LB / LE / LU Series
Load Measuring Pins

User's Manual

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First English Edition – rev. C– November 2014

MAGTROL

Revisions To This Manual

The contents of this manual are subject to change without prior notice. Should revisions be necessary, updates to all Magtrol User's Manuals can be found at Magtrol's web site at http://www.magtrol.com/support/manuals.htm.

Please compare the date of this manual with the revision date on the web site, then refer to the manual's Table of Revisions for any changes/updates that have been made since this edition.

REVISION DATE

First English Edition – rev. C– November 2014

Date	Edition	Change	Section(s)
11/13/14	1st Edition - rev. C	Update all data sheet	1.2.1, 1.2.2, 1.2.3
07/17/12	1st Edition - rev. B	load measuring pin from LE 310 and LE 510 series added	1.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.3.1.1, 2.3.1.3, 2.3.2, 2.3.3, 2.3.3.2, 2.3.4, 2.3.5, 3.1, 3.3.2, 4, 4.1, 4.1.2, 4.2, 5.1, 5.2, 6.4
04/24/12	1st Edition - rev. A	Dimension L for LB 218 is now 32 mm instead of 25 mm before Dimension L for LB 220 is now 35 mm instead of 25 mm before	1.2.1

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Preface

PURPOSE OF THIS MANUAL

This manual contains all the information required for the setup, connection and general use of Magtrol's Load Measuring Pins. Please read this manual in its entirety before operating. Keep the manual in a safe place for quick reference whenever a question should arise.

WHO SHOULD USE THIS MANUAL

This manual is intended for those who install load measuring pins for lifting or weighing installations and connect them to electronic signal processing systems to carry out 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 structure of the manual is as follows:

Chapter 1: INTRODUCTION – Contains the technical data sheets for the load measuring pins, which describe the units and provide an overview of their possible applications.

Chapter 2: INSTALLATION/CONFIGURATION – Provides the information needed for the setup and connection of the load measuring pins.

Chapter 3: OPERATING PRINCIPLES – Describes the load measuring pins measuring principle.

Chapter 4: INFLUENCE FACTORS – Contains explanations concerning the influence of the mounting position of the load measuring pins on the measured signals.

Chapter 5: MAINTENANCE – Contains information on lubrication procedures and provides recommendations for the calibration and checking of the measuring current and voltage.

Chapter 6: TROUBLESHOOTING – Provides solutions to common problems encountered during configuration and running of the load measuring pins.

Appendix A: OIML CERTIFICATION – OIML Certificate (for certain LB 230 Series Load Measuring Pins.

CONVENTIONS USED IN THIS MANUAL

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

Note: 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 function of the product.

CAUTION: THIS IS USED TO DRAW THE OPERATOR'S ATTENTION TO INFORMATION, DIRECTIVES, PROCEDURES, ETC. WHICH, IF IGNORED, MAY RESULT IN DAMAGE TO THE MATERIAL BEING USED. THE ASSOCIATED TEXT DESCRIBES THE NECESSARY PRECAUTIONS TO TAKE AND THE CONSEQUENCES THAT MAY ARISE IF THESE PRECAUTIONS ARE IGNORED.

WARNING! THIS INTRODUCES DIRECTIVES, PROCEDURES, PRECAUTIONARY MEASURES, ETC. WHICH MUST BE EXECUTED OR FOLLOWED WITH THE UTMOST CARE AND ATTENTION, OTHERWISE THE PERSONAL SAFETY OF THE OPERATOR OR THIRD PARTY MAY BE AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT , BEFORE PROCEEDING FURTHER.

1. Introduction

1.1 GENERAL DESCRIPTION

When the force applied to mechanical structures needs to be measured, expensive modifications to the structure are often necessary. 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 Magtrol proposes a wide range of products dedicated to load measuring and overload protection:

- LB 210 - LB 221 : standard models with voltage output
- LB 231 - LB 241 : enhanced models for use in hostile environments
- LE 210 - LE 221 : models with calibrated current output.
- LU 210 - LU 221 : models with calibrated voltage output.
- LE 311 - LE 321 : models with calibrated voltage output and B.I.T.E monitoring.
- LE 511 - LE 521 : models with redundant calibrated voltage output and B.I.T.E monitoring.

1.2 DATA SHEETS

1.2.1 LB 210 Series Load Measuring Pins

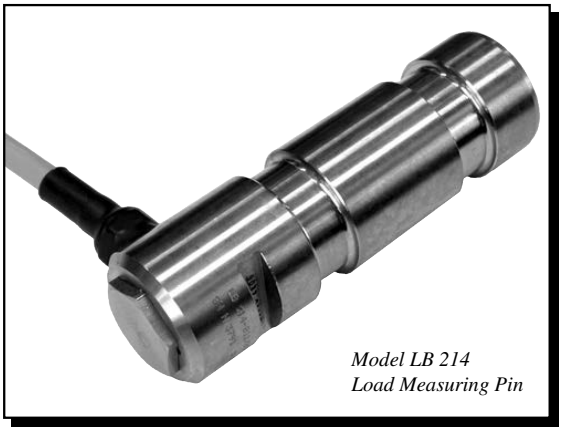
MAGTROL

LB 210
Data Sheet

LB 210 Series Load Measuring Pins

FEATURES

- For overload detection and load measurement from 2.5 kN to 1250 kN (0.28 tf to 140.5 tf).
- Admissible Overload: 150% of the nominal load.
- Overload at Rupture: up to 500% of the nominal load.
- Insensitive to external mechanical and chemical effects.
- Ideal for use in hostile environments.
- Temperature-compensated transducers with strain gauges in full-bridge configuration. On request, available with double bridge redundant.
- Simple installation for cost-saving solutions to measurement problems.
- High reliability for strict safety requirements.
- Many options may be added to the lower-cost standard load pin for greater flexibility.
- Can be designed with special dimensions for adaptation to various construction conditions.



Model LB 214
Load Measuring Pin

DESCRIPTION

Magtrol Load Measuring Pins are used to measure load and force and provide overload protection. The pins are mounted into machines in place of normal shafts and fitted with strain gauges, allowing them to produce a signal proportional to the measured load. Manufactured in Switzerland, Magtrol's LB 210 Series Load Pins are rugged with high resistance stainless steel and tight construction, designed specifically for use in harsh industrial environments. Available in 10 standard ranges from 2.5 kN to 1250 kN, these highly ergonomic pins can be used for either new or refitted installations and are adaptable to various conditions.

Magtrol Load Measuring Pins can be used alone or as part of a complete measurement system. Magtrol offers a wide range of Load-Force-Weight Transducers in various executions and accuracy classes and our Load Monitoring Units (LMUs) constitute an ideal safe measurement system which continuously checks for overloads and short circuits.

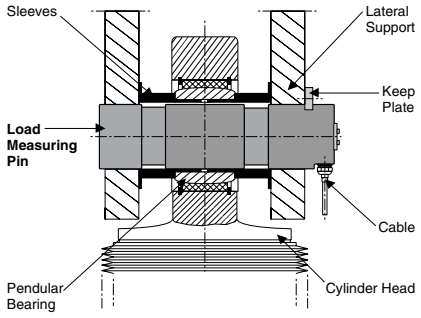
DESIGN

The Magtrol Load 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 have been optimized by means of the finite element method (FEM).

APPLICATIONS

When forces acting on mechanical constructions are measured, the additional equipment required can often be costly and difficult to install. Magtrol Load Measuring Pins offer an excellent solution since they act as a direct element in the assembly, replacing a non-instrumented pin or shaft. LB 210 Series Load Pins are used for load measuring devices and overload protection on cranes, hoisting gear, elevators and winches, and force measurement for regulation processes in industrial installations and machinery production.

MOUNTING EXAMPLE



Specifications LB 210

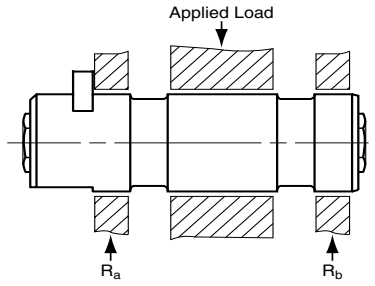
Standard Version*	LB 210	LB 211	LB 212	LB 213	LB 214	LB 216	LB 217	LB 218	LB 220	LB 221
MECHANICAL CHARACTERISTICS										
Nominal Load, fsd (Metric)	2.5 kN	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN	500 kN	1000 kN	1250 kN
Nominal Load, fsd (US)	0.28 tf	0.56 tf	1.12 tf	2.25 tf	5.62 tf	11.24 tf	22.48 tf	56.20 tf	112.4 tf	140.5 tf
Overload Admissible	150% of rated load without influence on measurement									
Overload Limit	250% of rated load with new calibration									
Overload at Rupture (of rated load)	≥ 500%							400%	300%	
Material	Stainless steel 1.4057									
Protection Class	IP 66 according to DIN 40050									
Fit	G7 / h6									
Lubrication	not available					Oiler ø4 DIN 3405 D or M10 DIN 3405 A according to the LB model				
ELECTRICAL CHARACTERISTICS										
Operating Principle	Full-bridge strain gauge									
Bridge Impedance: • Input • Output	400 Ω 350 Ω									
Power Supply	5 to 12 V DC / AC									
Zero Adjustment	± 1% of fsd									
Transducer Sensitivities	0.5 mV/V ± 3%				1 mV/V ± 3%				1.8 mV/V ± 3%	
Non-linearity Error	< 0.25% of fsd				< 0.25% of fsd				< 0.5% of fsd	
Non-linearity + Hysteresis Error	< 0.5% of fsd				< 0.5% of fsd				< 0.8% of fsd	
Repeatability	± 0.1% of fsd									
Operating Temperature	-25 °C to +80 °C									
Storage Temperature	-55 °C to +125 °C									
Temperature Influence: • On Zero • On Sensitivity	± 0.02% of fsd / K ± 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									
Cable Length	3 m (standard); 6 m, 12 m, 20 m (optional)									
PG Output	Axial, with heat-shrinkable sleeve				Radial, with heat-shrinkable sleeve (standard); Axial, with heat-shrinkable sleeve (optional)					
Optional Output Connector	not available				Radial, MS 3112 E 10-6P					
Optional Connection Cable Assembly	not available				3 m, 6 m, 12 m or 20 m Cable with: Straight Connector, MS 3116 J10 6S or 90° Connector, Souriau 851 08 EC 10 6S50					

** Ratings apply to standard load pins only, special models are available by contacting Magtrol.*

OPERATING PRINCIPLE

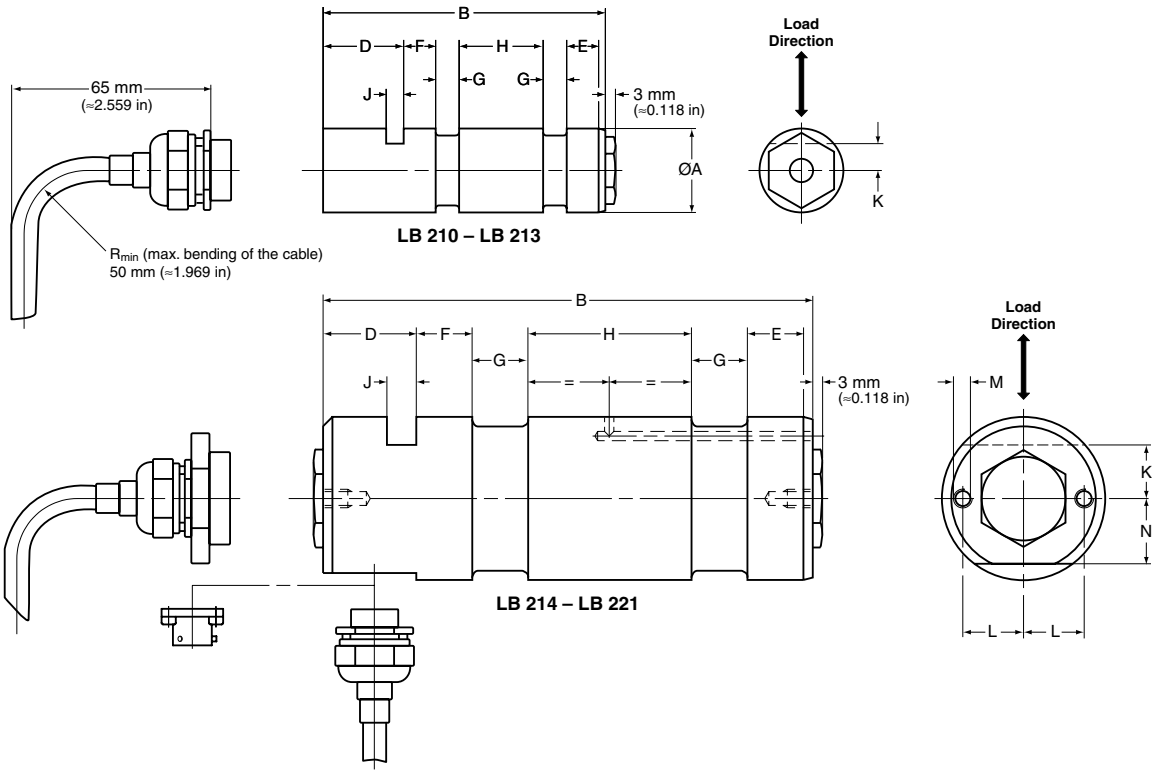
When force is applied to the Load Measuring Pin along its sensitive axis, the effect on the strain gauge bridge results in an output signal proportional to the applied force. The powering of the strain gauge bridge, as well as the amplification of its output signal voltage, is performed by an external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

R_a should equal R_b so that the force is evenly distributed.



Specifications LB 210

DIMENSIONS



NOTE: *Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 3 decimal places.*

Model	units	Ø A	B	D	E	F	G	H	J	K	L	M	N	Weight
LB 210	*mm*	25h6	84	18	16	10	7	24	5.2	9	---	---	---	0.2 kg
	in	0.984	3.307	0.709	0.630	0.394	0.276	0.945	0.205	0.354	---	---	---	0.441 lb
LB 211	*mm*	25h6	84	18	16	10	7	24	5.2	9	---	---	---	0.2 kg
	in	0.984	3.307	0.709	0.630	0.394	0.276	0.945	0.205	0.354	---	---	---	0.441 lb
LB 212	*mm*	25h6	84	18	16	10	7	24	5.2	9	---	---	---	0.2 kg
	in	0.984	3.307	0.709	0.630	0.394	0.276	0.945	0.205	0.354	---	---	---	0.441 lb
LB 213	*mm*	25h6	84	18	16	10	7	24	5.2	9	---	---	---	0.2 kg
	in	0.984	3.307	0.709	0.630	0.394	0.276	0.945	0.205	0.354	---	---	---	0.441 lb
LB 214	*mm*	35h6	112	25	14	12	12	35	6.3	11.5	---	---	16	0.65 kg
	in	1.378	4.409	0.984	0.551	0.472	0.472	1.378	0.248	0.453	---	---	0.630	1.433 lb
LB 216	*mm*	50h6	161	32	24	18	18	48	10.5	20	---	---	21.5	2.0 kg
	in	1.967	6.339	1.260	0.945	0.709	0.709	1.890	0.413	0.787	---	---	0.847	4.409 lb
LB 217	*mm*	65h6	196	32	26	20	25	65	10.5	22.5	---	---	28.5	4.4 kg
	in	2.559	7.717	1.260	1.024	0.787	0.984	2.559	0.413	0.886	---	---	1.122	9.700 lb
LB 218	*mm*	85h6	258	34	39	35	28	89	10.5	28	32	M6	35	10.6 kg
	in	3.347	10.158	1.339	1.535	1.378	1.102	3.504	0.413	1.102	1.260	---	1.378	23.369 lb
LB 220	*mm*	100h6	347	36	61	55	35	120	10.5	36	35	M8	45	19.2 kg
	in	3.937	13.661	1.417	2.402	2.165	1.378	4.724	0.413	1.417	1.378	---	1.772	42.328 lb
LB 221	*mm*	120h6	347	36	61	55	35	120	12.5	40	35	M8	45	28.4 kg
	in	4.724	13.661	1.417	2.402	2.165	1.378	4.724	0.492	1.575	1.378	---	1.772	62.611 lb

Ordering Information LB 210

OPTIONS AND ORDERING INFORMATION

STANDARD MODELS LB 2□□-011/ 0 0 □

- Model LB 2 1 0 – 2 1 3 Electrical Connection: PG Axial
- Model LB 2 1 4 – 2 2 1 Electrical Connection: PG Radial

OPTIONS FOR MODELS LB 214 – LB 221 LB 2□□-111/ □□□

- Model LB 2 1 4 – 2 2 1
- Lubrication (LB 214–221): Without (standard) — 0
  (LB 216–221): With — 1
- Electrical Connection: PG Radial (standard) — 0
  PG Axial — 1
  Radial Connector — 2 0

CONNECTION CABLE ASSEMBLY

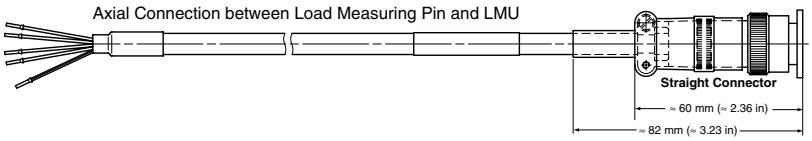
- Cable Length: 3 m — 1
  6 m — 2
  12 m — 3
  20 m — 4

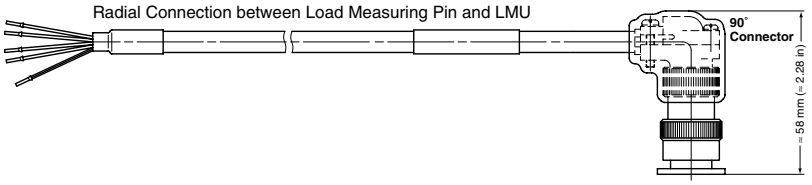
Example

An LB 216 Load Measuring Pin with lubrication, PG axial electrical connection and 20 m cable would be ordered as LB 216-111/114.

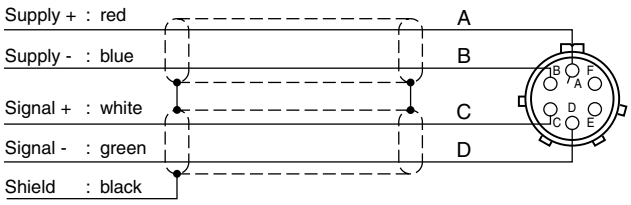
ACCESSORIES

Cable Assemblies





Pin Configuration



Accessory Ordering Information

COUNTER-CONNECTOR

Straight Connector	P/N 957.11.08.0030
90° Connector	P/N 957.11.08.0029

CONNECTION CABLE ASSEMBLY

Part Number EH 13□/0□1

- Straight Connector — 8
- 90° Connector — 9

CONNECTION CABLE ASSEMBLY

Cable Length: 3 m — 1; 6 m — 2; 12 m — 3; 20 m — 4

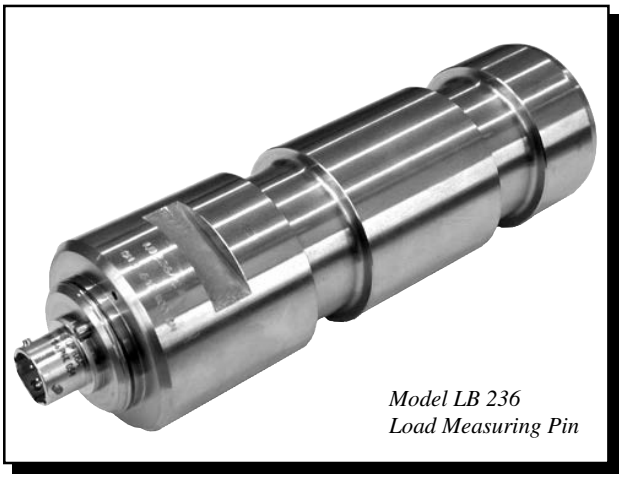
1.2.2 LB 230 Series Load Measuring Pins

LB 230 Series Load Measuring Pins

OIML Classified

FEATURES

- Temperature-compensated transducers with strain gauges in full-bridge configuration. On request, available with double bridge redundant.
- Available in 10 standard ranges from 5 kN to 1250 kN (0.56 tf to 140.5 tf).
- Classified according to OIML R60 D0.1 from 50 to 200 kN for scales in class IIII.
- Hermetically sealed execution for harsh environmental conditions (IP 67).
- Compensation for axial forces makes the load pin virtually insensitive to all lateral forces.
- Dimensions compatible with the standard LB 210 series.
- High reliability for strict safety requirements.
- Simple installation for cost-saving solutions to measurement problems.



Model LB 236
Load Measuring Pin

DESCRIPTION

Magtrol Load Measuring Pins are used to measure load and force and provide overload protection. The pins are mounted into machines in place of normal shafts and fitted with strain gauges, allowing them to produce a signal proportional to the measured load. Made in Switzerland, Magtrol's LB 230 Series Load Pins are rugged with high resistance stainless steel and tight construction, making for an essentially maintenance-free life. Available in 10 standard ranges from 5 kN to 1250 kN, these temperature compensated transducers come with strain gauges in full-bridge configuration. Because the strain gauges are inside a hermetically sealed pin, they are insensitive to external mechanical and chemical effects making them ideal for use in harsh environmental conditions.

Magtrol Load Measuring Pins can be used alone or as part of a complete measurement system. Magtrol offers a wide range of Load-Force-Weight Transducers in various executions and accuracy classes and our Load Monitoring Units (LMUs) constitute an ideal safe measurement system which continuously checks for overloads and short circuits.

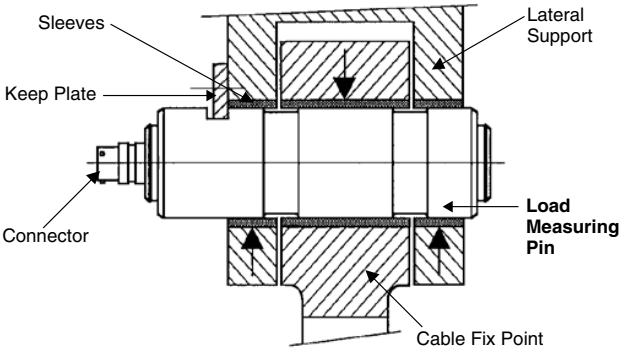
DESIGN

The load measuring pin has 2 circular grooves and an axial bore. Inside the central bore, adjacent to the external grooves, 8 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 practically no influence on the measurement signal.

APPLICATIONS

When forces acting on mechanical constructions are measured, the additional equipment required can often be costly and difficult to install. Magtrol Load Measuring Pins offer an excellent solution since they act as a direct element in the assembly, replacing a non-instrumented pin or shaft. LB 230 Series Load Pins can be used in new or refitted installations for many applications including mobile or stationary weighing, load measuring on cranes, hoisting gear, elevators and floor conveyors and force detection in harsh tropical, offshore, marine and harbor environments.

MOUNTING EXAMPLE



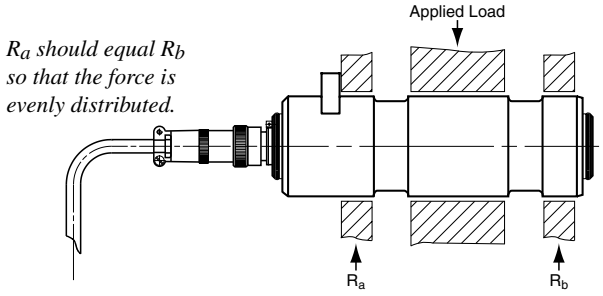
Specifications LB 230

Standard Version*	LB 231	LB 232	LB 233	LB 234	LB 235	LB 236	LB 237	LB 238	LB 240	LB 241
MECHANICAL CHARACTERISTICS										
Nominal Load, fsd (Metric)	5 kN	10 kN	20 kN	50 kN	70 kN	100 kN	200 kN	500 kN	1000 kN	1250 kN
Nominal Load, fsd (US)	0.56 tf	1.12 tf	2.25 tf	5.62 tf	7.87 tf	11.24 tf	22.48 tf	56.20 tf	112.4 tf	140.5 tf
Overload Admissible	150% of rated load without influence on the measurement									
Overload Limit	250% of rated load with new calibration									
Overload at Rupture (of rated load)	≥ 500%							400%	300%	
Material	Stainless steel 1.4057									
Protection Class	IP 67 according to DIN 40050									
Fit	G7 / h6									
ELECTRICAL CHARACTERISTICS										
Operating Principle	Double full-bridge strain gauge									
Bridge Impedance: • Input • Output	800 Ω 700 Ω									
Power Supply	5 to 12 V DC / AC									
Zero Adjustment	± 1% of fsd									
Transducer Sensitivities	0.5 mV/V ± 3%			1 mV/V ± 3%					1 mV/V ± 3%	
Non-linearity Error	< 0.2% of fsd									
Non-linearity + Hysteresis Error	< 0.4% of fsd									
Repeatability	± 0.1% of fsd									
OIML Class	not available			R60 D0.1				not available		
Operating Temperature	-25 °C to +80 °C									
Storage Temperature	-55 °C to +125 °C									
Temperature Influence: • On Zero • On Sensitivity	± 0.02% of fsd / K ± 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, Souriau 8525 IH 10B 06 PNH									
Connection Cable Assembly	3 m, 6 m, 12 m or 20 m Cable with: Straight Connector, MS 3116 J10 6S or 90° Connector, Souriau 851 08 EC 10 6S50									

** Ratings apply to standard load pins only, special models are available by contacting Magtrol.*

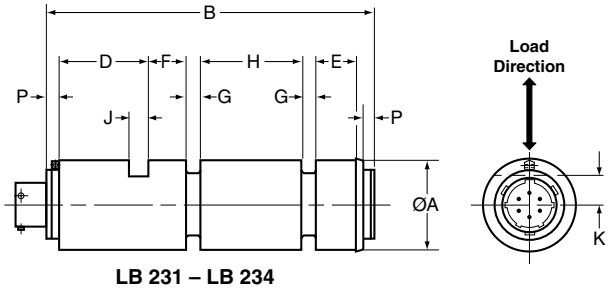
OPERATING PRINCIPLE

When 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. Depending on the execution, the latter allows the monitoring of several levels.

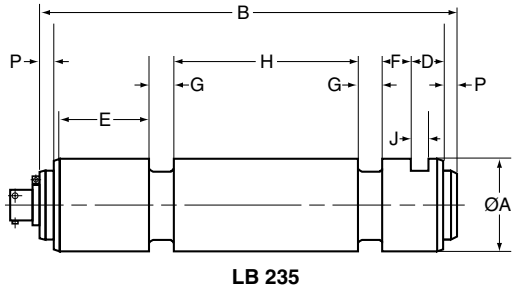


Specifications LB 230

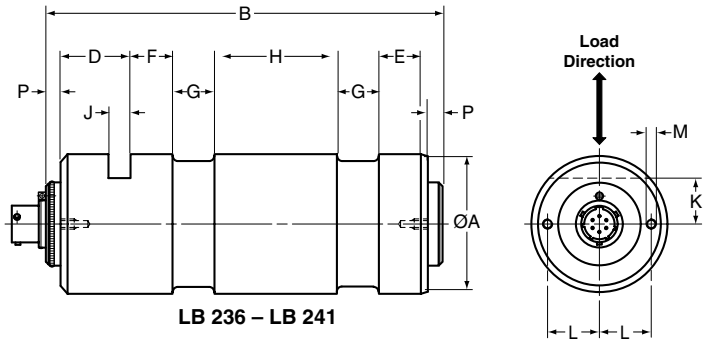
DIMENSIONS



LB 231 – LB 234



LB 235



LB 236 – LB 241

NOTE: Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 3 decimal places.

Model	units	Ø A	B	D	E	F	G	H	J	K	L	M	P	Weight
LB 231	*mm*	25h6	86	16	14	10	7	24	5.2	9	---	---	3	0.2 kg
	in	0.984	3.386	0.630	0.551	0.394	0.276	0.945	0.205	0.354	---	---	0.118	0.441 lb
LB 232	*mm*	25h6	86	16	14	10	7	24	5.2	9	---	---	3	0.2 kg
	in	0.984	3.386	0.630	0.551	0.394	0.276	0.945	0.205	0.354	---	---	0.118	0.441 lb
LB 233	*mm*	25h6	86	16	14	10	7	24	5.2	9	---	---	3	0.2 kg
	in	0.984	3.386	0.630	0.551	0.394	0.276	0.945	0.205	0.354	---	---	0.118	0.441 lb
LB 234	*mm*	35h6	114	23	12	12	12	35	6.3	11.5	---	---	3	0.65 kg
	in	1.378	4.488	0.906	0.472	0.472	0.472	1.378	0.248	0.453	---	---	0.118	1.433 lb
LB 235	*mm*	45h6	196	15	41	14	12	88	8.5	16	---	---	6	1.8 kg
	in	1.772	7.717	0.591	1.614	0.551	0.472	3.465	0.335	0.630	---	---	0.236	3.968 lb
LB 236	*mm*	50h6	165	28	20	18	18	48	10.5	20	---	---	6	2 kg
	in	1.969	6.496	1.102	0.787	0.709	0.709	1.890	0.413	0.787	---	---	0.236	4.409 lb
LB 237	*mm*	65h6	200	28	22	20	25	65	10.5	22.5	---	---	6	4.4 kg
	in	2.559	7.874	1.102	0.866	0.787	0.984	2.559	0.413	0.886	---	---	0.236	9.700 lb
LB 238	*mm*	85h6	262	30	35	35	28	89	10.5	28	25	M6	6	10.6 kg
	in	3.346	10.315	1.181	1.378	1.378	1.102	3.504	0.413	1.102	0.984	---	0.236	23.369 lb
LB 240	*mm*	100h6	351	30	55	55	35	120	10.5	36	35	M8	8	19.2 kg
	in	3.937	13.819	1.181	2.165	2.165	1.378	4.724	0.413	1.417	1.378	---	0.315	42.329 lb
LB 241	*mm*	120h6	351	30	55	55	35	120	12.5	40	35	M8	8	28.4 kg
	in	4.724	13.819	1.181	2.165	2.165	1.378	4.724	0.492	1.575	1.378	---	0.315	62.611 lb

Ordering Information LB 230

ORDERING INFORMATION

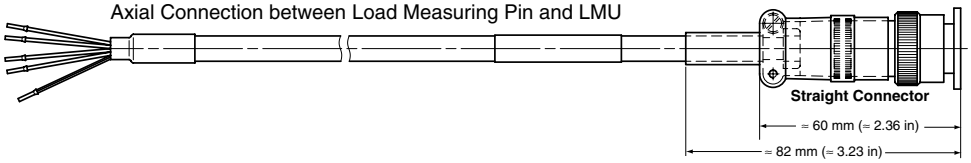
LOAD MEASURING PINS LB 2☐☐/021

- Model LB 2☐1 – 2☐1

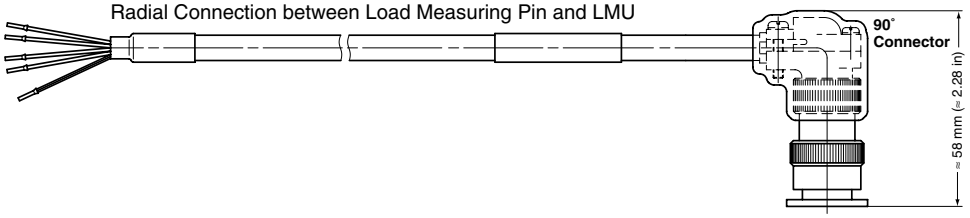
ACCESSORIES

Cable Assemblies

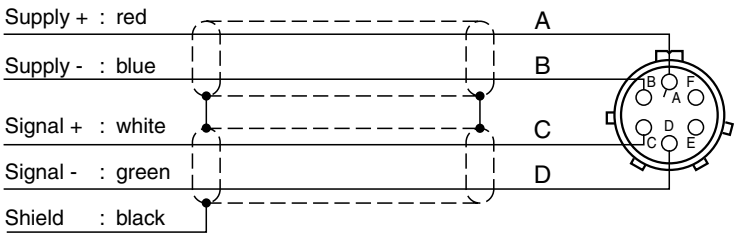
Axial Connection between Load Measuring Pin and LMU



Radial Connection between Load Measuring Pin and LMU



Pin Configuration



Accessory Ordering Information

COUNTER-CONNECTOR

Straight Connector	P/N 957.11.08.0030
90° Connector	P/N 957.11.08.0029

CONNECTION CABLE ASSEMBLY

Part Number EH 13☐/0☐1

- Straight Connector — 8
- 90° Connector — 9

CONNECTION CABLE ASSEMBLY

Cable Length:

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

1.2.3 LE 210, LE 310, LE 510 AND LU 210 LOAD MEASURING PINS

LE/LU Series Load Measuring Pins

FEATURES

- Temperature-compensated transducers with strain gauges in full-bridge configuration. On request, available with double bridge redundant.
- Available in 9 standard ranges from 5 kN to 1250 kN (0.56 tf to 140.5 tf).
- **Electronics for transmission over great distances:**
  - **2 wires (LE 210) 4-20 mA**
  - **3 wires (LE 310) 4-20 mA**
  - **4 wires (LU 210) 0-10 V.**
  - **5 wires (LE 510) available with dual channels 4-20 mA**
- Built-in test equipment (B.I.T.E.) included on LE 310 and LE 510 series.
- EMC execution for reliable trouble-free operation.
- Rugged design corresponding to the quality characteristics of LB 210 series.
- Insensitive to external mechanical and chemical effects.
- Ideal for use in hostile environments.
- Simple installation for cost-saving solutions to construction problems.
- Calibrated Output: 0–10 VDC (LU); 4–20 mA (LE)

Model LE 514 & LE 512 Load Measuring Pin

DESCRIPTION

Magtrol Load Measuring Pins are used to measure load and force and provide overload protection. The pins are mounted into machines in place of normal shafts and fitted with strain gauges, allowing them to produce a signal proportional to the measured load. Manufactured in Switzerland, Magtrol's LE/LU Series Load Measuring Pins are rugged with high resistance stainless steel and tight construction. Available in 9 standard ranges from 5 kN to 1250 kN, their operation remains trouble-free and reliable even in electromagnetically difficult environmental conditions.

Magtrol offers a wide range of Load-Force-Weight Transducers with optional integrated electronics or Load Monitoring Units (LMU) with B.I.T.E. functions creating an ideal measurement system which continuously checks for overloads and short circuits.

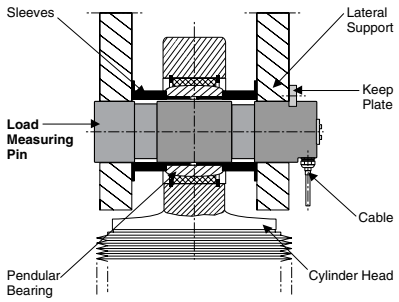
DESIGN

The Magtrol Load Measuring Pins 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 o rientation of the strain gauges have been optimized by means of the finite element method (FEM).

APPLICATIONS

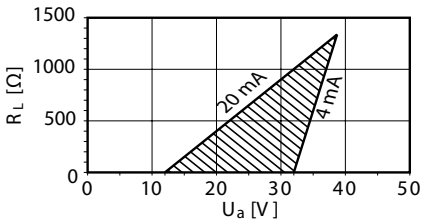
When forces acting on mechanical constructions are measured, the additional equipment required can often be costly and difficult to install. Magtrol Load Measuring Pins offer an excellent solution since they act as a direct element in the assembly, replacing a non-instrumented pin or shaft. LE/LU Series Load Measuring Pins are used for load measuring devices and overload protection on cranes, hoisting gear, elevators and winches. The integrated electronics makes it ideal for applications in which separate signal conditioning is difficult to install and where the monitoring electronics are positioned at extended distances.

MOUNTING EXAMPLE



(4-20 mA, 2 wires)

Specifications LE 210

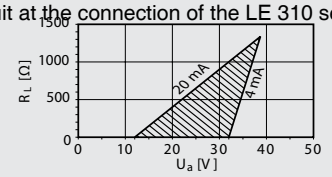
Standard Version*	LE 211	LE 212	LE 213	LE 214	LE 216	LE 217	LE 218	LE 220	LE 221
MECHANICAL CHARACTERISTICS									
Nominal Load, fsd (Metric)	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN	500 kN	1000 kN	1250 kN
Nominal Load, fsd (US)	0.56 tf	1.12 tf	2.25 tf	5.62 tf	11.24 tf	22.48 tf	56.20 tf	112.4 tf	140.5 tf
Overload Admissible	150% of rated load without influence on measurement								
Overload at Rupture (of rated load)	≥ 500%						400%	300%	
Material	Stainless steel 1.4057								
EMC	According to EN 61000-6-2 & EN 61326-1								
Protection Class	IP 66 according to DIN 40050								
Lubrication	Not available				Oiler ø4 DIN 3405 D or M10 DIN 3405 A according to the LE model (option)				
ELECTRICAL CHARACTERISTICS									
Operating Principle	Full-bridge strain gauge								
Strain Gauge Bridge Impedance:	5000 Ω								
Output Signal	Rated 4 to 20 mA; max. 3.5 to 25 mA								
Power Supply	12 to 32 VDC with protected polarity reversal < 35 mA								
Non-linearity Error	< 0.25% of fsd							< 0.5% of fsd	
Non-linearity + Hysteresis Error	< 0.5% of fsd							< 0.8% of fsd	
Repeatability	± 0.1% of fsd								
Operating Temperature	-25 °C to +80 °C								
Storage Temperature	-55 °C to +125 °C								
Temperature Influence: • On Zero • On Sensitivity	± 0.02% of fsd / K ± 0.02% / K								
Long Term Stability • Of Zero • Of Sensitivity	< 1% of fsd / year (not cumulative) < 0.5% / year (not cumulative)								
Influence on Measurement Signal (Shift of Force Angle with Respect to Measurement Axis)	According to the cosine function								
Standard Calibration	0 kN = 4 mA fsd in kN = 20 mA								
ELECTRICAL CONNECTION									
Output Connector	Axial, Souriau MS 3112 E 10-6P								
Configuration	2-wire								
Optional Connection Cable Assembly	3 m, 6 m, 12 m or 20 m Cable with: Straight Connector, Souriau MS 3116 J10 6S or 90° Connector, Souriau 851 08 EC 10 6S50								
Load Resistance	Admissible resistance of the 2-wire circuit at the connection of the LE 210 Hatched Operating Domain = Load Resistance R_L / Supply Voltage U_a 								

** Ratings apply to standard load pins only, special models are available by contacting Magtrol.*

(4-20 mA, 3 wires with B.I.T.E.)

Specifications

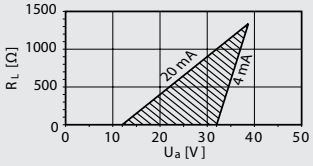
LE 310

Standard Version 1 channel *	LE 311	LE 312	LE 313	LE 314	LE 316	LE 317	LE 318	LE 320	LE 321
MECHANICAL CHARACTERISTICS									
Nominal Load, fsd (Metric)	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN	500 kN	1000 kN	1250 kN
Nominal Load, fsd (US)	0.56 tf	1.12 tf	2.25 tf	5.62 tf	11.24 tf	22.48 tf	56.20 tf	112.4 tf	140.5 tf
Overload Admissible	150% of rated load without influence on measurement								
Overload at Rupture (of rated load)	≥ 500%							400%	300%
Material	Stainless steel 1.4057								
EMC	According to EN 61326-1 & EN 61326-2-3								
Protection Class	IP 66 according to DIN 40050								
Lubrication	Not available				Oiler ø4 DIN 3405 D or M10 DIN 3405 A according to the LE model (variant)				
ELECTRICAL CHARACTERISTICS									
Operating Principle	Full-bridge strain gauge								
Strain Gauge Bridge Impedance:	350 Ω								
Output Signal	Rated 4 to 20 mA; max. 0.5 to 22 mA								
Power Supply	12 to 32 VDC with protected polarity reversal < 35 mA								
Non-linearity Error	< 0.5% of fsd								
Non-linearity + Hysteresis Error	< 0.8% of fsd								
Repeatability	± 0.1% of fsd								
Operating Temperature	-25 °C to +80 °C								
Storage Temperature	-30 °C to +90 °C								
Temperature Influence: • On Zero • On Sensitivity	± 0.02% of fsd / K ± 0.02% / K								
Long Term Stability • Of Zero • Of Sensitivity	< 1% of fsd / year (not cumulative) < 0.5% / year (not cumulative)								
Influence on Measurement Signal (Shift of Force Angle with Respect to Measurement Axis)	According to the cosine function								
Standard Calibration	0 kN = 4 mA fsd in kN = 20 mA								
B.I.T.E.									
Type of B.I.T.E. input	Logic signal, active-low, CMOS/TTL compatible, 1 B.I.T.E.								
Effect on the output	Addition of 70% ± 2% of the nominal load in standard (other % in option)								
ELECTRICAL CONNECTION									
Output	integrated 3 m, 6 m, 12 m or 20 m PVC Cable (Standard) or Axial Connector Souriau MS 3112 E10-6P (variant)								
Configuration	3-wire								
Wiring Colors	Supply + : Brown Common : Yellow Signal + : White B.I.T.E. : Green Case : Yellow/Black								
Optional Connection Cable Assembly	3 m, 6 m, 12 m or 20 m Cable with: Straight Connector, Souriau MS 3116 J10 6S or 90° Connector, Souriau 851 08 EC 10 6S50								
Load Resistance	Admissible resistance of the 3-wire circuit at the connection of the LE 310 series Hatched Operating Domain = Load Resistance R_L / Supply Voltage U_a 								

(4-20 mA (Redundant), 5 wires with B.I.T.E.)

Specifications

LE 510

Standard Version 2 channel *	LE 511	LE 512	LE 513	LE 514	LE 516	LE 517	LE 518	LE 520	LE 521
MECHANICAL CHARACTERISTICS									
Nominal Load, fsd (Metric)	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN	500 kN	1000 kN	1250 kN
Nominal Load, fsd (US)	0.56 tf	1.12 tf	2.25 tf	5.62 tf	11.24 tf	22.48 tf	56.20 tf	112.4 tf	140.5 tf
Overload Admissible	150% of rated load without influence on measurement								
Overload at Rupture (of rated load)	≥ 500%							400%	300%
Material	Stainless steel 1.4057								
EMC	According to EN 61326-1 & EN 61326-2-3								
Protection Class	IP 66 according to DIN 40050								
Lubrication	Not available				Oiler ø4 DIN 3405 D or M10 DIN 3405 A according to the LE model (variant)				
ELECTRICAL CHARACTERISTICS									
Operating Principle	2x Full-bridge strain gauge								
Strain Gauge Bridge Impedance:	2x 350 Ω								
Output Signal 2 channels	2x Rated 4 to 20 mA; max. 0.5 to 22 mA								
Power Supply	1 or 2x 12 to 32 VDC with protected polarity reversal < 35 mA / Common ground								
Non-linearity Error	< 0.5% of fsd								
Non-linearity + Hysteresis Error	< 0.8% of fsd								
Repeatability	± 0.1% of fsd								
Operating Temperature	-25 °C to +80 °C								
Storage Temperature	-30 °C to +90 °C								
Temperature Influence: • On Zero • On Sensitivity	± 0.02% of fsd / K ± 0.02% / K								
Long Term Stability • Of Zero • Of Sensitivity	< 1% of fsd / year (not cumulative) < 0.5% / year (not cumulative)								
Influence on Measurement Signal (Shift of Force Angle with Respect to Measurement Axis)	According to the cosine function								
Standard Calibration	0 kN = 4 mA fsd in kN = 20 mA								
Dual B.I.T.E.									
Type of B.I.T.E. input.	Logic signal, active-low, CMOS/TTL compatible, 1 B.I.T.E. input for each channel								
Effect on the output	Addition of 70% ± 2% of the nominal load in standard (other % in option)								
ELECTRICAL CONNECTION									
Output	Single integrated 3 m, 6 m, 12 m or 20 m PVC Cable (Standard) or Axial Connector Souriau MS 3112 E12-10P (variant)								
Configuration	5-wire								
Wiring Colors	Supply + Ch1 / Brown / Signal + Ch2 / Yellow Common / Black / B.I.T.E. Ch2 / Grey Signal + Ch1 / White / Case / Yellow/Black B.I.T.E. Ch1 / Green Supply + Ch2 / Red Common / Blue								
Optional Connection Cable Assembly	3 m, 6 m, 12 m or 20 m Cable with: Straight Connector, Souriau MS 3116 J12-10S or 90° Connector, Souriau 851 08 EC 12-10S50								
Load Resistance	Admissible resistance of the 5-wire circuit at the connection of the LE 510 series Hatched Operating Domain = Load Resistance R_L / Supply Voltage U_a 								

(0-10 VDC, 4 wires)

Specifications

LU 210

Standard Version*	LU 211	LU 212	LU 213	LU 214	LU 216	LU 217	LU 218	LU 220	LU 221
MECHANICAL CHARACTERISTICS									
Nominal Load, fsd (Metric)	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN	500 kN	1000 kN	1250 kN
Nominal Load, fsd (US)	0.56 tf	1.12 tf	2.25 tf	5.62 tf	11.24 tf	22.48 tf	56.20 tf	112.4 tf	140.5 tf
Overload Admissible	150% of rated load without influence on measurement								
Overload at Rupture (of rated load)	≥ 500%						400%	300%	
Material	LU load measuring pin: Stainless steel 1.4057 LU transmitter housing: Stainless steel 1.4305								
EMC	According to EN 61000-6-2 & EN 61000-6-4 category B								
Protection Class	IP 66 according to DIN 40050								
Lubrication	Not available				Oiler ø4 DIN 3405 D or M10 DIN 3405 A according to the LU model (option)				
ELECTRICAL CHARACTERISTICS									
Operating Principle	Full-bridge strain gauge								
Strain Gauge Bridge Impedance	350 Ω								
Output Signal	0–10 VDC								
Power Supply	12 to 32 VDC with protected polarity reversal < 35 mA								
Non-linearity Error	< 0.25% of fsd							< 0.5% of fsd	
Non-linearity + Hysteresis Error	< 0.5% of fsd							< 0.8% of fsd	
Repeatability	± 0.1% of fsd								
Operating Temperature	-25°C to +80°C								
Storage Temperature	-55°C to +125°C								
Temperature Influence: • On Zero • On Sensitivity	± 0.02% of fsd / K ± 0.02% / K								
Long Term Stability • Of Zero • Of Sensitivity	< 1% of fsd / year (not cumulative) < 0.5% / year (not cumulative)								
Influence on Measurement Signal (Shift of Force Angle with Respect to Measurement Axis)	According to the cosine function								
Standard Calibration	0 kN = 0 V fsd in kN = 10 V								
ELECTRICAL CONNECTION									
Output Connector	Axial, Souriau MS 3112 E10-6P								
Configuration	4-wire								
Connection Cable Assembly	3 m, 6 m, 12 m or 20 m Cable with: Straight Connector, Souriau MS 3116 J10 6S or 90° Connector, Souriau 851 08 EC 10 6S50								

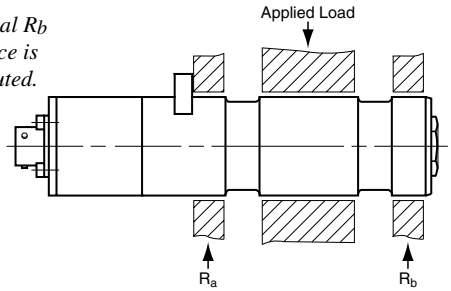
** Ratings apply to standard load pins only, special models are available by contacting Magtrol.*

Specifications LE/LU 210

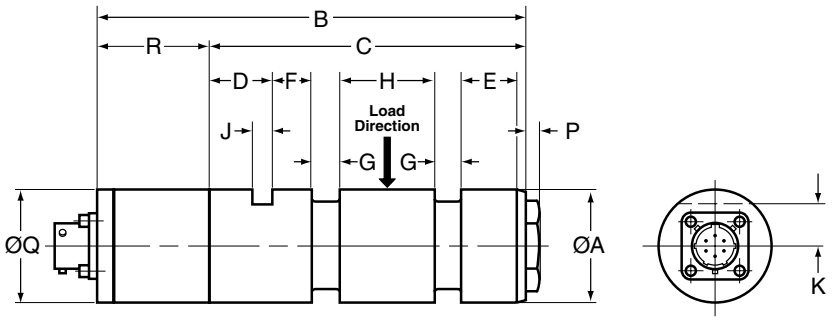
OPERATING PRINCIPLE

When 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 signal is then converted by the integrated electronics to a standard 4 to 20 mA (LE) or 0–10V (LU) output. Based on SMD (surface mounted device) technology, the electronics are well-protected against conducted and radiated electromagnetic fields.

R_a should equal R_b so that the force is evenly distributed.



DIMENSIONS

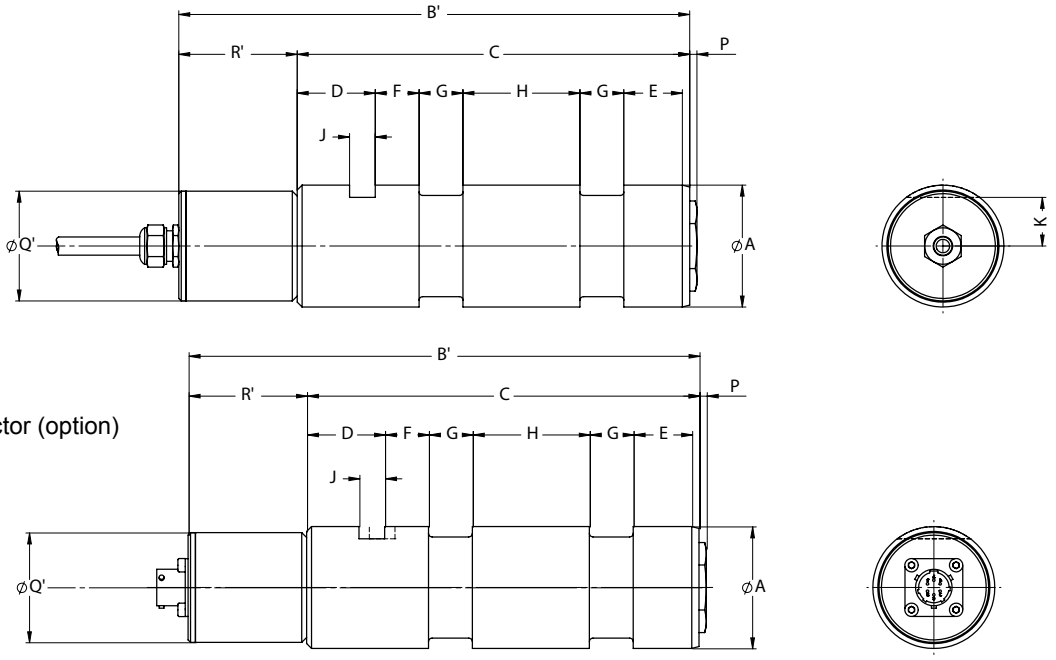


NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 3 decimal places.

Model	units	Ø A	B	C	D	E	F	G	H	J	K	P	Ø Q	R	Weight
LE/LU 211	*mm*	25h6	136	84	18	16	10	7	24	5.2	9	3	38	52	0.6 kg
	in	0.984	5.354	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.496	2.047	1.323 lb
LE/LU 212	*mm*	25h6	136	84	18	16	10	7	24	5.2	9	3	38	52	0.6 kg
	in	0.984	5.354	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.496	2.047	1.323 lb
LE/LU 213	*mm*	25h6	136	84	18	16	10	7	24	5.2	9	3	38	52	0.6 kg
	in	0.984	5.354	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.496	2.047	1.323 lb
LE/LU 214	*mm*	35h6	149	112	25	14	12	12	35	6.3	11.5	3	38	37	1.05 kg
	in	1.378	5.866	4.409	0.984	0.551	0.472	0.472	1.378	0.248	0.453	0.118	1.496	1.457	2.315 lb
LE/LU 216	*mm*	50h6	198	161	32	24	18	18	48	10.5	20	3	38	37	2.4 kg
	in	1.969	7.795	6.339	1.26	0.945	0.709	0.709	1.89	0.413	0.787	0.118	1.496	1.457	5.291 lb
LE/LU 217	*mm*	65h6	233	196	32	26	20	25	65	10.5	22.5	3	38	37	4.8 kg
	in	2.559	9.173	7.717	1.26	1.024	0.787	0.984	2.559	0.413	0.886	0.118	1.496	1.457	10.582 lb
LE/LU 218	*mm*	85h6	295	258	34	39	35	28	89	10.5	28	3	38	37	11 kg
	in	3.347	11.614	10.158	1.339	1.535	1.378	1.102	3.504	0.413	1.102	0.118	1.496	1.457	24.251 lb
LE/LU 220	*mm*	100h6	384	347	36	61	55	35	120	10.5	36	3	38	37	19.6 kg
	in	3.937	15.118	13.661	1.417	2.402	2.165	1.378	4.724	0.413	1.417	0.118	1.496	1.457	43.211 lb
LE/LU 221	*mm*	120h6	384	347	36	61	55	35	120	12.5	40	3	38	37	28.8 kg
	in	4.724	15.118	13.661	1.417	2.402	2.165	1.378	4.724	0.492	1.575	0.118	1.496	1.457	63.493 lb

Specifications LE 310 / 510

DIMENSIONS



With connector (option)

NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 3 decimal places.

Model	units	Ø A	B'	C	D	E	F	G	H	J	K	P	Ø Q'	R'	Weight
LE 311/511	*mm*	25h6	147.6	84	18	16	10	7	24	5.2	9	3	45	63.6	0.6 kg
	in	0.984	5.811	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.771	2.504	1.323 lb
LE 312/512	*mm*	25h6	147.6	84	18	16	10	7	24	5.2	9	3	45	63.6	0.6 kg
	in	0.984	5.811	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.771	2.504	1.323 lb
LE 313/513	*mm*	25h6	147.6	84	18	16	10	7	24	5.2	9	3	45	63.6	0.6 kg
	in	0.984	5.811	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.771	2.504	1.323 lb
LE 314/514	*mm*	35h6	175.6	112	25	14	12	12	35	6.3	11.5	3	45	63.6	1.05 kg
	in	1.378	6.913	4.409	0.984	0.551	0.472	0.472	1.378	0.248	0.453	0.118	1.771	2.504	2.315 lb
LE 316/516	*mm*	50h6	209.6	161	32	24	18	18	48	10.5	20	3	45	48.6	2.4 kg
	in	1.969	8.252	6.339	1.26	0.945	0.709	0.709	1.89	0.413	0.787	0.118	1.771	1.913	5.291 lb
LE 317/517	*mm*	65h6	244.6	196	32	26	20	25	65	10.5	22.5	3	45	48.6	4.8 kg
	in	2.559	9.629	7.717	1.26	1.024	0.787	0.984	2.559	0.413	0.886	0.118	1.771	1.913	10.582 lb
LE 318/518	*mm*	85h6	306.6	258	34	39	35	28	89	10.5	28	3	45	48.6	11 kg
	in	3.347	11.614	10.158	1.339	1.535	1.378	1.102	3.504	0.413	1.102	0.118	1.771	1.913	24.251 lb
LE 320/520	*mm*	100h6	395.6	347	36	61	55	35	120	10.5	36	3	45	48.6	19.6 kg
	in	3.937	15.575	13.661	1.417	2.402	2.165	1.378	4.724	0.413	1.417	0.118	1.771	1.913	43.211 lb
LE 321/521	*mm*	120h6	395.6	347	36	61	55	35	120	12.5	40	3	45	48.6	28.8 kg
	in	4.724	15.575	13.661	1.417	2.402	2.165	1.378	4.724	0.492	1.575	0.118	1.771	1.913	63.493 lb

Ordering Information LE/LU 210

OPTIONS AND ORDERING INFORMATION

LE SERIES LOAD MEASURING PINS LE 2□□/0□3

- Model LE 2 1 1 – 2 2 1
- Lubrication (LE 211–221): Without — 1
  (LE 216–221): With — 3

Example

An LE 216 Load Measuring Pin with lubrication would be ordered as LE 216/033.

LU SERIES LOAD MEASURING PINS LU 2□□/1□1

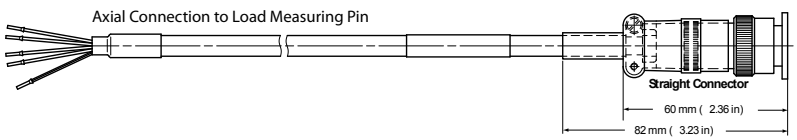
- Model LU 2 1 1 – 2 2 1
- Lubrication (LU 211–221): Without — 1
  (LU 216–221): With — 3

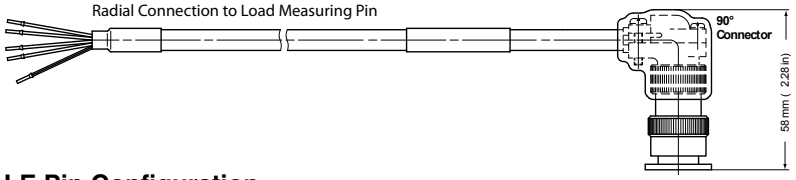
Example

An LU 216 Load Measuring Pin with lubrication would be ordered as LU 216/131.

ACCESSORIES

Cable Assemblies





Accessory Ordering Information

COUNTER-CONNECTOR

Straight Connector	P/N 957.11.08.0030
90° Connector	P/N 957.11.08.0029

CONNECTION CABLE ASSEMBLY

Part Number EH 13□/0□1

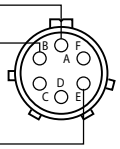
- Straight Connector — 8
- 90° Connector — 9

CONNECTION CABLE ASSEMBLY

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

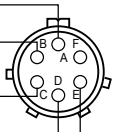
LE Pin Configuration

Supply +	red	A
Supply -	blue	B
Case	black	E



LU Pin Configuration

Supply +	red	A
Supply -	blue	B*
Signal +	white	C
Signal -	green	D*
Case	black	E



NOTE:
Pins B and D are connected together. This feature allows the user to cancel the voltage drop error due to the supply current on the cable (4-wire measurement).

Ordering Information LE 310

OPTIONS AND ORDERING INFORMATION

LE 310 SERIES LOAD MEASURING PINS LE 3☐☐/☐☐1

3-Wire LE (if the B.I.T.E. is used 1 extra wire has to be connected)

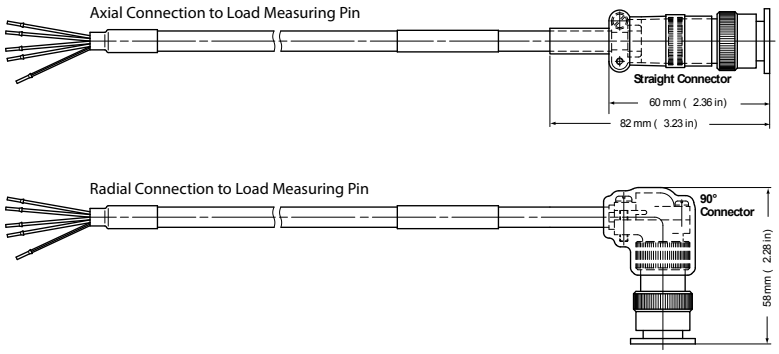
- Model LE 3[1][1]– 3[2][1]
- Lubrication NO (standard for any type from LE311 - 321): 0
  YES (available only on LE 316 - 321): 1
- Option: Axial connector: 0
  3 m length: 1
  6 m length: 2
  12 m length: 3
  20 m length: 4
- Minor revision number (compatibility is guaranteed)

Example

An LE 316 Load Measuring Pin with lubrication and 6m cable would be ordered as LE 316/121.

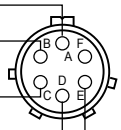
ACCESSORIES

LE 310 Cable Assemblies



LE 310 Pin Configuration

Supply +	red	A
Common	blue	B
Signal +	white	C
B.I.T.E.	green	D
Case	black	E



Accessory Ordering Information

COUNTER-CONNECTOR

Straight Connector	P/N 957.11.08.0030
90° Connector	P/N 957.11.08.0029

CONNECTION CABLE ASSEMBLY

Part Number EH 13☐/0☐1

- Straight Connector — 8
- 90° Connector — 9

CONNECTION CABLE ASSEMBLY

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

Ordering Information LE 510

OPTIONS AND ORDERING INFORMATION

LE 510 SERIES LOAD MEASURING PINS LE 5□□/□□ 1

5-Wire X-X (redundant) LE with B.I.T.E. for each channel
(if the B.I.T.E. is used 2 extra wires have to be connected):

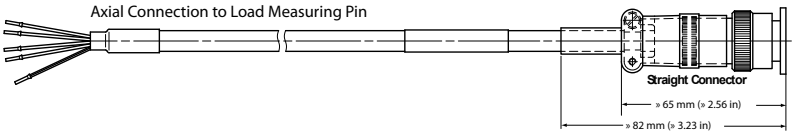
- Model LE 5 1 1 – 5 2 1
- Lubrication NO (standard for any type from LE511 - 521): 0
  YES (available only on LE 516 - 521): 1
- Option: Axial connector: 0
  3 m length: 1
  6 m length: 2
  12 m length: 3
  20 m length: 4
- Minor revision number (compatibility is guaranteed)

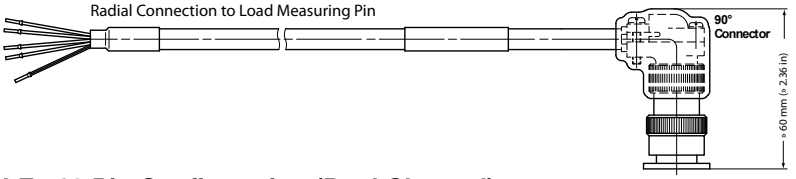
Example

An LE 516 Load Measuring Pin with lubrication and 6m cable would be ordered as LE 516/121.

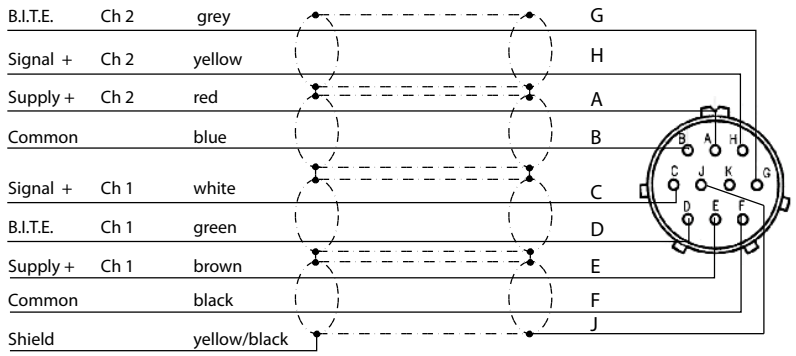
ACCESSORIES

LE 510 Cable Assemblies





LE 510 Pin Configuration (Dual Channel)



Accessory Ordering Information

COUNTER-CONNECTOR

Straight Connector	P/N 957.11.08.0103
90° Connector	P/N 957.11.08.0063

CONNECTION CABLE ASSEMBLY

Part Number ER 109 / □□ 1

- Straight Connector — 3
- 90° Connector — 1

CONNECTION CABLE ASSEMBLY

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

2. Installation / Configuration

In order to set up a functional system, it is important to follow the mechanical and electrical procedures described in the following sections. Proper installation is necessary to insure the measured signals will not be disrupted by incorrect mounting.

Note: The procedures contained in this instruction manual do not cover all the existing mounting and connection possibilities. However, they help the user find the appropriate solution for their specific application. Likewise, installation and connection of load pins specially designed for the specific requirements of the user should be carried out as described in this manual. Furthermore, the general manufacturer's instructions as well as security standards and recommendations should be respected by the user for special models.

2.1 MOUNTING THE LOAD MEASURING PINS

2.1.1 General mounting instructions

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 below.

Type of load measuring pin	Nominal load *kN*	Nominal diameter *mm*	Pin tolerance **h6** *µm*	Bore tolerance **G7** *µm*
LB 210	*2.5*	*25*	*0 / -13*	*+28 / +7*
LB/LE/LU 211, LB 231, LE 311 & LE 511	*5*	*25*	*0 / -13*	*+28 / +7*
LB/LE/LU 212, LB 232, LE 312 & LE 512	*10*	*25*	*0 / -13*	*+28 / +7*
LB/LE/LU 213, LB 233, LE 313 & LE 513	*20*	*25*	*0 / -13*	*+28 / +7*
LB/LE/LU 214, LB 234, LE 314 & LE 514	*50*	*35*	*0 / -16*	*+34 / +9*
LB 235	*70*	*45*	*0 / -16*	*+34 / +9*
LB/LE/LU 216, LB 236, LE 316 & LE 516	*100*	*50*	*0 / -16*	*+34 / +9*
LB/LE/LU 217, LB 237, LE 317 & LE 517	*200*	*65*	*0 / -19*	*+40 / +10*
LB/LE/LU 218, LB 238, LE 318 & LE 518	*500*	*85*	*0 / -22*	*+47 / +12*
LB/LE/LU 220, LB 240, LE 320 & LE 520	*1000*	*100*	*0 / -22*	*+47 / +12*
LB/LE/LU 221, LB 241, LE 321 & LE 521	*1250*	*120*	*0 / -22*	*+47 / +12*

Machining dimensions and tolerances according to DIN 7161

Note: 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 *Fig.2–1*). 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 *Fig.2–1*) 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 a friction on the gliding surface, thus impeding optimal force transmission to the load measuring pin.
- Use slide (see *Fig.2–1*) 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 the above figure 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.

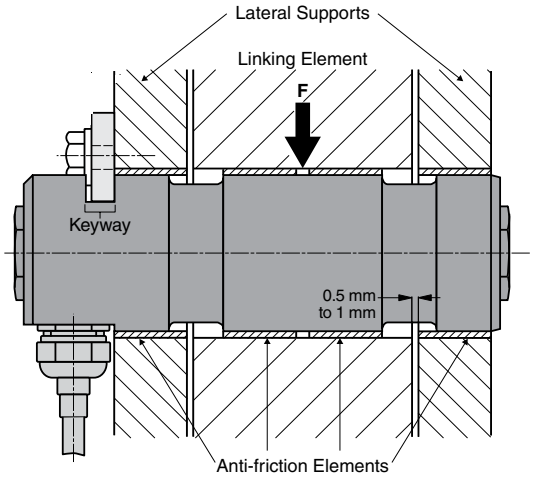
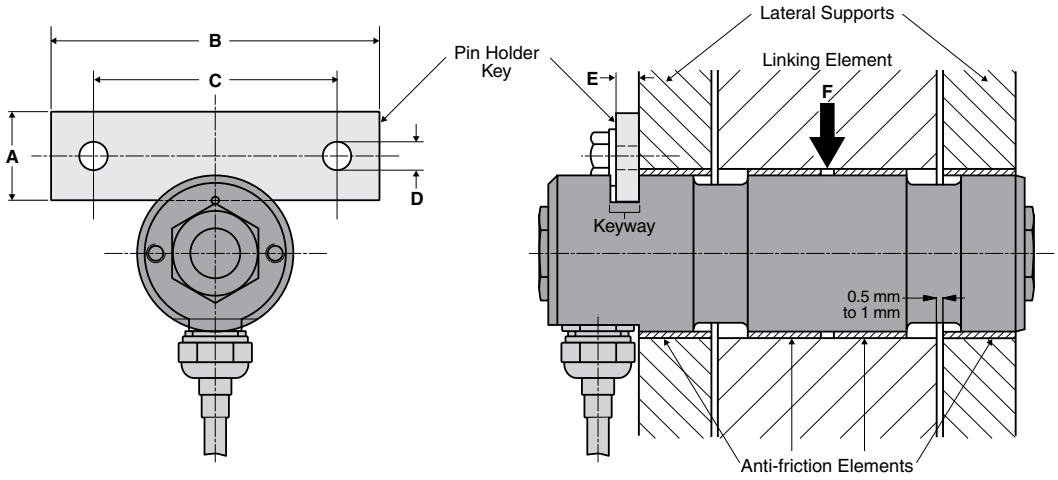


Fig.2–1 Load measuring pin mounted in its seat

2.1.2 PIN HOLDER KEY

1. Machine the pin holder key to the dimensions given in *Fig.2–2*. 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.
2. Prepare 2 screws and 2 single-coil spring-lock washers for the fixing of the pin holder key following the information in *Fig.2–2*.



Load measuring pins	Dimensions *mm*					Fastening screw	Screwing torque *Nm*	Spring-lock washer
	A	B	C	D	E			
LB 210	20	60	36	9	5	M8	24	M8
LB/LE/LU 211, LB 231, LE 311 & LE 511	20	60	36	9	5	M8	24	M8
LB/LE/LU 212, LB 232, LE 312 & LE 512	20	60	36	9	5	M8	24	M8
LB/LE/LU 213, LB 233, LE 313 & LE 513	20	60	36	9	5	M8	24	M8
LB/LE/LU 214, LB 234, LE 314 & LE 514	25	80	50	11	6	M10	48	M10
LB 235	30	100	70	13	8	M12	83	M12
LB/LE/LU 216, LB 236, LE 316 & LE 516	30	100	70	13	8	M12	83	M12
LB/LE/LU 217, LB 237, LE 317 & LE 517	40	140	100	17	10	M16	200	M16
LB/LE/LU 218, LB 238, LE 318 & LE 518	40	140	100	17	10	M16	200	M16
LB/LE/LU 220, LB 240, LE 320 & LE 520	40	140	100	17	10	M16	200	M16
LB/LE/LU 221, LB 241, LE 321 & LE 521	50	190	140	21	12	M20	390	M20

Fig.2–2 Dimensions of the pin holder key

2.1.3 POSITIONING OF THE LOAD MEASURING PIN

1. Clean the load measuring pin as well as the bores in which it will be placed to ensure clean contact surfaces.
2. Lubricate the load measuring pin as well as the bores in which it will be placed by means of grease or oil.

Note: When mounting roller bearings heat them to about 80 °C to slide them more easily on the load measuring pin.

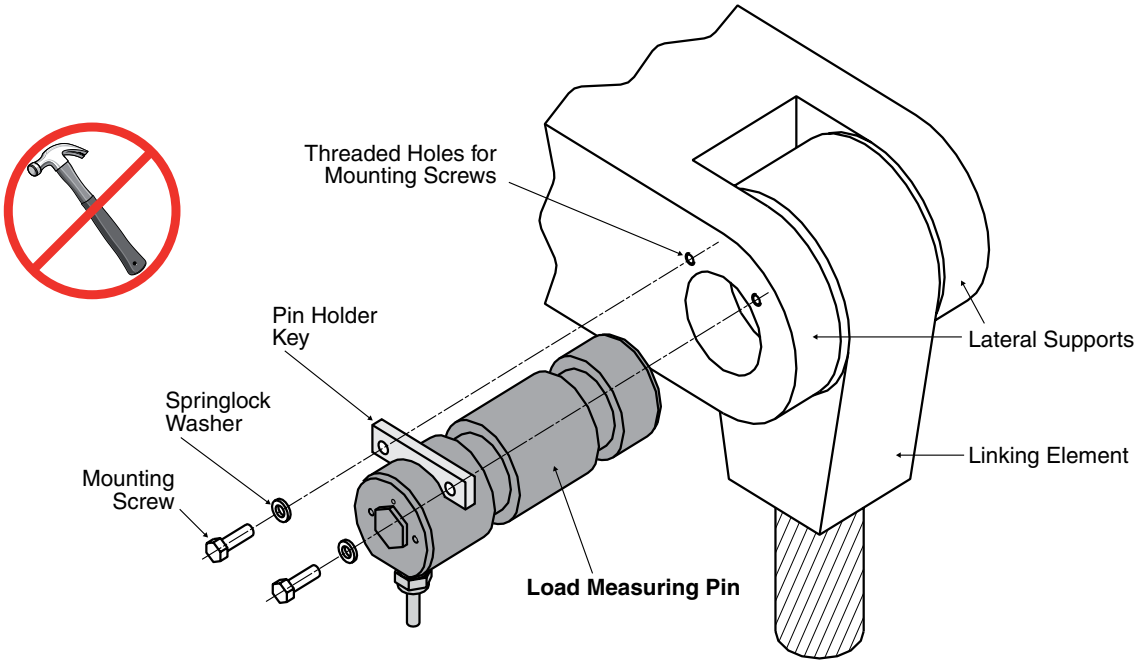


Fig.2–3 Positioning of the load measuring pin

CAUTION: NEVER HIT THE LOAD MEASURING PIN WITH A HAMMER OR ANY OTHER TOOL TO INSERT IT IN ITS SEAT.
MECHANICAL DAMAGE WHICH COULD RESULT IN MEASUREMENT ERRORS MAY OCCUR IF THIS WARNING IS NOT COMPLIED WITH.
ANY BREACH OF THIS WARNING WILL INVALIDATE THE GUARANTEE.

3. Position the load measuring pin facing the bores in which it will be seated (see *Fig.2–3*). Turn it so that the mortise for receiving the pin holder key is facing upward and perpendicular to the applied force.

Note: 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.

CAUTION: THE TEST REPORT OF OUR STANDARD LOAD PINS WERE CREATED WITH THE PIN HOLDER KEY FACING UPWARDS. IF THE LOAD PIN IS INSTALLED WITH THE PIN HOLDER KEY FACING DOWNWARDS, A SLIGHT VARIATION IN THE SIGNAL WILL BE OBSERVED.

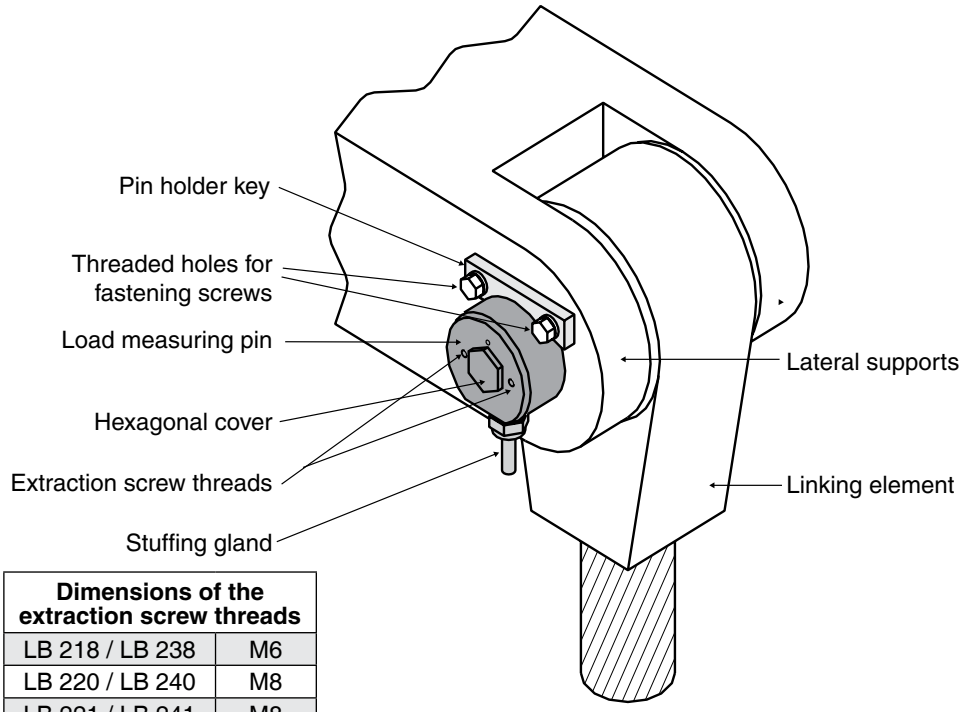
4. Manually slide the load measuring pin into its seat (see *Fig.2–3*), until the mortise for receiving the pin holder key reaches the lateral support. This inserting of the load measuring pin should be done without the use of any tool. If it is impossible to slide the pin in, check the alignment (concentricity and axiality) of the elements and machine again, if necessary.
5. Insert the pin holder key into the mortise and align the key to coincide with the threaded holes for the fastening screws.
6. Place the two fastening screws, fitted with their washers, into the holes of the pin holder key (see *Fig.2–3*), and screw them into the previously threaded holes, applying the screwing torque specified in *Fig.2.2*.
7. For pins equipped with lubricators (optional for LB 216 - LB 221, LE 216 - LE 221 and LU 216 - LU 221, LE 316 - LE 321 and LE 516 - LE 521) inject lubricant (grease or oil) by means of a grease gun or oil pump.

2.2 EXTRACTION OF THE LOAD MEASURING PINS

2.2.1 EXTRACTION OF PINS USING AN EXTRACTION DEVICE

1. Before any attempt to extract, unload the load measuring pin (remove tare). This should allow its easy extraction.
2. Load measuring pins LB 218 - LB 221, LE 218 - LE 221, LU 218 - LU 221, LB 238 - LB 241, LE 318 - LE 321 and LE 518 - LE 521 are fitted with two extraction screw threads at each end (see *Fig.2–4* and *Fig.2–6*) which should be used to fix the extraction device.

   Use this thread to fix an extraction device (not provided by Magtrol, see *Fig.2–5*). We recommend fixing it on the same side as the stuffing gland (LB 210, LE 310 and LE 510 series pins with integrated cable) or the electric connector (LB 230, LE 210, LU 210, LE 310 and LE 510 series pin with connector) to avoid their damage if the pin is pulled out on the opposite end (see *Fig.2–4*).



Dimensions of the extraction screw threads	
LB 218 / LB 238	M6
LB 220 / LB 240	M8
LB 221 / LB 241	M8

Fig.2–4 Mounted LB Series Load Measuring Pin

For load measuring pins with an electrical connector it is possible to disconnect the cable in order to facilitate the extraction.

CAUTION: 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 WARNING IS NOT COMPLIED WITH.

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

CAUTION: 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.

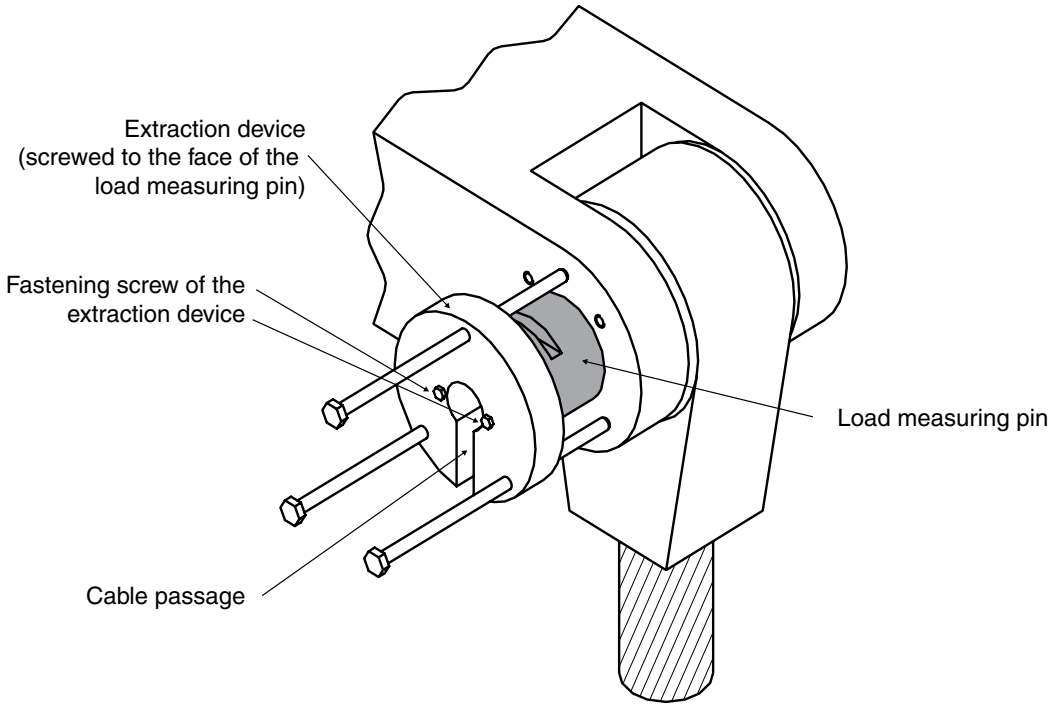
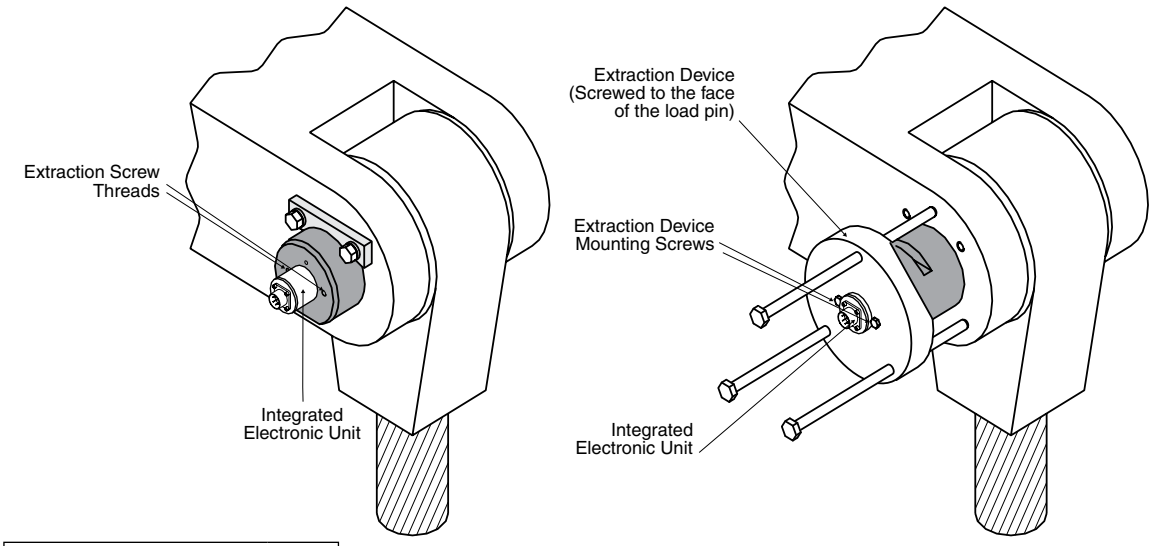


Fig.2–5 Pulling out a LB Series Load Measuring Pin by means of an extraction device



Dimensions of the extraction screw threads	
LE 218, LE 318 & LE 518	M6
LE 220, LE 320 & LE 520	M8
LE 221, LE 321 & LE 521	M8

Fig.2–6 Pulling out a load measuring pin by means of an extraction device (principle used with LE/LU 218, LE 318 and 518, LE/LU 221. LE 321 and 521 Series Load Pins)

2.2.2 EXTRACTION OF SMALL SIZE LOAD MEASURING PINS

1. For small size load measuring pins without extraction screw threads use a sleeve tube or a muff made of a metal of lesser stiffness than that of the pin (e.g. bronze, brass).
2. Place the tube against the pin end opposite the stuffing gland or electrical connector, taking care not to touch the hexagonal cover (see *Fig.2–8*).

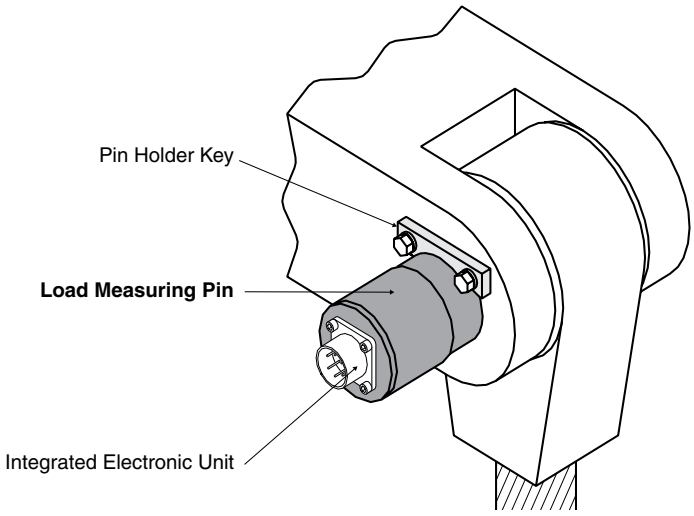
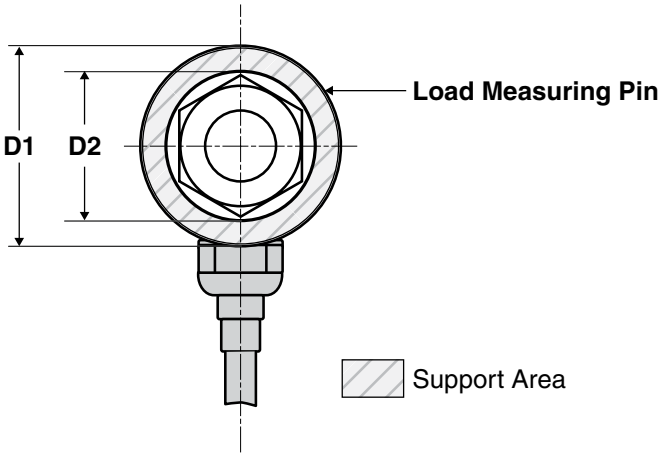


Fig.2–7 Mounted LE / LU Series Load Pin (LE/LU 211, LE 311 and LE 511 to LE/LU 217 respectively . LE 317 and LE 517)

3. Next, 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	D2
LB/LE/LU 214, LB 234, LE 314 & LE 514	30	26
LB 235	40	35
LB/LE/LU 216, LB 236, LE 316 & LE 516	46	40
LB/LE/LU 217, LB 237, LE 317 & LE 517	60	40
LB/LE/LU 218, LB 238, LE 318 & LE 518	80	40
LB/LE/LU 220, LB 240, LE 320 & LE 520	90	40
LB/LE/LU 221, LB 241, LE 321 & LE 521	110	40

Fig.2–8 Support area on the end of the load measuring pin for a sleeve tube or a muff.

Note: On the load measuring pins LB / LE / LU 210 - LB / LE / LU 213 and LB 231 - LB 233, LE 311 - LE 313 and LE 511 - LE 513 the area of support is not sufficient. Use a wooden cylinder for the extraction of the load measuring pin.

2.3 CONNECTION OF THE LOAD MEASURING PINS

Methods of connecting load measuring pins to electronic conditioning instruments supplied by Magtrol 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 an electronic signal conditioning module. For conditioning signals supplied by load measuring pins Magtrol offers a range of electronic units shown in *Fig.2–9*.

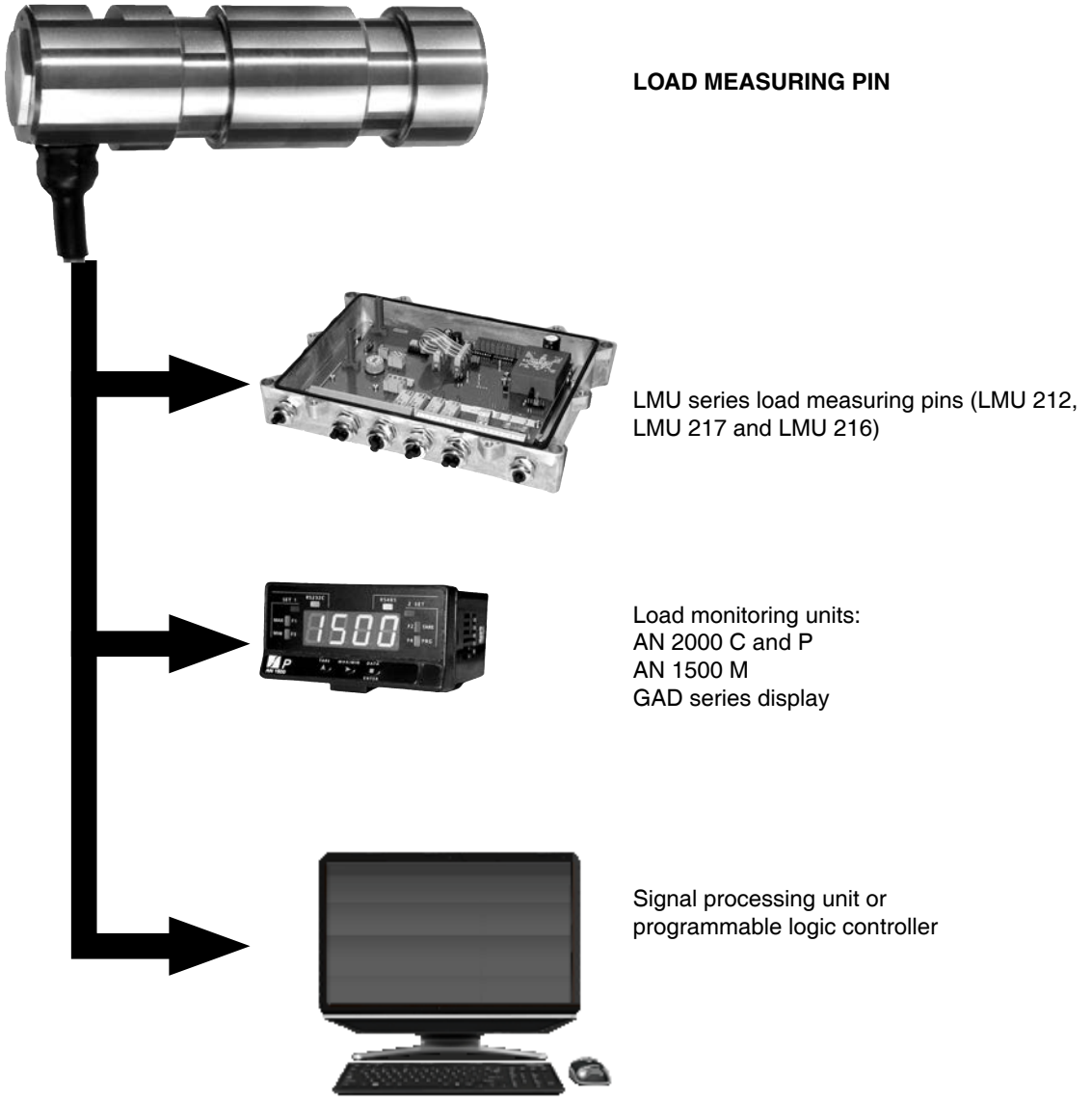


Fig.2–9 Electronic conditioning modules for connection to load measuring pins

2.3.1 CONNECTION OF A LOAD MEASURING PIN TO ANY INSTRUMENT

Connect the load measuring pin connection cable lead (see *section 2.3.1.2 Wiring*) to the input terminal of the instrument according to the instructions given in its instruction manual.

2.3.1.1 Preventing measuring problems

Instructions for all connection types.

CAUTION: DO NOT INSTALL A CABLE NEAR A HIGH-VOLTAGE LINE. DISRUPTION OF THE MEASUREMENT SIGNAL MAY OCCUR IF THIS WARNING IS NOT COMPLIED WITH.

CAUTION: CONNECT THE CABLE SCREENING TO THE EARTH AT ONE END ONLY. DISRUPTION OF THE MEASUREMENT SIGNAL DUE TO EARTH LOOPS MAY OCCUR IF THIS WARNING IS NOT COMPLIED WITH.

If it is not possible to orient the LB 210 and LB 230 Series 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 %).

Note: LE 210, LU 210, LE 310 and LE 510 Series Load Measuring Pins cannot be mounted upside down. An inverted force would generate a negative current in the current source contained in the load pin, which is in fact impossible.

2.3.1.2 Cable Connection

CAUTION: BEFORE CONNECTING A LOAD MEASURING PIN TO A SIGNAL PROCESSING UNIT, MAKE SURE THAT BOTH UNITS ARE NOT RECEIVING POWER. THE CONNECTION WILL ONLY TAKE PLACE WHEN ALL THE USUAL MEASURES TO AVOID AN ELECTRIC SHOCK, WERE TAKEN.

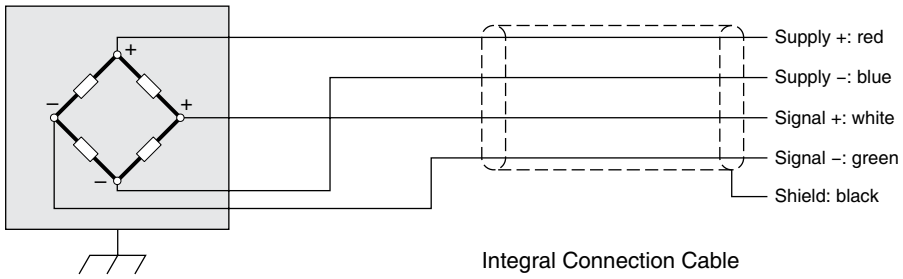


Fig.2–10 Connection of a LB 210 Series Load Measuring Pin (without connector)

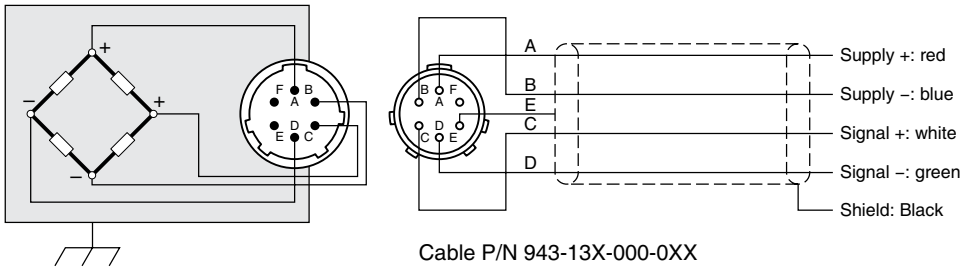


Fig.2–11 Connection of a LB 210 Series Load Measuring Pin (with connector)

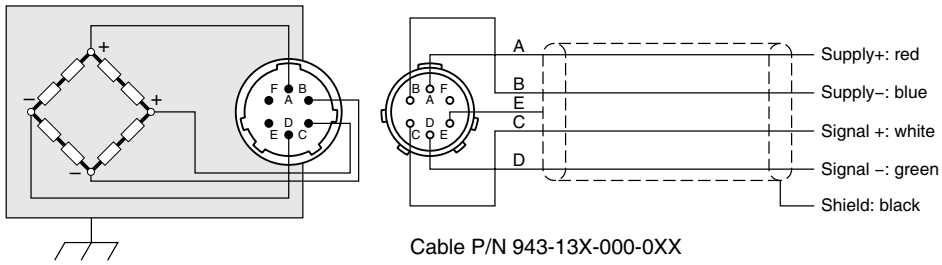


Fig.2–12 Connection of a LB 230 Series Load Measuring Pin

CAUTION: THE MAXIMUM CURRENT CONSUMPTION OF A LOAD MEASURING PIN OF THE LE 210 SERIES IS 25 MA. TO PREVENT ALL RISKS IN CASE OF A SHORT-CIRCUIT, IT IS ADVISABLE TO INSTALL A FUSE OR A CIRCUIT BREAKER OF 0.1 A ON THE CURRENT OUTPUT OF THE SIGNAL CONDITIONING UNIT.

Note: If a programmable logic controller with built-in current limitation is used, there is no need for installing an additional device.

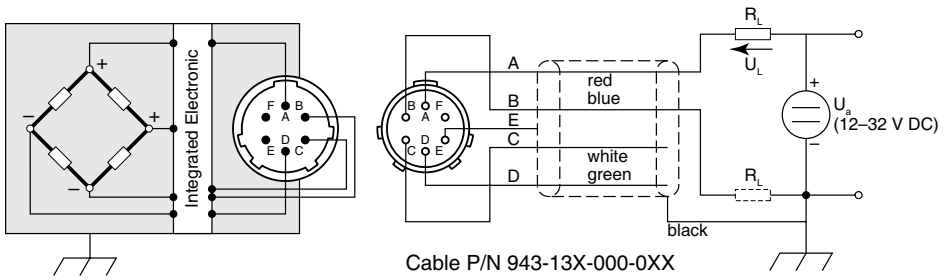


Fig.2–13 Connection of a LE 210 Series Load Measuring Pin

CAUTION THE MAXIMUM CURRENT CONSUMPTION OF A LOAD MEASURING PIN OF THE LU 210 SERIES IS 35 MA. TO PREVENT ALL RISKS IN CASE OF A SHORT-CIRCUIT, IT IS ADVISABLE TO INSTALL A FUSE OR A CIRCUIT BREAKER OF 0.1 A ON THE CURRENT OUTPUT OF THE SIGNAL CONDITIONING UNIT.

Note: If a programmable logic controller with built-in current limitation is used, there is no need for installing an additional device.

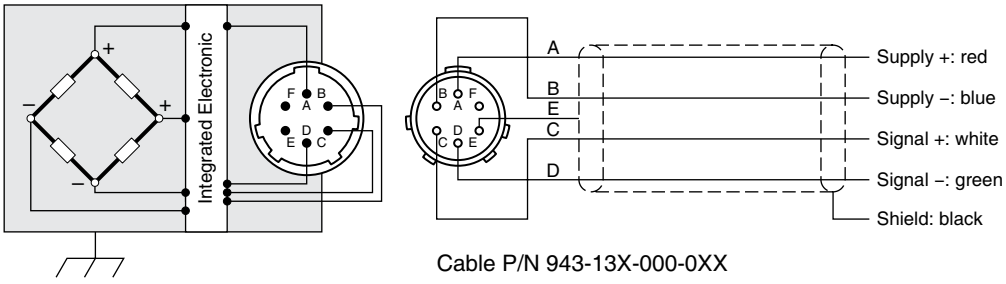
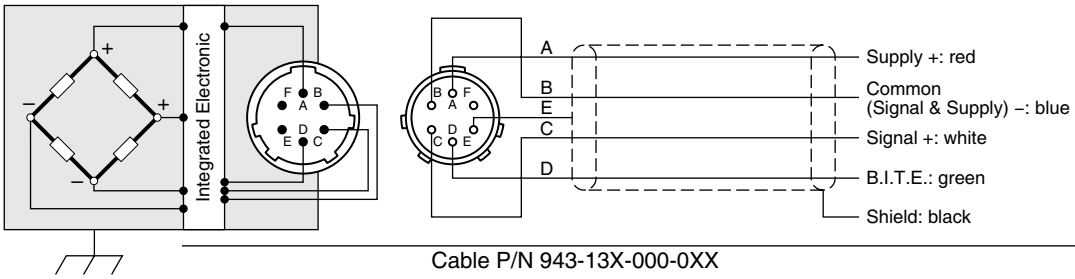


Fig.2–14 Connection of a LU 210 Series Load Measuring Pin

CAUTION: THE MAXIMUM CURRENT CONSUMPTION OF A LOAD MEASURING PIN OF THE LE 310 SERIES IS 50 MA. TO PREVENT ALL RISKS IN CASE OF A SHORT-CIRCUIT, IT IS ADVISABLE TO INSTALL A FUSE OR A CIRCUIT BREAKER OF 0.1 A ON THE CURRENT OUTPUT OF THE SIGNAL CONDITIONING UNIT.

Note: If a programmable logic controller with built-in current limitation is used, there is no need for installing an additional device.

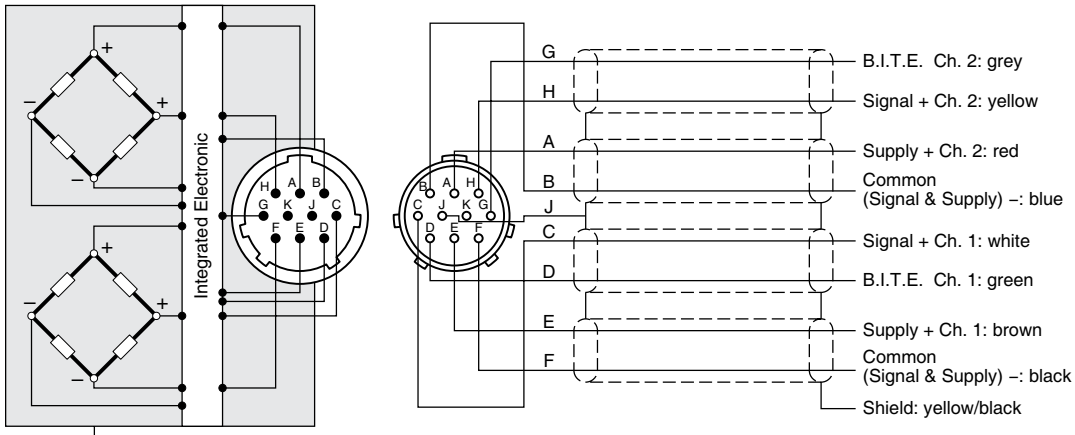


Cable P/N 943-13X-000-0XX

Fig.2–15 Connection of a LE 310 Series Load Measuring Pin

CAUTION: THE MAXIMUM CURRENT CONSUMPTION OF A LOAD MEASURING PIN OF THE LE 510 SERIES IS 2 X 50 MA. TO PREVENT ALL RISKS IN CASE OF A SHORT-CIRCUIT, IT IS ADVISABLE TO INSTALL A FUSE OR A CIRCUIT BREAKER OF 0.2 A ON THE CURRENT OUTPUT OF THE SIGNAL CONDITIONING UNIT.

Note: If a programmable logic controller with built-in current limitation is used, there is no need for installing an additional device.



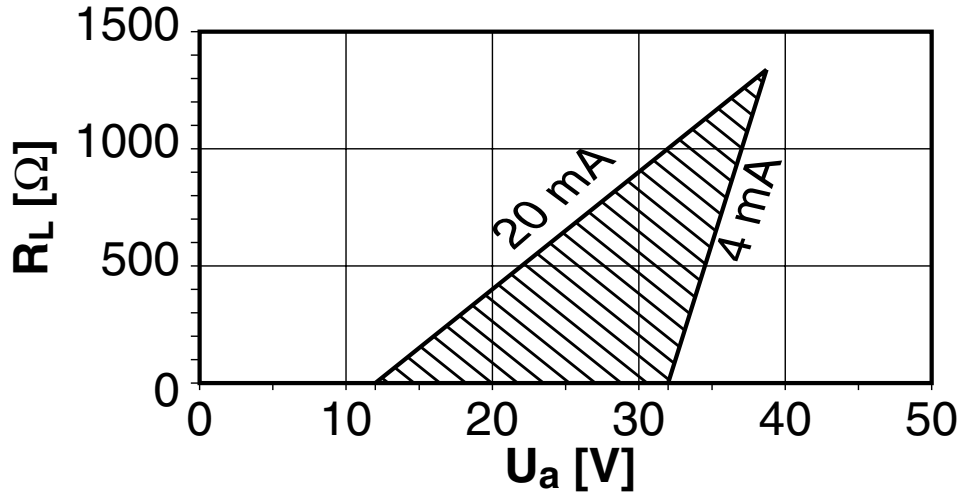
Cable P/N 983-109-000-XXX

Fig.2–16 Connection of a LE 510 Series Load Measuring Pin

2.3.1.3 Determining R_L : numeric example for the LE 210, LE 310 and LE 510 Series Load Pin

How to determine the load resistance R_L as a function of the supply voltage U_a?

1. The user wants to connect the load measuring pin to a device providing a supply voltage of 24 VDC ± 10 %.
2. Considering the defined tolerance, the supply voltage will range between 21.6 VDC and 26.4 VDC. Transfer the lowest value (21.6 VDC) on the X-axis of the diagram. Draw from this point a vertical line to the 20 mA line.
3. The intersection of this line (21,6 VDC) with the 20 mA determines the maximum value for the load resistance R_L (read the value on the y-coordinate). In the given example, the maximum value of the load resistance corresponds to approximately 490 Ohms.



$$\text{Operating range (hatched)} = \frac{\text{Load resistance } R_L}{\text{Power supply } U_a}$$

Fig.2–17 $R_L = f(U_a)$ diagram of the LE 210 Series Load Measuring Pins operating range

2.3.2 Connection of a load measuring pin (LB series) to an LMU series load monitoring unit

Connect the load measuring pin connection cable lead to the input terminal of the load monitoring unit according to the indications in *figures 2–18 through Fig.2–20*. All three units, LMU 212, LMU 217 and LMU 216, have the same terminals as the LMU 216 and LMU 217 are just extensions of the LMU 212 unit.

Note: For more information concerning the cabling of the LMU Series Load Monitoring Units, refer to their instruction manuals.

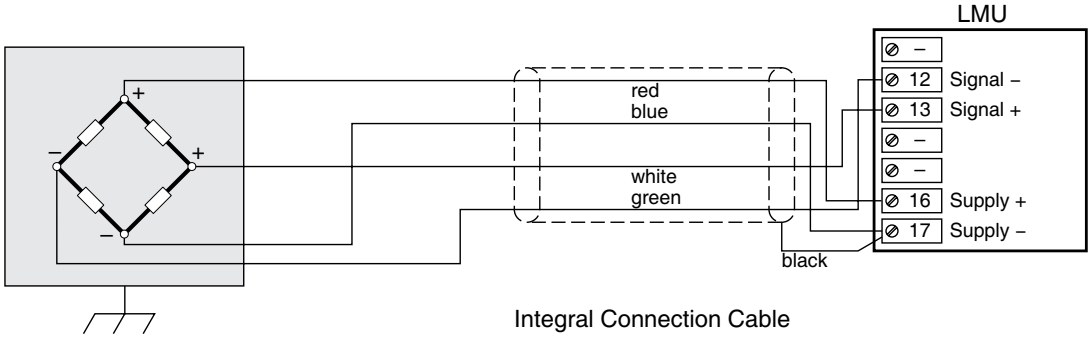


Fig.2–18 Connection of a LB 210 Series Load Pin (without connector) to a LMU Load Monitoring Unit

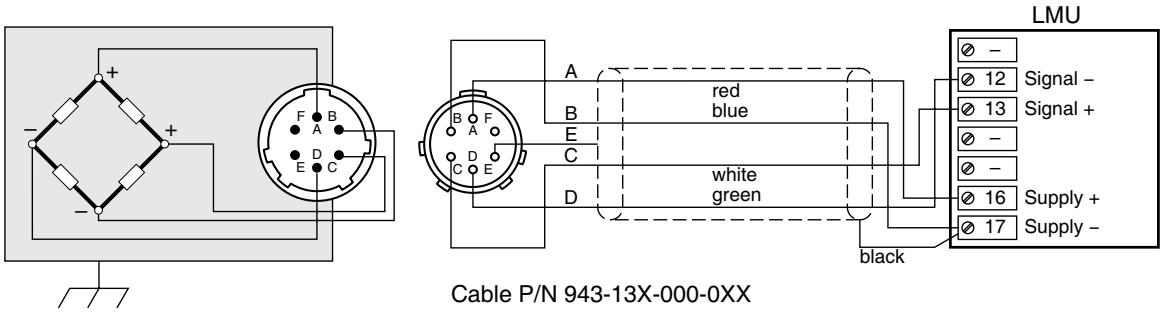


Fig.2–19 Connection of a LB 210 Series Load Pin (with connector) to a LMU Load Monitoring Unit

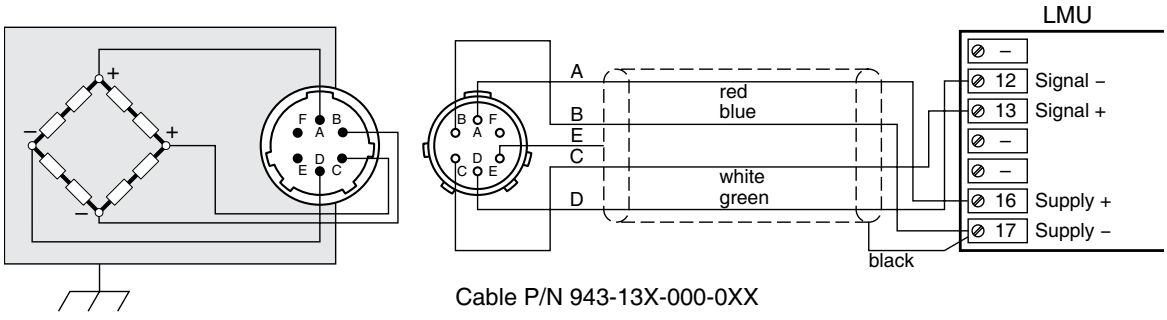


Fig.2–20 Connection of a LB 230 Series Load Pin to a LMU Load Monitoring Unit

2.3.3 CONNECTION OF A LOAD MEASURING PIN TO AN AN 1500 M DIGITAL DISPLAY MONITOR

For LB Series Load Pins, connect the load measuring pin cable to the AN 1500 M input terminals as indicated in *Fig.2–21*.

For LB, LE and LU Series Load Pins, connect the load measuring pin cable to the AN 1500 M input terminals as indicated in *figures 2–22, 2–23* and *2–24*.

Note: For more information concerning the cable connections of the AN 1500 M, refer to their instruction manual.

2.3.3.1 AN 1500 M Series Digital Signal Monitor

CN2 TERMINAL	AN 1500 M
PIN 1	power supply –
PIN 2	power supply +[24 VDC]
PIN 3	power supply +[5 or 10 VDC]
PIN 4	not used
PIN 5	signal + [mA]
PIN 6	signal + [V]
PIN 7	not used
PIN 8	signal - [V or mA]

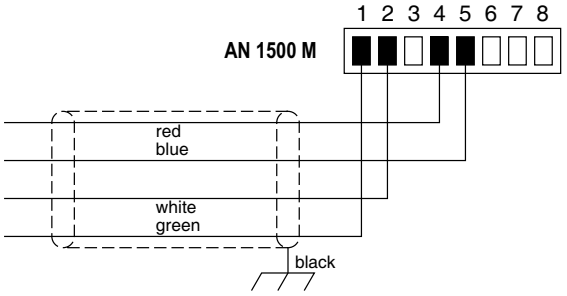


Fig.2–21 Connection of the LB 210 / LB 230 Series Load Measuring Pins to an AN 1500 M

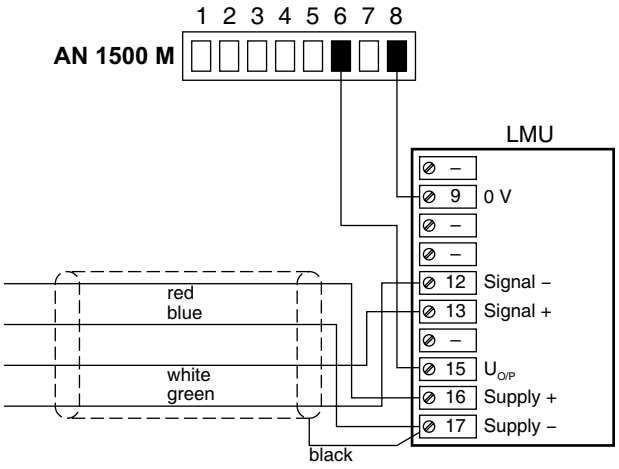


Fig.2–22 Connection of the LB 210 / LB 230 Series Load Pins to an AN 1500 M through an LMU Series Load Monitoring Unit

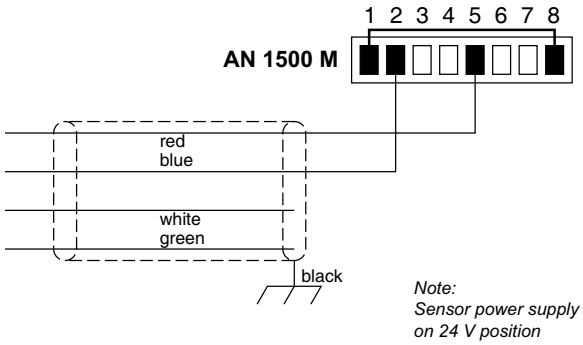


Fig.2–23 Connection of the LE 210 Series Load Measuring Pins to an AN 1500 M

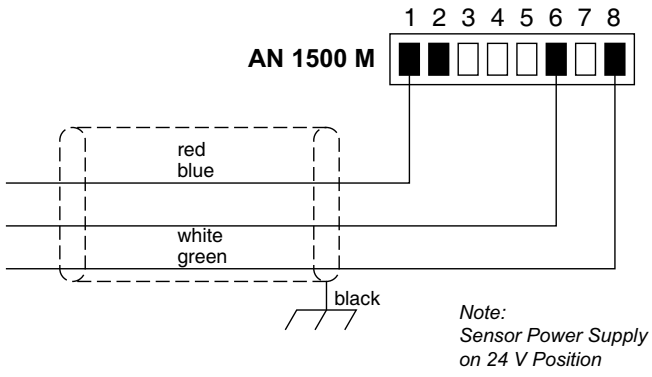


Fig.2–24 Connection of the LU 210 Series Load Measuring Pins to an AN 1500 M

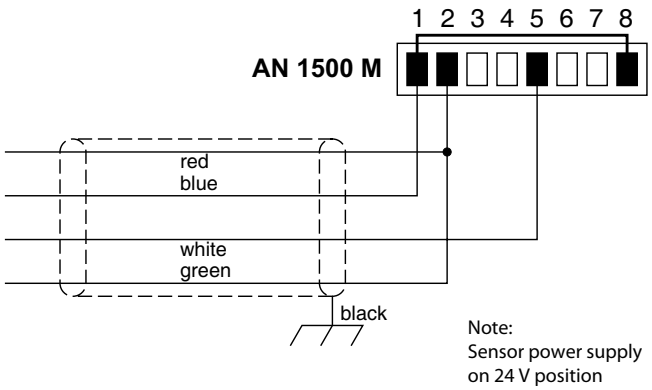


Fig.2–25 Connection of the LE 310 Series Load Measuring Pins to an AN 1500 M

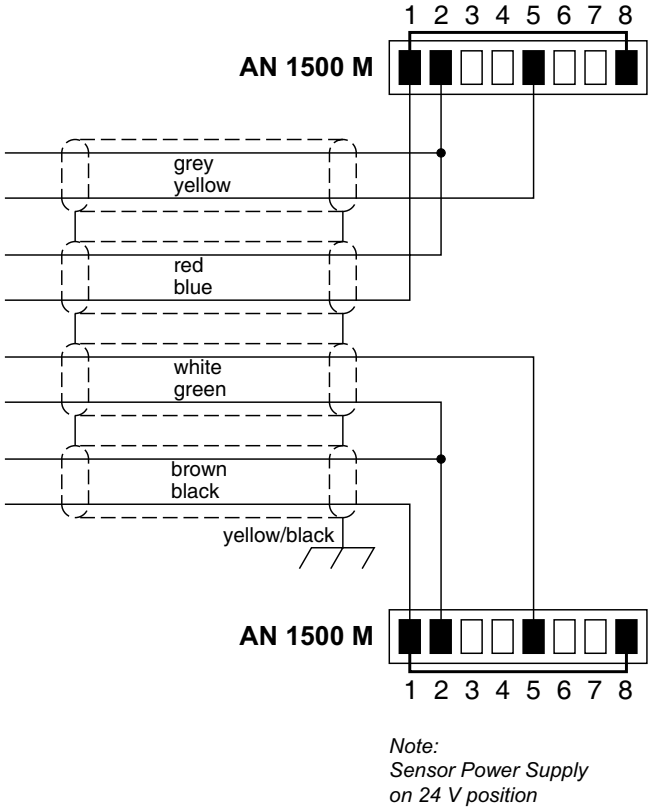


Fig.2–26 Connection of the LU 510 Series Load Measuring Pins to an AN 1500 M

2.3.4 CONNECTION OF A LOAD MEASURING PIN TO AN AN 2000 DIGITAL SIGNAL CONDITIONER/MONITOR

For LB Series Load Pins, connect the load measuring pin cable to the AN 2000 C input terminals as indicated in *Fig.2–27*.

For LB, LE and LU Series Load Pins, connect the load measuring pin cable to the AN 2000 P input terminals as indicated in *figures 2–28, 2–29* and *2–30*.

Note: For more information concerning the cable connections of the AN 2000 C, refer to the corresponding instruction manual.

Note: The AN 2000 C has no current input. The LE 210, LE 310 and LE 510 Series Load Measuring Pins cannot be directly connected to them.

2.3.4.1 AN 2000 C Series Digital Signal Conditioner/Monitor

CN3 TERMINAL	AN 2000 C
PIN 6	power supply –
PIN 5	power supply +
PIN 4	N/C
PIN 3	signal – [V]
PIN 2	N/C
PIN 1	signal + [V]

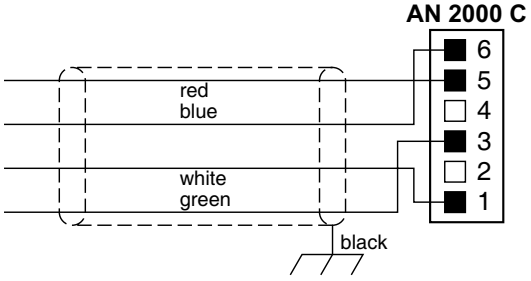


Fig.2–27 Connection of the LB 210 / LB 230 Series Load Measuring Pins to an AN 2000 C

2.3.4.2 AN 2000 P Series Digital Signal Conditioner/Monitor

CN TERMINAL 3	AN 2000 P
PIN 6	power supply –
PIN 5	power supply +
PIN 4	signal + [mA]
PIN 3	signal – [V ou mA]
PIN 2	signal + [V]
PIN 1	N/C

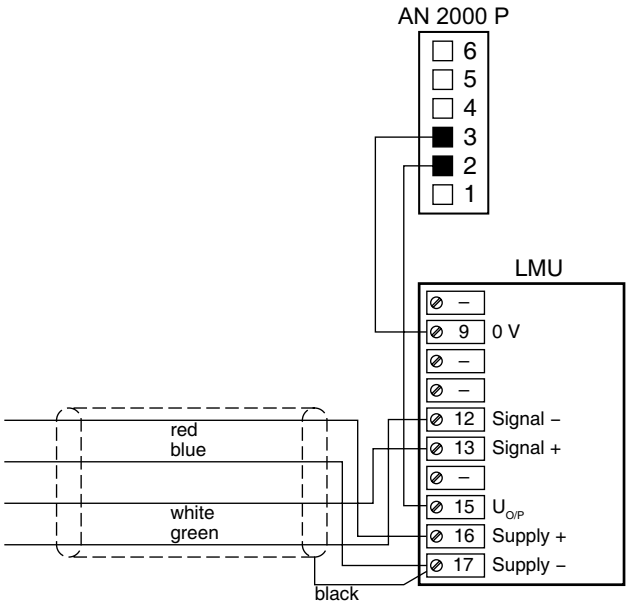


Fig.2–28 Connection of the LB 210 / LB 230 Series Load Pins to an AN 2000 P through an LMU Series Load Monitoring Unit

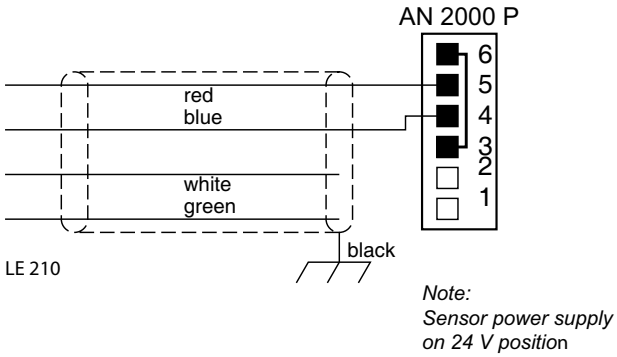


Fig.2–29 Connection of the LE 210 Series Load Measuring Pins to an AN 2000 P

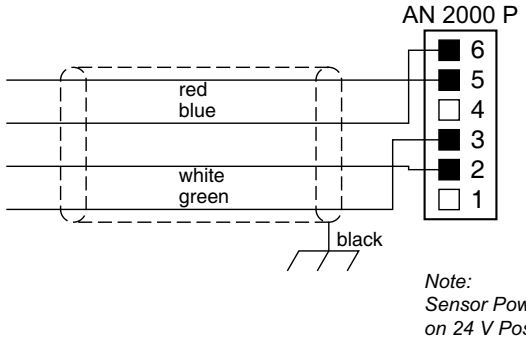


Fig.2–30 Connection of the LU 210 Series Load Measuring Pins to an AN 2000 P

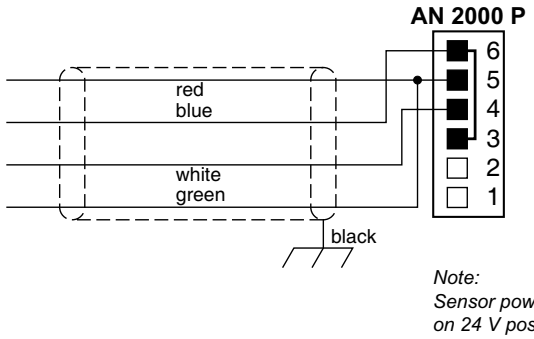


Fig.2–31 Connection of the LE 310 Series Load Measuring Pins to an AN 2000 P

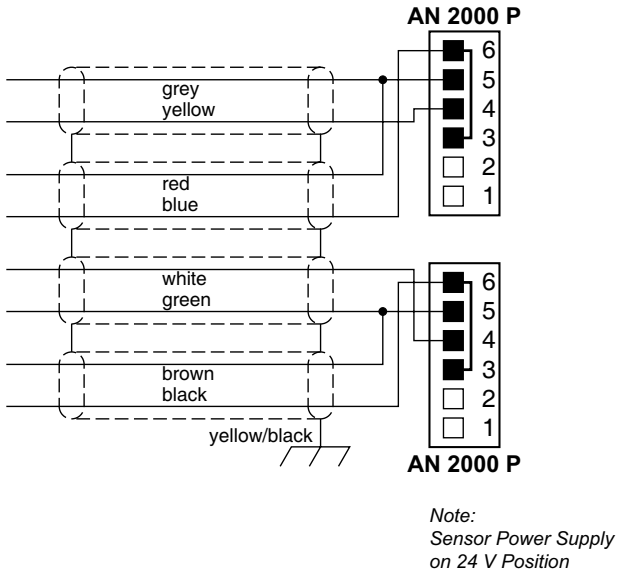


Fig.2–32 Connection of the LE 510 Series Load Measuring Pins to an AN 2000 P

2.3.5 Connection of a load measuring pin to GAD series large digital display

For LB Series Load Pins, connect the load measuring pin cable to the GAD Series Large Digital Display input terminals as indicated in *Fig.2–33*.

For LB, LE and LU Series Load Pins connect the load measuring pin cable to the GAD Series Large Digital Display input terminals as indicated in *figures 2–34* and *2–35.*

Note: For more information concerning the cabling of the GAD Series Large Digital Display, refer to the instruction manual.

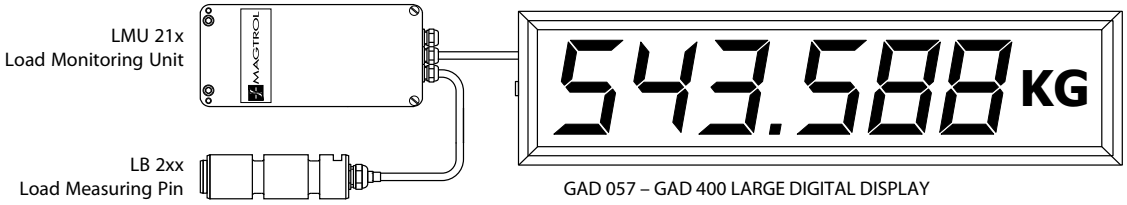


Fig.2–33 Connection of the LB 210 / LB 230 Series Load Pins to a GAD through an LMU Series Load Monitoring Unit

GAD 057 – GAD 280 : ANALOG INPUTS	
PIN 1	supply +
PIN 2	signal -
PIN 3	signal [mA]
PIN 4	signal [V]
PIN 5	NC
PIN 6	supply -

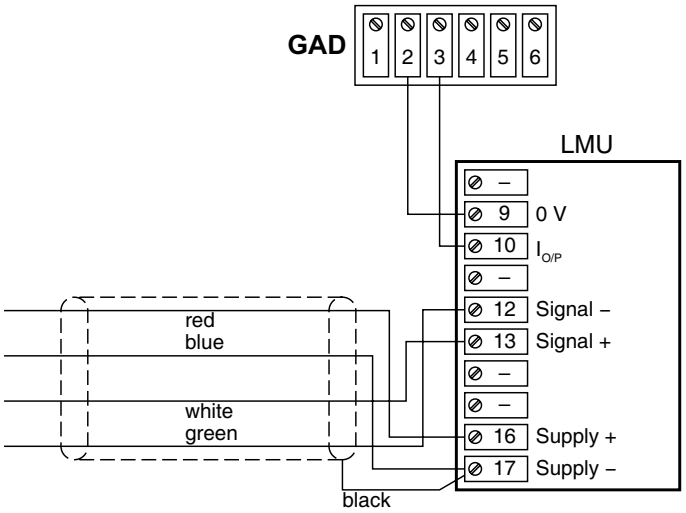


Fig.2–34 Connection of the LB 210 / LB 230 Series Load Measuring Pins to a GAD through an LMU Series Load Monitoring unit

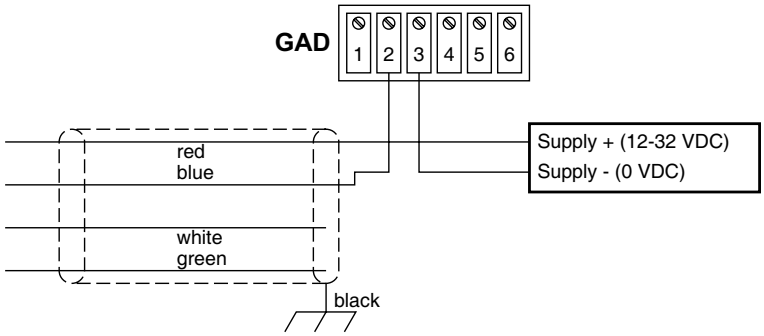


Fig.2–35 Connection of the LE 210 Series Load Measuring Pins

CAUTION: THE POWER SUPPLY VOLTAGE MUST BE AT LEAST 13 V, AND NOT ONLY 12 V AS THE GAD GENERATES A VOLTAGE DROP OF 1 V.

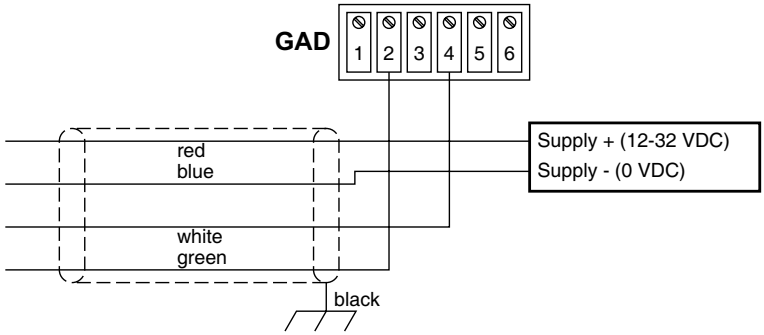


Fig.2–36 Connection of the LU 210 Series Load Measuring Pins

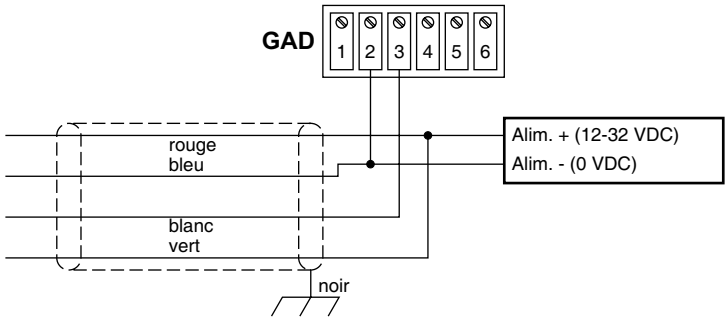


Fig.2–37 Connection of the LE 310 Series Load Measuring Pins

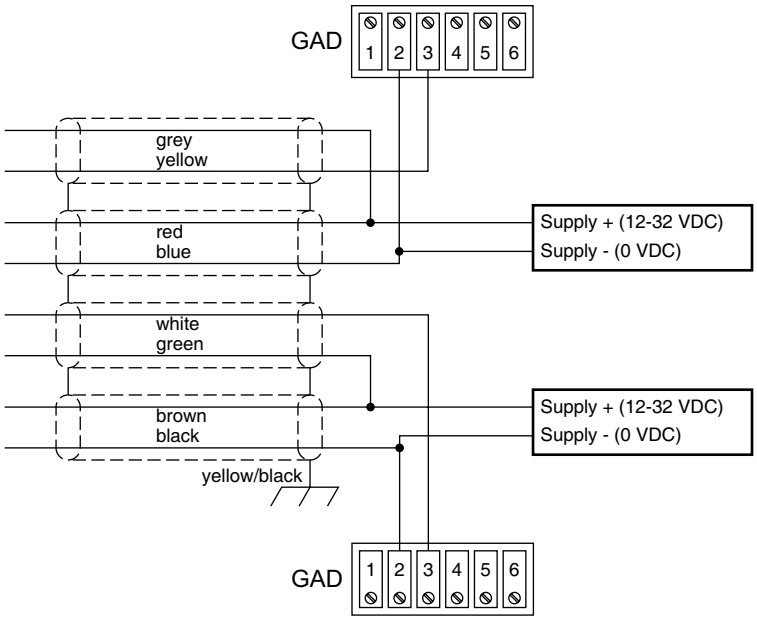


Fig.2–38 Connection of the LE 510 Series Load Measuring Pins

3. Operating Principle

3.1 MEASUREMENT PRINCIPLE

The LB 210, LB 230, LE 210 and LU 210, LE 310 and LE 510 Series Measuring Pins have the shape of a hollow cylinder. The outside diameter "A" features two circular grooves with a reduced diameter "X" (see *Fig.3–1*). Due to the reduced pin section, the deformations caused by the application of the force "F" on the central portion of the pin concentrate themselves on the area of both circular grooves.

Note: To avoid any unnecessary redundancy, the LB 210 Series Load Measuring Pins will, if not specially specified, be used to explain the operating principle of the pins manufactured by Magtrol.

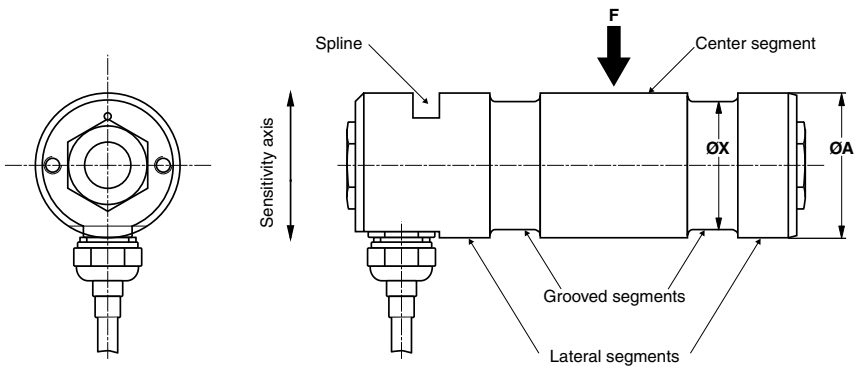


Fig.3–1 Body of the LB 210 Series Load Measuring Pin

Note: 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.

Note: Measurements with an LE 210, LU 210, LE 310 and LE 510 Series Load Measuring Pin mounted upside down will not work. Both series have been designed to produce a positive current (LE) or voltage (LU) measurement signal.

CAUTION: THE TEST REPORT OF OUR STANDARD LOAD PINS WERE CREATED WITH THE PIN HOLDER KEY FACING UPWARDS. IF THE LOAD PIN IS INSTALLED WITH THE PIN HOLDER KEY FACING DOWNWARDS, A SLIGHT VARIATION IN THE SIGNAL WILL BE OBSERVED.

3.2 STRAIN GAUGES

Strain gauges are placed on the inside of the load measuring pin. The strain gauges are situated symmetrically in the bore, their situation coinciding with that of the grooves visible outside.

When a load is applied to the load measuring pin in the direction of its sensitivity axis, the strain gauge full bridge produces a signal which is proportional to the load applied. For all LB Series Load Measuring Pins an external power supply for the strain gauges is necessary. The output signal processing is carried out by an external amplifier. Magtrol also offers LE and LU Series Load Pins with an integrated strain gauge power supply and amplifier.

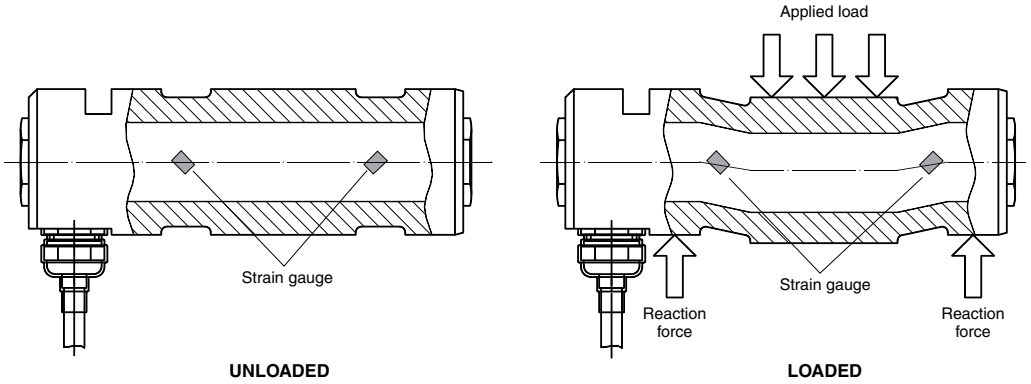


Fig.3–2 Unloaded and loaded LB 210 Series Load Measuring Pin

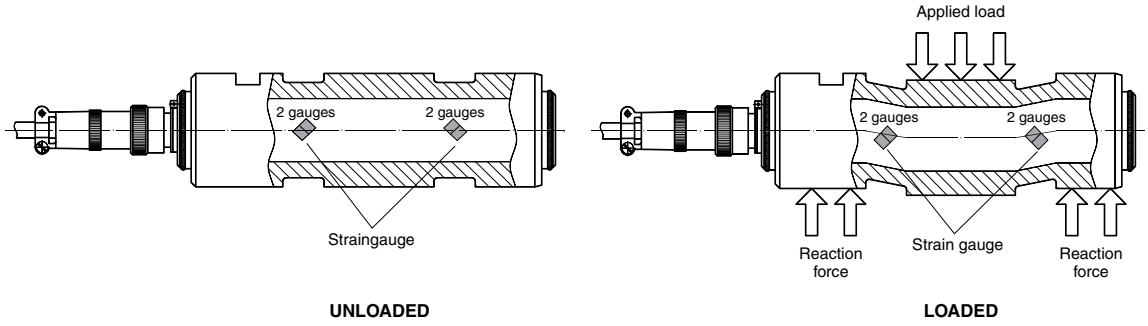


Fig.3–3 Unloaded and loaded LB 230 Series Load Measuring Pin

Note: With their double bridge strain gauges the LB 230 Series Load Measuring Pins are nearly insensitive to transversal or axial loads. This is equally true for excentered loads.

3.3 CHECKING OF THE APPLIED LOAD

3.3.1 LB 210 AND LB 230 SERIES LOAD MEASURING PINS

In order to determine or to check the load applied to an LB 210 or LB 230 Load Measuring Pin, proceed as follows:

1. Determine the sensitivity of the load measuring pin by referring to measuring protocol delivered with the load pin under “Rated output” (for example 0,998 mV/V).
2. Measure the pin's power supply voltage generated by the signal conditioning electronic using a digital voltmeter (for example 10 V DC).
3. At rated load, the signal supplied by the load measuring pin corresponds to the sensitivity value multiplied by the supply voltage (for example 0,998 mV/V × 10 V = 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 × SENSITIVITY

□□ · □□ V × □□ · □□□ mV/V = □□ · □□□ mV

Calculated signal:

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

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

Measured signal: □□ · □□□ mV

Note: This form, which can be copied, should simplify checking the load measuring system. In the case of measurement problems it can also be sent in to the After Sales Service Department at Magtrol

OPERATING PRINCIPLE

3.3.2 LE 210, LE 310 AND LE 510 SERIES LOAD MEASURING PINS

In order to determine or to check the load applied to an LE 210 Load Measuring Pin, proceed as follows:

1. The signal corresponding to the rated load is equal to 16 mA (20 mA–4 mA).
2. Calculate the signal corresponding to the applied load by means of the following formula:

$$\text{Calculated signal [mA]} = \left(\frac{\text{Rated signal [mA]} \times \text{Applied load [kN]}}{\text{Rated load [kN]}} \right) + 4\text{mA}$$

3. By means of a digital milliamperemeter measure the signal corresponding to the load applied.
4. Compare the values of the calculated and measured signals. The difference should not exceed 1 %.

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: _____

Calculated signal:

$$\frac{\text{RATED SIGNAL} \times \text{APPLIED LOAD}}{\text{RATED LOAD}} + 4\text{ mA} =$$

$$\frac{\square\square \cdot \square\square\ \text{mA} \times \square\square \cdot \square\square\ \text{kN}}{\square\square \cdot \square\square\ \text{kN}} + 4\text{ mA} = \square\square \cdot \square\square\ \text{mA}$$

Measured signal: $\square\square \cdot \square\square$ mA

Note: This form, which can be copied, should simplify checking the load measuring system. In the case of measurement problems it can also be sent in to the After Sales Service Department at Magtrol.

3.3.3 LU 210 SERIES LOAD MEASURING PIN

In order to determine or to check the load applied to the LU 210 Load Measuring Pin, proceed as follows:

1. The signal corresponding to the rated load is equal to 10 V.
2. Calculate the signal corresponding to the applied load by means of the following formula:

$$\text{Calculated signal [V]} = \left(\frac{\text{Rated signal [V]} \times \text{Applied load [kN]}}{\text{Rated load [kN]}} \right)$$

3. By means of a digital voltmeter measure the signal corresponding to the load applied.
4. Compare the values of the calculated and measured signals. The difference should not exceed 1 %.

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: _____

Calculated signal:

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

$$\frac{\square\square \cdot \square\square \text{ V} \times \square\square \cdot \square\square \text{ kN}}{\square\square \cdot \square\square \text{ kN}} = \square\square \cdot \square\square \text{ V}$$

Measured signal: $\square\square \cdot \square\square$ V

Note: This form, which can be copied, should simplify checking the load measuring system. In the case of measurement problems it can also be sent in to the After Sales Service Department at Magtrol

3.3.4 B.I.T.E. Test Function for the LE 310 and LE 510 Series

The B.I.T.E. test function of the LE 310 and LE 510 series makes it possible to test each channel separately by simulating a load of 70% of the nominal load. To enable the B.I.T.E. function, you must connect the B.I.T.E. input to the ground and the current output of the load pin will go up to 15.2 mA (= 4 mA + 70% x 16mA). The test signal shall be used only when there is no load acting on the load pin to avoid the indication of an incorrect load signal. It is possible to command the test signal with a programmable logic controller or a push-button. When the B.I.T.E. test function is not needed, you should either connect the B.I.T.E. connection to the + terminal of the power supply or not connect it at all (see Fig.3-4).

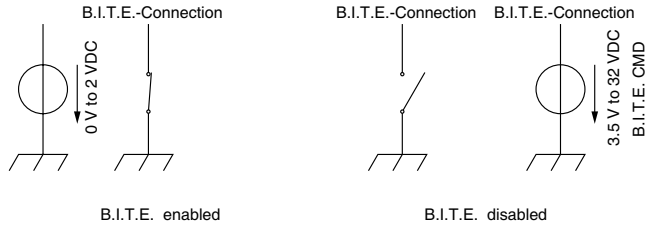


Fig.3–4 Activation/Deactivation of the B.I.T.E. Test Function for the LE 510 Series

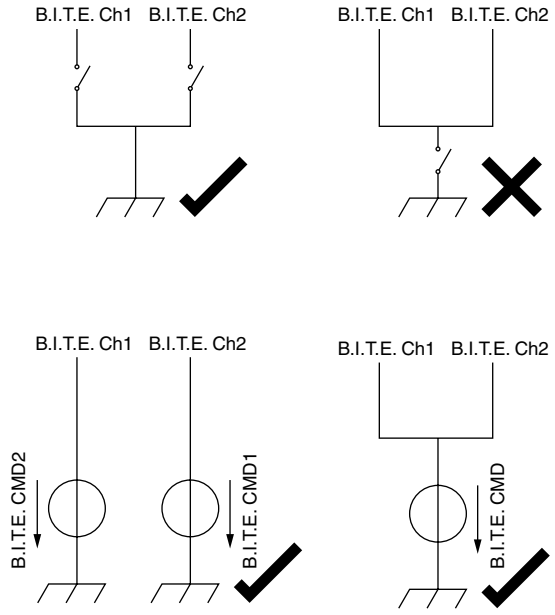


Fig.3–5 Connection of the B.I.T.E. Test Function for the LE 510 Series (dual channel)

4. 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.

Note: The recommendations listed in this chapter should be followed exactly so that the load measuring pin characteristics are guaranteed.This chapter will also demonstate how an incorrect mounting can impair the measurement accuracy of a load measuring pin and consequently diminish the security of the whole installation.

Note: Having been designed according to the EMC (Electro Magnetic Compatibility) directives, the LE 210, LU 210, LE 310 and LE 510 Series Load Measuring Pins with integrated electronics complies with EN 61000-6-2, EN 61326-1 & EN 61326-2-3 EN standard.

4.1 INFLUENCE OF THE PIN'S ORIENTATION

For the LB 210, LB 230, LE 210, LU 210, LE 310 and LE 510 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.

CAUTION: THE TEST REPORT OF OUR STANDARD LOAD PINS WERE CREATED WITH THE PIN HOLDER KEY FACING UPWARDS. IF THE LOAD PIN IS INSTALLED WITH THE PIN HOLDER KEY FACING DOWNWARDS, A SLIGHT VARIATION IN THE SIGNAL WILL BE OBSERVED.

Note: A measurement with an LE 210, LU 210, LE 310 and LE 510 Series Load Measuring Pin mounted upside down will not work, both series have been designed to produce a positive current (LE) or voltage (LU) measurement signal.

When the pin is not optimally positioned (see *figures 4–1 and 4–2*), the measurement signal will be altered accordingly, as follows:

4.1.1 LB 210 AND LB 230 LOAD MEASURING PINS

$$U_{eff} = U_{rated} \cos \varphi$$

where: U_{eff} represents the effective value of the measured signal
U_{rated} represents the rated value of the measured 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}) i.e. 100 % of the full scale value.

for $\varphi = 0°$	$\cos \varphi = 1$	$U_{eff} = U_{rated}$
for $\varphi = 10°$	$\cos \varphi = 0{,}985$	$U_{eff} = 98{,}5\ \%\ U_{rated}$

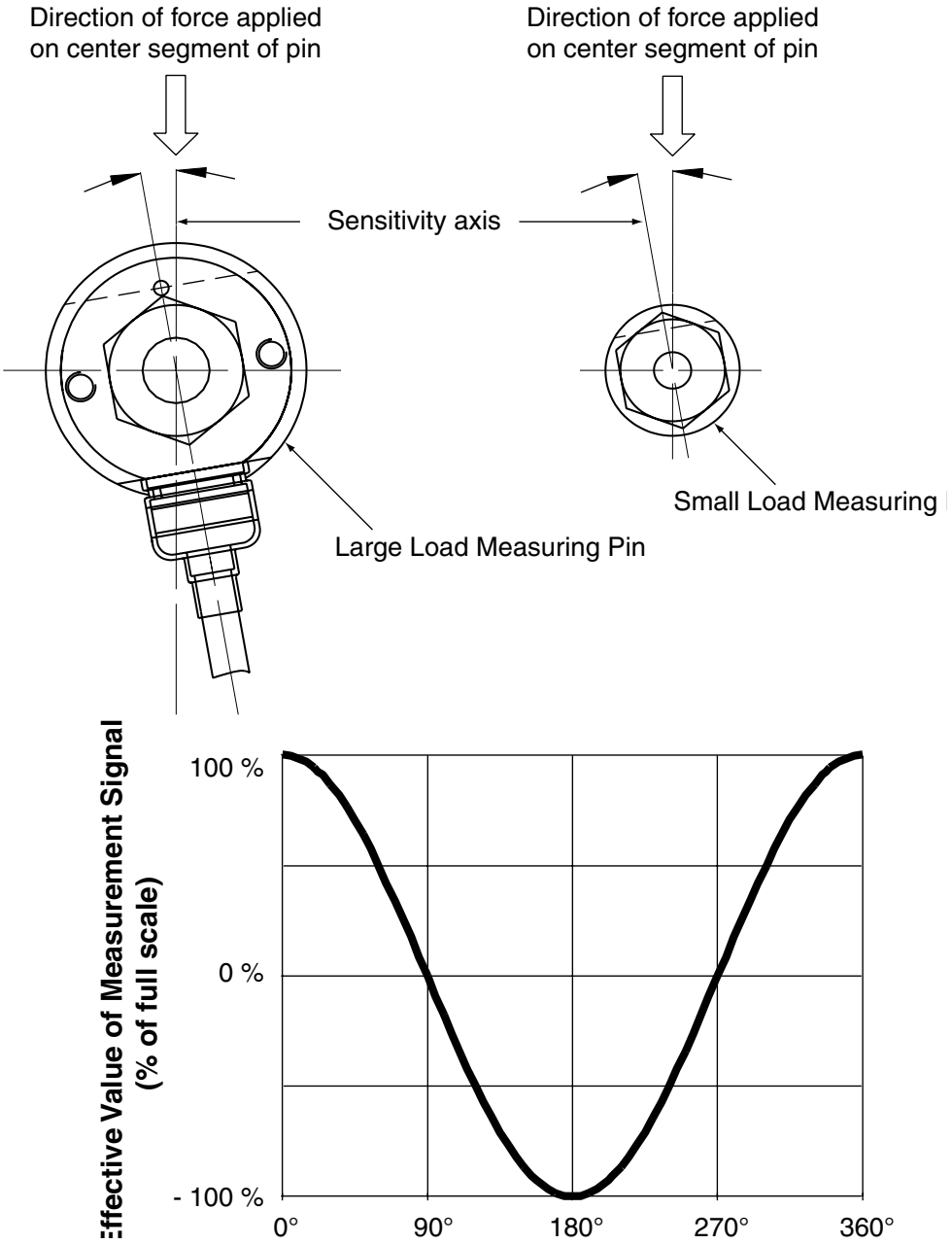


Fig.4–1 Influence of the LB 210 and LB 230 Series Load Measuring Pins' orientation

4.1.2 LE 210, LE 310 AND LE 510 SERIES LOAD MEASURING PINS

$$I_{eff} = I_{rated} \cos \varphi$$

where : I_{eff} represents the effective value of the measured signal
I_{rated} represents the rated value of the measured signal ($I_{rated} = I_{measured}$ - 4 mA)
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 (I_{eff}) i.e. 100 % of the full scale value.

for $\varphi = 0°$	$\cos \varphi = 1$	$I_{eff} = I_{rated}$
for $\varphi = 15°$	$\cos \varphi = 0{,}966$	$I_{eff} = 96{,}6\ \% I_{rated}$

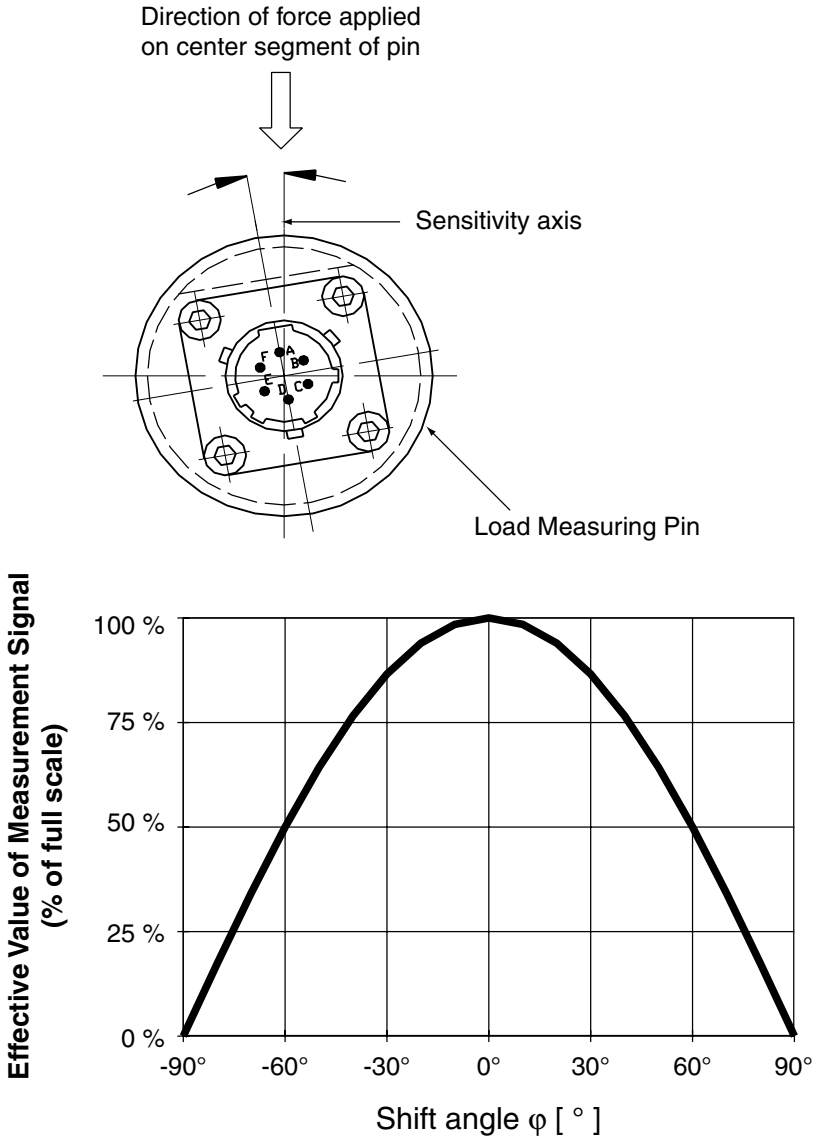


Fig.4–2 Influence of the LE 210, LE 310 and LE 510 Series Load Measuring Pins' orientation

4.1.3 LU 210 SERIES LOAD MEASURING PINS

$$U_{eff} = U_{rated} \cos \varphi$$

where : U_{eff} represents the effective value of the measured signal
U_{rated} represents the rated value of the measured 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}) i.e. 100 % of the full scale value.

for φ = 0°	cos φ = 1	$U_{eff} = U_{rated}$
for φ = 10°	cos φ = 0,985	U_{eff} = 98,5 % U_{rated}

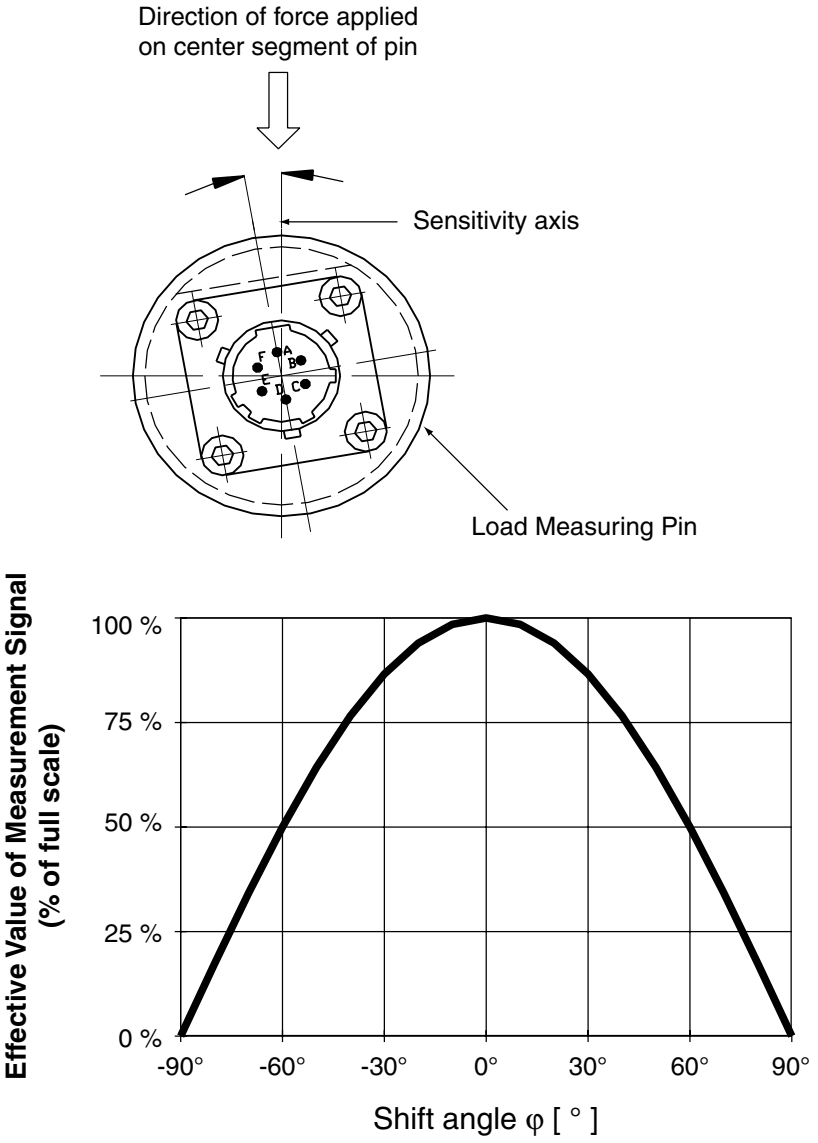


Fig.4–3 Influence of the LU 210 Series Load Measuring Pins' orientation

4.2 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 *Fig.4–4*).

However, applying loads in excess of these limits can result in permanent (plastic) deformation of the load measuring pin, or even cause it to be destroyed. 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 can no longer be guaranteed.

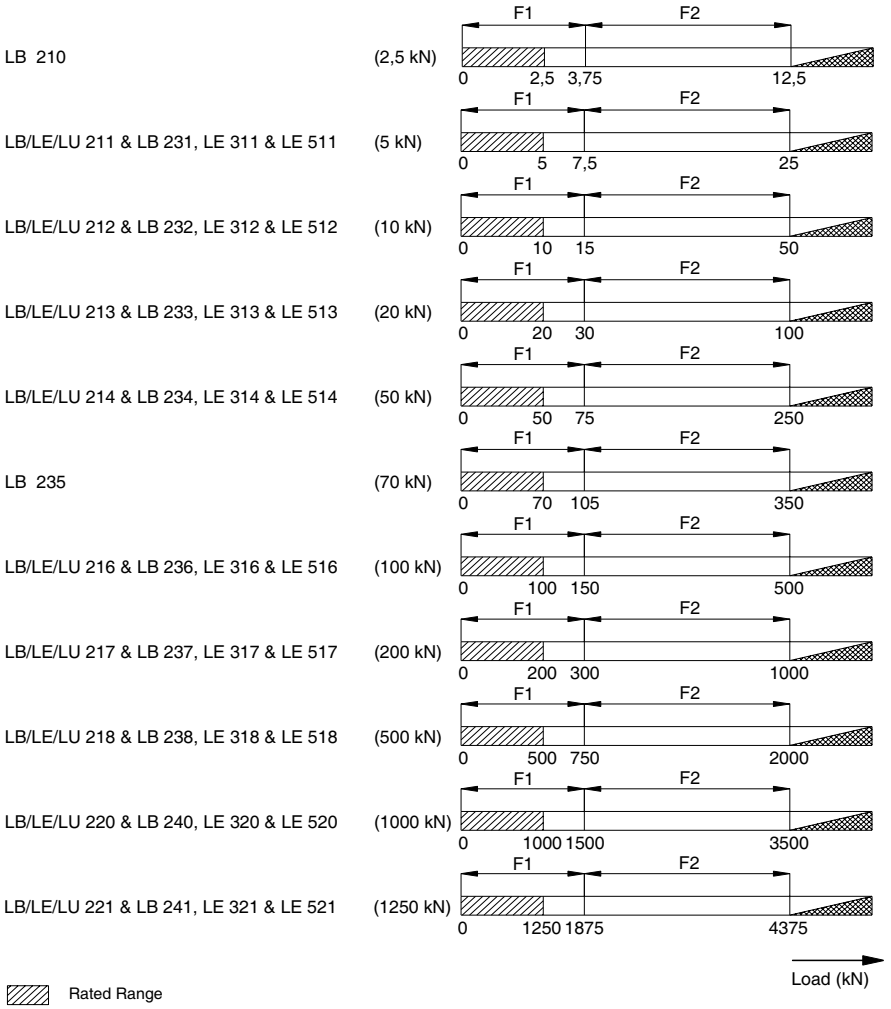


Fig.4–4 Application range of the load measuring pins.

5. Maintenance

5.1 LUBRICATION

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 important. On request Magtrol supplies load measuring pins with an incorporated device for the greasing of gliding surfaces (lubricator is an option on LB 216 - LB 221, LE 216 - LE 221, LU 216 - LU 221, LE 316 - LE 321 and LE 516 - LE 521 Load Measuring Pins).

5.2 CALIBRATION

Recommendations for calibrating (LB 210 and LB 230 Load Measuring Pins) and the checking of measuring current and voltage (LE 210 and LU 210 load measuring pins) and measuring current for LE 210, LE 310 and LE 510.

The most frequently encountered problems when operating load measuring pins are the detachment of the strain gauges or the plastic deformation due to an overload, as well as a torn cable during an incorrect manipulation.

The checking frequency depends on the application or on the maintenance schedule planned for the installation.

6. Troubleshooting

Two different procedures are used for troubleshooting, depending on where the load measuring pin is fitted with an integrated electronics (LE 210 and LU 210 Series) or not (LB 210 and LB 230 Series). The following tables list a number of problems encountered with load pins and the measure to take as a remedy. It is assumed that the installation has been completed.

Note: If none of the following measures show any effect, please contact your Magtrol representative.

6.1 TROUBLESHOOTING ON LB 210 AND LB 230 SERIES LOAD PINS

Problem	Possible cause	Remedy
No supply voltage	Broken transmission line	Check the line and the connections.
Output voltage < 0.000 V	Inversion of the applied load	Check and correct the direction of the applied load.
	Crossing of the power supply or signal cables	Check and correct the cabling.
Output voltage = 0.000 V	Broken transmission line	Check the line and the connections.
	No load	Apply a load of 20% of the rated load.
Error between measured and calculated signal	Difference between the applied effective load and the load used for calculation	Recalculate taking a possible demultiplication (pulley, lever arm, etc.).

6.2 TROUBLESHOOTING ON LE 210 SERIES LOAD PINS

Problem	Possible cause	Remedy
Output current < 4 mA	Calibration error	Send the pin back for calibration.
	Inversion of applied load	Check and correct the direction of the applied load.
Output current = 0 mA	Broken transmission line	Check the line and the connections.
	Defect in the integrated electronics or weighing bridge	Send the pin back for checking and repair.
Output current > 20 mA	Calibration error	Send the pin back for calibration.
	Overload	Check and reduce the applied load.
Output current > 25 mA	Calibration error	Send the pin back for calibration.
	Overload	Check and reduce the applied load.
	Short-circuited transmission line	Check the line and the connections.
	Defect in the integrated electronics	Send the pin back for checking and repair.

Note: The operating range of the integrated electronics is between 3.5 mA and 25 mA for all LE 210 Series Load Measuring Pins.

6.3 TROUBLESHOOTING ON LU 210 SERIES LOAD PINS

Problem	Possible cause	Remedy
Output voltage < 0.000 V	Calibration error	Send the pin back for calibration.
	Broken transmission line	Check the line and the connections.
Output voltage = 0.000 V	Inversion of the applied load	Check and correct the direction of the applied load.
	Defect in the integrated electronics or weighing bridge	Send the pin back for checking and repair.
Output voltage > 10.000 V	Calibration error	Send the pin back for calibration.
	Overload	Check and reduce the applied load.
Output voltage > 10.2 V	Calibration error	Send the pin back for calibration.
	Short-circuited transmission line	Check the line and the connections.
	Defect in the integrated electronics	Send the pin back for checking and repair.

Note: The operating range of the integrated electronics is between 0 V and 10.2 V for all LU 210 Series Load Measuring Pins.

6.4 TROUBLESHOOTING ON LE 310 AND LE 510 SERIES LOAD PINS

Problem	Possible cause	Remedy
Output current < 4 mA	Calibration error	Send the pin back for calibration
	Inversion of applied load	Check and correct the direction of the applied load.
Signal not expected > 4 mA	Calibration error	Send the pin back for calibration.
	Unexpected load in the installation	Remove unwanted load or tare
Output current = 0 mA	Supply voltage below 11.5 VDC	Increase supply voltage > 12 VDC
	Broken or short-circuit transmission line	Check the line and the connections.
	Defect in the integrated electronics or weighing bridge	Send the pin back for check and repair.
B.I.T.E. enabled and output current > 15.2 mA	A small load is already applied on the sensor	Remove all current applied load or take it in account in your calculation.
Output current > 20 mA	Calibration error	Send the pin back for calibration.
	Overload	Check and reduce the applied load.
	B.I.T.E. enabled and load applied	Reduce initial load applied
Output current > 25 mA	Calibration error	Send the pin back for calibration.
	Overload	Check and reduce the applied load.
	Short-circuited transmission line	Check the line and the connections
	Defect in the integrated electronics	Send the pin back for check and repair.
	B.I.T.E. enabled and large load applied	Remove load applied when using B.I.T.E.

Note: The operating range of the integrated electronics is between 3.5 mA and 25 mA for all load pins of the LE 310 and LE 510 series.

Appendix A : OIML Certification

Certain LB 230 (LB 334, LB 235, LB 236 and LB 237) series load measuring pin have been certified by the OIML.

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

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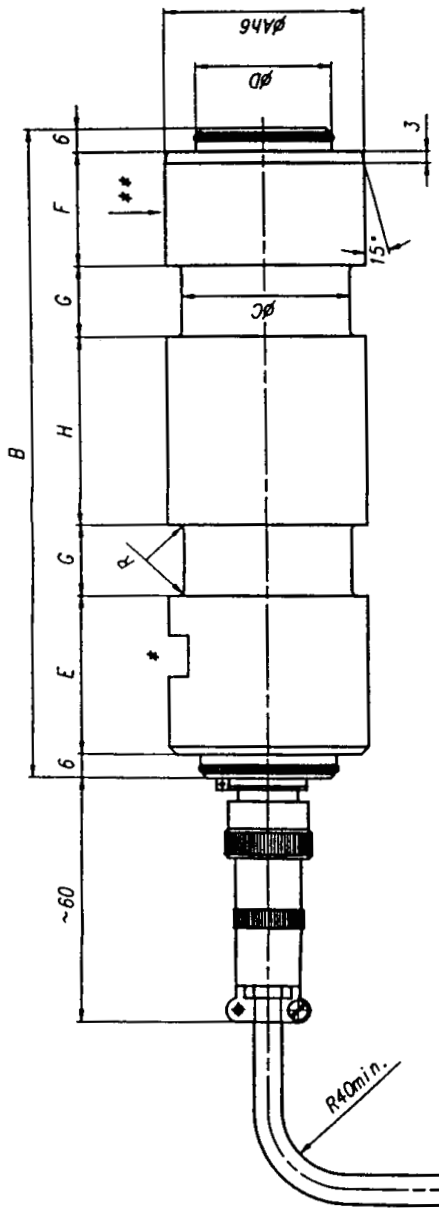
7 92 6000 61021/3

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



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

vibro-meter SWITZERLAND

FBCM N° S 3980 | Scale 1:1 | DWG. N° PZ 5876

Drawn 16.2.93 | Checked 24.2.93 | Appr. 25.2.93

Material: Antinit KMB Nr. 1.4057 780÷930 N/mm² | Finish: X-X

Tolerances: ± mm to 60 mm: ± mm over 60 mm

Rev | Date | Drawn | Appr | Rept. by: | Rept. for:

LOAD MEASURING PIN

P/N: 122-23X-000-021 | TYPE: LB 234 ÷ 237

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APPENDIX

Service Information

RETURNING MAGTROL EQUIPMENT FOR REPAIR AND/OR CALIBRATION

Before returning equipment to Magtrol for repair and/or calibration, please visit Magtrol's Web site at http://www.magtrol.com/support/rma.htm to begin the Return Material Authorization (RMA) process. Depending on where the equipment is located and which unit(s) will be returned, you will be directed to either ship your equipment back to Magtrol, Inc. in the United States or Magtrol SA in Switzerland.

Returning Equipment to Magtrol, Inc. (United States)

When returning equipment to Magtrol, Inc.'s factory in the United States for repair and/or calibration, a completed Return Material Authorization (RMA) form is required.

1. Visit Magtrol's Web site at http://www.magtrol.com/support/rma.htm to begin the RMA process.
2. Complete the RMA form online and submit.
3. An RMA number will be issued to you via e-mail. Include this number on all return documentation.
4. Ship your equipment to:
   MAGTROL, INC.
   70 Gardenville Parkway
   Buffalo, NY 14224
   Attn: Repair Department
5. After Magtrol's Repair Department receives and analyzes your equipment, a quotation listing all the necessary parts and labor costs, if any, will be faxed or e-mailed to you.
6. After receiving your repair estimate, provide Magtrol with a P.O. number as soon as possible. A purchase order confirming the cost quoted is required before your equipment can be returned.

Returning Equipment to Magtrol SA (Switzerland)

If you are directed to ship your equipment to Switzerland, no RMA form/number is required. Just send your equipment directly to Magtrol SA in Switzerland and follow these shipment instructions:

1. Ship your equipment to:
   MAGTROL SA
   After Sales Service
   Route de Montena 77
   1728 Rossens / Fribourg
   Switzerland
   VAT No: 485 572
2. Please use our forwarder : TNT • 1-800-558-5555 • Account No 154033
   Only ship ECONOMIC way (3 days max. within Europe)
3. Include the following documents with your equipment:
   - Delivery note with Magtrol SA's address (as listed above)
   - Three pro forma invoices with:
     - Your VAT number
     - Description of returned goods
     - Noticed failures
     - Value - for customs purposes only
     - Origin of the goods (in general, Switzerland)
4. A cost estimate for repair will be sent to you as soon as the goods have been analyzed. If the repair charges do not exceed 25% the price of a new unit, the repair or calibration will be completed without requiring prior customer authorization.

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Subsidiaries in:
Germany • France
China • India

Worldwide Network
of Sales Agents

ISO 9001
BUREAU VERITAS
Certification