

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. Ideally 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.



Fig. 1: Load Measuring Pin model LE 621, LE 418 (back); LE 217 & LE 211 (front)

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).

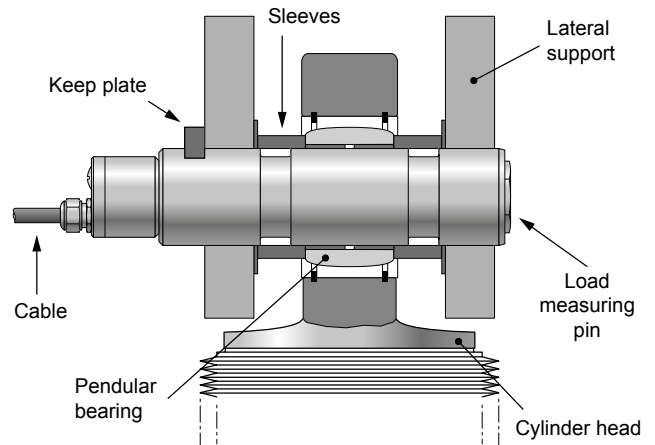


Fig. 2: Mounting example

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 20mA output. Based on SMD (Surface Mounted Device) technology, the electronics are well-protected against conducted and radiated electromagnetic fields.

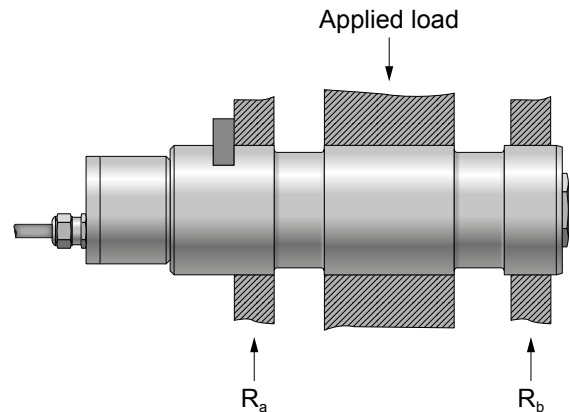
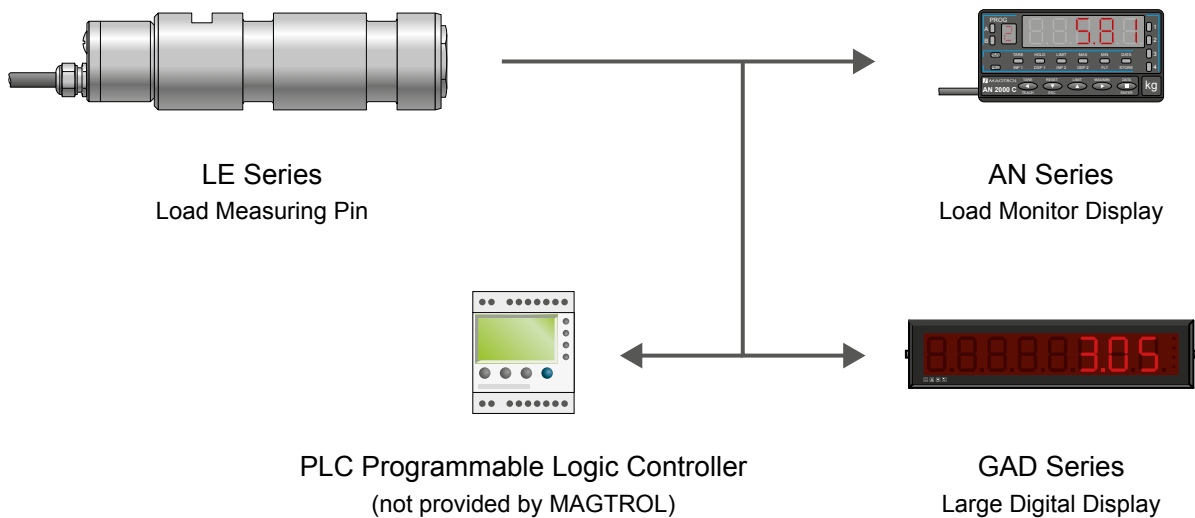


Fig. 3: R_a should equal R_b so that the force is evenly distributed

SYSTEM CONFIGURATION



TECHNICAL DATA - LE 4XX SERIES

STANDARD VERSION 1 CHANNEL ^{a)}	LE 410	LE 411	LE 412	LE 413	LE 414	LE 416	LE 417	LE 418	LE 420	LE 421
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LOAD MEASURING

Nominal Load (Metric) ^{b)}	2.5 kN	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN	500 kN	1 000 kN	1 250 kN
Nominal Load (US) ^{b)}	0.28 tf	0.56 tf	1.12 tf	2.25 tf	5.62 tf	11.24 tf	22.48 tf	56.2 tf	112.4 tf	140.5 tf
Overload Admissible (% of NL)	150 % (of rated load without influence on measurement)									
Overload at Rupture (% of NL)	≥ 500 %							400 %	300 %	
Non-linearity Error ^{b)}	< 0.25 %								< 0.5 %	
Non-linearity + Hysteresis Error ^{b)}	< 0.5 %								< 0.8 %	
Repeatability ^{b)}	± 0.1 %									
Standard Calibration	4 mA - 20 mA corresponds to 0 kN - Full Scale Deflection in kN									

MECHANICAL CHARACTERISTICS & ENVIRONMENT

Technology	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 ^{b)}	± 0.02 % / K	
Temperature Influence on Sensitivity	± 0.02 % / K	
Long Term Stability of Zero ^{b)}	< 1 % / year (not cumulative)	
Long Term Stability of Sensitivity	< 0.5 % / year (not cumulative)	
EMC Vehicle approval (E)	According to EN61326-1, EN61326-2-3 ECE-R10	
Angle influence on signal output ^{c)}	According to the cosine function	
Protection Class	IP 66 (connected) ^{e)} according to EN 60529	

SAFETY STANDARDS & B.I.T.E.

Safety Standards	ISO 13849-1 : CAT2 and PLd IEC 62061 : 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
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 32VDC (with protected polarity reversal)
Output Signal	Rated 4 to 20 mA; max. 0.5 to 22 mA
Load Resistance	<p>Admissible resistance of 3-wire circuit at connection of LE 4XX series</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>Hatched: Operating Domain = $\frac{\text{Load Resistance } R_L}{\text{Supply Voltage } U_s}$</p> </div> </div>
Output	Integrated 3m, 6m, 12m or 20m, cable Radox K-414 (standard) ^{d)} or axial connector HUMMEL M16
Configuration	3-wires
Optional Connection Cable Assembly	3m, 6m, 12m or 20m cable with connector HUMMEL M16 female ^{d)}
Wiring Colors	<ul style="list-style-type: none"> Power Supply + : red Ground (GND) - : blue Current Output + : white B.I.T.E : green Case / Shield : 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

TECHNICAL DATA - LE 6XX SERIES

STANDARD VERSION 2 CHANNELS ^{a)}	LE 610	LE 611	LE 612	LE 613	LE 614	LE 616	LE 617	LE 618	LE 620	LE 621
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LOAD MEASURING

Nominal Load (NL) (Metric) ^{b)}	2.5 kN	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN	500 kN	1 000 kN	1 250 kN
Nominal Load (NL) (US) ^{b)}	0.28 tf	0.56 tf	1.12 tf	2.25 tf	5.62 tf	11.24 tf	22.48 tf	56.2 tf	112.4 tf	140.5 tf
Overload Admissible (% of NL)	150 % (of rated load without influence on measurement)									
Overload at Rupture (% of NL))	≥ 500 %							400 %	300 %	
Non-linearity Error ^{b)}	< 0.25 %							< 0.5 %		
Non-linearity + Hysteresis Error ^{b)}	< 0.5 %							< 0.8 %		
Repeatability ^{b)}	± 0.1 %							± 0.1 %		
Standard Calibration	4 mA - 20 mA corresponds to 0 kN - Full Scale Deflection in kN									

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 ^{b)}	± 0.02 % / K									
Temperature Influence on Sensitivity	± 0.02 % / K									
Long Term Stability of Zero ^{b)}	< 1 % / year (not cumulative)									
Long Term Stability of Sensitivity	< 0.5 % / year (not cumulative)									
EMC Vehicle approval (E)	According to EN61326-1, EN61326-2-3 ECE-R10									
Angle influence on signal output ^{c)}	According to the cosine function									
Protection Class	IP 66 (connected) ^{e)} according to EN 60529									

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

Safety Standards	ISO 13849-1 : CAT4 and PLe IEC 62061 : 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 22mA (2x)									
Output	Integrated 3m, 6m, 12m or 20m cable Radox K-814 (standard) ^{d)} or axial connector HUMMEL M16									
Configuration	6-wire									
Optional Connection Cable Assembly	3m, 6m, 12m or 20m cable with connector HUMMEL M16 female ^{d)}									

Load Resistance

Admissible resistance of 6-wire circuit at connection of LE 6XX series

Hatched:
Operating Domain = $\frac{\text{Load Resistance } R_L}{\text{Supply Voltage } U_a}$

Wiring Colors

Channel 1	Power Supply +	: red
	Ground (GND) -	: blue
	Current Output +	: white
	B.I.T.E.	: green
Channel 2	Power Supply +	: brown
	Ground (GND) -	: black
	Current Output +	: grey
	B.I.T.E.	: yellow
	Case / Shield	: yellow / black

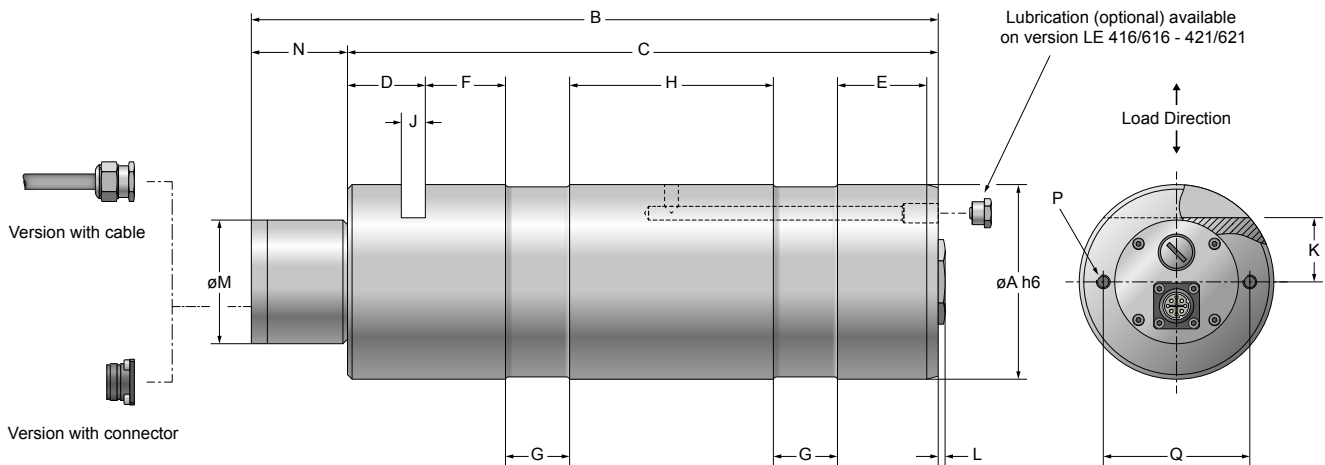
a) Rating apply to standard load pins only, special models available on request.

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

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.

MODEL	units	øA	B	C	D	E	F	G	H	J	K	L	øM	N	WEIGHT
LE410/610	mm	25 h6	137	84	18	16	10	7	24	5.2	9	3	54	57	0.6 kg
	in	0.984	5.394	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	2.126	2.244	1.323 lb
LE411/611	mm	25 h6	137	84	18	16	10	7	24	5.2	9	3	54	57	0.6 kg
	in	0.984	5.394	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	2.126	2.086	1.323 lb
LE412/612	mm	25 h6	137	84	18	16	10	7	24	5.2	9	3	54	57	0.6 kg
	in	0.984	5.394	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	2.126	2.086	1.323 lb
LE 413/613	mm	25 h6	137	84	18	16	10	7	24	5.2	9	3	54	57	0.6 kg
	in	0.984	5.394	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	2.126	2.086	1.323 lb
LE414/614	mm	35 h6	165	112	25	14	12	12	35	6.3	11.5	3	54	42	1.05 kg
	in	1.378	6.496	4.409	0.984	0.551	0.472	0.472	1.378	0.248	0.453	0.118	2.126	1.654	2.315 lb
LE416/616	mm	50 h6	214	161	32	24	18	18	48	10.5	20	3	54	42	2.4 kg
	in	1.969	8.425	6.339	1.26	0.945	0.709	0.709	1.89	0.413	0.787	0.118	2.126	1.654	5.291 lb
LE417/617	mm	65 h6	249	196	32	26	20	25	65	10.5	22.5	3	54	42	4.8 kg
	in	2.559	9.803	7.717	1.26	1.024	0.787	0.984	2.559	0.413	0.886	0.118	2.126	1.654	10.582 lb
LE418/618	mm	85 h6	311	258	34	39	35	28	89	10.5	28	3	54	42	11 kg
	in	3.347	12.244	10.158	1.339	1.535	1.378	1.102	3.504	0.413	1.102	0.118	2.126	1.654	24.251 lb
LE420/620	mm	100 h6	400	347	36	61	55	35	120	10.5	36	3	54	42	19.6 kg
	in	3.937	15.748	13.661	1.417	2.402	2.165	1.378	4.724	0.413	1.417	0.118	2.126	1.654	43.211 lb
LE421/621	mm	120 h6	400	347	36	61	55	35	120	12.5	40	3	54	42	28.8 kg
	in	4.724	15.748	13.661	1.417	2.402	2.165	1.378	4.724	0.492	1.575	0.118	2.126	1.654	63.493 lb

MODEL	units	P	Q	LUBRICATION
LE410-414/610-614				N/A
LE416/616	N/A	N/A	N/A	Optional lubrication ^{a)}
LE417/617				
LE418/618	mm	M6	64	
	in		2.520	
LE420/620	mm	M8	70	
	in		2.756	
LE421/621	mm		70	
	in		2.756	

a) Oiler ø4 DIN 3405D 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 ^{a)}	LE211	LE212	LE213	LE214	LE216	LE217	LE218	LE220	LE221
LOAD MEASURING									
Nominal Load (NL) (Metric) ^{b)}	5 kN	10 kN	20 kN	50 kN	100 kN	200 kN	500 kN	1 000 kN	1 250 kN
Nominal Load (NL) (US) ^{b)}	0.56 tf	1.12 tf	2.25 tf	5.62 tf	11.24 tf	22.48 tf	56.2 tf	112.4 tf	140.5 tf
Overload Admissible (% of NL)	150 % (without influence on measurement)								
Overload at Rupture (% of NL)	> 500 %						400 %	300 %	
Non-linearity Error ^{b)}	< 0.25 %							< 0.5 %	
Non-linearity + Hysteresis Error ^{b)}	< 0.5 %							< 0.8 %	
Repeatability ^{b)}	±0.1 %								
Standard Calibration	4 mA - 20 mA corresponds to 0 kN - Full Scale Deflection in kN								
MECHANICAL CHARACTERISTICS									
Technology	Full-bridge strain gauge								
Material	Stainless steel 1.4057								
Lubrication	Not available				Oiler ø4 DIN3405D or M10 DIN3405A				
ENVIRONMENT									
Operating Temperature	-25 °C to +80 °C								
Storage Temperature	-30 °C to +90 °C								
Temperature Influence on Zero ^{b)}	±0.02 % / K								
Temperature Influence on Sensitivity	±0.02 % / K								
Long Term Stability on Zero ^{b)}	< 1 % / year (not cumulative)								
Long Term Stability on Sensitivity	< 0.5 % / year (not cumulative)								
EMC	According to EN61000-6-2 & EN61326-1								
Influence α on Measurement Signal ^{c)}	According to the cosine function								
Protection Class	IP66 according to DIN 60529								
ELECTRICAL CHARACTERISTICS & CONNECTIONS									
Strain Gauge Bridge Impedance:	5 000 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								
	$\text{Hatched: Operating Domain} = \frac{\text{Load Resistance } R_L}{\text{Supply Voltage } U_a}$								
Output Connector	Axial connector, Souriau 851 02 E 106P50								
Configuration	2-wire								
Optional Connection Cable Assembly	3 m, 6 m, 12 m or 20 m cable with axial or 90° connector ^{d,e)}								

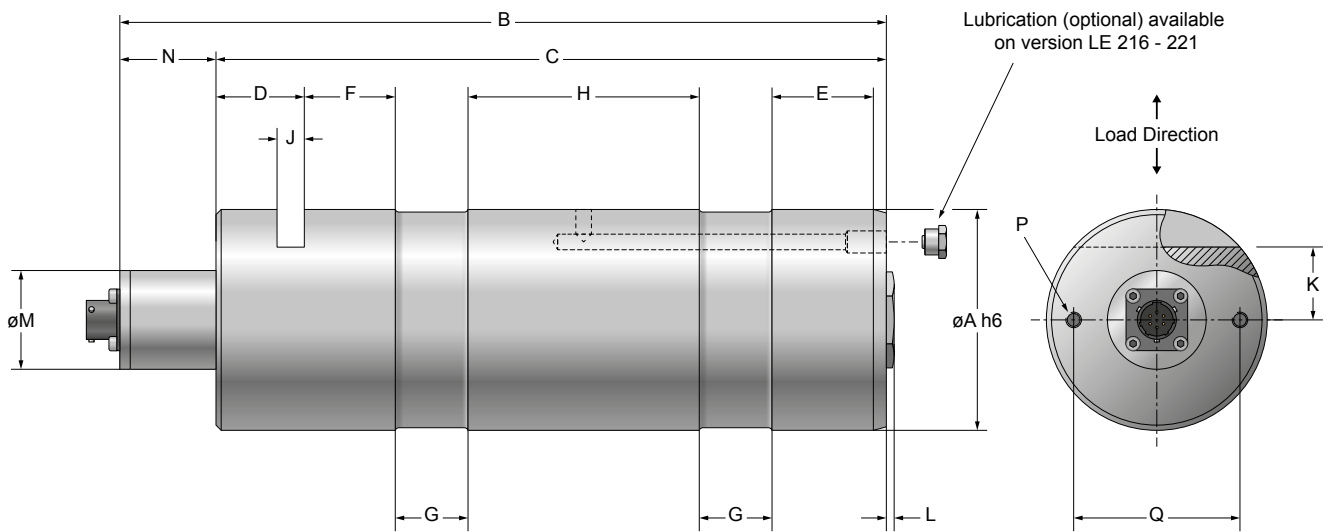
a) Ratings apply to standard load pins only, special models are available by contacting Magtrol.

b) Full scale.

c) Variation of the measuring signal due to the angle positioning.

d) Axial connector: Souriau 85106 JC 10 6S50, 90° connector: Souriau 85108 EC 106S50.

e) Other longer cables lengths 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.

MODEL	units	øA	B	C	D	E	F	G	H	J	K	L	øM	N	Weight
LE211	mm	25 h6	136	84	18	16	10	7	24	5.2	9	3	38	52	0.6 kg
	in	0.984	5.354	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.496	2.047	1.323 lb
LE212	mm	25 h6	136	84	18	16	10	7	24	5.2	9	3	38	52	0.6 kg
	in	0.984	5.354	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.496	2.047	1.323 lb
LE213	mm	25 h6	136	84	18	16	10	7	24	5.2	9	3	38	52	0.6 kg
	in	0.984	5.354	3.307	0.709	0.63	0.394	0.276	0.945	0.205	0.354	0.118	1.496	2.047	1.323 lb
LE214	mm	35 h6	149	112	25	14	12	12	35	6.3	11.5	3	38	37	1.05 kg
	in	1.378	5.866	4.409	0.984	0.551	0.472	0.472	1.378	0.248	0.453	0.118	1.496	1.457	2.315 lb
LE216	mm	50 h6	198	161	32	24	18	18	48	10.5	20	3	38	37	2.4 kg
	in	1.969	7.795	6.339	1.26	0.945	0.709	0.709	1.89	0.413	0.787	0.118	1.496	1.457	5.291 lb
LE217	mm	65 h6	233	196	32	26	20	25	65	10.5	22.5	3	38	37	4.8 kg
	in	2.559	9.173	7.717	1.26	1.024	0.787	0.984	2.559	0.413	0.886	0.118	1.496	1.457	10.582 lb
LE218	mm	85 h6	295	258	34	39	35	28	89	10.5	28	3	38	37	11 kg
	in	3.347	11.614	10.158	1.339	1.535	1.378	1.102	3.504	0.413	1.102	0.118	1.496	1.457	24.251 lb
LE220	mm	100 h6	384	347	36	61	55	35	120	10.5	36	3	38	37	19.6 kg
	in	3.937	15.118	13.661	1.417	2.402	2.165	1.378	4.724	0.413	1.417	0.118	1.496	1.457	43.211 lb
LE221	mm	120 h6	384	347	36	61	55	35	120	12.5	40	3	38	37	28.8 kg
	in	4.724	15.118	13.661	1.417	2.402	2.165	1.378	4.724	0.492	1.575	0.118	1.496	1.457	63.493 lb

MODEL	units	P	Q	LUBRICATION
LE211-214				N/A
LE216	N/A	N/A	N/A	Optional lubrication ^{a)}
LE217				
LE218	mm	M6	64	
	in		2.520	
LE220	mm	M8	70	
	in		2.756	
LE221	mm		70	
	in		2.756	

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

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ORDERING INFORMATION LE 4XX SERIES

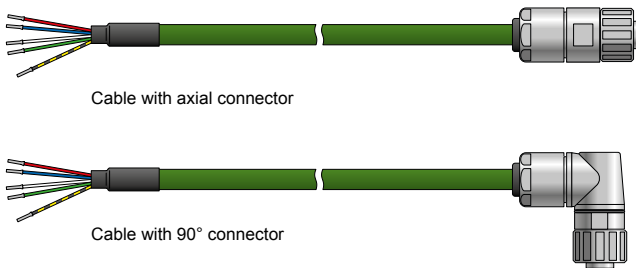
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	10, 11, 12, ... , 21 : Model LE				
	0 : Without Lubrication (standard) 1 : With Lubrication (available only on LE416-421)				
	0 : Axial connector 1 : Cable length 3 m 2 : Cable length 6 m 3 : Cable length 12 m 4 : Cable length 20 m ^{a)}				

a) Other longer cables lengths available on request.

Example: LE416 Load Measuring Pin with lubrication and 6m cable would be ordered as follows: LE416/12X.

ACCESSORIES LE 4XX SERIES

CABLE ASSEMBLIES

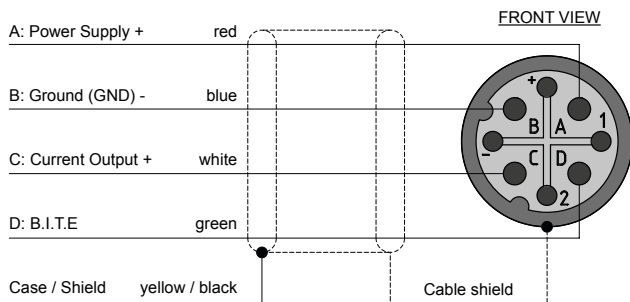


CABLE ASSEMBLY ORDERING INFORMATION

ORDERING NUMBER	EH 14	-	/ 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)}				

a) Other longer cables lengths available on request.

LE 4XX PIN CONFIGURATION



COUNTER CONNECTOR

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

ORDERING INFORMATION LE 6XX SERIES

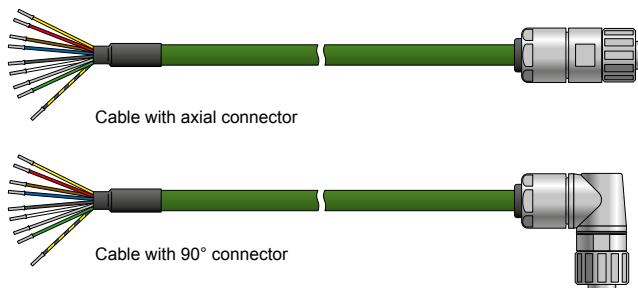
ORDERING NUMBER	LE 6	--	/	--	-	X
	10, 11, 12, ... , 21 : Model LE					
	0 : Without Lubrication (standard) 1 : With Lubrication (available only on LE 616-621)					
	0 : Axial connector 1 : Cable length 3 m 2 : Cable length 6 m 3 : Cable length 12 m 4 : Cable length 20 m ^{a)}					

a) Other longer cables lengths available on request.

Example: LE616 Load Measuring Pin with lubrication and 6 m cable would be ordered as follows : LE616/12X.

ACCESSORIES LE 6XX SERIES

CABLE ASSEMBLIES

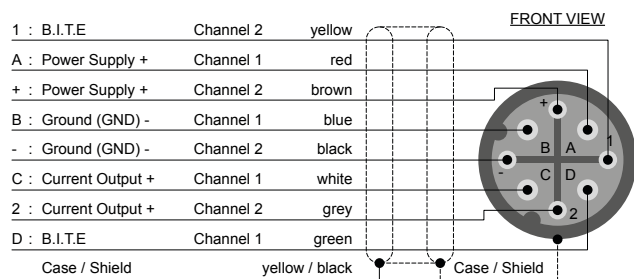


CABLE ASSEMBLY ORDERING INFORMATION

ORDERING NUMBER	ER 11	-	/ 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)}				

a) Other longer cables lengths available on request.

LE 6XX PIN CONFIGURATION (DUAL CHANNELS)



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

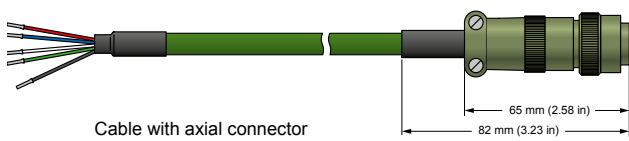
11, 12, ... , 21 : Model LE

1 : Without Lubrication (standard)
 3 : With Lubrication (available only on LE216-221)

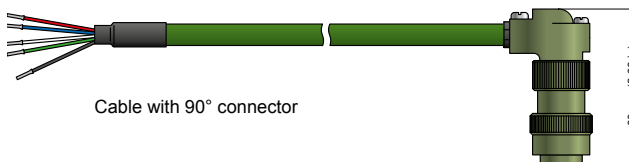
Example: LE 216 Load Measuring Pin with lubrication would be ordered as follows: LE216/03X.

ACCESSORIES LE 2XX SERIES

CABLE ASSEMBLIES



Cable with axial connector



Cable with 90° connector

CABLE ASSEMBLY ORDERING INFORMATION

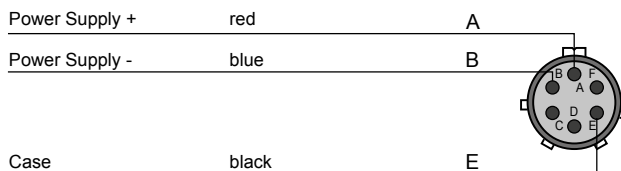
ORDERING NUMBER EH 13 - / 0 - X

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)}

a) Other longer cables lengths available on request.

LE 2XX PIN CONFIGURATION



COUNTER CONNECTOR

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