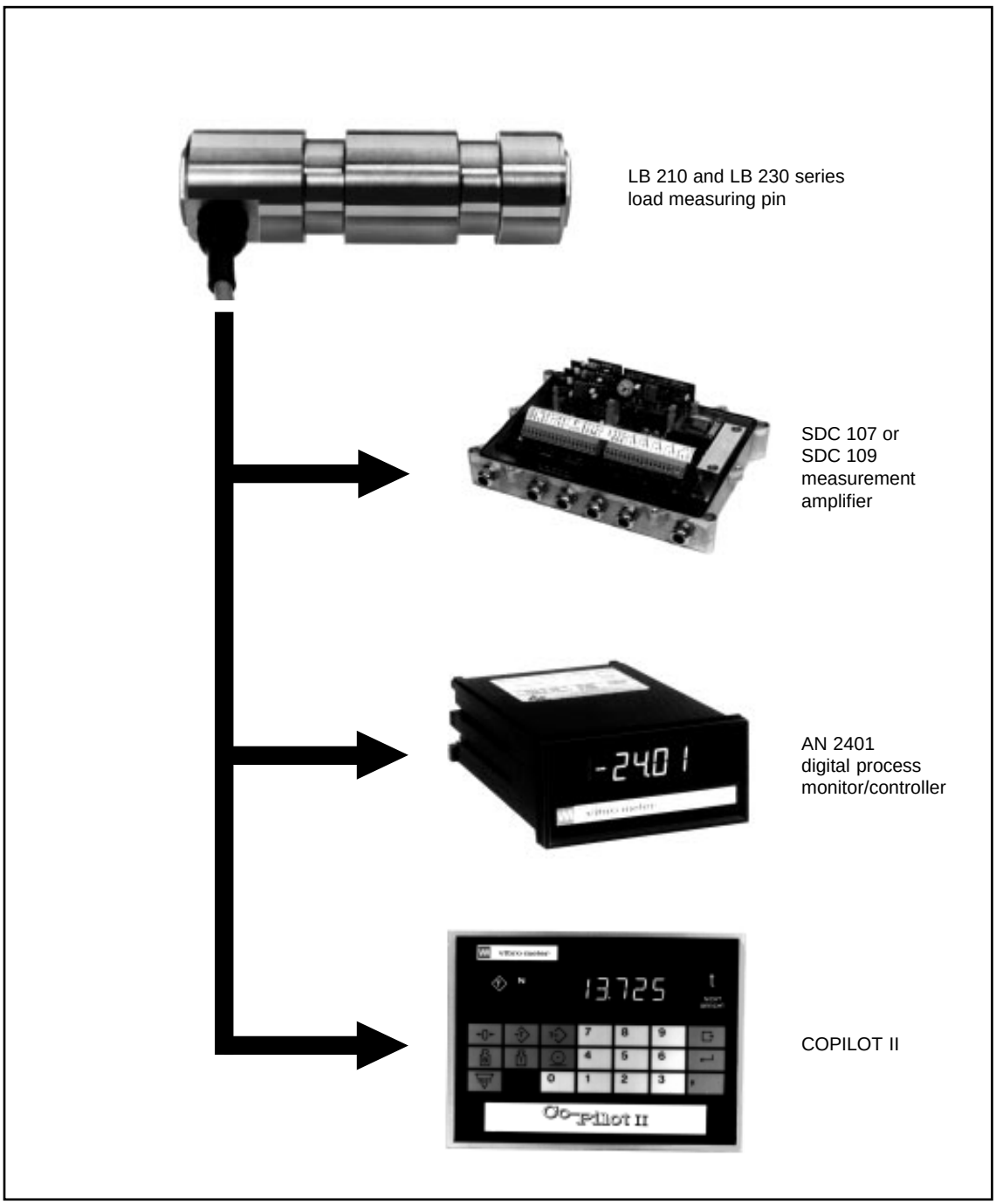


Fig. 4-9 : Electronic conditioning modules for connection to load measuring pins.

1) Connection of a load measuring pin to any instrument

Connect the load measuring pin connection cable lead (see figure 4-10) to the input terminal of the instrument according to the instructions given in its instruction manual.

Do not install a cable near a high-voltage line.
Perturbations of the measurement signal may occur if this prescription is not respected.

Connect the cable screening to the earth at one end only.
Perturbations of the measurement signal due to earth loops may occur if this prescription is not respected.

If several systems have been precalibrated, be careful to use each load measuring pin only with the electronic signal conditioning module with which it has been calibrated (refer to the measurement protocol and serial number S/N).
Errors of measurement may result necessitating recalibration if this prescription is not respected.

If it is not possible to orient the load measuring pin according to the mounting instructions given in the preceding sections, it may be mounted upside down (the mortise of the pin holder key downward). In this case, however, the sign of the signal is inverted. So that the sign is positive, two wires of the cable have to be interchanged (either those of the power supply or those of the signal), when connecting the conditioning module. In the case of inverted force, the sensitivity may be slightly altered (±1.5 %).

The above prescriptions are valid for all connection types.

2) Connection of a load measuring pin to a measurement amplifier SDC 107

Connect the load measuring pin connection cable to the input terminal of the SDC 107 according to the indications given in figure 4-11.

For more information concerning the cabling of the SDC 107, refer to its instruction manual.

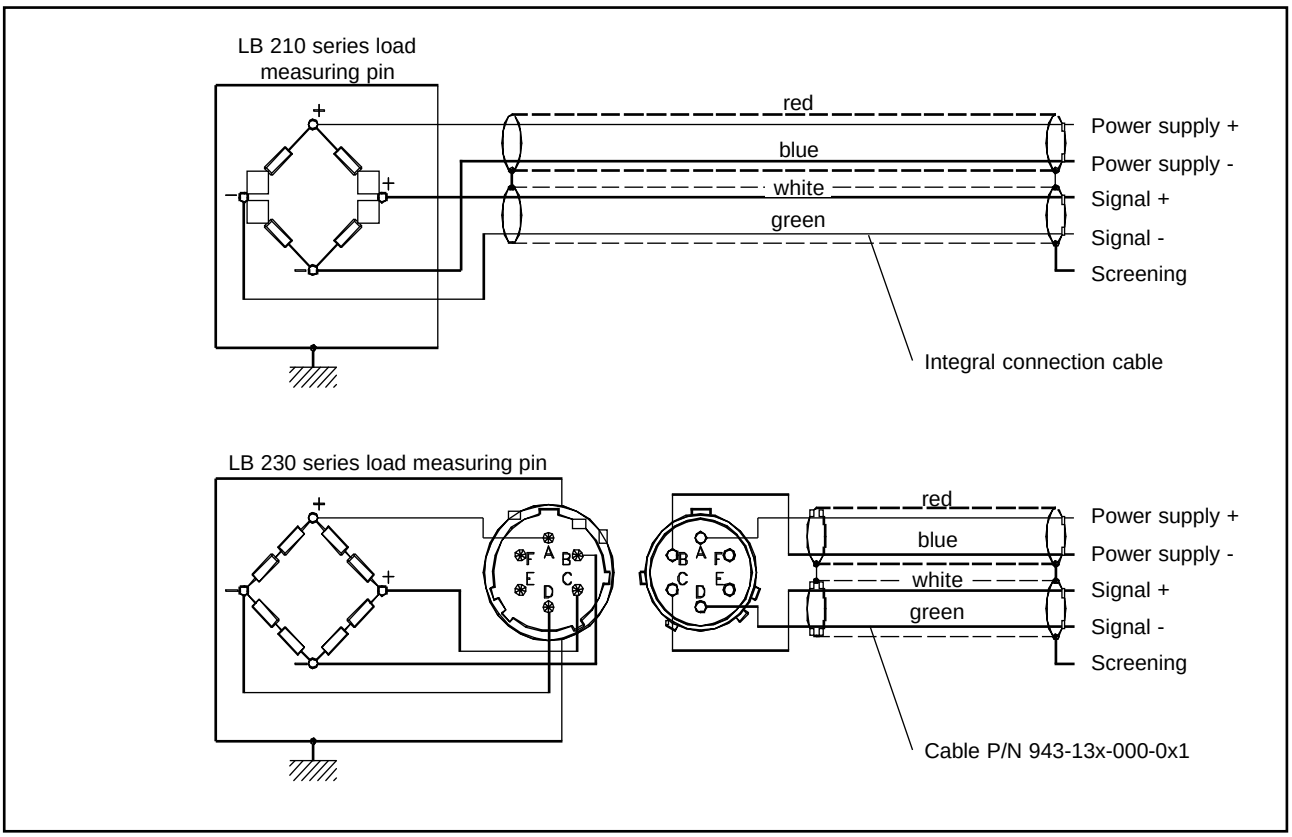


Fig. 4-10 : Connection of the load measuring pin to any instrument.

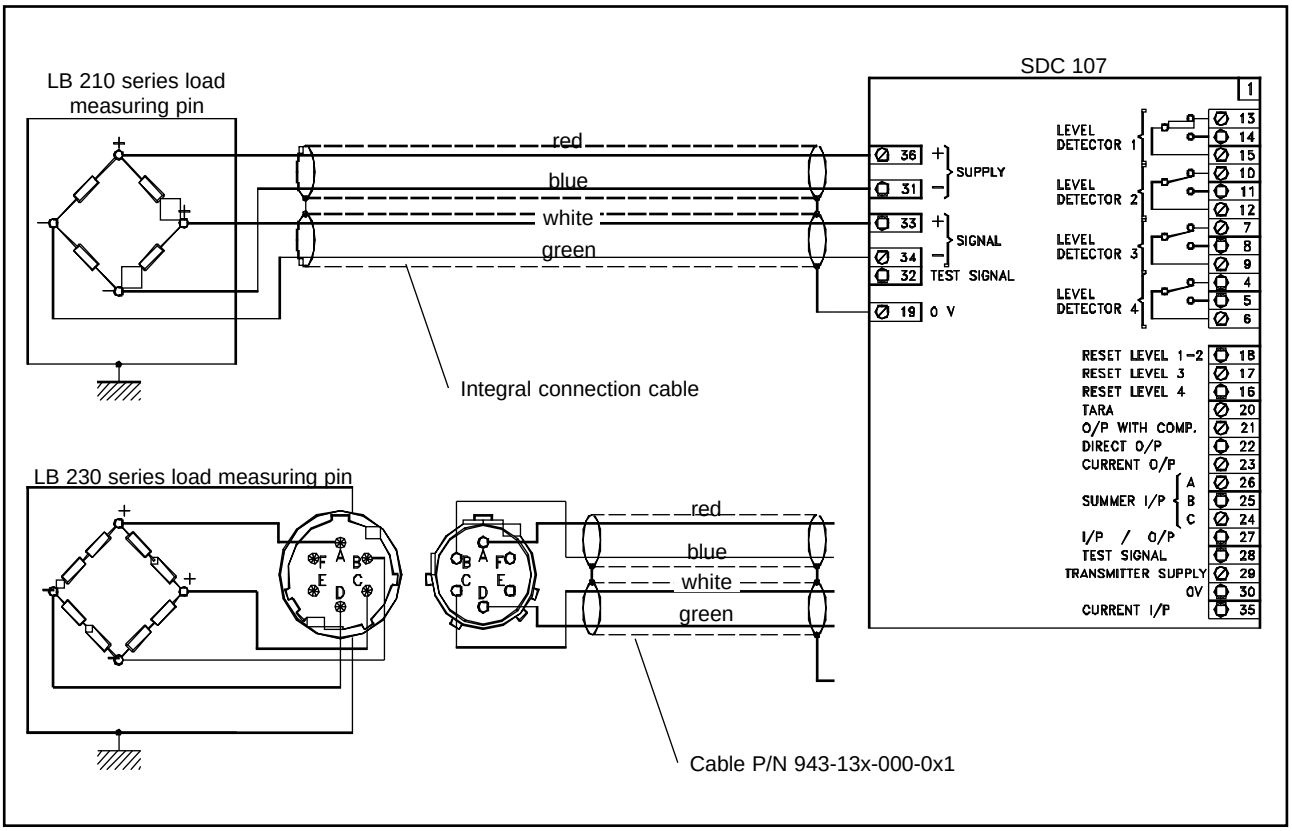


Fig. 4-11 : Connection of the load measuring pin to an SDC 107 measurement amplifier.

3) Connection of a load measuring pin to an SDC 109 measurement amplifier

Connect the load measuring pin connection cable to the input terminal of the SDC 109 according to the indications given in figure 4-12.

☞ *For more information concerning the cabling of the SDC 109, refer to its instruction manual.*

4) Connection of a load measuring pin to an AN 2401 digital process monitor/controller

Connect the load measuring pin connection cable to the input terminal of the AN 2401 according to the indications given in figure 4-13.

☞ *For more information concerning the cabling of the AN 2401, refer to its instruction manual.*

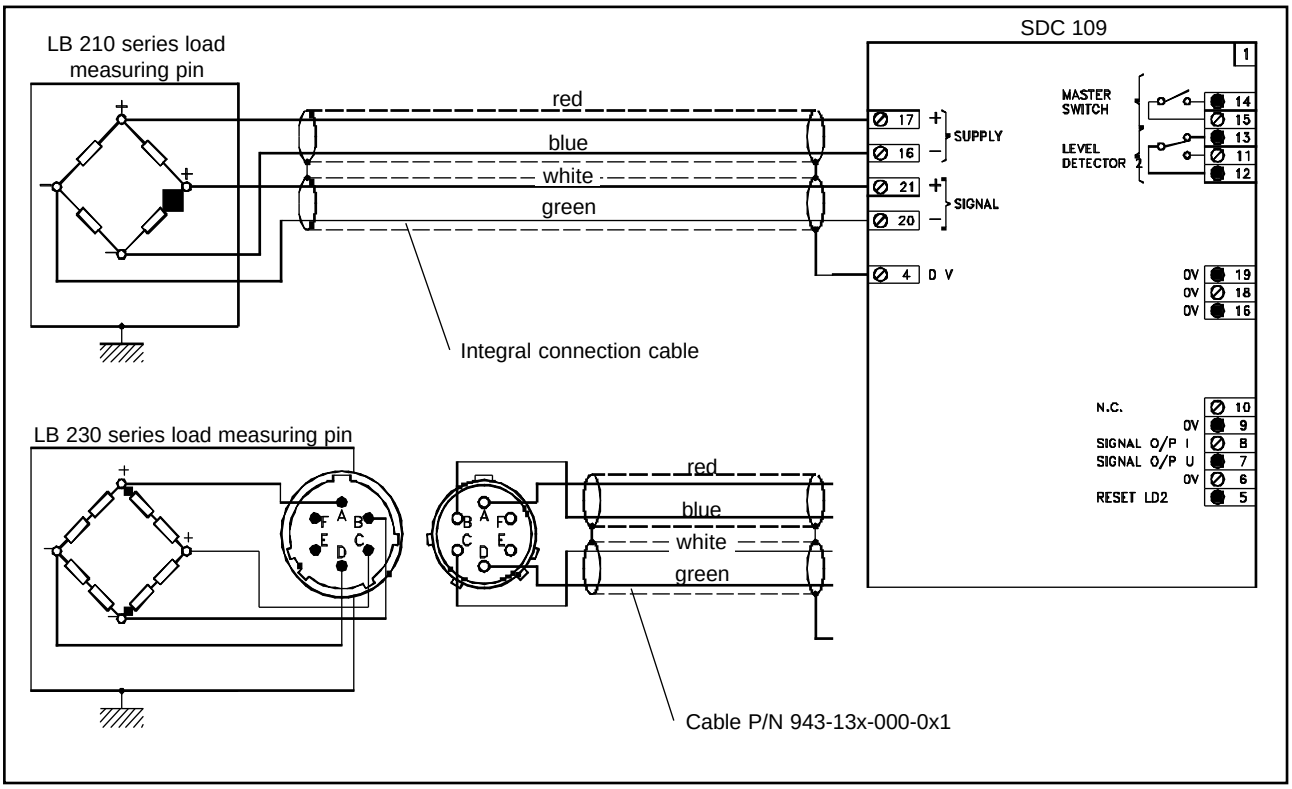


Fig. 4-12 : Connection of the load measuring pin to an SDC 109 measurement amplifier.

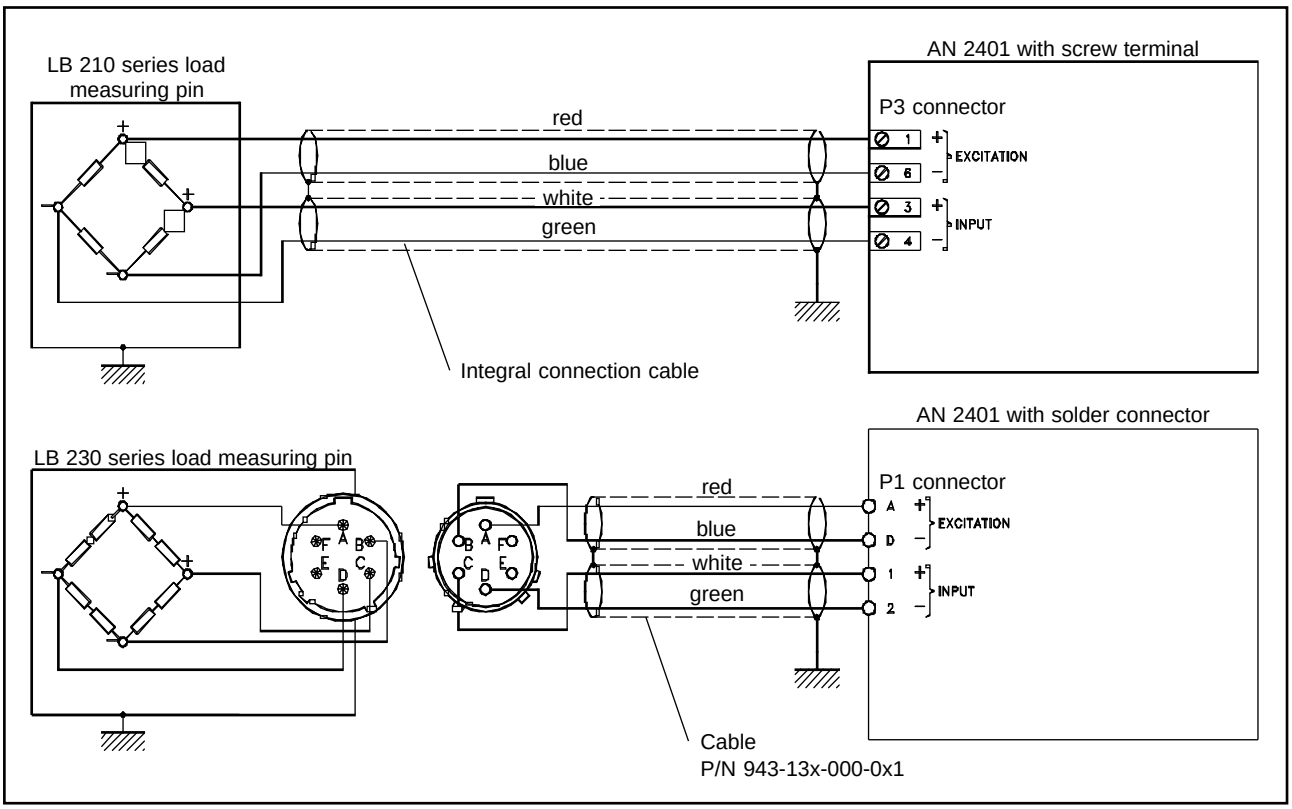


Fig. 4-13 : Connection of the load measuring pin to an AN 2401 digital process monitor/controller.

vibro-meter
SWITZERLAND

5) Connection of a load measuring pin to a COPILOT II

Connect the load measuring pin connection cable to the input terminal of the COPILOT II according to the indications given in figure 4-14.

☞ *For more information concerning the cabling of COPILOT II, refer to the instruction and calibration manual "Weighing system for refuse transport vehicles".*

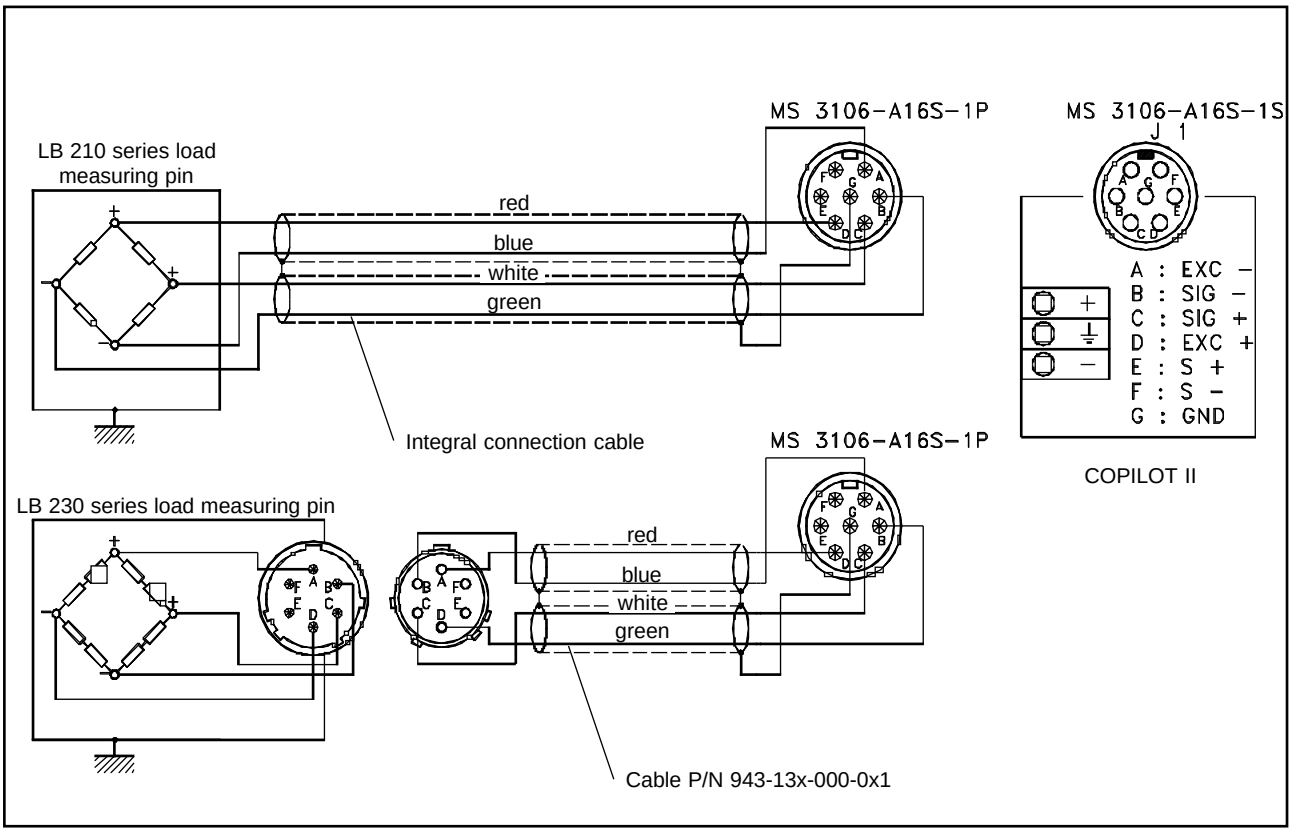


Fig. 4-14 : Connection of the load measuring pin to a COPILOT II.

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5 INFLUENCE FACTORS

The measurement signal delivered by the load measuring pin can be influenced by the orientation of the pin in its seat and by possible overloads. Both topics are treated in this chapter.

☞ *The recommendations listed in this chapter should be followed exactly so that the load measuring pin characteristics are guaranteed.*

It will also be shown in this chapter that a badly effected mounting can rapidly impair the measurement accuracy of a load measuring pin and consequently diminish the security of the whole installation.

5.1 Influence of the pin's orientation

For the LB 210 and LB 230 series load measuring pins the identification of the sensitivity axis is performed by means of the pin holder key mortise. This being by definition perpendicular to the sensitivity axis, the pin should be mounted so that it is perpendicular to the force applied on the central portion of the pin.

When the pin is not oriented optimally (see figure 5-1), the measurement signal is altered according to the following relation :

$$U_{eff} = U_{nom} \cdot \cos \varphi$$

where : U_{eff} represents the effective value of the signal
U_{nom} represents the rated value of the signal
φ represents the angle between the sensitivity axis of the transducer and the direction of the force applied on the central portion of the pin.

Example : Output signal = effective value (U_{eff}) ie 100 % of the full-scale value

for $\varphi = 0°$	$\cos \varphi = 1$	$U_{eff} = U_{nom}$
for $\varphi = 10°$	$\cos \varphi = 0.985$	U_{eff} = 98.5 % of U_{nom}

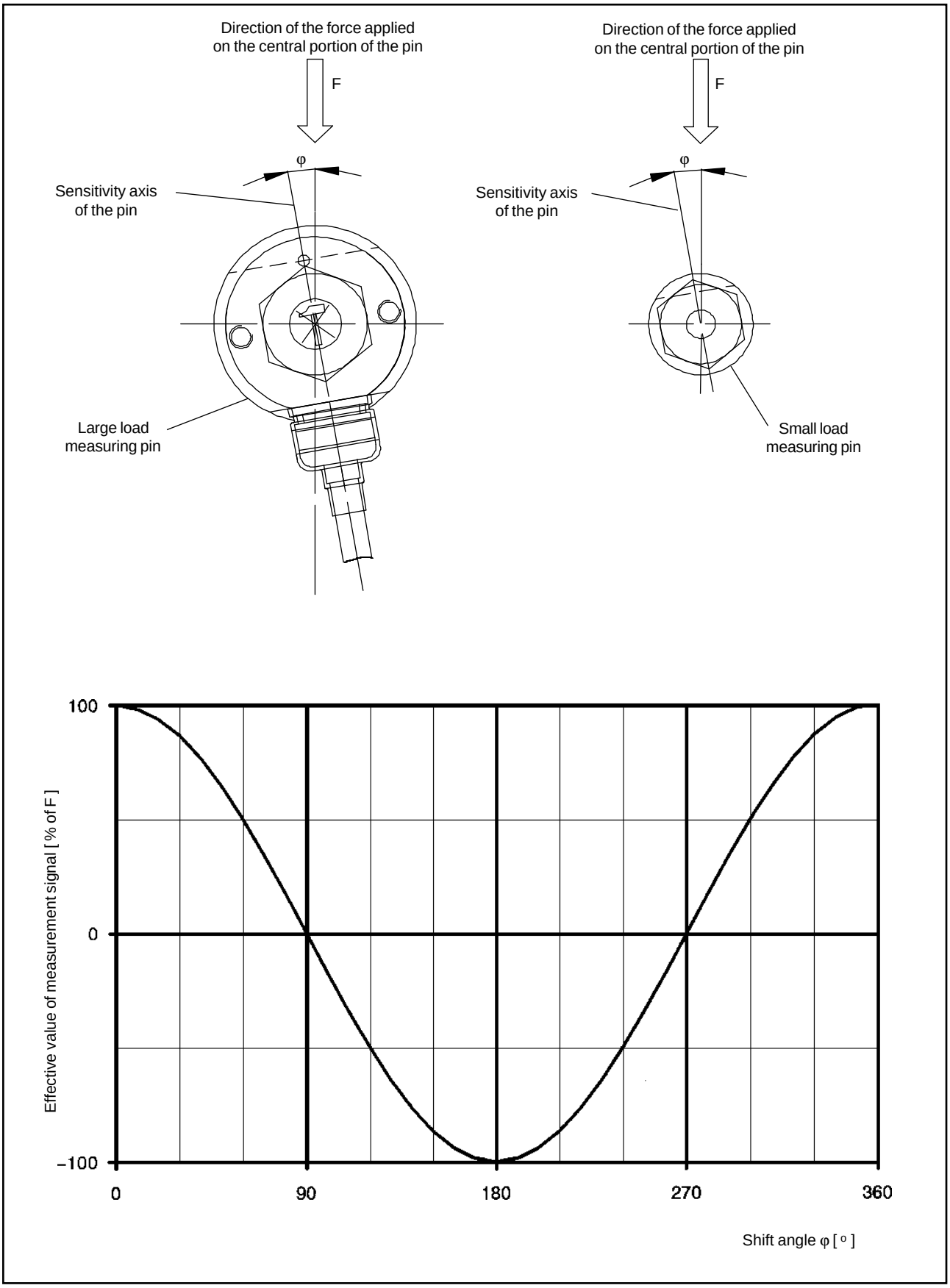

Fig. 5-1 : Influence of the pin's orientation.

5.2 Influence of the applied force

A load measuring pin is capable of measuring not only loads within the rated load range but loads up to 150 % of the rated load (see figure 5-2).

However, the application of loads exceeding these limits can incur a permanent (plastic) deformation of the load measuring pin, or even its destruction). In such a case the measurement signals do not correspond to the load applied in reality. Consequently the security of the installation and that of the user are no longer guaranteed.

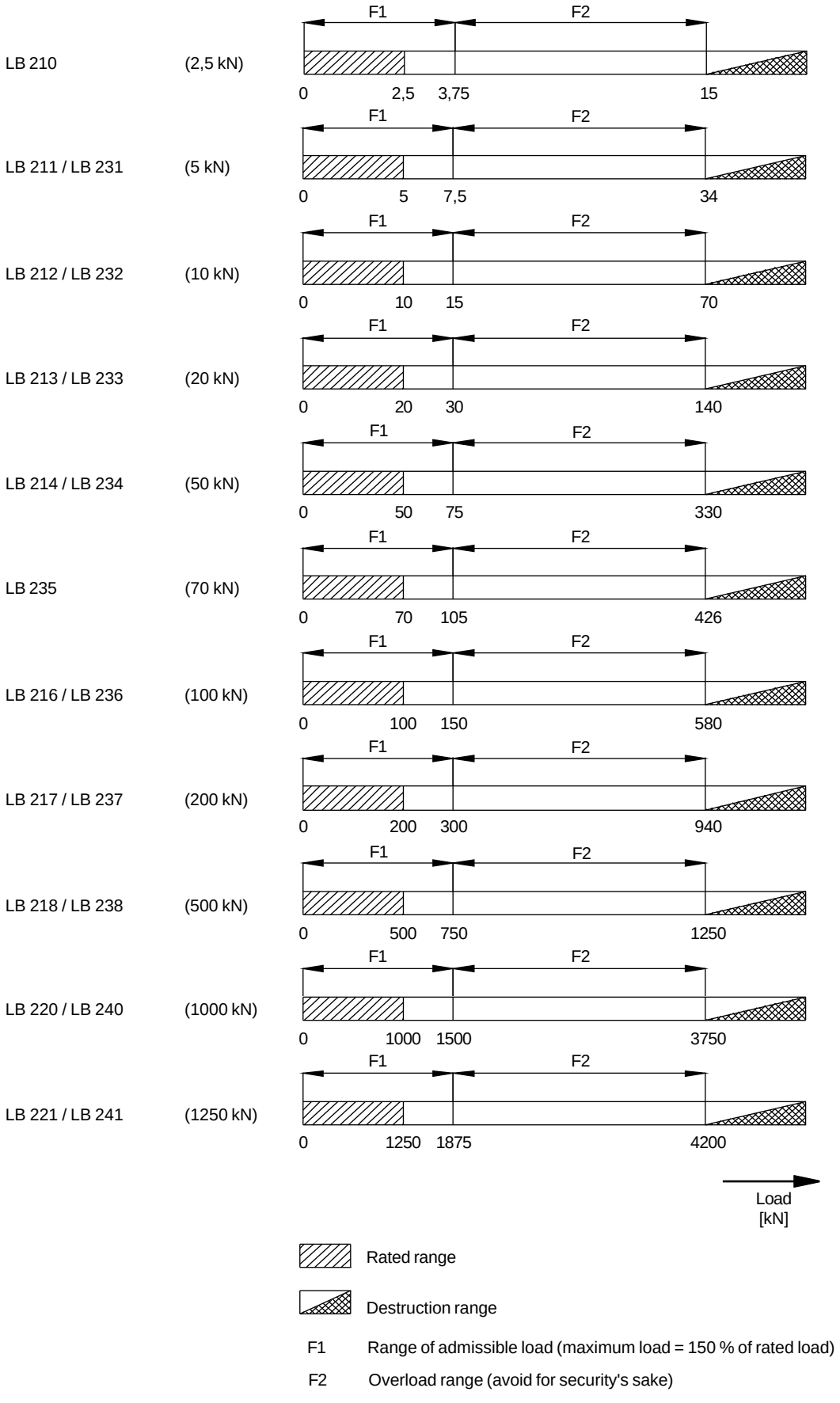

Fig. 5-2 : Application range of the load measuring pins.

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6 MAINTENANCE

6.1 Maintenance

All gliding surfaces of mechanical parts must be lubricated. In particular, the load measuring pin must be greased before it is mounted.

If the load measuring pin is used with compensation pulleys, a periodical greasing is sufficient. When the operating conditions are particularly hostile (considerable humidity, high temperature, dust, etc), it is recommended to grease the bearings at short intervals.

For rotating pulleys mounted on gliding bearings lubrication is indispensable. On request Vibro-Meter supplies load measuring pins with an incorporated device for the greasing of gliding surfaces (lubricator on option on load measuring pins LB 216 and LB 221).

Calibration recommendations

The checking interval will depend on the kind of application or the maintenance schedule planned for the installation.

6.2 Fault finding

The flow chart in figures 6-1 and 6-2 provides a procedure allowing easy checking of a load measuring pin's operation, on condition that the installation is fully cabled.

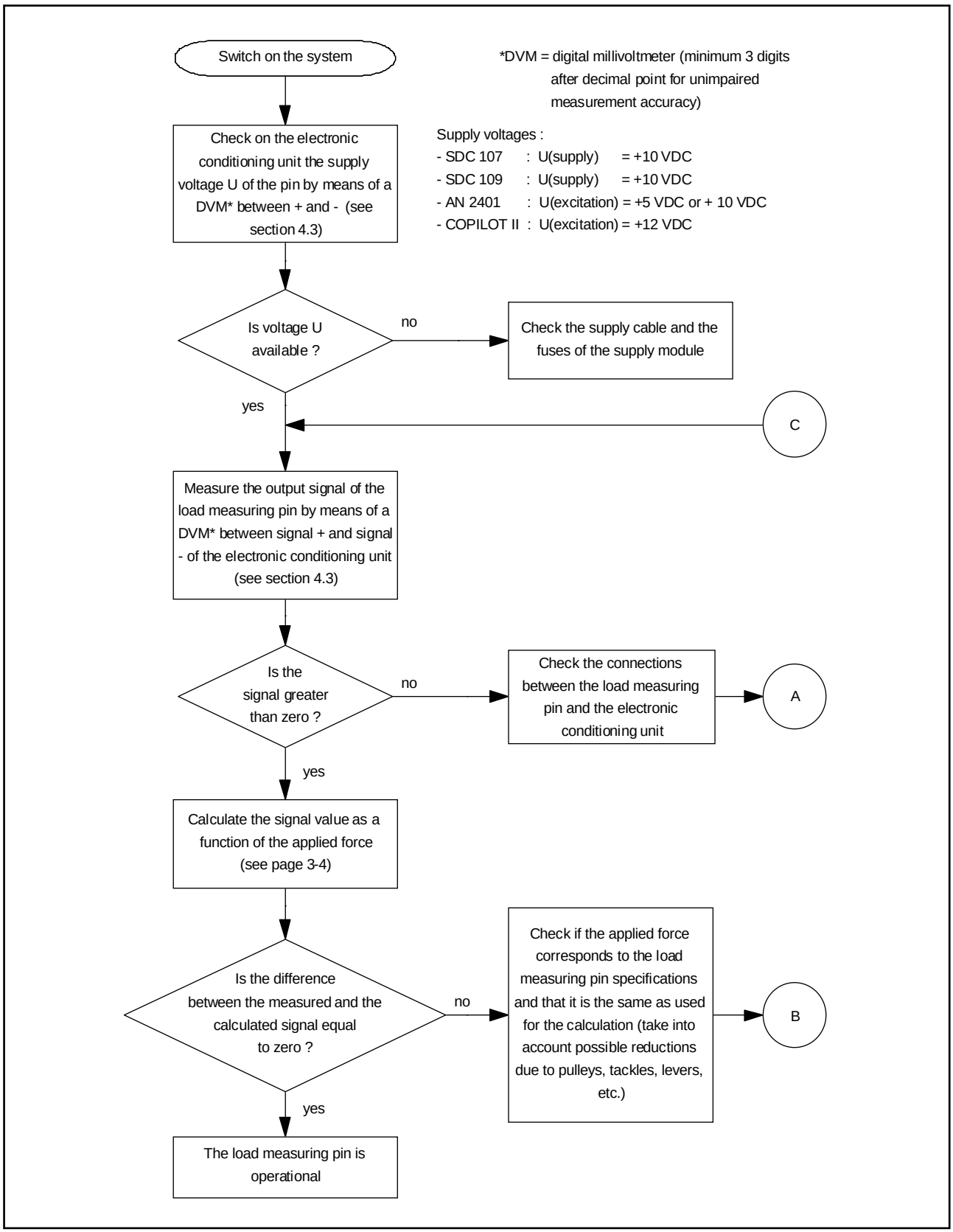
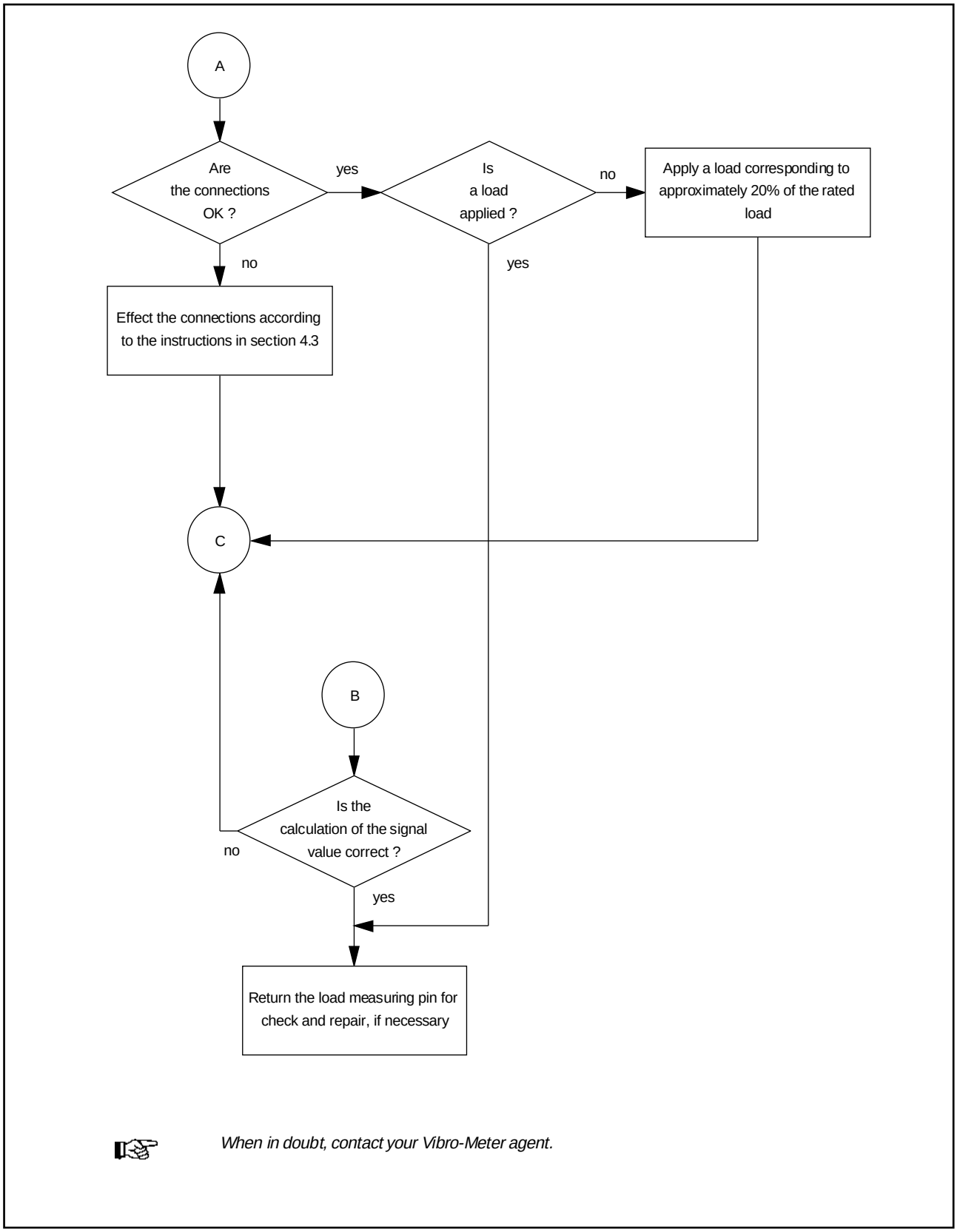


Fig. 6-1 : Fault finding flow chart (part 1).



☞ *When in doubt, contact your Vibro-Meter agent.*

Fig. 6-2 : Fault finding flow chart (part 2).

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7 SPECIFICATIONS

The specifications of the load measuring pins described in this instruction manual are contained in the following data sheets :

Data sheet designation	P/N
- LB 210 load measuring pins	234-007
- LB 230 load measuring pins	234-005

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LB 210 Series

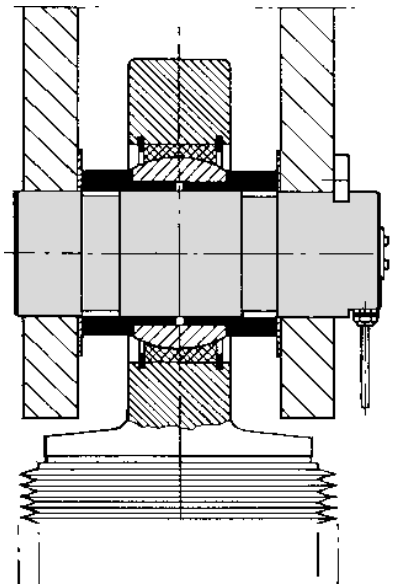
Load Measuring Pins
LB 210 Series

vibro-meter
certified by
ISO 9001

FEATURES

- **Temperature-compensated transducers**
  with strain gauges in full-bridge configuration
- **Available in 10 standard ranges**
  from 2.5 to 1250 kN
- **Simple installation**
  for cost-saving solutions to measurement problems
- **High reliability**
  for your safety requirements
- **Rugged design**
  for application in harsh industrial environments
- **Standard version with variants**
  for greater flexibility at lower cost
- **Versions with special dimensions**
  for adaptation to various construction conditions

MOUNTING EXAMPLE



TYPICAL APPLICATIONS

When forces acting on mechanical constructions are measured, the additional equipment required can often be costly and difficult to install. The load measuring pin offers an excellent solution since it acts as a direct element in the assembly, replacing a non-instrumented pin or shaft. The load pin can be used for :

Load measuring devices and overload protection on :
- cranes, hoisting gear, elevators and winches

Traction force measurement on cables for :
- ski-lifts, cable-cars and chair-lifts

Force measurement for regulation processes in :
- industrial installations and machinery production

SPECIFICATIONS (Standard Version)* LB 210 Series

DESIGN

The load measuring pin has 2 circular grooves and an axial bore. Inside the central bore, adjacent to the external grooves, the strain gauges are mounted in a full-bridge configuration. The positioning and orientation of the strain gauges has been optimized by means of the finite element method (FEM).

OPERATING PRINCIPLE

When a force is applied to the load measuring pin along its sensitive axis, the effect on the strain gauge bridge results in an output signal proportional to the applied force. The powering of the strain gauge bridge as well as the amplification of its output signal voltage is performed by an external amplifier. The latter allows, depending on the execution, the monitoring of several levels.

ELECTRICAL CHARACTERISTICS

Operating principle	: Full-bridge strain gauge
Bridge impedance	
- input	: 400 Ω
- output	: 350 Ω
Power supply	: 5 to 12 V DC / AC
Transducer sensitivities	
- LB 210 to LB 213	: 0.5 mV/V ± 3 %
- LB 214 to LB 218	: 1 mV/V ± 3 %
- LB 220 and LB 221	: 1.8 mV/V ± 3 %
Zero adjustment	: ± 1 % of fsd
Non-linearity error	: < 0.25 % of fsd (LB 220 & LB 221 : 0.5 %)
Non-linearity error + hysteresis error	: < 0.5 % of fsd (LB 220 & LB 221 : 0.8 %)
Repeatability	: ± 0.1 % of fsd
Operating temperature	: -25°C to +80°C
Storage temperature	: -55°C to +125°C
Temperature influence	
- on zero	: ± 0.02 % of fsd / K
- on sensitivity	: ± 0.02 % / K
Influence on measurement signal	
- shift of force angle with respect to measurement axis	: According to the cosine function

ELECTRICAL CONNECTION

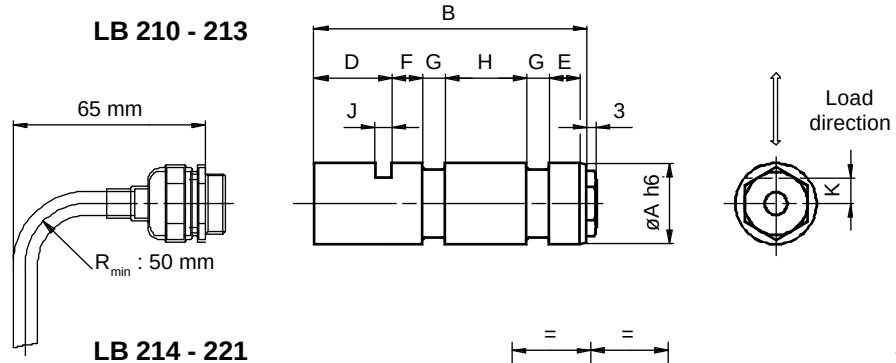
Cable type	: K-414 (refer to data sheet P/N 224-002)
Cable length (standard)	: 3 m
PG output (standard)	
- LB 210 to LB 213	: Axial, with heat-shrinkable sleeve
- LB 214 to LB 221	: Radial, with heat-shrinkable sleeve
Optional variants	
- for all the range	
• cable lengths	: 6, 12, 20 m
- LB 214 to LB 221	
• PG output	: Axial, with heat-shrinkable sleeve
• output connector	: Radial, MS 311 E 10-6P
• connection cable assembly	: Options 3, 6 ,12, 20 m with : • straight connector MS 11S 3116 J10 6S • 90° connector, Souriau 851 08 EC 10 6S50
- LB 216 to LB 221	: Oiler

MECHANICAL CHARACTERISTICS

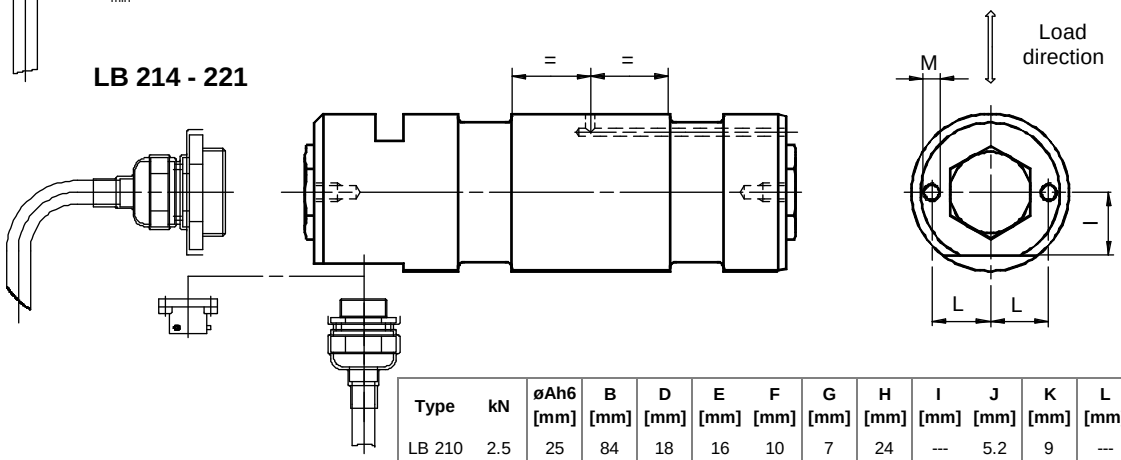
Material	: Stainless steel 1.4057
Nominal load (fsd)	: Refer to table on page 3
Overload admissible	: 150 % of rated load without influence on the measurement
Overload limit	: 250 % of of rated load with new calibration
Overload at rupture	: ≥ 500 % of rated load according to the type
Protection class	: IP 66 according to DIN 40050
Fit	: G7 / h6
Lubrification	: Oiler ø4 DIN 3405 D or M10 DIN 3405 A according to the LB type
Weight	: Refer to table on page 3

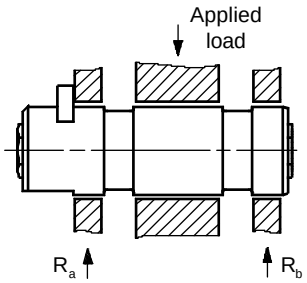
* For the special load measuring pins, some characteristics are not always valid.

LB 210 - 213



LB 214 - 221





Type	kN	øAh6 [mm]	B [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	J [mm]	K [mm]	L [mm]	M [mm]	Weight [kg]
LB 210	2.5	25	84	18	16	10	7	24	---	5.2	9	---	---	0.2
LB 211	5	25	84	18	16	10	7	24	---	5.2	9	---	---	0.2
LB 212	10	25	84	18	16	10	7	24	---	5.2	9	---	---	0.2
LB 213	20	25	84	18	16	10	7	24	---	5.2	9	---	---	0.2
LB 214	50	35	112	25	14	12	12	35	16	6.3	11.5	---	---	0.65
LB 216	100	50	161	32	24	18	18	48	21.5	10.5	20	---	---	2
LB 217	200	65	196	32	26	20	25	65	28.5	10.5	22.5	---	---	4.4
LB 218	500	85	258	34	39	35	28	89	35	10.5	28	25	M6	10.6
LB 220	1000	100	347	36	61	55	35	120	45	10.5	36	25	M8	19.2
LB 221	1250	120	347	36	61	55	35	120	45	12.5	40	35	M8	28.4

Ordering information :

STANDARD VERSION

LOAD MEASURING PINS : P/N 122-2□□-000-011 / 0 0 □

- Type LB 2[1][0] - 2[1][3] Electrical connection : PG axial
- Type LB 2[1][4] - 2[2][1] Electrical connection : PG radial

OPTIONAL VARIANTS

LOAD MEASURING PINS : P/N 122-2□□-000-111 /□□□

- Type LB 2[1][4] - 2[2][1]

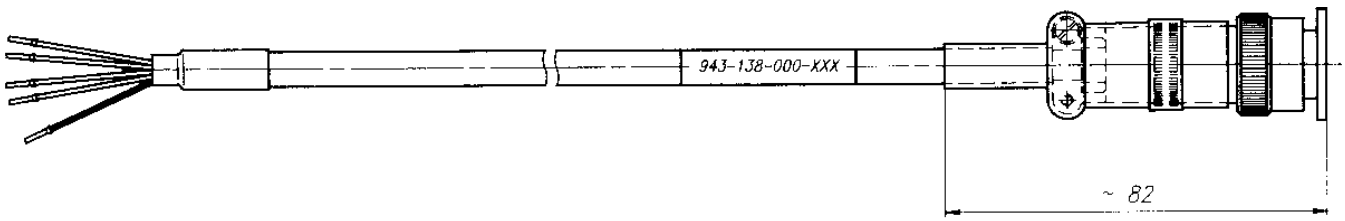
Lubrification : without LB 214 - 221 — **0**
with LB 216 to LB 221 — 1

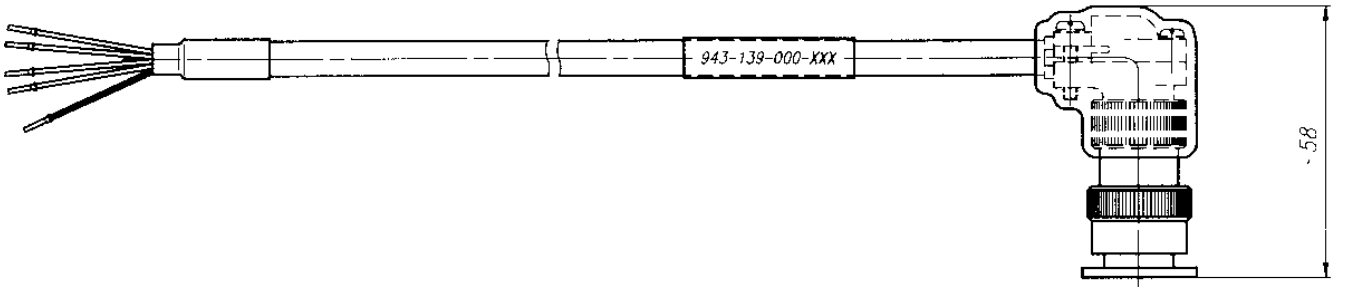
Electrical connection : PG radial — **0**
PG axial — 1
radial connector — 2-0

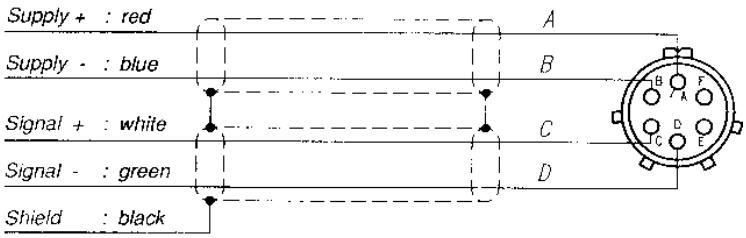
CONNECTION CABLE ASSEMBLY

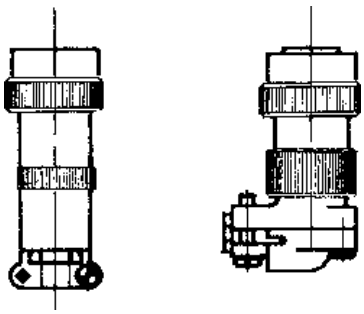
- Length : 3 m — **1**
  6 m — 2
  12 m — 3
  20 m — 4

Notes : A P/N with /**001** (ex. 122-216-000-111/**001**) indicates an optional variant corresponding to the standard version.









Ordering information :

COUNTER-CONNECTOR

- straight connector : P/N 957.11.08.0030
- 90° connector : P/N 957.11.08.0029

CONNECTION CABLE ASSEMBLY : P/N 943-13□-000-0□1

Straight connector 8
90° connector 9

Cable length
3 m 1
6 m 2
12 m 3
20 m 4

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

vibro-meter

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VIBRO-METER SA, Fribourg/Switzerland 234-007 / 10.96 / E

OIML classified

LB 230 Series

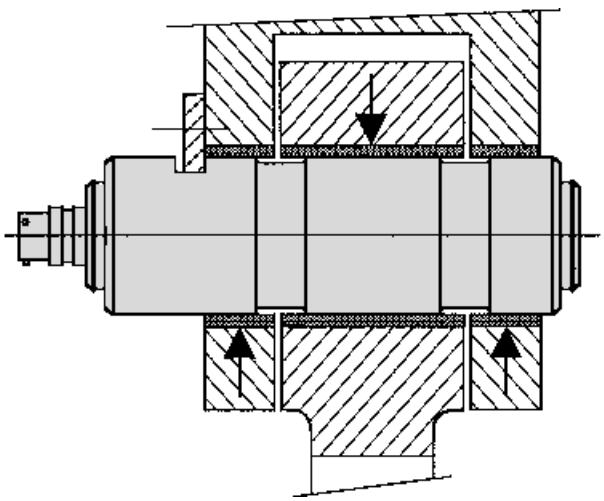
vibro-meter
certified by
ISO 9001

Load Measuring Pins
LB 230 Series

FEATURES

- **Temperature-compensated transducers**
  with strain gauges in full-bridge configuration
- **Available in 10 standard ranges**
  from 5 to 1250 kN
- **Classified according to OIML R60 D0.1**
  from 50 to 200 kN
  for scales of the class IIII
- **Hermetically sealed execution**
  for harsh environmental conditions (IP 67)
- **Axial forces compensated**
  insensitive to virually all lateral forces
- **Dimensions compatible**
  with the standard type range LB 210
- **Simple installation**
  for cost-saving solutions to measurement problems

MOUNTING EXAMPLE



TYPICAL APPLICATIONS

When forces acting on mechanical constructions are measured, the additional equipment required can often be costly and difficult to install. The load measuring pin offers an excellent solution since it acts as a direct element in the assembly, replacing a non-instrumented pin or shaft. The load pin can be used for :

Weighing in stationary conditions :
- platforms, tanks, silos

Mobile weighing :
- lorry superstructure, multibucket vehicles, wagons

Load measuring devices on :
- cranes, hoisting gear, eevators and floor conveyors

Force detection under harsh environmental conditions :
- intropical, offshore, marine and harbour applications

SPECIFICATIONS (Standard Version)*

LB 230 Series

DESIGN

The load measuring pin has 2 circular grooves and an axial bore. Inside the central bore, adjacent to the external grooves, 4 strain gauges are mounted in a double full-bridge configuration. The positioning and orientation of the strain gauges has been optimized by means of the finite element method (FEM). Any transverse or axial forces, even when acting on any part of the pin, have no influence on the measurement signal.

OPERATING PRINCIPLE

When a force is applied to the load measuring pin along its sensitive axis, the effect on the strain gauge bridge results in an output signal proportional to the applied force. The powering of the strain gauge bridge as well as the amplification of its output signal voltage is performed by an external amplifier. The latter allows, depending on the execution, the monitoring of several levels.

ELECTRICAL CHARACTERISTICS

Operating principle	: Double full-bridge strain gauge in series
Bridge impedance	
- input	: 800 Ω
- output	: 700 Ω
Power supply	: 5 to 12 V DC / AC
Transducer sensitivities	
- LB 231 to LB 233	: 0.5 mV/V ± 3 %
- LB 234 to LB 238	: 1 mV/V ± 3 %
- LB 240 and LB 241	: 1,8 mV/V ± 3 %
Zero adjustment	: ± 1 % of fsd
Non-linearity error	: < 0.2 % of fsd
Non-linearity error + hysteresis error	: < 0.4 % of fsd
Repeatability	: ± 0.1 % of fsd
OIML class	: R60 D0.1 for LB 234 to LB 237
Operating temperature	: -25°C to +80°C
Storage temperature	: -55°C to +125°C
Temperature influence	
- on zero	: ± 0.02 % of fsd / K
- on sensitivity	: ± 0.02 % / K
Influence on measurement signal	
- shift of force angle with respect to measurement axis	: According to the cosine function

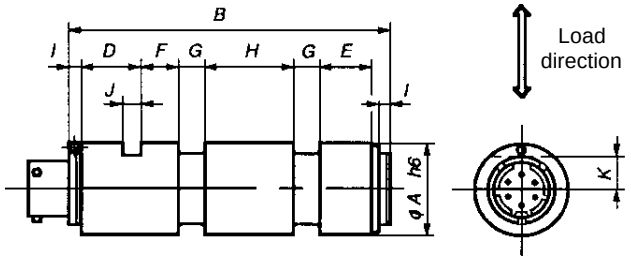
ELECTRICAL CONNECTION

Output connector	: Axial, type Souriau 0525 1H 10B 06 PN
Connection cable assembly	: Options 3, 6 ,12, 20 m with : • straight connector MS 11S 3116 J10 6S • 90° connector, Souriau 851 08 EC 10 6S50

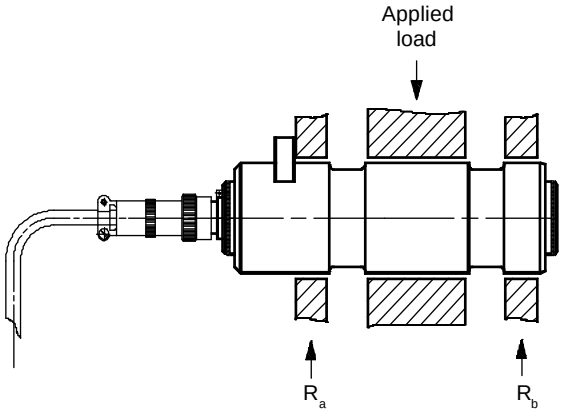
MECHANICAL CHARACTERISTICS

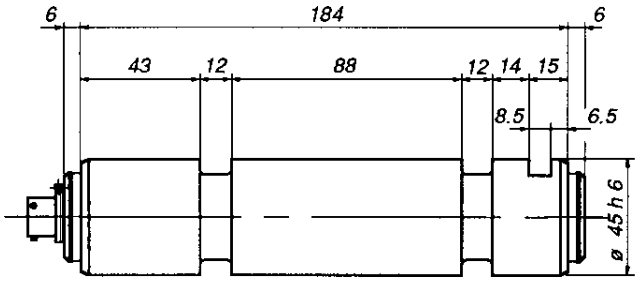
Material	: Stainless steel 1.4057
Nominal load (fsd)	: Refer to table on page 3
Overload admissible	: 150 % of rated load without influence on the measurement
Overload limit	: 250 % of of rated load with new calibration
Overload at rupture	: ≥ 500 % of rated load according to the type
Protection class	: IP 67 according to DIN 40050
Fit	: G7 / h6
Weight	: Refer to table on page 3

* For the special load measuring pins, some characteristics are not always valid.

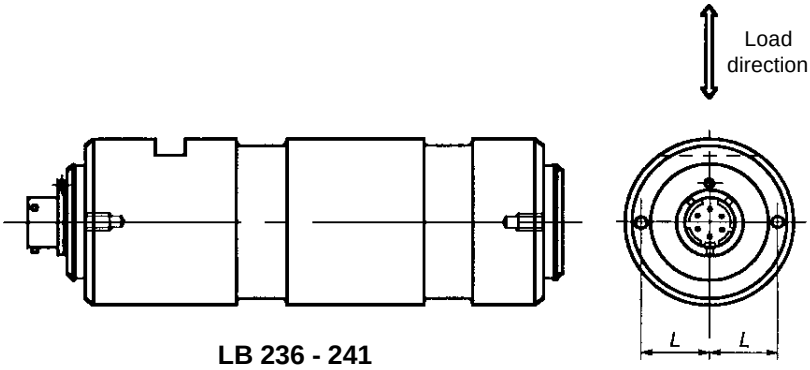


LB 231 - 234





LB 235



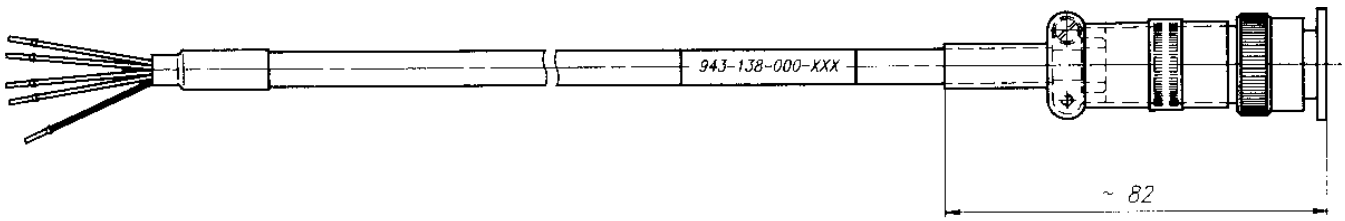
LB 236 - 241

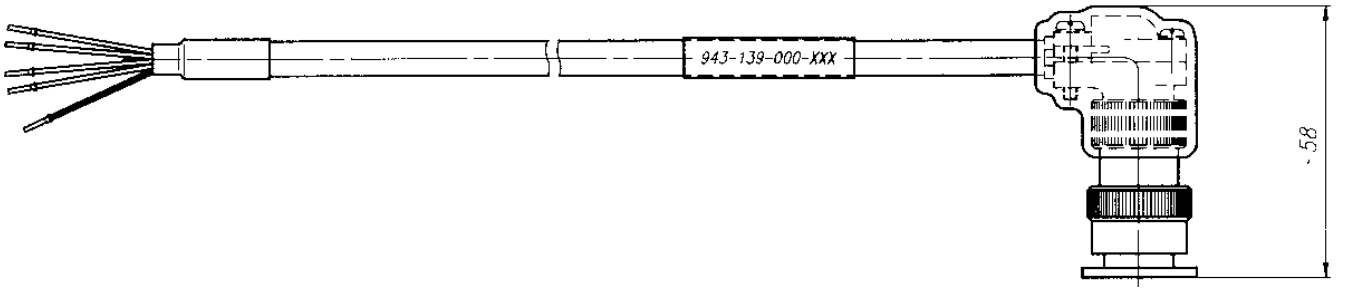
Type	kN	OIML	øAh6 [mm]	B [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	J [mm]	K [mm]	L [mm]	Weight [kg]
LB 231	5		25	86	16	14	10	7	24	3	5.2	9	---	0.2
LB 232	10		25	86	16	14	10	7	24	3	5.2	9	---	0.2
LB 233	20		25	86	16	14	10	7	24	3	5.2	9	---	0.2
LB 234	50	*	35	114	23	12	12	12	35	3	6.3	11.5	---	0.65
LB 235	70	*	45	196	15	41	14	12	88	6	8.5	16	---	1.8
LB 236	100	*	50	165	28	20	18	18	48	6	10.5	20	---	2
LB 237	200	*	65	200	28	22	20	25	65	6	10.5	22.5	---	4.4
LB 238	500		85	262	30	35	35	28	89	6	10.5	28	25	10.6
LB 240	1000		100	351	30	55	55	35	120	8	10.5	36	25	19.2
LB 241	1250		120	351	30	55	55	35	120	8	12.5	40	35	28.4

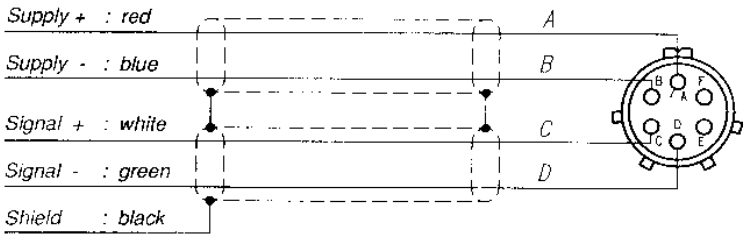
Ordering information :

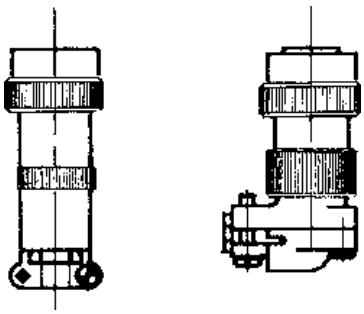
LOAD MEASURING PINS : P/N 122-2□□-000-021

- Type LB 2③① - 2④①









Ordering information :

COUNTER-CONNECTOR

- straight connector : P/N 957.11.08.0030
- 90° connector : P/N 957.11.08.0029

CONNECTION CABLE ASSEMBLY : P/N 943-13□-000-0□1

Straight connector 8
90° connector 9

Cable length
3 m 1
6 m 2
12 m 3
20 m 4

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

vibro-meter

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VIBRO-METER SA, Fribourg/Switzerland 234-005 / 10.96 / E

A MECHANICAL DRAWINGS

Designation	Drawing number
- Load Measuring Pin	PZ 5896
- Load Measuring Pin	PZ 5877
- Load Measuring Pin	PZ 5880

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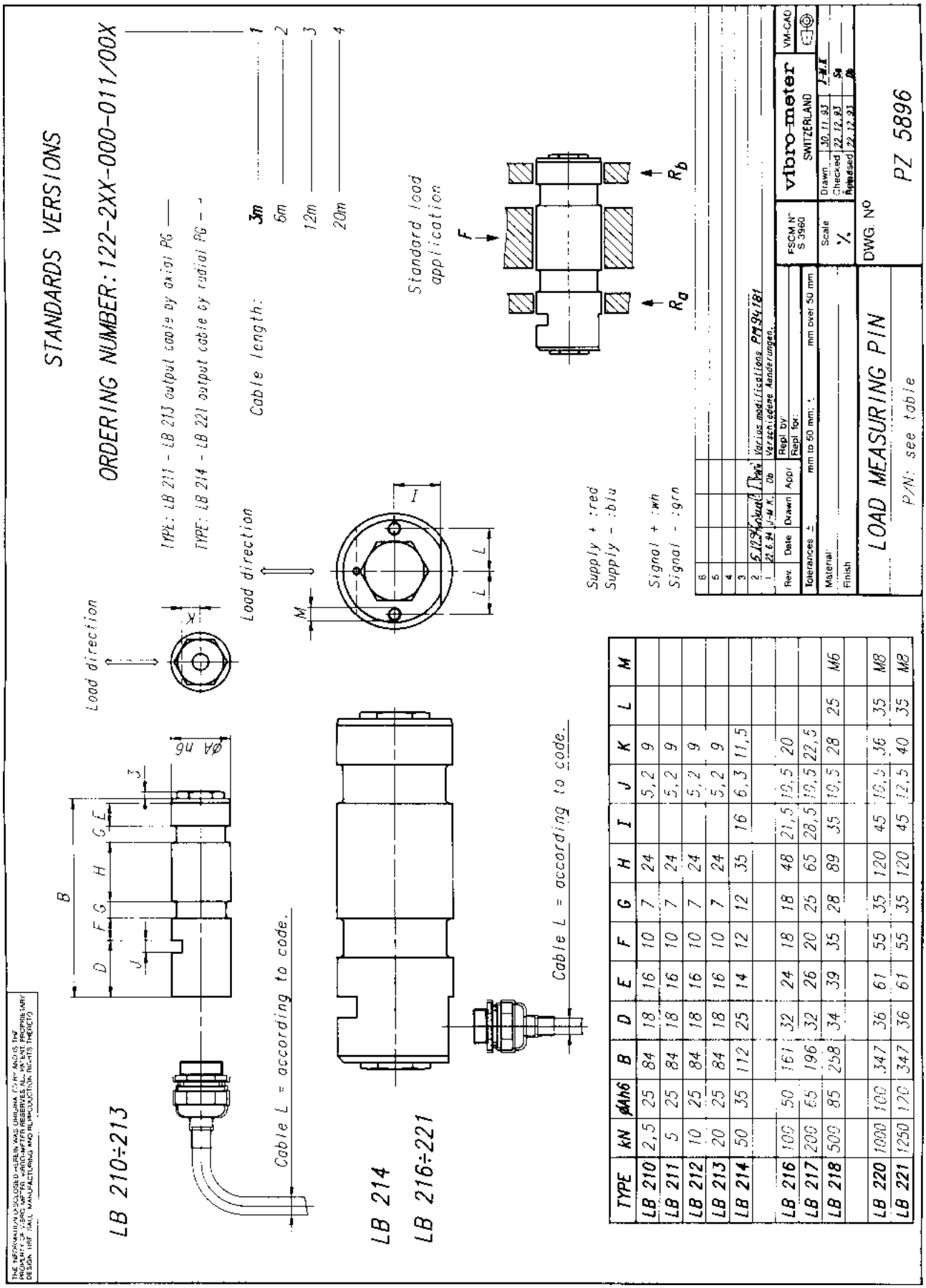

TYPE	kN	ØA h6	B	D	E	F	G	H	I	J	K	L	M
LB 210	2,5	25	84	18	16	10	7	24		5,2	9		
LB 211	5	25	84	18	16	10	7	24		5,2	9		
LB 212	10	25	84	18	16	10	7	24		5,2	9		
LB 213	20	25	84	18	16	10	7	24		5,2	9		
LB 214	50	35	112	25	14	12	12	35	16	6,3	11,5		
LB 216	100	50	161	32	24	18	18	48	21,5	10,5	20		
LB 217	200	65	196	32	26	20	25	65	28,5	10,5	22,5		
LB 218	500	85	258	34	39	35	28	89	35	10,5	28	25	M6
LB 220	1000	100	347	36	61	55	35	120	45	10,5	36	35	M8
LB 221	1250	120	347	36	61	55	35	120	45	12,5	40	35	M8

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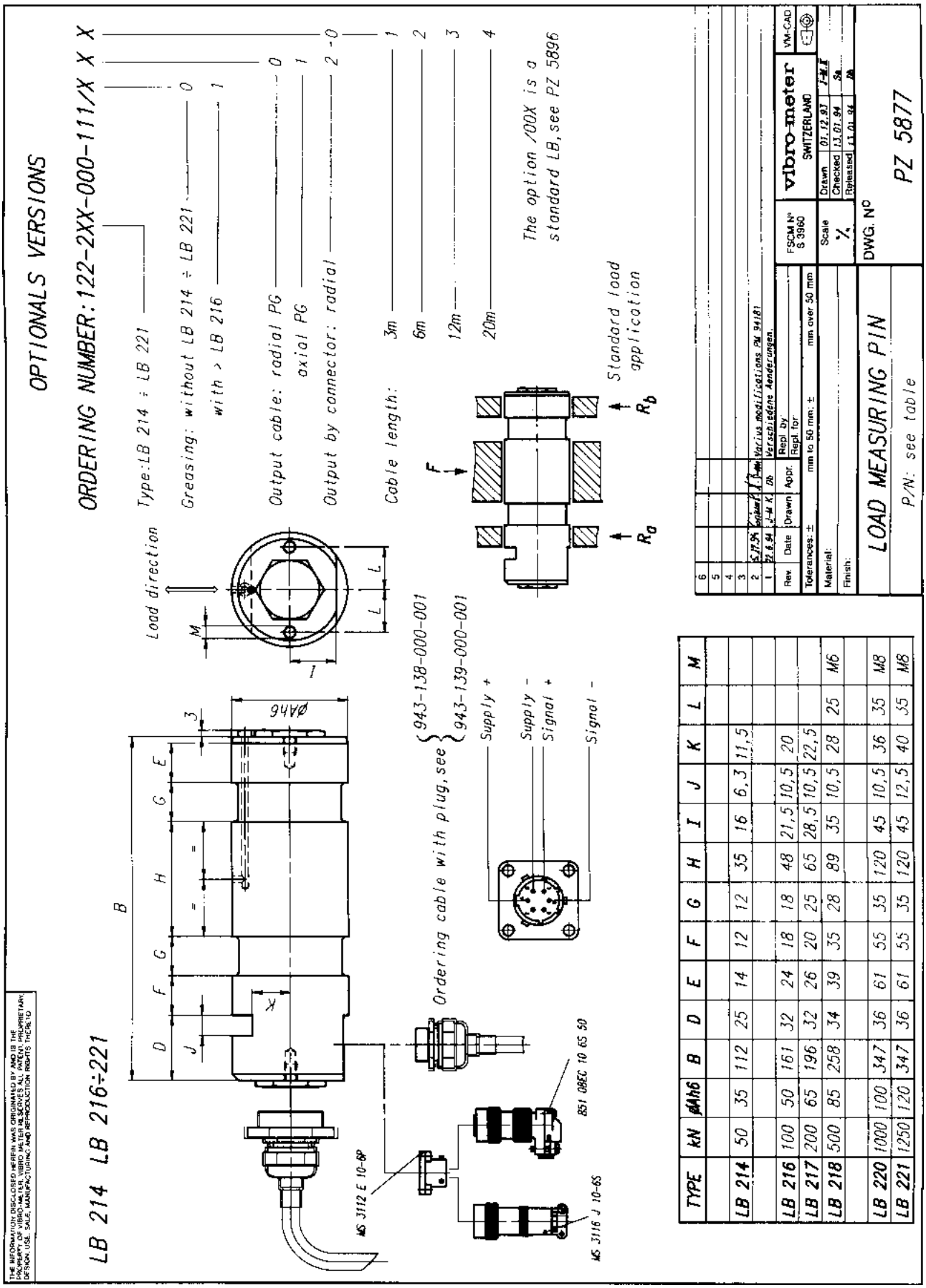

TYPE	kN	ØM6	B	D	E	F	G	H	I	J	K	L	M
LB 214	50	35	112	25	14	12	12	35	16	6,3	11,5		
LB 216	100	50	161	32	24	18	18	48	21,5	10,5	20		
LB 217	200	65	196	32	26	20	25	65	28,5	10,5	22,5		
LB 218	500	85	258	34	39	35	28	89	35	10,5	28	25	M6
LB 220	1000	100	347	36	61	55	35	120	45	10,5	36	35	M8
LB 221	1250	120	347	36	61	55	35	120	45	12,5	40	35	M8

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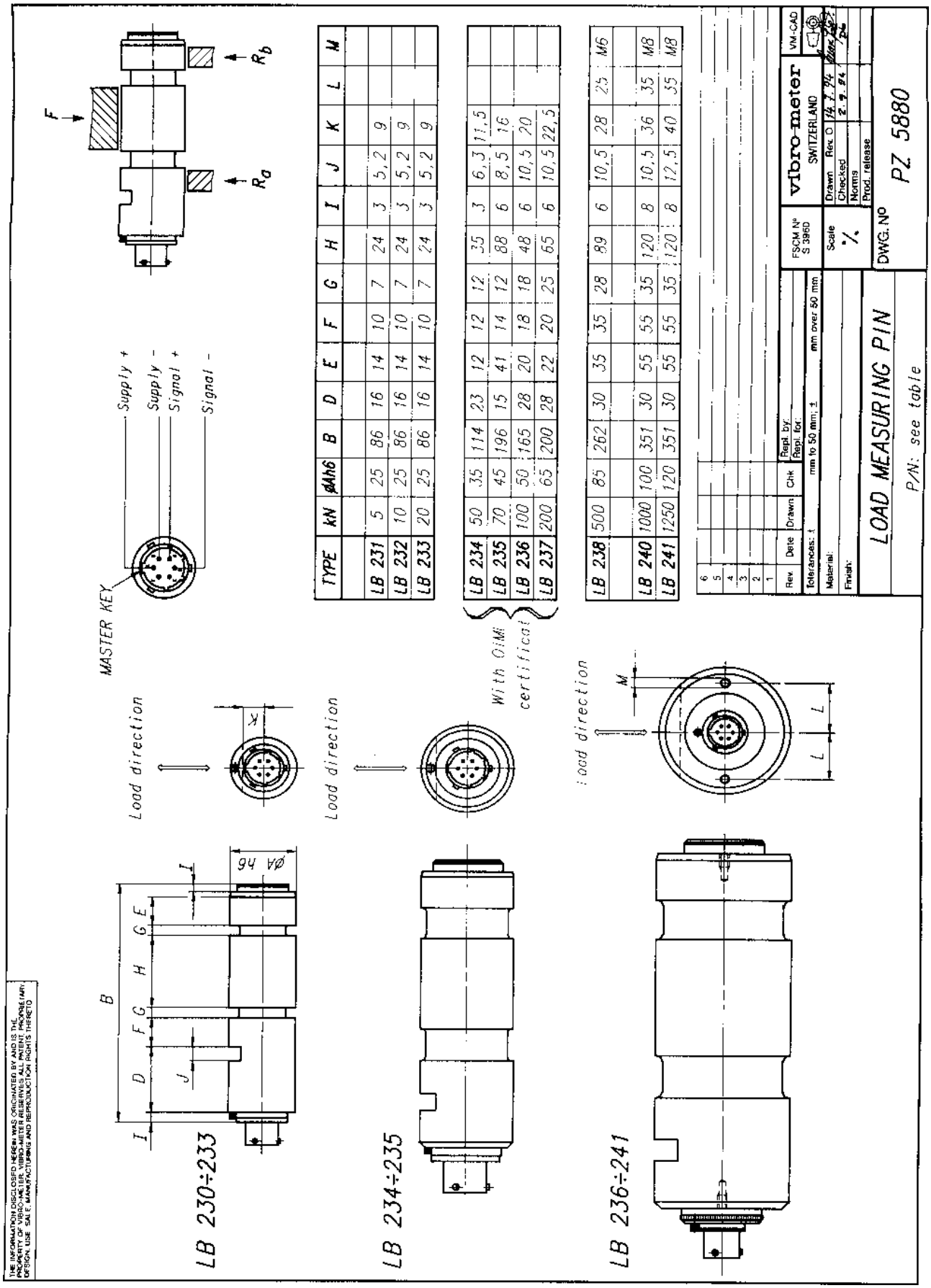

TYPE	kN	ØAh6	B	D	E	F	G	H	I	J	K	L	M
LB 231	5	25	86	16	14	10	7	24	3	5,2	9		
LB 232	10	25	86	16	14	10	7	24	3	5,2	9		
LB 233	20	25	86	16	14	10	7	24	3	5,2	9		
LB 234	50	35	114	23	12	12	12	35	3	6,3	11,5		
LB 235	70	45	196	15	41	14	12	88	6	8,5	16		
LB 236	100	50	165	28	20	18	18	48	6	10,5	20		
LB 237	200	65	200	28	22	20	25	65	6	10,5	22,5		
LB 238	500	85	262	30	35	35	28	89	6	10,5	28	25	M6
LB 240	1000	100	351	30	55	55	35	120	8	10,5	36	35	M8
LB 241	1250	120	351	30	55	55	35	120	8	12,5	40	35	M8

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B OIML CERTIFICATE

The LB 230 series load measuring pins (LB 234, LB 235, LB 236 and LB 237) are OIML certified.

Certificate designation	**Certificate No.**
- Konformitätszertifikat	12.2-0311

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Eidgenössisches Amt für Messwesen
Office fédéral de métrologie
Ufficio federale di metrologia
Swiss Federal Office of Metrology

Nr. 12.2-0311

Konformitätszertifikat

Messmittel:

Lastmessbolzen
Fabrikant: Vibro-Meter AG, Fribourg
Typ: LB234, LB235, LB236, LB237
OIML-Klassierung: D0.1
Höchstlast: 5000 kg, 7000 kg, 10000 kg, 20000 kg
Minimale Totlast: 0 kg
Grenzlast: 1.5 Mal die Höchstlast
Kleinstes Eichintervall: v_{min} = Lastbereich/100
Konstruktion gemäss Zeichnung PZ 5876

Antragsteller:

Vibro-Meter AG, Fribourg

Dieses Zertifikat bestätigt die Übereinstimmung der oben genannten Typenserie mit den Anforderungen der Empfehlung der Organisation Internationale de Métrologie Légale (OIML)

R60 "Metrological regulation for load cells" ed. 1991.

Die Konformität mit der R60 wurde aufgrund der Resultate der Prüfungen an dem mit den übrigen Typen baugleichen Typ LB235 festgestellt. Diese Resultate sind im zugehörigen Messbericht Nr. 12.2-0283.beschrieben.

Abteilung Mechanik, Strahlung
und Thermometrie

Dr. Bruno Vaucher, Abteilungschef

Wabern, 12. März 1993
Zg

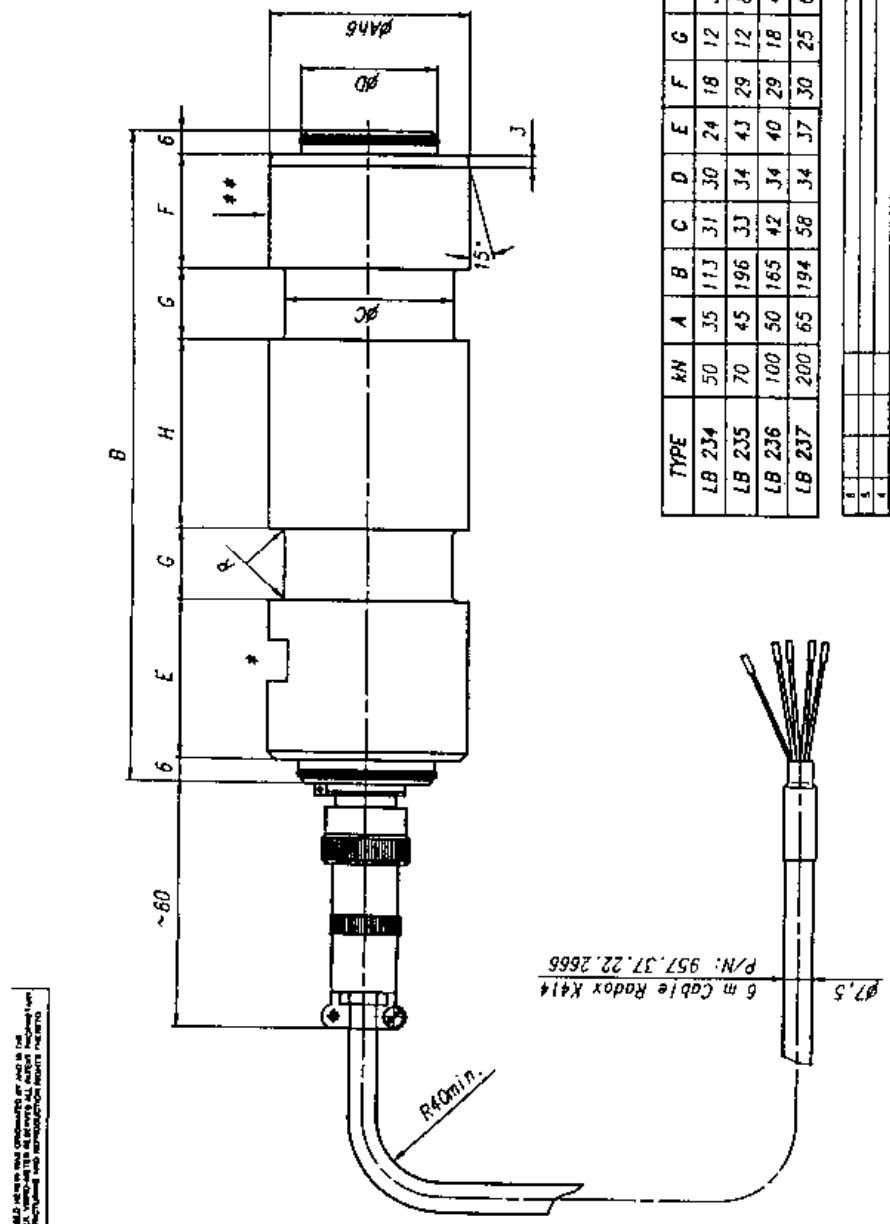
CH-3084 Wabern, Lindenweg 50
Tel. +41 (0)31 963 31 11
Fax +41 (0)31 963 32 10
Telex 912 860 topo ch

Eidgenössisches Amt für Messwesen
Office fédéral de métrologie
Ufficio federale di metrologia
Swiss Federal Office of Metrology

Messbericht (Fortsetzung)

Nr. 12.2-0283

TYPE	kN	A	B	C	D	E	F	G	H	R
LB 234	50	35	113	31	30	24	18	12	35	1,5
LB 235	70	45	196	33	34	43	29	12	88	2
LB 236	100	50	165	42	34	40	29	18	48	1,5
LB 237	200	65	194	58	34	37	30	25	65	1,5



vibro-meter SWITZERLAND
FSCM N° 0 3980
Scale 1:1
DWG. N° PZ 5876
LOAD MEASURING PIN
P/N: 122-23X-000-021 TYPE: LB 234 ÷ 237
Material: Anticorodal AlMgSi1 Nr. 1.4057 780÷930 N/mm²
Finish: K-K
Tolerances: ± mm to 50 mm: ± mm over 50 mm

*: Retainer key is on the other side ** for LB 235

PRODUCT DEFECT REPORT

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

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 ?
☐ Temperature dependent ?
☐ Intermittent ?

(☒ 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 :** _____

PRODUCT DEFECT REPORT
(cont.)

Please use this space for any additional information :

DOCUMENTATION EVALUATION FORM

Instruction Manual : LB 210 AND LB 230 SERIES LOAD MEASURING PINS **P/N :** 632.005 E

Vibro-Meter welcomes your evaluation of this intruction 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 : _____

_____

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_____

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 Tape here

Tape here

Tape here

Fold here

Attn : Technical Documentation Dept. (I / M)

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

Place
stamp
here