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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.

Chapter 7: SERVICES INFORMATION – Informations, contact and adresse relative for repair and/or calibration

CONVENTIONS USED IN THIS MANUAL

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

**NOTICE**
Indicates information considered important but not hazard related.
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**
Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
This is also 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**
Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
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.

**DANGER**
Indicates a hazardous situation that, if not avoided, will result in death or serious injury. The signal word "DANGER" is to be limited to the most extreme situations.
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.

The safety symbol may subsequently vary depending on the source of the hazard. Here below are examples:

![Safety Pictograms](image-url)

Fig.A-1 Various safety pictograms according to ISO 7010
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
- LB 231 - LB 241: enhanced models for use in hostile environments
- LE 2XX Series: models with calibrated current output.
- LE 4XX Series: models with calibrated current output and B.I.T.E monitoring.
- LE 6XX Series: models with redundant calibrated current output and B.I.T.E monitoring.

1.2 SEMANTIC

In this manual, often different terminologies are used to speak about the “Load Measuring Pins”. The primary purpose is to make this user manual useful and easily readable. Below are the different terminologies used: “Load Measuring Pin” and “Load Pin” are synonyms; “LX XXX Series” is an abbreviation for “LX XXX Series Load Measuring Pins”, etc. The term “Series” stand for all the products of the series (e.g. LE 4XX Series refers to LE 410 to LE 421).
1.3 DATASHEETS

1.3.1 LB SERIES - LOAD MEASURING PINS

**LB SERIES LOAD MEASURING PINS**

LB Series 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.

**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.
- 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.
- High reliability for strict safety requirements.

**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 LB2XX Series Load Pins are rugged with high resistance stainless steel and tight construction, designed specifically for use in harsh industrial environments. Available in several 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.

**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. LB2XX 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. Moreover it is an ideally transducer to detect and measure forces in harsh, tropical, offshore, marine and harbor environments.
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 (double full-bridge for LB 23X models). The positioning and orientation of the strain gauges have 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.

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, this amplifier allows the monitoring of several levels.

SYSTEM CONFIGURATION

![Diagram of system configuration]

- LB Series: Load Measuring Pin
- LMU Series: Load Monitor Unit
- AN Series: Load Monitor / Signal Conditioner / Display
- PLC - Programmable Logic Controller (not provided by MAGTROL)
- GAD Series: Large Digital Display
TECHNICAL DATA - LB 21X SERIES

STANDARD VERSION a) |
<table>
<thead>
<tr>
<th>LB 210</th>
<th>LB 211</th>
<th>LB 212</th>
<th>LB 213</th>
<th>LB 214</th>
<th>LB 216</th>
<th>LB 217</th>
<th>LB 218</th>
<th>LB 220</th>
<th>LB 221</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Load (NL) (Metric) b)</td>
<td>2.5 kN</td>
<td>5 kN</td>
<td>10 kN</td>
<td>20 kN</td>
<td>50 kN</td>
<td>100 kN</td>
<td>200 kN</td>
<td>500 kN</td>
<td>1 000 kN</td>
</tr>
<tr>
<td>Nominal Load (NL) (US) b)</td>
<td>0.28 tf</td>
<td>0.56 tf</td>
<td>1.12 tf</td>
<td>2.25 tf</td>
<td>5.62 tf</td>
<td>11.24 tf</td>
<td>22.48 tf</td>
<td>56.2 tf</td>
<td>112.4 tf</td>
</tr>
<tr>
<td>Overload Admissible (% of NL)</td>
<td>150 % (of nominal load without influence on measurement)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload at Rupture (% of NL)</td>
<td>&gt; 500 %</td>
<td>400 %</td>
<td>300 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-linearity Error b)</td>
<td>&lt; 0.25 %</td>
<td>&lt; 0.5 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-linearity + Hysteresis Error b)</td>
<td>&lt; 0.5 %</td>
<td>&lt; 0.8 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability b)</td>
<td>± 0.1 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL CHARACTERISTICS & ENVIRONMENT

- Operating Principle: Full-bridge strain gauge
- Material: Stainless steel 1.4057
- Lubrication: Not available
- Oiler ø4 DIN 3405 D or M10 DIN 3405 A
- Operating Temperature: -25 °C to + 80 °C
- Storage Temperature: -55 °C to + 125 °C
- Temperature Influence on Zero: ± 0.02 % / K
- Temperature Influence on Sensitivity: ± 0.02 % / K
- Fit: G7 / h6
- Angle influence on signal output c) According to the cosine function
- Protection Class: IP 66 according to DIN 60529

ELECTRICAL CHARACTERISTICS & CONNECTIONS

- Bridge Impedance Input: 400 Ω
- Bridge Impedance Output: 350 Ω
- Power Supply: 5 to 12 VDC/AC
- Zero Adjustment b) ± 1 %
- Transducer Sensitivities
  - 0.5 mV/V ± 3 %
  - 1 mV/V ± 3 %
  - 1.8 mV/V ± 3 %
- Output: Integrated 3 m, 6 m, 12 m or 20 m cable Radox K-414 (standard) e)
- PG Output: Axial, with heat-shrinkable sleeve
  - Radial, with heat-shrinkable sleeve (standard)
  - Axial, with heat-shrinkable sleeve (optional)
- Wiring Colors
  - Supply + : red
  - Supply - : blue
  - Signal + : white
  - Signal - : green
  - Case / Shield : black
- Output Connector (Optional): Not available
  - Radial, connector: Souriau 85102 E 106 P50
- Connection Cable Assembly (Optional): Not available
  - 3 m, 6 m, 12 m or 20 m cable with axial or 90° connector d,e)

a) Rating apply to standard load pins only, special models available on request.
b) Of full scale.
c) Variation of the measuring signal due to the angle positioning.
e) Other longer cables lengths available on request.
DIMENSIONS LB21X SERIES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>units</th>
<th>ØA</th>
<th>B</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>WEIGHT</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB210-13</td>
<td>mm</td>
<td>25</td>
<td>h6</td>
<td>84</td>
<td>18</td>
<td>16</td>
<td>10</td>
<td>7</td>
<td>24</td>
<td>5.2</td>
<td>9</td>
<td>N/A</td>
<td>N/A</td>
<td>0.2 kg</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>0.984</td>
<td>3.307</td>
<td>0.709</td>
<td>0.63</td>
<td>0.394</td>
<td>0.276</td>
<td>0.945</td>
<td>0.205</td>
<td>0.354</td>
<td>N/A</td>
<td>N/A</td>
<td>0.441 lb</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>LB214</td>
<td>mm</td>
<td>35</td>
<td>h6</td>
<td>112</td>
<td>25</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>35</td>
<td>6.3</td>
<td>11.5</td>
<td>N/A</td>
<td>N/A</td>
<td>0.65 kg</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>1.378</td>
<td>4.409</td>
<td>0.984</td>
<td>0.551</td>
<td>0.472</td>
<td>0.472</td>
<td>1.378</td>
<td>0.248</td>
<td>0.453</td>
<td>N/A</td>
<td>N/A</td>
<td>1.433 lb</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>LB216</td>
<td>mm</td>
<td>50</td>
<td>h6</td>
<td>161</td>
<td>32</td>
<td>24</td>
<td>18</td>
<td>18</td>
<td>48</td>
<td>10.5</td>
<td>20</td>
<td>N/A</td>
<td>N/A</td>
<td>2.15 kg</td>
<td>21.5</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>1.969</td>
<td>6.339</td>
<td>1.26</td>
<td>0.945</td>
<td>0.709</td>
<td>0.709</td>
<td>1.89</td>
<td>0.413</td>
<td>0.787</td>
<td>N/A</td>
<td>N/A</td>
<td>4.409 lb</td>
<td>21.5</td>
<td></td>
</tr>
<tr>
<td>LB217</td>
<td>mm</td>
<td>65</td>
<td>h6</td>
<td>196</td>
<td>32</td>
<td>26</td>
<td>20</td>
<td>25</td>
<td>65</td>
<td>10.5</td>
<td>22.5</td>
<td>N/A</td>
<td>N/A</td>
<td>28.5 kg</td>
<td>28.5</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>2.559</td>
<td>7.717</td>
<td>1.26</td>
<td>1.024</td>
<td>0.787</td>
<td>0.984</td>
<td>2.559</td>
<td>0.413</td>
<td>0.886</td>
<td>N/A</td>
<td>N/A</td>
<td>7.900 lb</td>
<td>28.5</td>
<td></td>
</tr>
<tr>
<td>LB218</td>
<td>mm</td>
<td>85</td>
<td>h6</td>
<td>258</td>
<td>34</td>
<td>39</td>
<td>35</td>
<td>28</td>
<td>89</td>
<td>10.5</td>
<td>28</td>
<td>32</td>
<td>M6</td>
<td>35</td>
<td>10.6 lb</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>3.347</td>
<td>10.158</td>
<td>1.339</td>
<td>1.535</td>
<td>1.378</td>
<td>1.102</td>
<td>3.504</td>
<td>0.413</td>
<td>1.102</td>
<td>1.260</td>
<td>M6</td>
<td>1.378</td>
<td>23.369 lb</td>
<td></td>
</tr>
<tr>
<td>LB220</td>
<td>mm</td>
<td>100</td>
<td>h6</td>
<td>347</td>
<td>36</td>
<td>61</td>
<td>55</td>
<td>35</td>
<td>120</td>
<td>10.5</td>
<td>36</td>
<td>35</td>
<td>M8</td>
<td>45</td>
<td>19.2 lb</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>3.937</td>
<td>13.661</td>
<td>1.417</td>
<td>2.402</td>
<td>2.165</td>
<td>1.378</td>
<td>4.724</td>
<td>0.413</td>
<td>1.417</td>
<td>1.378</td>
<td>M8</td>
<td>1.772</td>
<td>42.328 lb</td>
<td></td>
</tr>
<tr>
<td>LB221</td>
<td>mm</td>
<td>120</td>
<td>h6</td>
<td>347</td>
<td>36</td>
<td>61</td>
<td>55</td>
<td>35</td>
<td>120</td>
<td>12.5</td>
<td>40</td>
<td>35</td>
<td>M8</td>
<td>45</td>
<td>28.4 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>4.724</td>
<td>13.661</td>
<td>1.417</td>
<td>2.402</td>
<td>2.165</td>
<td>1.378</td>
<td>4.724</td>
<td>0.492</td>
<td>1.575</td>
<td>1.378</td>
<td>M8</td>
<td>1.772</td>
<td>62.611 lb</td>
<td></td>
</tr>
</tbody>
</table>

a) Oiler ø4 DIN 3405D or M10 DIN 3405A

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

NOTE: 3D STEP files of most of our products are available on our website: www.magtrol.com; other files are available on request.
TECHNICAL DATA - LB 23X SERIES

--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---
Nominal Load (Metric) b) | 5 kN | 10 kN | 20 kN | 50 kN | 70 kN | 100 kN | 200 kN | 500 kN | 1000 kN | 1250 kN
Nominal Load (US) b) | 0.28 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 (% of NL) | 150 % of rated load without influence on measurement
Overload at Rupture (of rated load) | > 500 % | 400 % | 300 %
Non-linearity Error b) | < 0.25 %
Non-linearity + Hysteresis Error b) | < 0.4 %
Repeatability b) | ± 0.1 %

MECHANICAL CHARACTERISTICS & ENVIRONMENT

Operating Principle | Double full-bridge strain gauge
Material | Stainless steel 1.4057
Operating Temperature | -25 °C to + 80 °C
Storage Temperature | -55 °C to + 125 °C
Temperature Influence on Zero b) | ± 0.02 % / K
Temperature Influence on Sensitivity | ± 0.02 % / K
Fit | G7 / h6
Angle influence on signal output c) | According to the cosine function
Protection Class | IP 67 according to DIN 60529

SAFETY STANDARDS

OIML Class | Not available | R60 D0.1 | Not available

ELECTRICAL CHARACTERISTICS & CONNECTIONS

Bridge Impedance Input | 800 Ω
Bridge Impedance Output | 700 Ω
Power Supply | 5 to 12 V DC/AC
Zero Adjustment b) | ± 1 %
Transducer Sensitivities | 0.5 mV/V ± 3 % | 1 mV/V ± 3 % | 1.8 mV/V ± 3 %
Output Connector | Axial connector, Souriau 8525 IH 10B06 PNH
Connection Cable Assembly (option) | 3m, 6m, 12m or 20m cable with axial or 90° connector d,e)
Wiring Colors |

a) Rating apply to standard load pins only, special models available on request.
b) Of full scale.
c) Variation of the measuring signal due to the angle positioning.
e) Other longer cables lengths available on request.
DIMENSIONS LB 23X SERIES

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

<table>
<thead>
<tr>
<th>MODEL</th>
<th>UNITS</th>
<th>Ø A</th>
<th>B</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB 231-234</td>
<td>mm</td>
<td>25</td>
<td>86</td>
<td>16</td>
<td>14</td>
<td>10</td>
<td>7</td>
<td>24</td>
<td>5.2</td>
<td>9</td>
<td>N/A</td>
<td>3</td>
<td>0.2 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>0.984</td>
<td>3.386</td>
<td>0.630</td>
<td>0.551</td>
<td>0.394</td>
<td>0.276</td>
<td>0.945</td>
<td>0.205</td>
<td>0.354</td>
<td>N/A</td>
<td>0.118</td>
<td>0.441 lb</td>
</tr>
<tr>
<td>LB 235</td>
<td>mm</td>
<td>45</td>
<td>196</td>
<td>15</td>
<td>41</td>
<td>14</td>
<td>12</td>
<td>88</td>
<td>8.5</td>
<td>16</td>
<td>N/A</td>
<td>6</td>
<td>1.8 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>1.772</td>
<td>7.717</td>
<td>0.591</td>
<td>1.614</td>
<td>0.551</td>
<td>0.472</td>
<td>3.465</td>
<td>0.335</td>
<td>0.630</td>
<td>N/A</td>
<td>0.236</td>
<td>3.968 lb</td>
</tr>
<tr>
<td>LB 236</td>
<td>mm</td>
<td>50</td>
<td>165</td>
<td>28</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>48</td>
<td>10.5</td>
<td>20</td>
<td>N/A</td>
<td>6</td>
<td>2 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>1.969</td>
<td>6.496</td>
<td>1.102</td>
<td>0.787</td>
<td>0.709</td>
<td>0.709</td>
<td>1.890</td>
<td>0.413</td>
<td>0.787</td>
<td>N/A</td>
<td>0.236</td>
<td>4.409 lb</td>
</tr>
<tr>
<td>LB 237</td>
<td>mm</td>
<td>65</td>
<td>200</td>
<td>28</td>
<td>22</td>
<td>20</td>
<td>25</td>
<td>65</td>
<td>10.5</td>
<td>22.5</td>
<td>N/A</td>
<td>6</td>
<td>4.4 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>2.559</td>
<td>7.874</td>
<td>1.102</td>
<td>0.866</td>
<td>0.787</td>
<td>0.984</td>
<td>2.559</td>
<td>0.413</td>
<td>0.886</td>
<td>N/A</td>
<td>0.236</td>
<td>9.700 lb</td>
</tr>
<tr>
<td>LB 238</td>
<td>mm</td>
<td>85</td>
<td>262</td>
<td>30</td>
<td>35</td>
<td>35</td>
<td>28</td>
<td>89</td>
<td>10.5</td>
<td>28</td>
<td>M6</td>
<td>6</td>
<td>10.6 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>3.346</td>
<td>10.315</td>
<td>1.181</td>
<td>1.378</td>
<td>1.378</td>
<td>1.102</td>
<td>3.504</td>
<td>0.413</td>
<td>1.102</td>
<td>0.984</td>
<td>0.236</td>
<td>23.369 lb</td>
</tr>
<tr>
<td>LB 240</td>
<td>mm</td>
<td>100</td>
<td>351</td>
<td>30</td>
<td>55</td>
<td>55</td>
<td>35</td>
<td>120</td>
<td>10.5</td>
<td>36</td>
<td>35</td>
<td>8</td>
<td>19.2 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>3.937</td>
<td>13.819</td>
<td>1.181</td>
<td>2.165</td>
<td>2.165</td>
<td>1.378</td>
<td>4.724</td>
<td>0.413</td>
<td>1.417</td>
<td>1.378</td>
<td>0.315</td>
<td>42.329 lb</td>
</tr>
<tr>
<td>LB 241</td>
<td>mm</td>
<td>120</td>
<td>351</td>
<td>30</td>
<td>55</td>
<td>55</td>
<td>35</td>
<td>120</td>
<td>12.5</td>
<td>40</td>
<td>35</td>
<td>8</td>
<td>28.4 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>4.724</td>
<td>13.819</td>
<td>1.181</td>
<td>2.165</td>
<td>2.165</td>
<td>1.378</td>
<td>4.724</td>
<td>0.492</td>
<td>1.575</td>
<td>1.378</td>
<td>0.315</td>
<td>62.611 lb</td>
</tr>
</tbody>
</table>

NOTE: 3D STEP files of most of our products are available on our website: www.magtrol.com; other files are available on request.
**ACCESSORIES LB 2XX SERIES**

**CABLE ASSEMBLIES**

- Cable with axial connector
- Cable with 90° connector

**PIN CONFIGURATION**

<table>
<thead>
<tr>
<th>Power Supply +</th>
<th>red</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply -</td>
<td>blue</td>
<td>B</td>
</tr>
<tr>
<td>Signal +</td>
<td>white</td>
<td>C</td>
</tr>
<tr>
<td>Signal -</td>
<td>green</td>
<td>D</td>
</tr>
<tr>
<td>Case</td>
<td>black</td>
<td>E</td>
</tr>
</tbody>
</table>

*Fig. 6: LB 216
Fig. 7: LB 237
Fig. 8: LB 218/221*

a) 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).

**CABLE ASSEMBLY ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>ORDERING NUMBER</th>
<th>EH 13 / 0 X</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Axial connector</td>
</tr>
<tr>
<td>9</td>
<td>90° connector</td>
</tr>
<tr>
<td>1</td>
<td>Cable length 3m</td>
</tr>
<tr>
<td>2</td>
<td>Cable length 6m</td>
</tr>
<tr>
<td>3</td>
<td>Cable length 12m</td>
</tr>
<tr>
<td>4</td>
<td>Cable length 20m a)</td>
</tr>
</tbody>
</table>

a) Other longer cable lengths available on request.

**COUNTER CONNECTOR**

<table>
<thead>
<tr>
<th>Axial connector</th>
<th>PN 957-11-08-0030</th>
</tr>
</thead>
<tbody>
<tr>
<td>90° connector</td>
<td>PN 957-11-08-0029</td>
</tr>
</tbody>
</table>

**ORDERING INFORMATION LB 21X SERIES**

**STANDARD MODEL / ORDERING NUMBER**

<table>
<thead>
<tr>
<th>LB 2 _ _ / 0 0 _</th>
</tr>
</thead>
<tbody>
<tr>
<td>10, 11, ..., 13</td>
</tr>
<tr>
<td>14, 16, ..., 21</td>
</tr>
</tbody>
</table>

**OPTIONAL MODEL / ORDERING NUMBER**

<table>
<thead>
<tr>
<th>LB 2 _ _ / _ _ _</th>
</tr>
</thead>
<tbody>
<tr>
<td>14, 16, ..., 21</td>
</tr>
</tbody>
</table>

0: Without Lubrication (standard)
1: With Lubrication (available only on LB 216-221)

Electrical Connection:

- 0: PG Radial (standard)
- 1: PG Axial
- 2: Radial Connector

Connection cable:

- 0: Connector (axial or radial)
- 1: Cable length 3m
- 2: Cable length 6m
- 3: Cable length 12m
- 4: Cable length 20m a)

Example: LB 218 Load Measuring Pin (Optional Model) with lubrication, PG Axial and 6m cable would be ordered as follows: LB 218/112.

LB 212 Load Measuring Pin (Standard Model) with 3m cable would be ordered as follows: LB 212/001.

**ORDERING INFORMATION LB 23X SERIES**

<table>
<thead>
<tr>
<th>ORDERING NUMBER</th>
<th>LB 2 _ _ / XXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>31, 32, ..., 41</td>
<td>Model LB 23X</td>
</tr>
</tbody>
</table>

Example: LB 237 Load Measuring Pin would be ordered as follows: LB 237/XXX.
**SYSTEM OPTIONS & ACCESSORIES**

**MB-02 SERIES - MINIATURE LOAD PINS**

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 MB-02 Series Miniature Load Pins are rugged with high resistance stainless steel and tight construction, designed specifically for use in harsh industrial environments.

The compact design as well as the high protection class give this sensor an excellent aptitude for the measurement and monitoring of forces and overloads on mechanical compact applications, as well as in harsh environments.

**AN SERIES - LOAD MONITOR DISPLAY WITH INTEGRATED SIGNAL CONDITIONER**

The AN 1500M Load Monitor is designed to process and display signals coming from various types of transducers (weight, load, pressure, torque, etc.) that use standard strain-gauge bridges.

The basic instrument is a soldered assembly composed of a main board, a tri-color programmable display and a power circuit. Standard features include the reading of the input variable as well as remote hold, reading and memorization of max and min values (peak / valley), tare and reset function.

**LMU SERIES - LOAD MONITORING UNIT**

Magtrol's Load Monitoring Units are used for measuring load, force and weight from signals generated by strain gauge transducers. Specifically designed for use with Magtrol's Load Measuring Pins and Load-Force-Weight Sensors, the LMU Series provides excitation voltage while conditioning the bridge output signal.

Each unit contains DIP-switches and jumpers for greater flexibility and complete adaptability. User-defined alarm limits can be configured into the unit, which when combined with our sensors, provides a safe and rugged measurement system that continuously monitors for short-circuits and interrupted signal lines. Magtrol LMUs are specially designed for use in harsh environments and are suitable for crane security systems.

**GAD SERIES - LARGE DIGITAL DISPLAYS**

These high quality, large character digital displays can be used for crane weight display, process weight display, and all other remote weighing applications. They use microprocessor based technology for high reliability and have a non-volatile memory to store all the calibration data.

Magtrol Large Digital Displays are used with Load Monitoring Units (LMUs) or signal conditioners (AN Series), as part of a complete measurement system. Magtrol load measuring pins, which measure load and force to provide overload protection, are available for a wide range of Load-Force-Weight, and in various executions and accuracy classes. Combined, these products constitute an ideal safe measurement system for continuous overload monitoring.
1.3.2 LE SERIES - LOAD MEASURING PINS

LE SERIES
LOAD MEASURING PINS

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. Ideal for use on Safety Applications according to ECE-R10, ISO 13849-1 : CAT4 & PLe and IEC 62061 : SIL3 (LE 6XX SERIES); ISO 13849-1 : CAT2 & PLd and IEC 62061 : SIL2 (LE 4XX SERIES).

FEATURES

- Temperature-compensated transducers with strain gauges in full-bridge configuration. On request, available with double bridge redundant.
- Available in several standard ranges from 2.5 kN to 1250 kN (0.28 tf to 140.5 tf).
- Electronics for transmission over great distances:
  - 2 wires (LE 2XX) 4-20 mA
  - 3 wires (LE 4XX) 4-20 mA
  - 6 wires (LE 6XX) available with dual channels 4-20 mA
- Built-in test equipment (B.I.T.E.) included on LE 4XX Series & LE 6XX Series.
- Complies with Safety Standards ISO 13849-1 and IEC 62061.
- EMC execution for reliable trouble-free operation.
- Rugged design corresponding to the quality characteristics of LB 2XX 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: 4-20 mA.

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 Series Load Measuring Pins are rugged with high resistance stainless steel and tight construction. Available in several standard ranges from 2.5 kN to 1250 kN, their operation remains trouble-free and reliable even in electromagnetically difficult environmental conditions.

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 Series Load Measuring Pins are used for measuring loads and overload protection on cranes, hoisting gear, elevators and winches. The integrated electronics makes them ideal for applications in which separate signal conditioning is difficult to install and where the monitoring electronics are positioned at extended distances.
DESIGN
Magtrol's Load Measuring Pins have two 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).

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 output. Based on SMD (Surface Mounted Device) technology, the electronics are well-protected against conducted and radiated electromagnetic fields.

SYSTEM CONFIGURATION
![Diagram of system configuration]

- **LE Series**
  - Load Measuring Pin
- **AN Series**
  - Load Monitor Display
- **PLC Programmable Logic Controller**
  - (not provided by MAGTROL)
- **GAD Series**
  - Large Digital Display
**TECHNICAL DATA - LE 4XX SERIES**

**LOAD MEASURING**

<table>
<thead>
<tr>
<th>LE410</th>
<th>LE411</th>
<th>LE412</th>
<th>LE413</th>
<th>LE414</th>
<th>LE416</th>
<th>LE417</th>
<th>LE418</th>
<th>LE420</th>
<th>LE421</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Load (Metric)</td>
<td>2.5 kN</td>
<td>5 kN</td>
<td>10 kN</td>
<td>20 kN</td>
<td>50 kN</td>
<td>100 kN</td>
<td>200 kN</td>
<td>500 kN</td>
<td>1000 kN</td>
</tr>
<tr>
<td>Nominal Load (US)</td>
<td>0.28 tf</td>
<td>0.56 tf</td>
<td>1.12 tf</td>
<td>2.25 tf</td>
<td>5.62 tf</td>
<td>11.24 tf</td>
<td>22.48 tf</td>
<td>56.2 tf</td>
<td>112.4 tf</td>
</tr>
<tr>
<td>Overload Admissible (% of NL)</td>
<td>150 % (of rated load without influence on measurement)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload at Rupture (% of NL)</td>
<td>≥ 500 %</td>
<td>400 %</td>
<td>300 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-linearity Error</td>
<td>&lt; 0.25 %</td>
<td>&lt; 0.5 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-linearity + Hysteresis Error</td>
<td>&lt; 0.5 %</td>
<td>&lt; 0.8 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>± 0.1 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Calibration</td>
<td>4 mA - 20 mA corresponds to 0 kN - Full Scale Defection in kN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MECHANICAL CHARACTERISTICS & ENVIRONMENT**

- Technology: Full-bridge strain gauge
- Material: Stainless steel 1.4057
- Lubrication: Not available, Oiler ø4 DIN 3405 D or M10 DIN 3405 A
- Operating Temperature: -25 °C to + 80 °C
- Storage Temperature: -30 °C to + 90 °C
- Temperature Influence on Zero: ± 0.02 % / K
- Temperature Influence on Sensitivity: ± 0.02 % / K
- Long Term Stability of Zero: < 1 % / year (not cumulative)
- Long Term Stability of Sensitivity: < 0.5 % / year (not cumulative)
- EMC: According to EN61326-1, EN61326-2-3 | ECE-R10
- Angle influence on signal output: According to the cosine function
- Protection Class: IP66 (connected) according to EN60529

**SAFETY STANDARDS & B.I.T.E.**

- Safety Standards: ISO13849-1 : CAT2 and PLd | IEC62061 : SIL 2
- Type of B.I.T.E. input: Active low, compatible with switch, relay, open collector or open drain, 1 B.I.T.E. input for each channel
- Effect on the output: Addition of 70 % (± 10 %) of the nominal load in standard (other % in option)

**ELECTRICAL CHARACTERISTICS & CONNECTIONS**

- Strain Gauge Bridge Impedance: 350 Ω
- Power Supply: 19 to 32 VDC (with protected polarity reversal)
- Output Signal: Rated 4 to 20 mA; max. 0.5 to 22 mA
- Load Resistance: Admissible resistance of 3-wire circuit at connection of LE 4XX series
- Output: Integrated 3m, 6m, 12m or 20m, cable Radox K-414 (standard) or axial connector HUMMEL M16
- Configuration: 3-wires
- Optional Connection Cable Assembly: 3 m, 6 m, 12 m or 20 m cable with connector HUMMEL M16 female

---

a) Rating apply to standard load pins only, special models available on request.
b) Full scale.
c) Variation of the measuring signal due to the angle positioning.
d) Other longer cables lengths available on request.
e) When the counter-connector is connected
TECHNICAL DATA - LE 4XX SERIES

<table>
<thead>
<tr>
<th>LOAD MEASURING</th>
<th>LE 610</th>
<th>LE 611</th>
<th>LE 612</th>
<th>LE 613</th>
<th>LE 614</th>
<th>LE 616</th>
<th>LE 617</th>
<th>LE 618</th>
<th>LE 620</th>
<th>LE 621</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Load (NL) (Metric)</td>
<td>2.5 kN</td>
<td>5 kN</td>
<td>10 kN</td>
<td>20 kN</td>
<td>50 kN</td>
<td>100 kN</td>
<td>200 kN</td>
<td>500 kN</td>
<td>1 000 kN</td>
<td>1 250 kN</td>
</tr>
<tr>
<td>Nominal Load (NL) (US)</td>
<td>0.28 tf</td>
<td>0.56 tf</td>
<td>1.12 tf</td>
<td>2.25 tf</td>
<td>5.62 tf</td>
<td>11.24 tf</td>
<td>22.48 tf</td>
<td>56.2 tf</td>
<td>112.4 tf</td>
<td>140.5 tf</td>
</tr>
<tr>
<td>Overload Admissible (% of NL)</td>
<td>150 %</td>
<td>(of rated load without influence on measurement)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload at Rupture (% of NL)</td>
<td>≥500 %</td>
<td>400 %</td>
<td>300 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-linearity Error</td>
<td>&lt;0.25 %</td>
<td>&lt;0.5 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-linearity + Hysteresis Error</td>
<td>&lt;0.5 %</td>
<td>&lt;0.8 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.1 %</td>
<td>±0.1 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Calibration</td>
<td>4 mA - 20 mA corresponds to 0 kN - Full Scale Deflection in kN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL CHARACTERISTICS & ENVIRONMENT

| Technology | 2x Full-bridge strain gauge |
| Material | Stainless steel 1.4057 |
| Lubrication | Not available Oiler ø4 DIN 3405D or M10 DIN 3405A |
| Operating Temperature | -25 °C to + 80 °C |
| Storage Temperature | -30 °C to + 90 °C |
| Temperature Influence on Zero | ±0.02 % / K |
| Temperature Influence on Sensitivity | ±0.02 % / K |
| Long Term Stability of Zero | <1 % / year (not cumulative) |
| Long Term Stability of Sensitivity | <0.5 % / year (not cumulative) |
| EMC | Vehicle approval according to EN 61326-1, EN 61326-2-3 | ECE-R10 |
| Angle influence on signal output | According to the cosine function |
| Protection Class | IP66 (connected) according to EN 60529 |

SAFETY STANDARDS & DUAL B.I.T.E.

| Safety Standards | ISO13849-1 : CAT4 and PLe | IEC62061 : SIL 3 |
| Type of B.I.T.E. input. | Active low, compatible with switch, relay, open collector or open drain, 1 B.I.T.E. input for each channel |
| Effect on the output | Addition of 70 % (± 10 %) of the nominal load in standard (other % in option) |

ELECTRICAL CHARACTERISTICS & CONNECTIONS

| Strain Gauge Bridge Impedance | 2 x 350 Ω |
| Power Supply | 19 to 32VDC (with protected polarity reversal (1x or 2x)) |
| Output Signal 2 channels | Rated 4 to 20 mA; max. 0.5 to 22 mA (2x) |
| Output | Integrated 3m, 6m, 12m or 20m cable Radox K-814 (standard) or axial connector HUMMEL M16 |
| Configuration | 6-wire |
| Optional Connection Cable Assembly | 3m, 6m, 12m or 20m cable with connector HUMMEL M16 female |

Load Resistance

| Admissible resistance of 6-wire circuit at connection of LE 6XX series |
| Hatched: Operating Domain |
| Load Resistance $R_L$ [Ω] | 750 |
| Supply Voltage $U_s$ [V] | 500 |
| 250 |
| 0 |
| 10 |
| 20 |
| 30 |
| 40 |
| 50 |

Wiring Colors

- Power Supply + Ground (GND) - : red
- Current Output + B.I.T.E. : blue
- Power Supply + Ground (GND) - : green
- Current Output + B.I.T.E. : brown
- Case / Shield : yellow
- B.I.T.E : black
- Ground (GND) - : grey
- Current Output : yellow / black

a) Rating apply to standard load pins only, special models available on request.
b) Full scale.
c) Variation of the measuring signal due to the angle positioning.
d) Other longer cables lengths available on request.
e) When the counter-connector is connected.

www.magtrol.com
DIMENSIONS LE 4XX-6XX SERIES

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

<table>
<thead>
<tr>
<th>MODEL</th>
<th>units</th>
<th>øA</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>øM</th>
<th>N</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE410/610</td>
<td>mm</td>
<td>25 h6</td>
<td>137</td>
<td>84</td>
<td>18</td>
<td>16</td>
<td>10</td>
<td>7</td>
<td>24</td>
<td>5.2</td>
<td>9</td>
<td>3</td>
<td>54</td>
<td>57</td>
<td>0.6 kg</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>0.984</td>
<td>5.394</td>
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a) Oiler ø4 DIN3405D or M10 DIN 3405A

NOTE: 3D STEP files of most of our products are available on our website: www.magtrol.com; other files are available on request.
## TECHNICAL DATA - LE 2XX SERIES

### STANDARD VERSION

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<th>LOAD MEASURING</th>
<th>LE 211</th>
<th>LE 212</th>
<th>LE 213</th>
<th>LE 214</th>
<th>LE 216</th>
<th>LE 217</th>
<th>LE 218</th>
<th>LE 220</th>
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<td>Overload Admissible (% of NL)</td>
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<td>Overload at Rupture (% of NL)</td>
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<td>Non-linearity + Hysteresis Error</td>
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### MECHANICAL CHARACTERISTICS

- **Technology**: Full-bridge strain gauge
- **Material**: Stainless steel 1.4057
- **Lubrication**: Not available, Oiler ø4 DIN 3405 D or M10 DIN 3405 A

### ENVIRONMENT

- **Operating Temperature**: -25 °C to +80 °C
- **Storage Temperature**: -30 °C to +90 °C
- **Temperature Influence on Zero**: ±0.02% / K
- **Temperature Influence on Sensitivity**: ±0.02% / K
- **Long Term Stability on Zero**: < 1% / year (not cumulative)
- **Long Term Stability on Sensitivity**: < 0.5% / year (not cumulative)
- **EMC**: According to EN 61000-6-2 & EN 61326-1
- **Influence on Measurement Signal**: According to the cosine function
- **Protection Class**: IP66 according to DIN 60529

### ELECTRICAL CHARACTERISTICS & CONNECTIONS

- **Strain Gauge Bridge Impedance**: 5000 Ω
- **Power Supply**: 12 to 32 VDC (with protected polarity reversal < 35 mA)
- **Output Signal**: Rated 4 to 20 mA; max. 3.5 to 25 mA
- **Load Resistance**: Admissible resistance of the 2-wire circuit at the connection of the LE 2XX

### Configuration

- **Output Connector**: Axial connector, Souriau 85102E 106P50
- **Configuration**: 2-wire
- **Optional Connection Cable Assembly**: 3 m, 6 m, 12 m or 20 m cable with axial or 90° connector

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a) Ratings apply to standard load pins only, special models are available by contacting Magtrol.
b) Full scale.
c) Variation of the measuring signal due to the angle positioning.
e) Other longer cable lengths available on request.

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**NOTE:**

3D STEP files of most of our products are available on our website: www.magtrol.com; other files are available on request.
**DIMENSIONS LE 2XX SERIES**

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

<table>
<thead>
<tr>
<th>MODEL</th>
<th>units</th>
<th>øA</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
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<td>120</td>
<td>10.5</td>
<td>36</td>
<td>3</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>3.937</td>
<td>15.118</td>
<td>13.661</td>
<td>1.417</td>
<td>2.402</td>
<td>2.165</td>
<td>1.378</td>
<td>4.724</td>
<td>0.413</td>
<td>1.417</td>
<td>0.118</td>
<td>1.496</td>
<td>1.457</td>
<td>43.211 lb</td>
</tr>
<tr>
<td>LE221</td>
<td>mm</td>
<td>120</td>
<td>h6</td>
<td>384</td>
<td>347</td>
<td>36</td>
<td>61</td>
<td>55</td>
<td>35</td>
<td>120</td>
<td>12.5</td>
<td>40</td>
<td>3</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>in</td>
<td>4.724</td>
<td>15.118</td>
<td>13.661</td>
<td>1.417</td>
<td>2.402</td>
<td>2.165</td>
<td>1.378</td>
<td>4.724</td>
<td>0.492</td>
<td>1.575</td>
<td>0.118</td>
<td>1.496</td>
<td>1.457</td>
<td>63.493 lb</td>
</tr>
</tbody>
</table>

**LUBRICATION**

- **LE 211-214**: N/A
- **LE 216**: N/A
- **LE 217**: N/A
- **LE 218**: M6 64
- **LE 220**: M8 70
- **LE 221**: M8 70

Optional lubrication a)

a) Oiler ø4 DIN 3405 D or M10 DIN 3405 A

**NOTE**: 3D STEP files of most of our products are available on our website: www.magtrol.com; other files are available on request.
ORDERING INFORMATION LE 4XX SERIES

<table>
<thead>
<tr>
<th>ORDERING NUMBER</th>
<th>LE 4</th>
<th>/</th>
<th></th>
<th></th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>10, 11, 12, ... , 21</td>
<td>Model LE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

0 : Without Lubrication (standard)
1 : With Lubrication (available only on LE 416-421)

0 : Axial connector
1 : Cable length 3 m
2 : Cable length 6 m
3 : Cable length 12 m
4 : Cable length 20 m a)

a) Other longer cable lengths available on request.

Example: LE 416 Load Measuring Pin with lubrication and 6 m cable would be ordered as follows: LE 416/12X.

ACCESSORIES LE 4XX SERIES

CABLE ASSEMBLIES

CABLE ASSEMBLY ORDERING INFORMATION

<table>
<thead>
<tr>
<th>ORDERING NUMBER</th>
<th>EH 14</th>
<th>/ 0</th>
<th></th>
<th></th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Axial connector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>90° connector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 : Cable length 3 m
2 : Cable length 6 m
3 : Cable length 12 m
4 : Cable length 20 m a)

COUNTER CONNECTOR

Axial connector PN 957-11-07-3101
90° connector PN 957-11-07-3102

LE 4XX PIN CONFIGURATION

FRONT VIEW

A: Power Supply + red
B: Ground (GND) - blue
C: Current Output + white
D: B.I.T.E green
Case / Shield yellow / black

Cable shield
ORDERING INFORMATION LE 6XX SERIES

**ORDERING NUMBER** | LE 6 _ _ / _ _ X
---|---
10, 11, 12, ... , 21 : Model LE
0 : Without Lubrication (standard)
1 : With Lubrication (available only on LE 616-621)

0 : Axial connector
1 : Cable length 3m
2 : Cable length 6m
3 : Cable length 12m
4 : Cable length 20m a)

a) Other longer cable lengths available on request.

Example: LE 616 Load Measuring Pin with lubrication and 6m cable would be ordered as follows: LE 616/12X.

ACCESSORIES LE 6XX SERIES

**CABLE ASSEMBLIES**

Cable with axial connector

Cable with 90° connector

**LE 6XX PIN CONFIGURATION (DUAL CHANNELS)**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Channel 1</th>
<th>Channel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 :</td>
<td>B.I.T.E</td>
<td>yellow</td>
</tr>
<tr>
<td>A :</td>
<td>Power Supply +</td>
<td>Channel 1 red</td>
</tr>
<tr>
<td>+ :</td>
<td>Power Supply +</td>
<td>Channel 2 brown</td>
</tr>
<tr>
<td>B :</td>
<td>Ground (GND) -</td>
<td>Channel 1 blue</td>
</tr>
<tr>
<td>- :</td>
<td>Ground (GND) -</td>
<td>Channel 2 black</td>
</tr>
<tr>
<td>C :</td>
<td>Current Output +</td>
<td>Channel 1 white</td>
</tr>
<tr>
<td>2 :</td>
<td>Current Output +</td>
<td>Channel 2 grey</td>
</tr>
<tr>
<td>D :</td>
<td>B.I.T.E</td>
<td>Channel 1 green</td>
</tr>
<tr>
<td></td>
<td>Case / Shield</td>
<td>yellow / black</td>
</tr>
</tbody>
</table>

**CABLE ASSEMBLY ORDERING INFORMATION**

**ORDERING NUMBER** | ER 11 _ / 0 _ X
---|---
8 : Axial connector
9 : 90° connector

1 : Cable length 3m
2 : Cable length 6m
3 : Cable length 12m
4 : Cable length 20m a)

a) Other longer cable lengths available on request.

**COUNTER CONNECTOR**

Axial connector : PN 957-11-07-3111
90° connector : PN 957-11-07-3112
ORDERING INFORMATION LE 2XX SERIES

ORDERING NUMBER LE 2 _ _ / 0 _ X

11, 12, … , 21 : Model LE
1 : Without Lubrication (standard)
3 : With Lubrication (available only on LE 216-221)

Example: LE 216 Load Measuring Pin with lubrication would be ordered as follows: LE 216/03X.

ACCESSORIES LE 2XX SERIES

CABLE ASSEMBLIES

CABLE ASSEMBLY ORDERING INFORMATION

ORDERING NUMBER EH 13 _ / 0 _ X

8 : Axial connector
9 : 90° connector
1 : Cable length 3 m
2 : Cable length 6 m
3 : Cable length 12 m
4 : Cable length 20 m a)

CABLE ASSEMBLY ORDERING INFORMATION

CABLE ASSEMBLY ORDERING INFORMATION

CABLE ASSEMBLY ORDERING INFORMATION

CABLE ASSEMBLY ORDERING INFORMATION

CABLE ASSEMBLY ORDERING INFORMATION

CABLE ASSEMBLY ORDERING INFORMATION

CABLE ASSEMBLY ORDERING INFORMATION

CABLE ASSEMBLY ORDERING INFORMATION

a) Other longer cables lengths available on request.

COUNTER CONNECTOR

Axial connector PN 957-11-08-0030
90° connector PN 957-11-08-0029

LE2XX PIN CONFIGURATION

<table>
<thead>
<tr>
<th>Power Supply +</th>
<th>red</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply -</td>
<td>blue</td>
<td>B</td>
</tr>
<tr>
<td>Case</td>
<td>black</td>
<td>E</td>
</tr>
</tbody>
</table>

65 mm (2.56 in)
10 mm (0.39 in)
60 mm (2.36 in)
82 mm (3.23 in)
85 mm (3.35 in)
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.

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.

<table>
<thead>
<tr>
<th>TYPE OF LOAD MEASURING PIN</th>
<th>NOMINAL LOAD kN</th>
<th>NOMINAL DIAMETER mm</th>
<th>PIN TOLERANCE h6 µm</th>
<th>BORE TOLERANCE G7 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB 210, LE 410 &amp; LE 610</td>
<td>2.5</td>
<td>25</td>
<td>0 / -13</td>
<td>+28 / +7</td>
</tr>
<tr>
<td>LB/LE 211, LB 231, LE 411 &amp; LE 611</td>
<td>5</td>
<td>25</td>
<td>0 / -13</td>
<td>+28 / +7</td>
</tr>
<tr>
<td>LB/LE 212, LB 232, LE 412 &amp; LE 612</td>
<td>10</td>
<td>25</td>
<td>0 / -13</td>
<td>+28 / +7</td>
</tr>
<tr>
<td>LB/LE 213, LB 233, LE 413 &amp; LE 613</td>
<td>20</td>
<td>25</td>
<td>0 / -13</td>
<td>+28 / +7</td>
</tr>
<tr>
<td>LB/LE 214, LB 234, LE 414 &amp; LE 614</td>
<td>50</td>
<td>35</td>
<td>0 / -16</td>
<td>+34 / +9</td>
</tr>
<tr>
<td>LB 235</td>
<td>70</td>
<td>45</td>
<td>0 / -16</td>
<td>+34 / +9</td>
</tr>
<tr>
<td>LB/LE 216, LB 236, LE 416 &amp; LE 616</td>
<td>100</td>
<td>50</td>
<td>0 / -16</td>
<td>+34 / +9</td>
</tr>
<tr>
<td>LB/LE 217, LB 237, LE 417 &amp; LE 617</td>
<td>200</td>
<td>65</td>
<td>0 / -19</td>
<td>+40 / +10</td>
</tr>
<tr>
<td>LB/LE 218, LB 238, LE 418 &amp; LE 618</td>
<td>500</td>
<td>85</td>
<td>0 / -22</td>
<td>+47 / +12</td>
</tr>
<tr>
<td>LB/LE 220, LB 240, LE 420 &amp; LE 620</td>
<td>1000</td>
<td>100</td>
<td>0 / -22</td>
<td>+47 / +12</td>
</tr>
<tr>
<td>LB/LE 221, LB 241, LE 421 &amp; LE 621</td>
<td>1250</td>
<td>120</td>
<td>0 / -22</td>
<td>+47 / +12</td>
</tr>
</tbody>
</table>

Machining dimensions and tolerances according to DIN 7161

**NOTICE**

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.
2.1.2 PIN HOLDER KEY

1. Machine the pin holder key to the dimensions given (see 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 (see Fig.2-3).

![Fig.2-2 Instalation of the pin holder key](image)

<table>
<thead>
<tr>
<th>TYPE OF LOAD MEASURING PIN</th>
<th>DIMENSIONS mm</th>
<th>FASTENING SCREW</th>
<th>SCREWING TORQUE N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB 210, LE 410 &amp; LE 610</td>
<td>20 60 36 9 5</td>
<td>M8</td>
<td>24</td>
</tr>
<tr>
<td>LB/LE 211, LB 231, LE 411 &amp; LE 611</td>
<td>20 60 36 9 5</td>
<td>M8</td>
<td>24</td>
</tr>
<tr>
<td>LB/LE 212, LB 232, LE 412 &amp; LE 612</td>
<td>20 60 36 9 5</td>
<td>M8</td>
<td>24</td>
</tr>
<tr>
<td>LB/LE 213, LB 233, LE 413 &amp; LE 613</td>
<td>20 60 36 9 5</td>
<td>M8</td>
<td>24</td>
</tr>
<tr>
<td>LB/LE 214, LB 234, LE 414 &amp; LE 614</td>
<td>25 80 50 11 6</td>
<td>M10</td>
<td>48</td>
</tr>
<tr>
<td>LB 235</td>
<td>30 100 70 13 8</td>
<td>M12</td>
<td>83</td>
</tr>
<tr>
<td>LB/LE 216, LB 236, LE 416 &amp; LE 616</td>
<td>30 100 70 13 8</td>
<td>M12</td>
<td>83</td>
</tr>
<tr>
<td>LB/LE 217, LB 237, LE 417 &amp; LE 617</td>
<td>40 140 100 17 10</td>
<td>M16</td>
<td>200</td>
</tr>
<tr>
<td>LB/LE 218, LB 238, LE 418 &amp; LE 618</td>
<td>40 140 100 17 10</td>
<td>M16</td>
<td>200</td>
</tr>
<tr>
<td>LB/LE 220, LB 240, LE 420 &amp; LE 620</td>
<td>40 140 100 17 10</td>
<td>M16</td>
<td>200</td>
</tr>
<tr>
<td>LB/LE 221, LB 241, LE 421 &amp; LE 621</td>
<td>50 190 140 21 12</td>
<td>M20</td>
<td>390</td>
</tr>
</tbody>
</table>
### 2.1.3 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.

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.

**NOTICE**

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

Position the load measuring pin facing the bores in which it will be seated (see Fig. 2-4). Turn it so that the mortise for receiving the pin holder key is facing upward and perpendicular to the applied force.

**NOTICE**

The direction of the sensitivity axis is defined by the position of holding key. This one is perpendicular to the sensitivity axis and is normally facing the force applied to the central portion (please refer to section 4.1)
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. Manually slide the load measuring pin into its seat (see Fig.2-4), 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.

4. Insert the pin holder key into the mortise and align the key to coincide with the threaded holes for the fastening screws.

5. Place the two fastening screws, fitted with their washers, into the holes of the pin holder key (see Fig.2-4), and screw them into the previously threaded holes, applying the screwing torque specified in table (see Fig.2-3).

6. For pins equipped with lubricators (optional for LB 216 - LB 221 and LE 216 - LE 221, LE 416 - LE 421 and LE 616 - LE 621) inject lubricant (grease or oil) by means of a grease gun or oil pump.
2.2 EXTRACTION OF THE LOAD MEASURING PINS

**NOTICE**
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.

**NOTICE**
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.
2.2.1 EXTRACTION OF LARGE SIZE LOAD PINS USING AN EXTRACTION DEVICE

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

8. Load measuring pins LB/LE 218 - 221, LB 238 - 241, LE 418 - 421 and LE 618 - 621 are fitted with two extraction screw threads at each end (see Fig.2-5 & 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 4XX and LE 6XX series load pins with integrated cable) or the electric connector (LB 230, LE 2XX, LE 4XX and LE 6XX series load pin with connector) to avoid their damage if the pin is pulled out on the opposite end (see Fig.2-5).

2.2.1.1 LB SERIES LOAD MEASURING PINS

![Diagram of LB Series Load Measuring Pin Extraction](Fig.2-5)

Dimensions of the extraction screw threads

<table>
<thead>
<tr>
<th>Load Pin Series</th>
<th>Screw Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB 218 / LB 238</td>
<td>M6</td>
</tr>
<tr>
<td>LB 220 / LB 240</td>
<td>M8</td>
</tr>
<tr>
<td>LB 221 / LB 241</td>
<td>M8</td>
</tr>
</tbody>
</table>

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

2.2.1.2 LE SERIES LOAD MEASURING PINS

![Diagram of LE Series Load Measuring Pin Extraction](Fig.2-6)

Dimensions of the extraction screw threads

<table>
<thead>
<tr>
<th>Load Pin Series</th>
<th>Screw Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE 218, LE 418 &amp; LE 618</td>
<td>M6</td>
</tr>
<tr>
<td>LE 220, LE 420 &amp; LE 620</td>
<td>M8</td>
</tr>
<tr>
<td>LE 221, LE 421 &amp; LE 621</td>
<td>M8</td>
</tr>
</tbody>
</table>

Fig.2-6 Pulling out a load measuring pin by means of an extraction device (principle used with LE 218, LE 418 and 618, LE 221, LE 421 and 621 Series Load Pins)
2.2.2 EXTRACTION OF SMALL SIZE LOAD MEASURING PINS

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

2. 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).

3. 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).

4. 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.

2.2.3 EXTRACTION OF LOAD MEASURING PINS ON BEARINGS

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.

**NOTICE**

On the load measuring pins LB/LE 210 - 213, LB 231 - 233, LE 411 - 413 and LE 611 - 613 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 (see Fig.2-9).

![Diagram of measuring chain]

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) 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.

**CAUTION**

IF SEVERAL SYSTEMS HAVE BEEN PRECALIBRATED, ENSURE THAT EACH AXIS IS USED WITH THE CONDITIONING ELECTRONICS WITH WHICH IT HAS BEEN CALIBRATED (REFER TO MEASUREMENT PROTOCOLS AND SERIAL NUMBERS)

OTHERWISE MEASUREMENT ERRORS COULD BE GENERATED AND A RECALIBRATION WOULD THEN BECOME NECESSARY

If it is not possible to orient the LB 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 %).

**NOTICE**

LE 2XX, LE 4XX and LE 6XX 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 LB SERIES

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
2.3.1.3 CABLE CONNECTION LE 2XX SERIES

**CAUTION**

THE MAXIMUM CURRENT CONSUMPTION OF A LOAD MEASURING PIN OF THE LE 2XX 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.

**NOTICE**

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

![Diagram of LE 2XX Series Load Measuring Pin Connection](image-url)

Fig.2-13 Connection of a LE 2XX Series Load Measuring Pin
2.3.1.4 CABLE CONNECTION LE 4XX SERIES

THE MAXIMUM CURRENT CONSUMPTION OF A LOAD MEASURING PIN OF THE LE 4XX 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.

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 LE 4XX Series Load Measuring Pin

Fig. 2-15 Connection of a LE 4XX Series Load Measuring Pin
2.3.1.5 CABLE CONNECTION LE 6XX SERIES

**CAUTION**

The maximum current consumption of a load measuring pin of the LE 6XX 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 2 x 0.1 A on the current output of the signal conditioning unit.

**NOTICE**

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

![Fig.2-16 Connection of a LE 6XX Series Load Measuring Pin](image1)

![Fig.2-17 Connection of a LE 6XX Series Load Measuring Pin](image2)
2.3.1.6 DETERMINING $R_L$: NUMERIC EXAMPLE FOR THE LE SERIES

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 $\Omega$.

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

Fig.2-18 $R_L = \int (U_a)$ diagram of the LE 2XX Series Load Measuring Pins operating range

Fig.2-19 $R_L = \int (U_a)$ diagram of the LE 4XX & LE 6XX Series Load Measuring Pins operating range
2.3.2 CONNECTION OF A LOAD MEASURING PIN LB SERIES TO 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 (see Fig.2-20 to Fig.2-22). All three units, LMU 212, LMU 216 and LMU 217, have the same terminals as the LMU 216 and LMU 217 are just extensions of the LMU 212 unit.

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

2.3.2.1 LB 210 SERIES & LMU LOAD MONITORING UNIT

Fig.2-20 Connection of a LB 210 Series Load Pin (without connector) to a LMU Load Monitoring Unit

Fig.2-21 Connection of a LB 210 Series Load Pin (with connector) to a LMU Load Monitoring Unit

2.3.2.2 LB 230 SERIES & LMU LOAD MONITORING UNIT

Fig.2-22 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 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 (see Fig.2-24). It is also possible to connect the AN 1500 M by means of an LMU (see Fig.2-25).

For LE Series Load Pins, connect the load measuring pin cable to the AN 1500 M input terminals as indicated (see Fig.2-26 to Fig.2-28).

---

**NOTICE**

For more information concerning the cable connections of the AN 1500 M, please refer to its user manual.

---

**AN 1500 M - CN2 TERMINAL**

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>power supply –</td>
</tr>
<tr>
<td>2</td>
<td>power supply + [24 VDC]</td>
</tr>
<tr>
<td>3</td>
<td>power supply + [5 or 10 VDC]</td>
</tr>
<tr>
<td>4</td>
<td>not used</td>
</tr>
<tr>
<td>5</td>
<td>signal + [mA]</td>
</tr>
<tr>
<td>6</td>
<td>signal + [V]</td>
</tr>
<tr>
<td>7</td>
<td>not used</td>
</tr>
<tr>
<td>8</td>
<td>signal - [V or mA]</td>
</tr>
</tbody>
</table>

---

2.3.3.1 LB SERIES & AN 1500 M SERIES DIGITAL SIGNAL CONDITIONER/MONITOR

---

2.3.3.2 LB SERIES, LMU & AN 1500 M SERIES DIGITAL SIGNAL DISPLAY MONITOR

In the following configuration the AN 1500 M Series is used only as display.
2.3.3.3 LE 2XX SERIES & AN 1500 M SERIES DIGITAL SIGNAL DISPLAY MONITOR

NOTE: Sensor power supply on 24 V position

Fig.2-26 Connection of the LE 210 Series Load Measuring Pins to an AN 1500 M

2.3.3.4 LE 4XX SERIES & AN 1500 M SERIES DIGITAL SIGNAL DISPLAY MONITOR

NOTE: Sensor power supply on 24 V position

* B.I.T.E function: please refer to chapter 3.4

Fig.2-27 Connection of the LE 4XX Series Load Measuring Pins to an AN 1500 M

2.3.3.5 LE 6XX SERIES & AN 1500 M SERIES DIGITAL SIGNAL DISPLAY MONITOR

NOTE: Sensor power supply on 24 V position

* B.I.T.E function: please refer to chapter 3.4

Fig.2-28 Connection of the LE 6XX Series Load Measuring Pins to an AN 1500 M

* B.I.T.E function: please refer to chapter 3.4
2.3.4 CONNECTION OF A LOAD MEASURING PIN TO AN 2000 C (DIGITAL SIGNAL CONDITIONER / MONITOR)

For LB Series Load Pins, connect the load measuring pin cable to the AN 2000 C input terminals as indicated (see Fig.2-29).

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

The AN 2000 C has no current input. The LE 2XX, LE 4XX and LE 6XX Series Load Measuring Pins cannot be directly connected to them.

2.3.4.1 LB SERIES & AN 2000 C SERIES DIGITAL SIGNAL CONDITIONER / MONITOR

Fig.2-29 Connection of the LB Series Load Measuring Pins to an AN 2000 C
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 (see Fig.2-30 & Fig.2-31).

For LE Series Load Pins connect the load measuring pin cable to the GAD Series Large Digital Display input terminals as indicated (see Fig.2-32 to Fig.2-34).

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

2.3.5.1 LB SERIES, LMU & GAD SERIES LARGE DIGITAL DISPLAY

![Diagram](image)

**GAD 057 - 280 : ANALOG INPUTS**

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>supply +</td>
</tr>
<tr>
<td>2</td>
<td>signal -</td>
</tr>
<tr>
<td>3</td>
<td>signal [mA]</td>
</tr>
<tr>
<td>4</td>
<td>signal [V]</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
</tr>
<tr>
<td>6</td>
<td>supply -</td>
</tr>
</tbody>
</table>

![Diagram](image)

**Fig.2-30 Connection of the LB Series Load Pins to a GAD through an LMU Series Load Monitoring Unit**

**Fig.2-31 Connection of the LB Series Load Measuring Pins to a GAD through an LMU Series Load Monitoring unit**
2.3.5.2 LE 2XX SERIES & GAD SERIES LARGE DIGITAL DISPLAY

![Connection diagram](image)

**Fig.2-32** Connection of the LE 2XX 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.

2.3.5.3 LE 4XX SERIES & GAD SERIES LARGE DIGITAL DISPLAY

![Connection diagram](image)

**Fig.2-33** Connection of the LE 4XX Series Load Measuring Pins

* B.I.T.E function: please refer to chapter 3.4

2.3.5.4 LE 6XX SERIES & GAD SERIES LARGE DIGITAL DISPLAY

![Connection diagram](image)

**Fig.2-34** Connection of the LE 6XX Series Load Measuring Pins

* B.I.T.E function: please refer to chapter 3.4
3. OPERATING PRINCIPLE

3.1 MEASUREMENT PRINCIPLE

The LB 210, LB 230, LE 2XX, LE 4XX and LE 6XX Series Load 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.

**NOTICE** 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

**NOTICE** 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.

**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 NEGATIVE SIGNAL WILL BE OBSERVED.

**NOTICE** Measurements with an LE Series Load Measuring Pin mounted upside down will not work. This series has been designed to produce a positive current measurement signal.
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 Series Load Pins with an integrated strain gauge power supply and amplifier.

NOTICE
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 SERIES LOAD MEASURING PINS

In order to determine or to check the load applied to an LB Series 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.

<table>
<thead>
<tr>
<th>CHECKING EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model LB SERIES</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Type of load measuring pin :</td>
</tr>
<tr>
<td>Serial number :</td>
</tr>
<tr>
<td>RATED SIGNAL</td>
</tr>
<tr>
<td>SUPPLY VOLTAGE × SENSITIVITY = RATED SIGNAL</td>
</tr>
<tr>
<td>V × mV/V = mV</td>
</tr>
<tr>
<td>CALCULATED SIGNAL</td>
</tr>
<tr>
<td>RATED SIGNAL × APPLIED LOAD = RESULTE</td>
</tr>
<tr>
<td>RATED LOAD</td>
</tr>
<tr>
<td>mV × kN = mV</td>
</tr>
<tr>
<td>MEASURED SIGNAL</td>
</tr>
<tr>
<td>mV</td>
</tr>
</tbody>
</table>

NOTICE

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.
3.3.2 LE SERIES LOAD MEASURING PINS

In order to determine or to check the load applied to a LE Series 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**

Model LE SERIES

<table>
<thead>
<tr>
<th>Type of load measuring pin:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial number:</td>
<td></td>
</tr>
</tbody>
</table>

**CALCULATED SIGNAL**

\[
\frac{\text{Rated signal [mA] } \times \text{ Applied load [kN]} }{\text{Rated load [kN]}} + 4 \text{ mA} = \text{RESULTE}
\]

\[
16.00 \text{ mA } \times \frac{\text{[kN]}}{\text{[kN]}} + 4 \text{ mA} = \text{[mA]}
\]

**MEASURED SIGNAL**

\[
\text{[mA]}
\]

---

**NOTICE**

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.
3.4 **B.I.T.E. TEST FUNCTION FOR LE 4XX & LE 6XX SERIES**

The B.I.T.E. (Built In Test Function) of the LE 4XX and LE 6XX 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 16 mA). 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 (use PLC relay, open collector or open-drain output) 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.3-3 & Fig.3-4).

**B.I.T.E. Connection - activated**

```
<table>
<thead>
<tr>
<th></th>
<th>PLC Relay</th>
<th>Open-collector</th>
<th>Open-drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>
```

![Fig.3-3 Activation of the B.I.T.E. Test Function for the LE 4XX & LE 6XX Series](#)

**B.I.T.E. Connection - disabled**

```
<table>
<thead>
<tr>
<th></th>
<th>PLC Relay</th>
<th>Open-collector</th>
<th>Open-drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>
```

![Fig.3-4 Desactivation of the B.I.T.E. Test Function for the LE 4XX & LE 6XX Series](#)

**NOTICE**

Another property of the LE 4XX and LE6XX is monitoring the supply voltage permanently: if it drops below 16 V, the output current shut down to 0 mA.
4. INFLUENCE FACTORS

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

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

This chapter will also demonstrate how an incorrect mounting can impair the measurement accuracy of a load measuring pin and consequently diminish the security of the whole installation.

**NOTICE**
Having been designed according to the EMC (Electro Magnetic Compatibility) directives, the LE Series Load Measuring Pins with integrated electronics complies with EN 61000-6-2, EN 61326-1 & EN 61326-2-3.

4.1 INFLUENCE OF THE LOAD PIN ORIENTATION

For the LB Series and LE 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.

**NOTICE**
A measurement with an LE 2XX, LE 4XX and LE 6XX Series Load Measuring Pin mounted upside down will not work, this series has been designed to produce a positive current measurement signal.

When the pin is not optimally positioned (see Fig.4-1 & Fig.4-2), the measurement signal will be altered accordingly, as follows:
4.1.1 LB SERIES, LOAD PINS ORIENTATION

\[ U_{\text{eff}} = U_{\text{rated}} \cos \varphi \]

Where:
- \( U_{\text{eff}} \) represents the effective value of the measured signal.
- \( U_{\text{rated}} \) represents the rated value of the measured signal.
- \( \varphi \) 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 (\( U_{\text{eff}} \)) i.e. 100 % of the full scale value.
- \( \varphi = 0^\circ \) \( \Rightarrow \) \( \cos \varphi = 1 \) \( \Rightarrow \) \( U_{\text{eff}} = U_{\text{rated}} \)
- \( \varphi = 10^\circ \) \( \Rightarrow \) \( \cos \varphi = 0,985 \) \( \Rightarrow \) \( U_{\text{eff}} = 98,5 \% U_{\text{rated}} \)

Fig.4-1 Influence of the LB Series Load Measuring Pins’ orientation
### 4.1.2 LE SERIES, LOAD PINS ORIENTATION

\[ I_{\text{eff}} = I_{\text{rated}} \cos \varphi \]

Where:
- \( I_{\text{eff}} \) represents the effective value of the measured signal.
- \( I_{\text{rated}} \) represents the rated value of the measured signal \( (I_{\text{rated}} = I_{\text{measured}} - 4 \text{ mA}) \).
- \( \varphi \) 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 \( (I_{\text{eff}}) \) i.e. 100 % of the full scale value.
  - for \( \varphi = 0^\circ \) \( \cos \varphi = 1 \) \( \Rightarrow I_{\text{eff}} = I_{\text{rated}} \)
  - for \( \varphi = 15^\circ \) \( \cos \varphi = 0.966 \) \( \Rightarrow I_{\text{eff}} = 96.6 \% I_{\text{rated}} \)

![Direction of force applied on center segment of pin](image-url)

![Sensitivity axis](image-url)

![Load Measuring Pin](image-url)

![Effective Value of Measurement Signal vs. Shift angle](image-url)

Fig.4-2: Influence of the LE 2XX, LE 4XX and LE 6XX 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. 4-3).

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. 4-3 Application range of the load measuring pins.](image-url)

<table>
<thead>
<tr>
<th>Load Measuring Pin</th>
<th>Range of Admissible Load (maximum load = 150% of rated load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB 210, LE 410 &amp; LE 610</td>
<td>(2.5 kN)</td>
</tr>
<tr>
<td>LB/LE 211 &amp; LB 231, LE 411 &amp; LE 611</td>
<td>(5 kN)</td>
</tr>
<tr>
<td>LB/LE 212 &amp; LB 232, LE 412 &amp; LE 612</td>
<td>(10 kN)</td>
</tr>
<tr>
<td>LB/LE 213 &amp; LB 233, LE 413 &amp; LE 613</td>
<td>(20 kN)</td>
</tr>
<tr>
<td>LB/LE 214 &amp; LB 234, LE 414 &amp; LE 614</td>
<td>(50 kN)</td>
</tr>
<tr>
<td>LB 235</td>
<td>(70 kN)</td>
</tr>
<tr>
<td>LB/LE 216 &amp; LB 236, LE 416 &amp; LE 616</td>
<td>(100 kN)</td>
</tr>
<tr>
<td>LB/LE 217 &amp; LB 237, LE 417 &amp; LE 617</td>
<td>(200 kN)</td>
</tr>
<tr>
<td>LB/LE 218 &amp; LB 238, LE 418 &amp; LE 618</td>
<td>(500 kN)</td>
</tr>
<tr>
<td>LB/LE 220 &amp; LB 240, LE 420 &amp; LE 620</td>
<td>(1000 kN)</td>
</tr>
<tr>
<td>LB/LE 221 &amp; LB 241, LE 421 &amp; LE 621</td>
<td>(1250 kN)</td>
</tr>
</tbody>
</table>

- **F1** Range of Admissible Load (maximum load = 150% of rated load)
- **F2** Overload Range (avoid for security’s sake)
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, LE 416 – LE 421 and LE 616 – LE 621 Load Measuring Pins).

5.2 CALIBRATION

Recommendations for calibrating (LB 210 and LB 230 Load Measuring Pins) and the checking of measuring current for LE 2XX, LE 4XX and LE 6XX.

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 Series) or not (LB 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.

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

6.1 TROUBLESHOOTING ON LB SERIES

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>No supply voltage</td>
<td>Broken transmission line</td>
<td>Check the line and the connections.</td>
</tr>
<tr>
<td>Output voltage &lt; 0.000 V</td>
<td>Inversion of the applied load</td>
<td>Check and correct the direction of the applied load.</td>
</tr>
<tr>
<td></td>
<td>Crossing of the power supply or signal cables</td>
<td>Check and correct the cabling.</td>
</tr>
<tr>
<td>Output voltage = 0.000 V</td>
<td>Broken transmission line</td>
<td>Check the line and the connections.</td>
</tr>
<tr>
<td></td>
<td>No load</td>
<td>Apply a load of 20% of the rated load.</td>
</tr>
<tr>
<td>Error between measured and calculated signal</td>
<td>Difference between the applied effective load and the load used for calculation</td>
<td>Recalculate taking a possible demultiplication (pulley, lever arm, etc.).</td>
</tr>
</tbody>
</table>

6.2 TROUBLESHOOTING ON LE 2XX SERIES

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output current &lt; 4 mA</td>
<td>Calibration error</td>
<td>Send the pin back for calibration.</td>
</tr>
<tr>
<td></td>
<td>Inversion of applied load</td>
<td>Check and correct the direction of the applied load.</td>
</tr>
<tr>
<td>Output current = 0 mA</td>
<td>Broken transmission line</td>
<td>Check the line and the connections.</td>
</tr>
<tr>
<td></td>
<td>Defect in the integrated electronics or weighing bridge</td>
<td>Send the pin back for checking and repair.</td>
</tr>
<tr>
<td>Output current &gt; 20 mA</td>
<td>Calibration error</td>
<td>Send the pin back for calibration.</td>
</tr>
<tr>
<td></td>
<td>Overload</td>
<td>Check and reduce the applied load.</td>
</tr>
<tr>
<td>Output current &gt; 25 mA</td>
<td>Calibration error</td>
<td>Send the pin back for calibration.</td>
</tr>
<tr>
<td></td>
<td>Overload</td>
<td>Check and reduce the applied load.</td>
</tr>
<tr>
<td></td>
<td>Short-circuited transmission line</td>
<td>Check the line and the connections.</td>
</tr>
<tr>
<td></td>
<td>Defect in the integrated electronics</td>
<td>Send the pin back for checking and repair.</td>
</tr>
</tbody>
</table>

The operating range of the integrated electronics is between 3.5 mA and 25 mA for all LE 2XX Series Load Measuring Pins.
# 6.3 TROUBLESHOOTING ON LE 4XX AND LE 6XX SERIES

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output current &lt; 4 mA</td>
<td>Calibration error</td>
<td>Send the pin back for calibration</td>
</tr>
<tr>
<td></td>
<td>Inversion of applied load</td>
<td>Check and correct the direction of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>applied load.</td>
</tr>
<tr>
<td>Signal not expected &gt; 4 mA</td>
<td>Calibration error</td>
<td>Send the pin back for calibration</td>
</tr>
<tr>
<td></td>
<td>Unexpected load in the installation</td>
<td>Remove unwanted load or tare</td>
</tr>
<tr>
<td>Output current = 0 mA</td>
<td>Supply voltage below 18 VDC</td>
<td>Increase supply voltage &gt; 19 to 32 VDC</td>
</tr>
<tr>
<td></td>
<td>Broken or short-circuit transmission line</td>
<td>Check the line and the connections.</td>
</tr>
<tr>
<td></td>
<td>Defect in the integrated electronics or</td>
<td>Send the pin back for check and repair.</td>
</tr>
<tr>
<td></td>
<td>weighing bridge</td>
<td></td>
</tr>
<tr>
<td>B.I.T.E. enabled and output current &gt; 15.2 mA ±2.4 mA</td>
<td>A small load is already applied on the sensor</td>
<td>Remove all current applied load or take it in account in your calculation.</td>
</tr>
<tr>
<td>Output current &gt; 20 mA</td>
<td>Calibration error</td>
<td>Send the pin back for calibration</td>
</tr>
<tr>
<td></td>
<td>Overload</td>
<td>Check and reduce the applied load.</td>
</tr>
<tr>
<td></td>
<td>B.I.T.E. enabled and load applied</td>
<td>Check and reduce the applied load.</td>
</tr>
<tr>
<td>Output current &gt; 25 mA</td>
<td>Calibration error</td>
<td>Send the pin back for calibration</td>
</tr>
<tr>
<td></td>
<td>Overload</td>
<td>Check and reduce the applied load.</td>
</tr>
<tr>
<td></td>
<td>Short-circuited transmission line.</td>
<td>Check the line and the connections.</td>
</tr>
<tr>
<td></td>
<td>Defect in the integrated electronics</td>
<td>Send the pin back for check and repair.</td>
</tr>
<tr>
<td></td>
<td>B.I.T.E. enabled and large load applied</td>
<td>Remove load applied when using B.I.T.E.</td>
</tr>
</tbody>
</table>

**NOTICE**

The operating range of the integrated electronics is between 0.5 mA and 22 mA for all load pins of the LE 4XX and LE 6XX Series.
7. 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 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.

7.1 RETURNING EQUIPMENT TO MAGTROL INC. (UNITED STATES)

When returning equipment to MAGTROL INC. in the United States for repair and/or calibration, a completed Return Material Authorization (RMA) form is required.

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.

CONTACT FOR AFTER SALES SERVICE AT MAGTROL INC. (UNITED STATES)

After Sales, Repair & Calibration Services

phone    +1 716 668 5555 ext. 115
fax      +1 716 668 3162

e-mail    service@magtrol.com
7.2 RETURNING EQUIPMENT TO MAGTROL S.A. (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 S.A.
   After Sales Service
   Route de Montena 77
   1728 Rossens | Switzerland
   VAT No: CHE-105.475.279 TVA

   You can call our official carrier, TNT (account n° 154 033), and return in Economy Express mode (maximum 3 days for shipments to Europe), or choose your usual carrier.

2. Include the following documents with your equipment:
   • Delivery note with Magtrol SA’s address (as listed above)
   • Five (5) pro forma invoices with:
     • Your VAT number
     • Mention «Definitive Exportation»
     • Description of returned goods
     • Value for customs purposes only. This value should not exceed 1000 CHF for repair units
     • Origin of the goods (Switzerland or USA)
     • Noticed failures or complaints

3. A cost estimate for services will be sent to you as soon as the goods have been evaluated.

   Any repair or calibration job with charges below 850 EUR / 1000 CHF / 1000 USD, will be directly serviced. You will then receive a quote that you must approve to allow the return of your material.

   For all other jobs, a detailed service quote will be provided in the coming days. Please note that, for special products, the process time could be longer.

4. If you choose to not repair your equipment, Magtrol reserves the right to charge you the following fees:
   • Return of unrepaired equipment: 250 EUR / 300 CHF / 300 USD
   • Disposal of the equipment: 170 EUR / 200 CHF / 200 USD

CONTACT FOR AFTER SALES SERVICE AT MAGTROL S.A. (SWITZERLAND)

After Sales, Repair & Calibration Services

phone +41 26 407 30 00
fax +41 26 407 30 01
e-mail repair@magtrol.ch
Some Load Measuring Pins from the Series LB 230 (LB 334, LB 235, LB 236 and LB 237) have been certified by the OIML.
Messbericht (Fortsetzung)
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 website at http://www.magtrol.com/support/manuals.

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 DATES

<table>
<thead>
<tr>
<th>DATE</th>
<th>EDITION</th>
<th>CHANGE</th>
<th>SECTION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2020</td>
<td>2nd Edition - rev. C</td>
<td>Fixed an issue in illustration 3.3 &amp; 3.4; inversion of the diagrams</td>
<td>3.4</td>
</tr>
<tr>
<td>June 2020</td>
<td>2nd Edition - rev. B</td>
<td>Update of the template Updated all informations concerning the LB &amp; LE Series like datasheets... Removing information related to AN2000P (obsolete)</td>
<td>All</td>
</tr>
<tr>
<td>Nov. 2014</td>
<td>1st Edition - rev. C</td>
<td>Update all data sheet</td>
<td>1.2.1, 1.2.2, 1.2.3</td>
</tr>
<tr>
<td>July 2012</td>
<td>1st Edition - rev. B</td>
<td>Load measuring pin from LE 310 and LE 510 series added</td>
<td>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</td>
</tr>
<tr>
<td>April 2012</td>
<td>1st Edition - rev. A</td>
<td>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</td>
<td>1.2.1</td>
</tr>
</tbody>
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