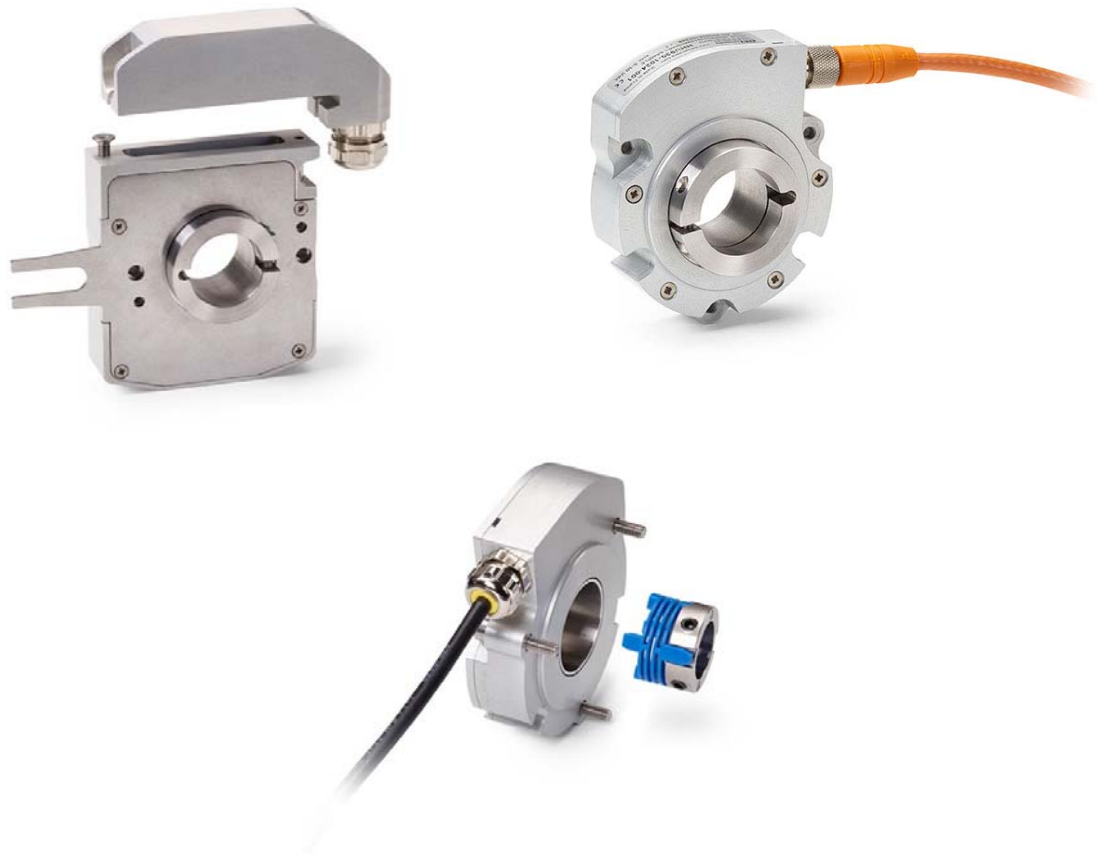


LP SERIES ENCODERS

US User Manual – LP35



IMPORTANT INFORMATION

- This manual contains important information regarding proper installation and operation of the LP35 encoder. Ensure that this manual and all other pertinent product documentation is available to all users of the product.
- Carefully read and observe all safety instructions contained in this manual and other documentation provided with your LP35 encoder.
- The specifications and data in this manual are subject to modifications without notice. See individual product specification sheets for additional information.
- All details provided are technical data which do not imply warranted performance. Products are warranted against defects in material and workmanship only. For more detailed warranty information please refer to section “7. Warranty”.
- Keep this manual for future reference.

Safety instructions are highlighted by safety alert symbols in the manual.

Depending on the seriousness of the hazard, the safety instructions are divided into two hazard categories.



WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, can result in death, serious injury, or equipment damage.



CAUTION

CAUTION indicates a recommendation, which, if not followed, may eventually result in death, serious injury, or equipment damage depending on the context.

TABLE OF CONTENTS

IMPORTANT INFORMATION 2

TABLE OF CONTENTS 3

1. LP SERIES – TECHNICAL FEATURES 5

 1.1. Range presentation 5

 1.2. MECHANICAL SPECIFICATIONS 6

 1.2.1. General 6

 1.2.2. Mechanical outlines 7

 1.2.3. Bearing life 14

 1.2.4. Accessories 15

 1.3. INCREMENTAL ENCODER ELECTRICAL SPECIFICATIONS 17

 1.3.1. Power supply 17

 1.3.2. Electrical protection 17

 1.3.3. Output signals 17

 1.3.4. Recommended receiver circuitry 19

 1.4. ABSOLUTE ENCODER ELECTRICAL SPECIFICATIONS 19

 1.4.1. Power supply 19

 1.4.2. Electrical protection 20

 1.4.3. SSI Output signals 20

 1.4.4. Recommended receiver circuitry 21

 1.5. ENVIRONMENTAL SPECIFICATIONS 21

 1.5.1. Ingress protection 21

 1.5.1. Operating temperatures 21

 1.5.2. Chemical protection 22

 1.5.3. EMC 23

 1.6. HAZARDOUS AREA PRODUCT 24

2. ENCODER PROGRAMMING TOOL 24

3. CERTIFICATIONS 25

4. INSTALLATION AND START UP 26

 4.1. GENERAL CAUTIONS 26

 4.1.1. General mechanical precautions 26

 4.1.2. General Electrical and wiring precautions 27

 4.2. MECHANICAL MOUNTING PROCEDURE 32

- 4.2.1. Through hollow shaft - mounting instructions..... 33
- 4.2.2. Hollow shaft with integrated coupling - mounting instructions 34
- 4.2.3. Terminal box - connection and mounting instructions 36
- 5. PACKAGING, STORAGE AND TRANSPORT 37
 - 5.1. BOX CONTENT 37
 - 5.2. STORAGE CONDITIONS..... 37
 - 5.3. GENERAL CAUTIONS FOR TRANSPORT 37
- SERVICE, MAINTENANCE AND RECYCLING..... 38
 - 5.4. COMPANY’S CONTACTS..... 38
 - 5.5. MAINTENANCE 38
 - 5.6. SPARE PARTS 39
 - 5.7. Recycling..... 39
- WARRANTY 40

1. LP SERIES – TECHNICAL FEATURES

1.1. Range presentation

Typical model numbers – see individual product specifications for details of model number configuration.

1. LP35-S-Q29-02048-H8EP-28/V-SM12-T2
2. LP35-S-Q29-02048-H8EP-28/V-T-T4
3. LP35-S-Q28-01000-C20P-28/VR-T-T5

1.2. MECHANICAL SPECIFICATIONS

1.2.1. General

Installation of the encoder must be done in such a way to prevent excessive loads on the encoder bearings. Some parts of the installation are compliant (or flexible) by design to accomplish this. For the Thru Hollow shaft and Blind Hollow shaft, a flexible tether arm is used. See Tether Mounts on pages 11-13. The integrated coupling includes a flexible part which provides the necessary compliance. The Solid Shaft variation requires the use of a separate flexible shaft coupling. See pages 14-15 for details.

Note: Flexible coupling installation must be done so that the coupling device is not distorted or crushed and there is no contact between the driving shaft and encoder shaft. Ignoring this may result in premature failure of coupling or encoder bearings.



CAUTION

Secure the fasteners (on flange, shaft, clamping rings, couplings...) by using a screw with the appropriate torque and lock the treads with Thread locker Loctite 243 or equivalent

In case of electrical leakage currents on the drive shaft, a common occurrence with the use of Variable Frequency Drives (VFD's) or industrial DC motors, use an insulated sleeve. Refer to section "2.2.5.3. *Sleeves*".

If possible, mount the encoder shaft horizontal or facing downward with the cable-glands or the connector facing downward.

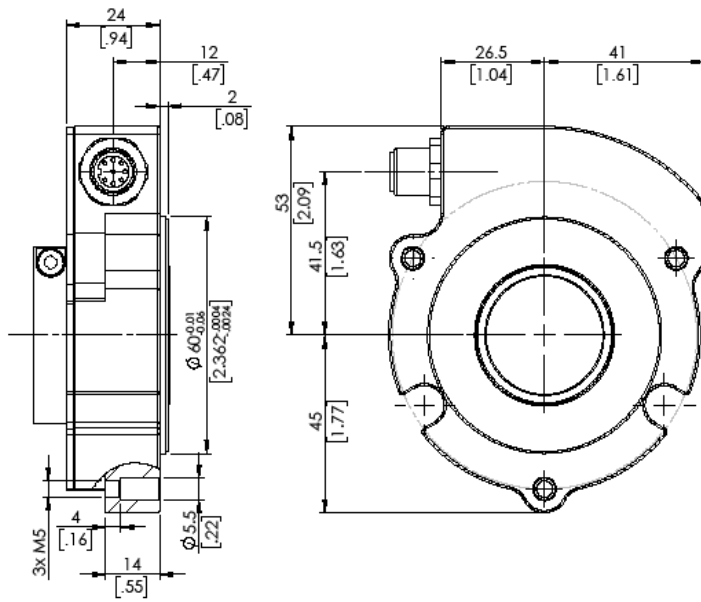
Mounting cautions and mechanical interface configurations are described in detail in the next sections.

1.2.2. Mechanical outlines

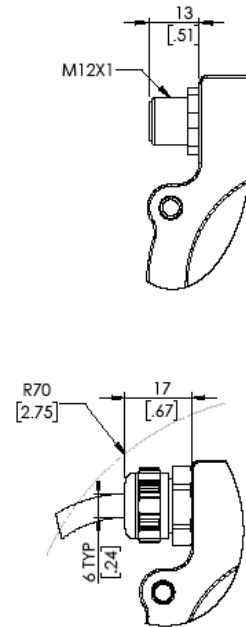
All dimensions are in millimeters [inches] and are for reference only. See individual specification sheets for more detailed product outlines.

1.2.2.1. Overall dimensions

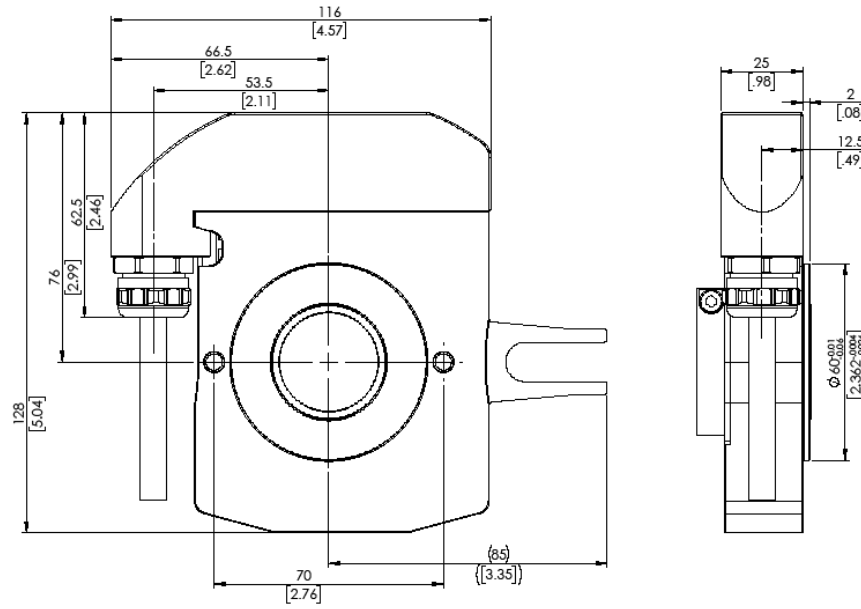
Standard through Hollow shaft



Connection dimensions



Terminal box through hollow shaft



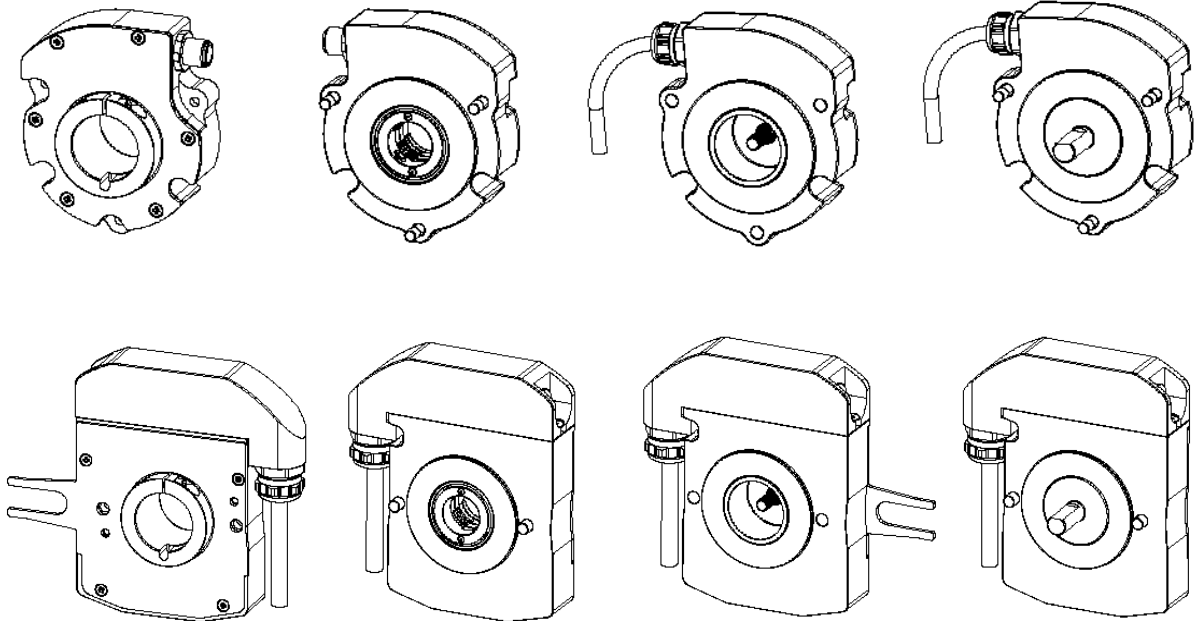
Standard shaft configurations

Through hollow shaft

Hollow shaft with integrated coupling

Blind Shaft

Solid shaft



Mechanical detailed outline drawings are available for each configuration on request.

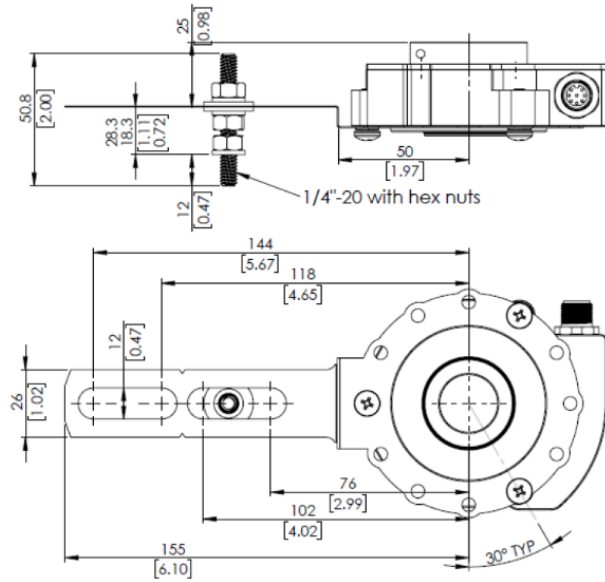
Mounting options

1.2.2.2. Flange and shaft configurations

Tether mounts									
<p>Customer shaft dimensions and geometric tolerance</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">Speed (RPM)</th> <th style="padding: 5px;">Permissible Runout (X mm)</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">< 1000</td> <td style="padding: 5px;">0,2 [0.008 in.]</td> </tr> <tr> <td style="padding: 5px;">< 3000</td> <td style="padding: 5px;">0,1 [0.004 in.]</td> </tr> <tr> <td style="padding: 5px;">< 6000</td> <td style="padding: 5px;">0,05 [0.002 in.]</td> </tr> </tbody> </table>	Speed (RPM)	Permissible Runout (X mm)	< 1000	0,2 [0.008 in.]	< 3000	0,1 [0.004 in.]	< 6000	0,05 [0.002 in.]
Speed (RPM)	Permissible Runout (X mm)								
< 1000	0,2 [0.008 in.]								
< 3000	0,1 [0.004 in.]								
< 6000	0,05 [0.002 in.]								
<p>Standard Configuration</p>	<p>Terminal Box Configuration</p>								
<p>Tether arm options – tether arm is installed by customer at any angle to best fit the application. (See 4.2.2)</p>									

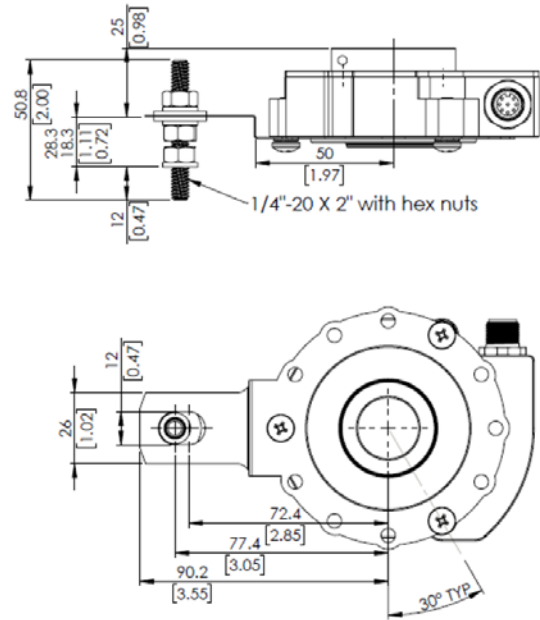
T2 – Long Tether arm with 1/4"-20 adj. hardware

P/N : M9445/053-02



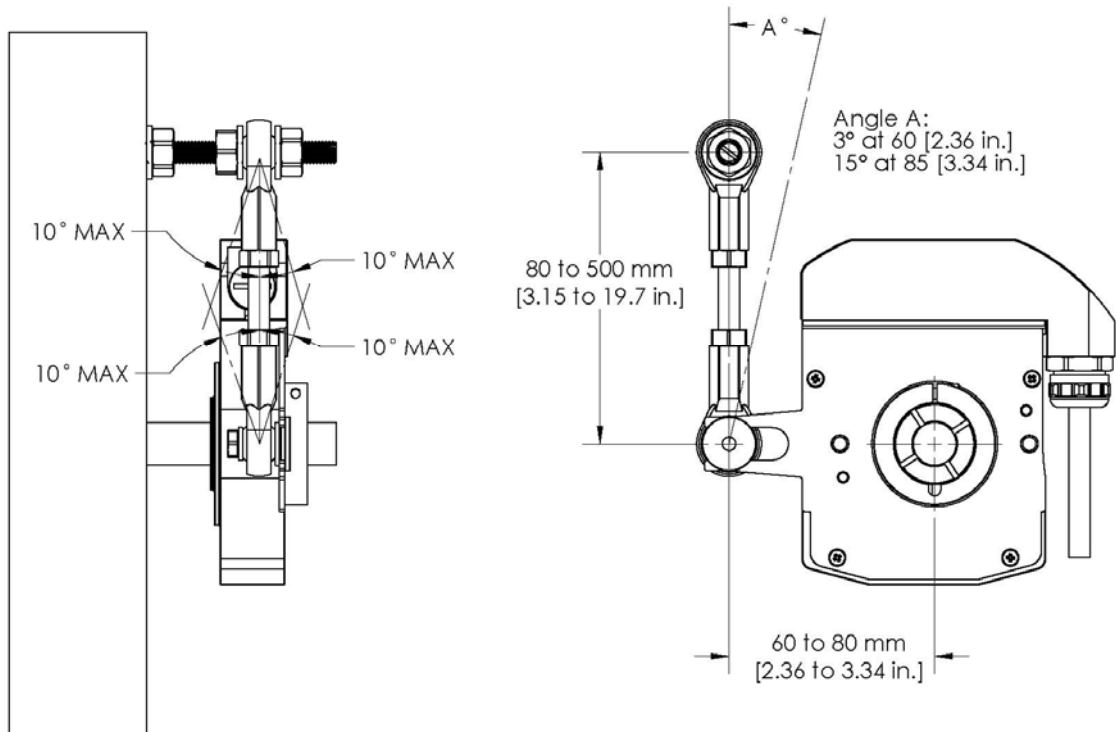
T3 – Short Tether arm (56C flange compatible) with 1/4"-20 adj. hardware

P/N : M9445/058-02



Permissible misalignments	
Axial	+/-2mm [0.08 in.]
Perpendicularity	+/-5°
Angular rigidity >200 N.m/rad [147 lbf*ft/rad]	

Ball end tether arm set for terminal box version
P/N – M9230-04/xxx
(xxx = length in mm) to be ordered separately



Flange Mountings

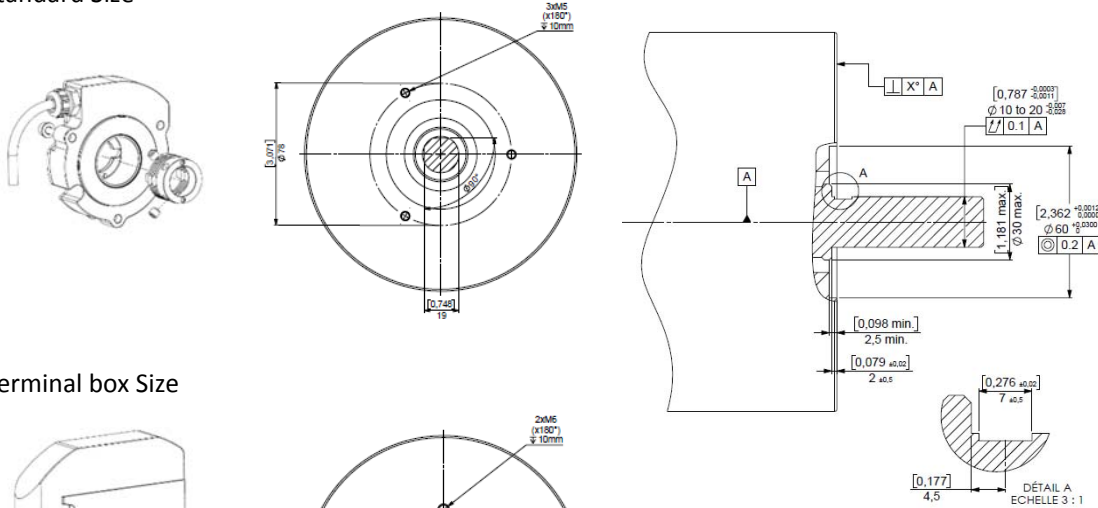
Integrated coupling



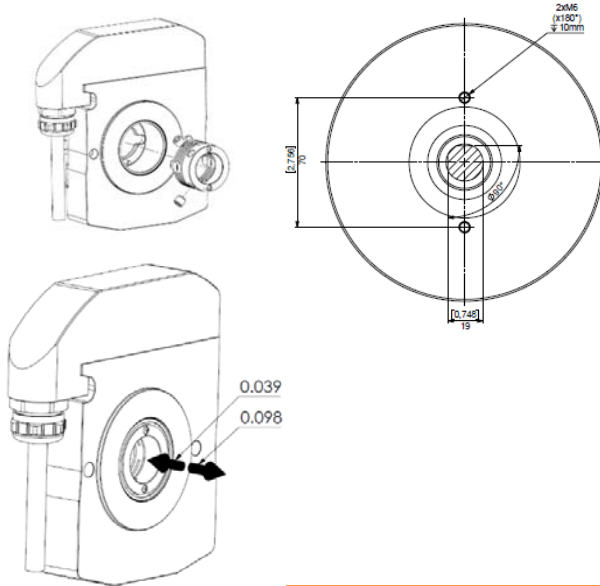
CAUTION

The mounting face must be rigid and aligned according the dimensions and geometry given on the drawing and table below.

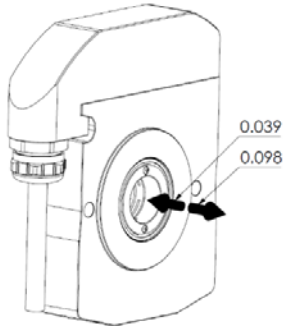
Standard Size



Terminal box Size

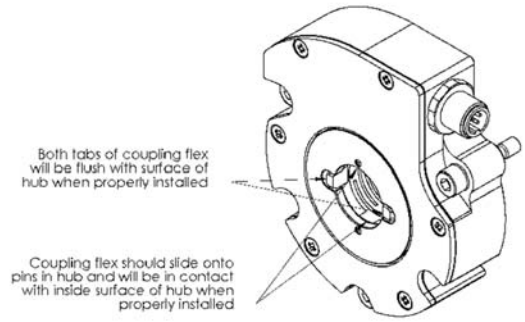


Shaft Diameter	Perpendicularity (X°)
Ø<0.7" (18mm)	+/- 1°
0.787" (Ø20mm)	+/- 0.25°



Axial Permissible misalignment
(Standard and Terminal Box)

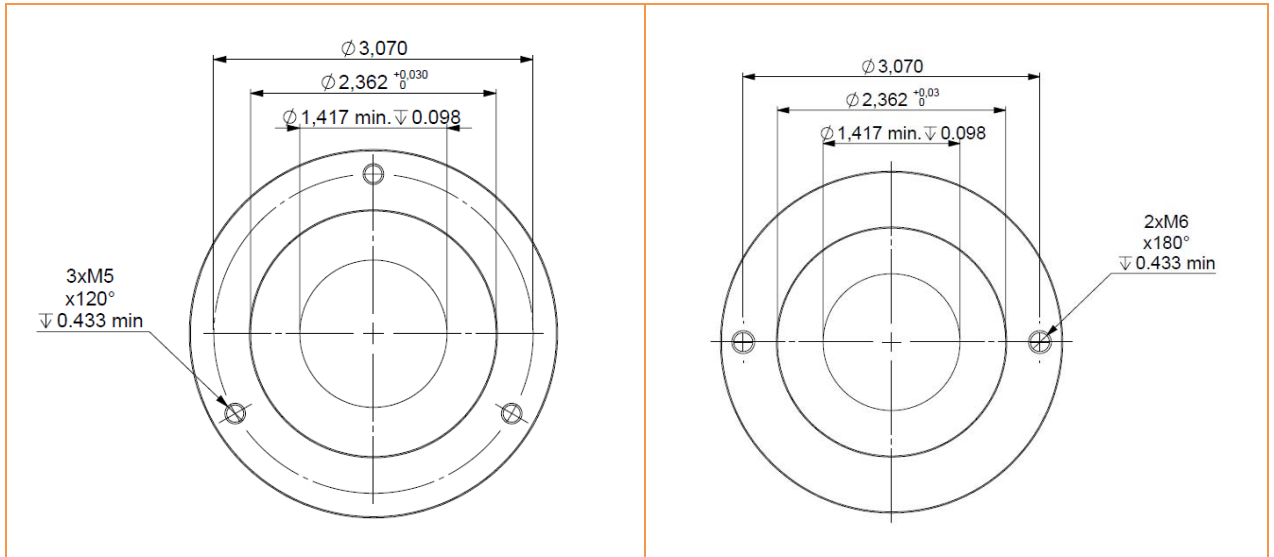
+1.0mm/-2.5mm [+0.039 in/-0.098 in]



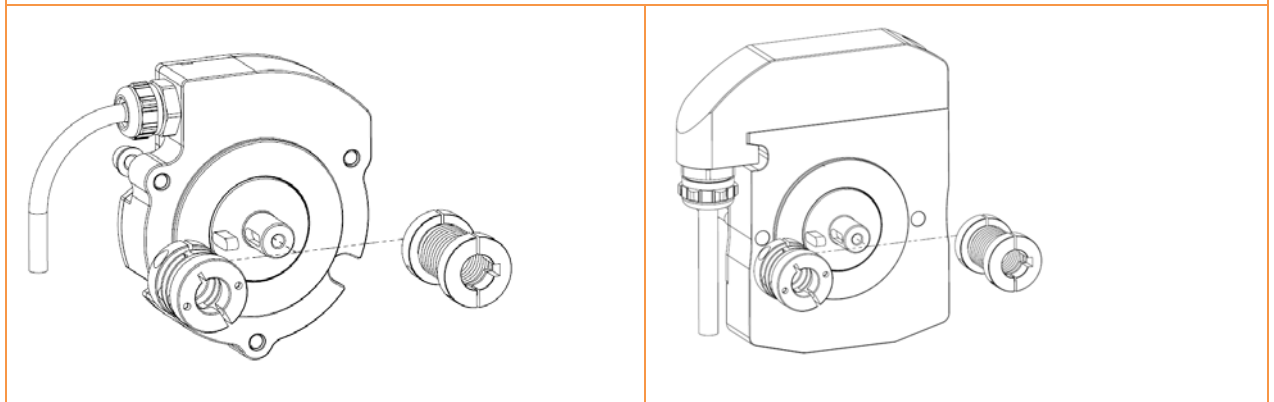
Flange Mountings

Solid shaft

Standard mounting hole pattern	Terminal box mounting hole pattern
--------------------------------	------------------------------------



Flexible shaft couplings are recommended



Mechanical figures

Parameter	Value
Material, Bearings, Maximum loads, Shaft inertia, Dynamic torque. Maximal speed (continuous & permissible) Encoder weight	This data may vary from one configuration to another one. Consequently, refer to the specific datasheets for detailed information.

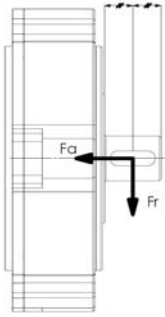
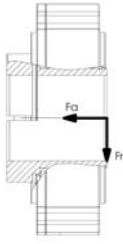
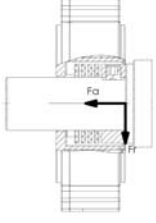
Other important parameters are described in more detail in specific sections of this manual.

1.2.3. Bearing life



CAUTION

Exceeding the values listed below drastically reduces the expected life time of the products. Avoid working at or near the load limits and consider the relation between misalignment and lifetime expectancy.

Scheme	Model	Axial/radial load (N) Pounds (Fa/Fr)	Continuous speed (rpm)	Bearing Life: L _{10h} * (hours)
	Solid shaft	100 / 200 [22 / 44 lbf] 40 / 80 [9 / 18 lbf]	3 000 6 000	< 7200 < 8300
	Through hollow shaft	20 / 40 [4.5 / 9 lbf]	6 000	> 100 000
	Integrated coupling	10/20 [2.2 / 4.4 lbf] (max; load transmitted by the integrated coupling)	6 000	> 100 000

* According to ISO 281: 1990, L₁₀, Values are calculated based on the complete temperature range of the encoders.

1.2.4. Accessories

1.2.4.1. Tethers

Tethers are designed to provide a high degree of angular stability while at the same time allowing compensation for the driving shaft runout and dimensional errors as well as any normal axial shaft movement.

The complete mounting set for tethers including all fasteners are described in the section “1.2.2.2 Flange and shaft configurations”

1.2.4.2. Isolation Sleeve

The use of Variable Frequency Drives (VFD's) or industrial DC motors often results in induced currents on the driving shaft which can damage the encoder bearings.

For through hollow shaft encoders:

Use an insulated sleeve to prevent these currents from damaging the encoder bearings and reducing their service life. They are included in the Encoder P/N for all shaft diameters smaller than 30mm.

Ordering code, when bought separately:

P/N: 9418/H20 for 20 mm shaft

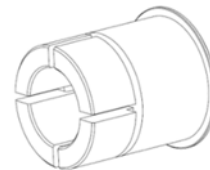
P/N: 9418/HE8 for 1" shaft

P/N: 9418/HE7 for 7/8" shaft

P/N: 9418/HE6 for 3/4" shaft

P/N: 9418/HE5 for 5/8" shaft

Reduction sleeve insulation: 2.5 kV



For integrated coupling encoders:

The integrated coupling device is insulated by design to prevent leakage currents from damaging the encoder bearings and reducing their service life.

Insulation using integrated coupling is 1 kV for a 20mm shaft.



CAUTION

Exceeding the misalignment and dimensional values listed in the section “1.2.2.2” drastically reduce the insulation capability of the products.

1.2.4.3. Cable-connector assemblies

For reliability reasons, we recommend to use BEI sensors qualified cables or M12 cable-connector assemblies.

Cable type (refer 2.1.Range presentation for description)	Jacket material	Temperature range (Static/dynamic)	Smallest bending radius (static use)	Smallest bending radius (dynamic use)	Order format
SGXXX (1)	PVC	-40°+80°C	30mm	90mm	Ex: SG120; 120 = 120''
STEXX (2)	Silicone	-40°+100°C	60mm	60mm	Ex: STE005; 005 = .5m
SQPXXX (1)	PUR	-40°+80°C	30mm	90mm	Ex: SQP020; 020 = 2 m

(1) UL listed: -20°C +80°C

(2) Advised cable for mobile application, in extreme temperature from -40°C to +100°C

M12 cable assembly	Customized	Connector	Cable type	Wiring	Length
		9416/111 M12 – 8 poles mating connector with terminals	8230/005 8230/165 8230/200	GM (compatible with M12 connector)	XXX From 0,5m (code: 005) to 25m (code: 250) by 0,1m steps
P/N example :9416/111-8230/200-GM-005					
M12 Over-molded		8230/362	PVC Jacket	GM	2 m
		8230/356			5 m
		8230/365			10 m

BEI Sensors is not responsible for cable-connector assemblies not supplied by the company.

1.3. INCREMENTAL ENCODER ELECTRICAL SPECIFICATIONS

1.3.1. Power supply

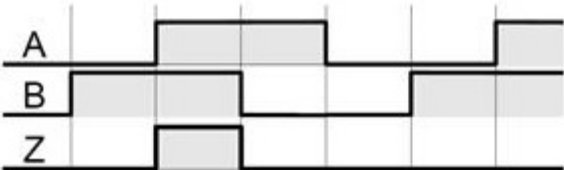
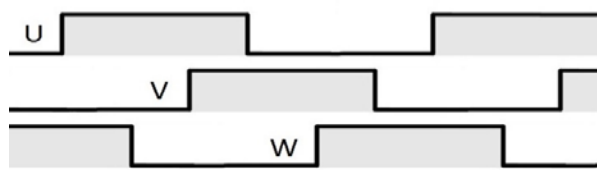
	28/5	28/V	28/VR
Supply voltage +V:	4.75-30VDC	5-30VDC	11-30VDC
Ripples:	250mV max.		
Consumption without load:	75mA max.		100mA max.
Consumption with load:	200mA max.	200mA max.	250mA max.
Output current:	40mA max by pair		60mA max by pair
Min/Max load:	100 ohms – 240 ohms	at 11V: 275 ohms – 3k ohms at 24V: 600 ohms – 3k ohms at 30V: 750 ohms – 3k ohms	
Supply type:	Power supply according to SELV/PELV with a maximum 60VDC fault.		

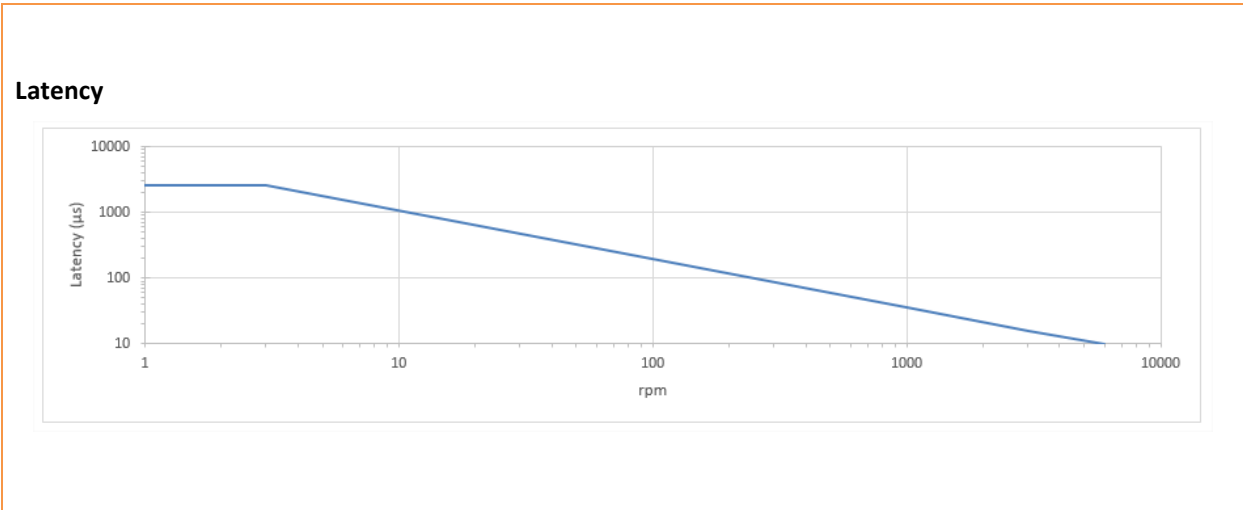
1.3.2. Electrical protection

	28V/5	28V/V	28/VR
Polarity inversion:	Yes (without time limit)		
Short circuit (when properly powered):	To 0V = yes To +V = no To other signals = yes	To 0V = yes To +V = yes To other signals = yes	To 0V = yes To +V = yes To other signals = yes
Overvoltage:	Exceeding the nominal supply voltage range may definitely damage the encoder		Up to 60VDC
Surges/transients:	Yes		

For further details on electrical immunity, refer to “2.4.4. EMC section”.

1.3.3. Output signals

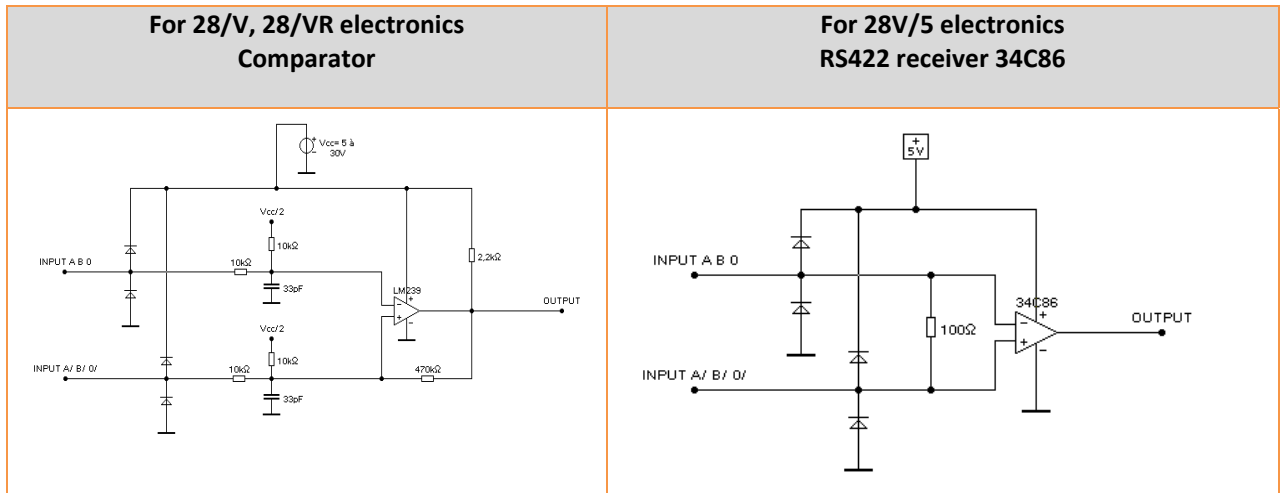
Incremental signals	Commutation tracks signals (contact factory)
<p>Two signals A and B, phased by 90°, indicates the speed, relative count, and rotation direction. One ¼ cycle wide Z pulse per turn is provided.</p>  <p>Inverted signals A/, B/, and Z/ are also present but have been omitted for clarity.</p>	<p>Three channels U V W, phased by 120°, giving the position of the motor rotor.</p>  <p>Inverted signals U/, V/, and W/ are also present but have been omitted for clarity.</p>



Output specifications (**typical data**):

Phasing tolerance	90° +/-45°	
Duty cycle	50% +/-25%	
Output signal frequency	300kHz max. depending on cable length. Refer "4.1.2. General Electrical and wiring precautions" section for further details.	
Jitter (average)	1024 : < 8%	2048 : < 16%
	4096 : < 30%	10000 : < 45%

1.3.4. Recommended receiver circuitry



1.4. ABSOLUTE ENCODER ELECTRICAL SPECIFICATIONS

1.4.1. Power supply

	28/SI – 28/SR
Supply voltage +V:	5-30VDC
Ripples:	250mV max.
Consumption without load:	75mA max.
Consumption with load:	150mA max.
Output current:	10 mA max by Data pair
Min max load:	100 ohms – 240 ohms
Supply type:	Power supply according to SELV/PELV with a maximum 60VDC fault.

1.4.2. Electrical protection

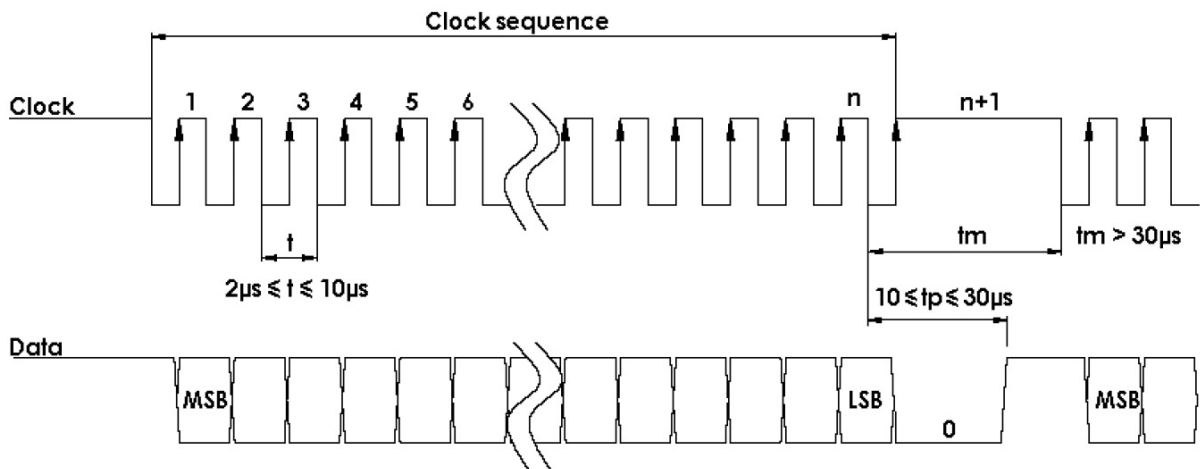
	28/SI	28/SR
Polarity inversion:	Yes	Yes
Short circuit when properly powered:	To 0V = yes To +V = no To other signals = yes	To 0V = yes To +V = yes To other signals = yes
Overvoltage:	Exceeding the nominal supply voltage range may definitely damage the encoder.	Exceeding the nominal supply voltage range may definitely damage the encoder.
Surges/transients:	Yes	Yes

For further details on electrical immunity, refer to “2.4.4. EMC section”.

1.4.3. SSI Output signals

SSI

For the transmission of one position value of a rotary encoder, a specific number (n) of clock signals (one clock sequence) must be sent to the clock input of the rotary encoder where n = number of bits to be transferred. The data doesn't change during the transmission of a position value. With the following rising edge transition of the clock signal the serial transmission begins with the most significant bit (MSB). With each following rising edge transition of the clock signal, the next lower significant bit is placed on the serial output data line. After the least significant bit (LSB) is shifted out, the last rising edge transition of the clock signal switches the data line to low, signaling transmission end.



SSI transmission without parity bit

Latency

See “1.3.2. Output signals – Latency”

MAXIMUM FREQUENCY

A delay due to cable capacitance must be taken into consideration for the outward signal (CLOCK) and the return (DATA). It must always be less than a transmission period, otherwise the word cannot be properly reconstructed. A limit on the transmission frequency, depending on the cable length is shown in the table, below. The table shows the approximate maximum length of cable allowed as a function of the clock frequency (this is dependent on the cable).

Length of cable	Frequency
< 50 m	< 400 kHz
< 90 m	< 300 kHz
< 150 m	< 200 kHz
< 350 m	< 100 kHz

CABLE CHARACTERISTICS ACCORDING TO RS422 STANDARDS

Capacitance :

< 60 pF/m between conductors of a same pair

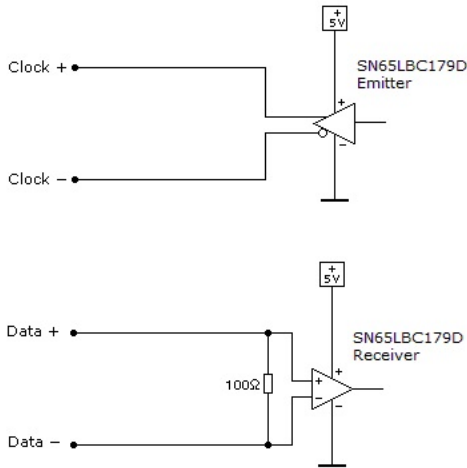
< 120 pF/m between a conductor and others connected to the ground

SSI drivers support high transmission rates and long line lengths.

One twisted pair line for the data and one twisted pair line for the shift clock are necessary.

BEI Sensors preferred reference cable for long length = SQPXXX. Ex: SQP500 = 50 m cable

1.4.4. Recommended receiver circuitry




1.5. ENVIRONMENTAL SPECIFICATIONS

1.5.1. Ingress protection

Refer to the Datasheets for the IP rating in each product configuration.

1.5.1. Operating temperatures



CAUTION

Overheating of the encoder could cause irreversible mechanical damage leading to a potential loss of seal. Any encoder which has been subjected to temperatures outside its rated specifications may be damaged.

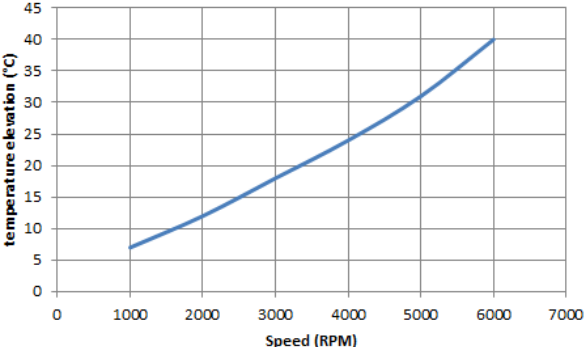
Maximum working temperature range is **from -40°C to +100°C**. This temperature range corresponds to the housing surface temperature. The de-rating parameters listed below must be considered when estimating the maximum permissible ambient temperature range in any application.

CAUTION

For UL listed products the temperature range is limited to -40°C to +85°C housing surface temperature.

CAUTION

Operating within admissible ambient temperature is dependent on cable parameters listed in the section “4.1.2.General Electrical and wiring precautions” and the table below

De-rating parameters	Value
Power supply*	Typically, the higher the supplied voltage, the more the power dissipation of the input stage will be.
Electrical loads*	The lower the output impedance, the hotter the output driver stage will be. However, never exceed the highest value of output load given in the documentation.
Mechanical loads*	Mechanical heating is influenced by the load on the bearing block.
Application power dissipation*	Encoder’s surface temperature is dependent on the configuration of the area around the device: heat transmission with other parts (frame, shaft, radiator...), to the air (air flow)/liquid/dust.
Encoder speed	<p>The temperature given on the following charts is to be added to the ambient temperature. The total must never exceed the maximum T°C given by the datasheet.</p>  <p>These temperature elevations are typical values which should be considered as indications only.</p>

* For further information on de-rating parameters, please contact the factory.

1.5.2. Chemical protection

All housings have been submitted to salt spray test – EN 60068-2-11 / Part 2, Test type Ka – 168 hours according to their respective datasheet.

Aluminum parts are protected by clear anodization.

All shafts are AISI 303 stainless steel.

Connectors and cable glands are in nickel-plated brass or stainless steel.

Rotary seals and O-rings are in Nitrile. Detailed specifications are available on request.

Several cable jacket materials are available (PVC, PUR or Silicone). Environmental specifications are available on request.

1.5.3. EMC

The complete encoder range is compliant with EMC as follows:

1.5.3.1. Emission:

According to general standard **EN 61000-6-4**

Phenomenon	Basic standard	Level
Radiated emission	EN 5016-2-3	Test from 30MHz to 1GHz, 3m distant antenna

1.5.3.2. Immunity:

According to general standard **EN 61000-6-2**

The increased levels are in accordance with the IEC 62061 (2005).

Port	Phenomenon	Basic standard	Increased value for additional tests for SRECS performance
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	6kV/8kV contact/air discharge
	Electromagnetic (EM) field	IEC 61000-4-3	20V/m (80MHz – 1GHz) 6V/m (1.4GHz – 2GHz) 3V/m (2GHz – 2.7GHz)
	Rated power frequency magnetic field	IEC 61000-4-8	30A/m
VDC Power	Burst	IEC 61000-4-4	4kV
	Surge	IEC 61000-4-5	1kV line-to-line 4kV line-to-ground
	Conducted RF	IEC 61000-4-6	10V at frequencies given
I/O signals / Control lines	Burst	IEC 61000-4-4	2kV for lines >3m
	Surge	IEC 61000-4-5	2kV line-to-ground
	Conducted RF	IEC 61000-4-6	10V at frequencies given
Functional earth	Burst	IEC 61000-4-4	2kV

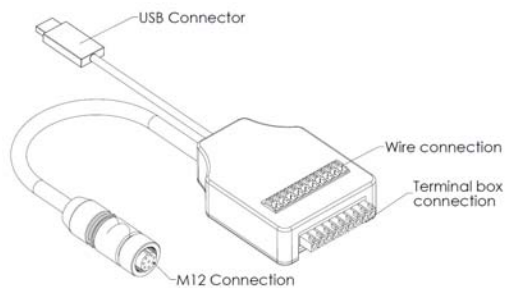
To fully comply with the EMC performance test done, the encoder body and the cable shield must be grounded to earth or 0V.

1.6 HAZARDOUS AREA PRODUCT

This user Manual contains general installation instructions and operation details usable for most applications. For LP35 products used in hazardous areas, you must also refer to the indicated product specification sheets for important warnings, installation and operation details related to the specific protection method. They contain very important information and special conditions for safe use vital to the safe operation of the product in a hazardous environment.

Protection method	Encoder model	Document reference
Intrinsic safety	LP35-HX (HH_9_/_/E4,E6,E8/)	02152-001
	LP35-HX_T (HH_B_/_/E4,E6,E8/)	
Explosion proof	Control Drawing & Declaration	2000/011
	LP35-HC (HH_X/..._ & AH_X...)	02162-001
Non-sparking	Control Drawing & Declaration	2000/040
	LP35-HN (HH_9_/_/E5,E7,E9/)	02164-001
	LP35-HN_T (HH_B_/_/E5,E7,E9/)	
	LP35-HN-X (AH_9_/_/E5,E7,E9/)	
LP35-HN-Z_T (AH_B_/_/E5,E7,E9/)		
	Control Drawing & UL-EU declaration	2000/013


2. ENCODER PROGRAMMING TOOL




Download the software and drivers on BEI Sensors website www.beisensors.com
 Prior to using the software programming tool, additional USB drivers may be needed.
 OS requirements: Windows XP or higher.

For more detailed instructions on programming refer to the Programmable LP Series specification sheet.

3. CERTIFICATIONS

UL Mark : Certified by	Assessment number
UL International France S.A. Espace Technologique, Bâtiment Explorer Route de l'Orme F-91190 SAINT-AUBIN France T:: +33 1 60 19 88 00 F:: +33 1 60 19 88 80	 LISTED Proc. Cont. Eq. E477663


CE marking :




EC DECLARATION OF CONFORMITY


We, BEI Sensors, declare that the products listed below meet the requirements of the EC Directives indicated with respect to design and manufacturing. This declaration becomes invalid in the case of any modification to the product not authorized by BEI Sensors.

Range:	LP series Encoders
Products:	HHU9/AHU9xx-xxxx-xxx, HHUB/AHUBxx-xxxx-xxx, HHK9/AHK9xx-xxxx-xxx, HHKB/AHKBxx-xxxx-xxx, HHA9/AHA9xx-xxxx-xxx, HHAB/AHABxx-xxxx-xxx, HHM9/AHM9xx-xxxx-xxx, HHMB/AHMBxx-xxxx-xxx,
Directives	EC Directive EMC 2004/108/EC EC Directive Low Voltage 2006/95/EC
Applied harmonized standards, especially:	EN 61000-6-4:2007/A1:2011 EN 61000-6-2:2005/AC:2005
Technical specifications	Product Datasheet User Manual

Company stamp: <div style="text-align: center;"> BEI SENSORS SAS 9, rue de Copernique Espace Européen de l'Entreprise - Schiltigheim BP 70044+ • F 67013 STRASBOURG Cedex Tél. : +33 (0)3 81 20 60 80 Fax: +33 (0)3 88 20 67 8 </div>	Date: October 17 th , 2015 Name: Matuszewski Ludivine Department: quality Signature: 
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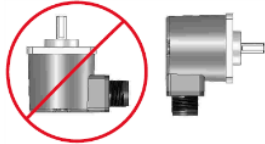

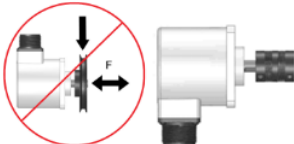


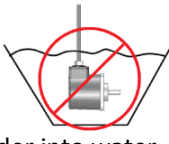
BEI SENSORS Siège social : 9, rue de Copernique - Espace Européen de l'Entreprise - F-67300 Schiltigheim - France
 Tél. : +33 (0)3 88 20 89 80 • Fax : +33 (0)3 88 20 87 87 • Mail : info@beisensors.com • www.beisensors.com
 Société par actions enregistrée au capital de 300 000 € I.S.R. - RCS Strasbourg B 419 890 728
 Code NAF 2651 B - N° Mark TVA FR 25 419 890 728




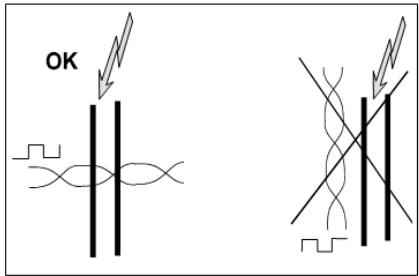
4. INSTALLATION AND START UP

4.1. GENERAL CAUTIONS

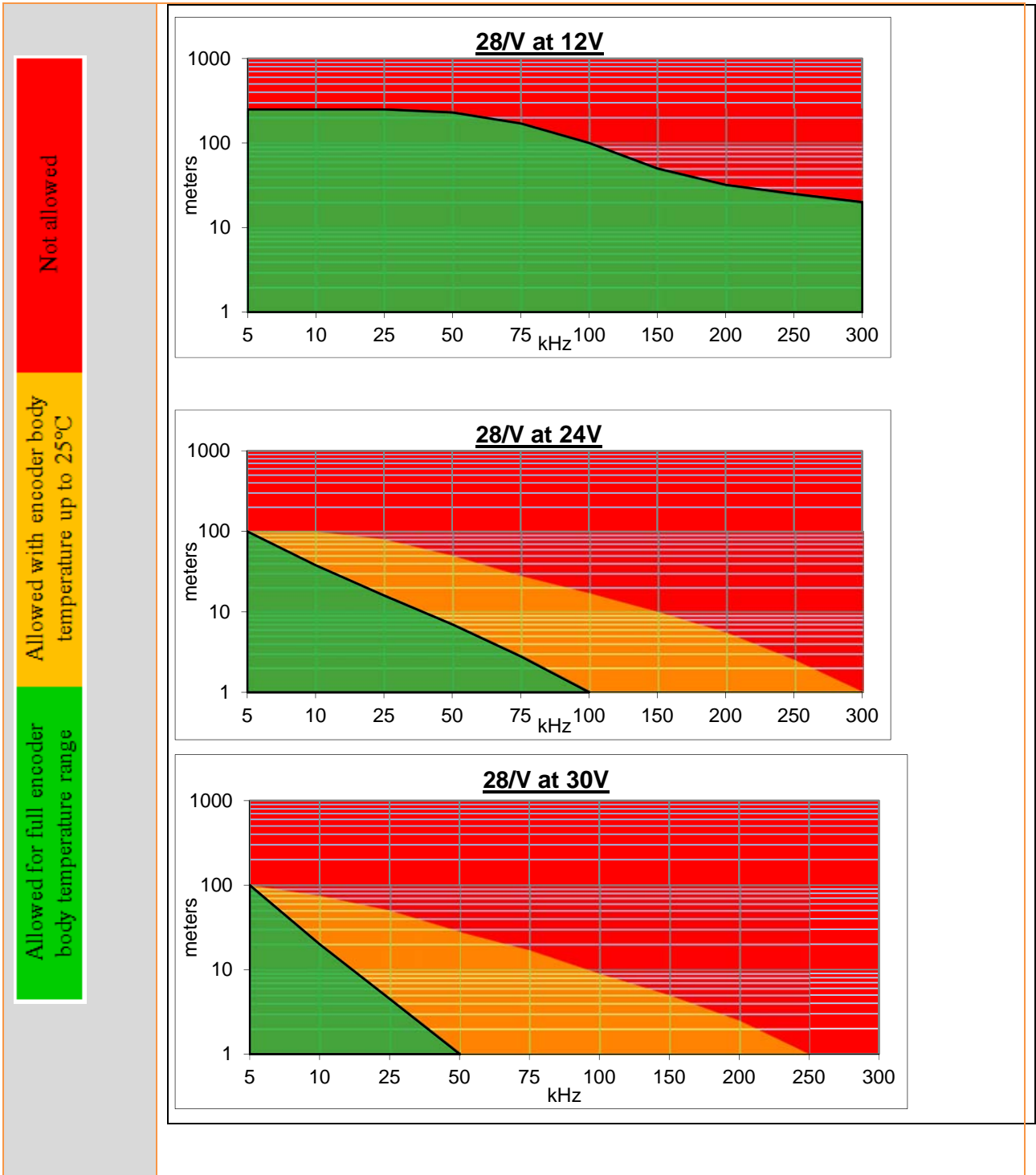
4.1.1. General mechanical precautions

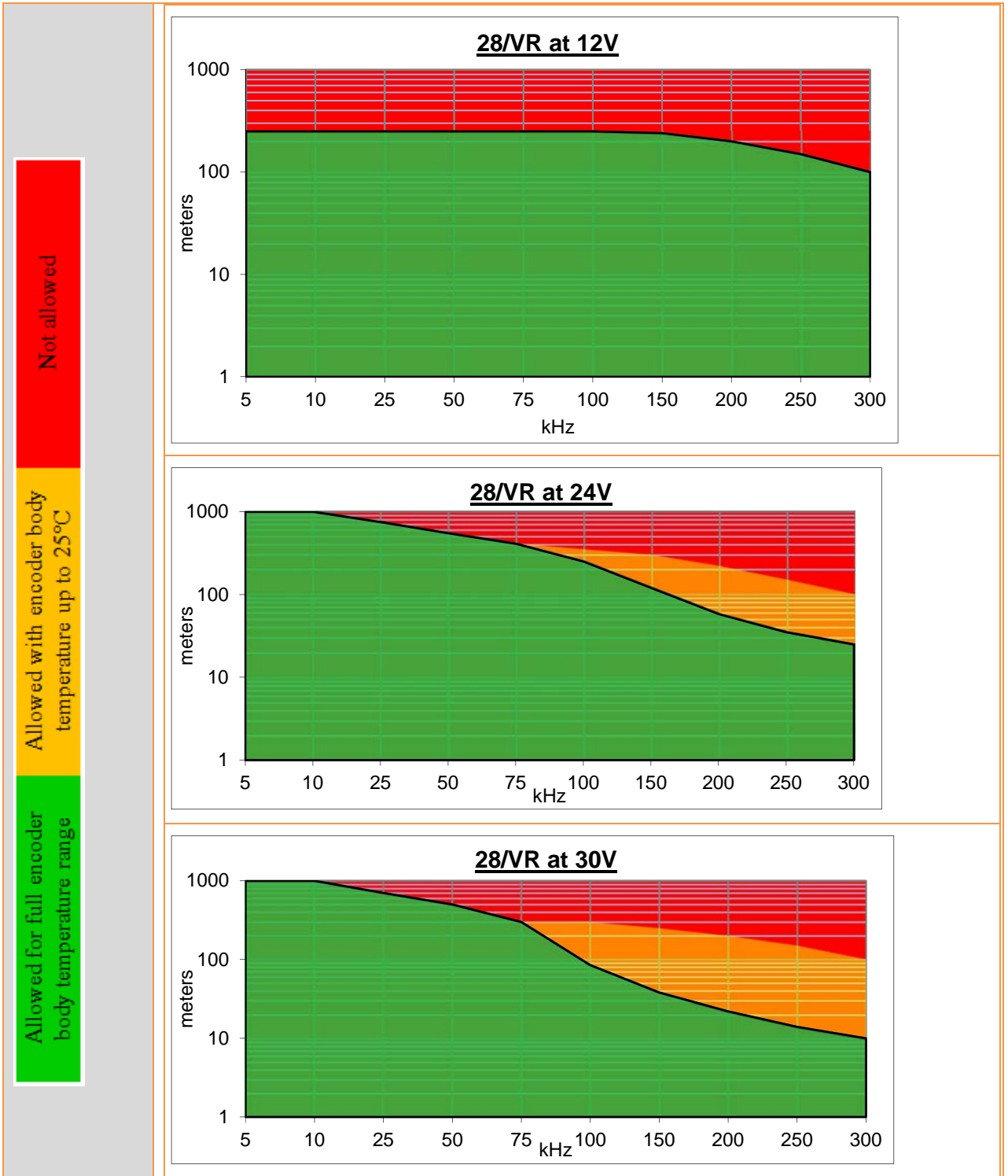
 <p>No shocks nor unnecessary stresses</p>	 <p>Do not drill, file or otherwise modify the product</p>	 <p>Avoid installing with shaft upright, liquid may pool and eventually cause internal leaking.</p>
 <p>Do not drop</p>	 <p>Do not hard couple encoder to driving shaft. Instead use flexible couplings to minimize stress on encoder bearings</p>	 <p>Do not dismantle nor repair</p>
 <p>Do not carry the encoder by the cable.</p>		 <p>Do not dip encoder into water, check encoder IP code.</p>

4.1.2. General Electrical and wiring precautions

General	General parameters given in the LP35 Series product datasheet or in this manual (electrical and environmental) should never be exceeded or the LP35 Series product or associated control devices may be damaged							
	Respect the standard recommendations governing the use of cables and other connection devices in industrial applications, including all the recommendations listed in this table.							
Mechanical precautions	Bending radius: refer to section “ 1.2.4.3 Cable-connector assemblies”							
	Protect the cables to avoid a cut or damage during operation, otherwise safety or function could be compromised.							
	Do not pull cable during mounting and operation.							
	Avoid loads generated on the encoder by cable tension. Always allow a service loop in the cable length between encoder and the first cable clamp to relieve stresses.							
Electrical precautions	 WARNING Never connect the encoder to mains (115V, 220V...)!							
	Never operate with a cable which is totally or partially coiled. It could lead to EMC disturbances or irreversible electrical damage on the installation.							
	Never connect outputs together.							
	Never connect outputs to a potential.							
	Never connect outputs directly to ground.							
	Never use the same cable for driving high power lines and encoder signals: separate output data signal cables (low voltage) and potentially interfering signal cables (higher voltage, such as power supply, variable frequency drive, etc.) with a grounded metal screen. Do not let power and signal cables run parallel – Cross them perpendicularly.							
	<u>Power supply wires section</u> When using 5V power supplies, care must be taken on conductor cross-section. A small conductor cross-section can cause power supply voltage drop on the cable, on 0V and +V wires. BEI Sensors cable-connectors assemblies are recommended. If using another cable type, contact customer service for more information. Ensure that cable impedance is adapted to the encoder:	<table border="1"> <tr> <td>Max. impedance</td> <td>100 ohms/km</td> </tr> </table>	Max. impedance	100 ohms/km				
	Max. impedance	100 ohms/km						
	<u>Signal wires section</u> A section of 0.14mm ² up to 0.22mm ² is recommended to avoid high capacitance between signals causing coupling.	<table border="1"> <tr> <td>Max. impedance</td> <td>150 ohms/km</td> </tr> <tr> <td>Max. capacitance between wires</td> <td>100 pF/m</td> </tr> <tr> <td>Max. capacitance wires to shield</td> <td>150 pF/m</td> </tr> </table>	Max. impedance	150 ohms/km	Max. capacitance between wires	100 pF/m	Max. capacitance wires to shield	150 pF/m
	Max. impedance	150 ohms/km						
Max. capacitance between wires	100 pF/m							
Max. capacitance wires to shield	150 pF/m							
Check that the user electrical input interface is compliant with the external loads required on “2.3.Electrical specifications” section.								

<p>Wiring precautions</p> <div style="background-color: red; color: white; text-align: center; padding: 5px; margin: 5px 0;">Not allowed</div> <div style="background-color: yellow; text-align: center; padding: 5px; margin: 5px 0;">Allowed with encoder body temperature up to 25°C</div> <div style="background-color: green; text-align: center; padding: 5px; margin: 5px 0;">Allowed for full encoder body temperature range</div>	<p>Check that cable length is adapted to your application in terms of max. frequency and electronics type.</p>		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; padding: 5px;">Electronics</td> <td style="padding: 5px;"> <p>Electrical operating area (for BEI Sensors cables)</p> <p>The maximum cable length is a function of encoder electronic type, power supply, working frequency and body temperature.</p> </td> </tr> </table>	Electronics	<p>Electrical operating area (for BEI Sensors cables)</p> <p>The maximum cable length is a function of encoder electronic type, power supply, working frequency and body temperature.</p>
	Electronics	<p>Electrical operating area (for BEI Sensors cables)</p> <p>The maximum cable length is a function of encoder electronic type, power supply, working frequency and body temperature.</p>	
<div style="text-align: center; margin-bottom: 10px;"><u>28/5 at 5V</u></div> <div style="text-align: center; margin-bottom: 10px;"><u>28/5 at 24V</u></div>			





	Shield connection
	Ensure that encoder's case and cable shield are both connected to the same potential ground. Do not cut nor leave the ground grid unconnected.
	In the cabinet, connect the encoder cable shield to the ground grid if available, otherwise to the 0V (signal common).
	If a metallic connector is assembled by the user on the encoder cable, ensure a 360° contact on that connector.
	When using a shielded pair cable, always connect signals of the same channel to receiver pair: A with A/, B with B/, and Z with Z/.
Verify that all electrical devices are switched off before starting the installation.	
Check that you have all the necessary information on wiring connections: refer to the encoder sticker or outline drawing	
Check that you have the right power supply.	

4.2. MECHANICAL MOUNTING PROCEDURE



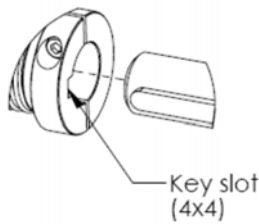
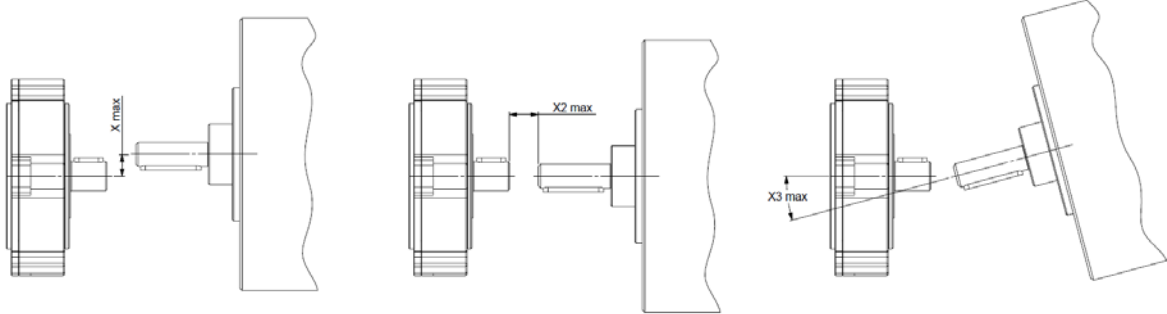
CAUTION

Solid shaft coupling: before mounting, check the shaft run out and alignment. These parameters must be in accordance with the coupling manufacturer’s specifications.

Solid shaft - mounting instructions

1- Preliminary Inspection

Before mounting, check the shaft run out and alignment. These parameters must be in accordance with coupling’s specifications.



Lateral misalignment has a negative effect on the service life of the couplings. Exact alignment of the coupling considerably increases the service life of the encoder. By reducing or eliminating lateral misalignment, the radial load on the adjacent bearing is reduced while increasing service life and reducing heat generation (see section “**Error! Reference source not found.**”). It is important to remain within the coupling supplier’s Technical Specifications to operate within the permissible values for the three types of misalignment limits. This ensures long life and proper operation of the

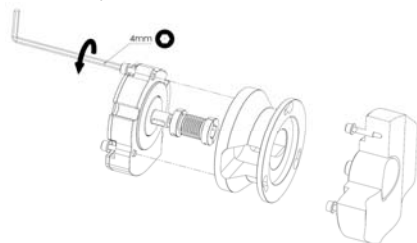
coupling.

Encoder shafts are machined with a key slot. Use a keyed coupling to secure the rotation transmission. Coupling dimensions and tolerances must comply with the shaft dimensions and tolerances given in the encoder’s datasheet. It is recommended to use diameter XXmm H7 and Ra 0.4-1.6.

2- Mount encoder on a mechanical frame (bell, bracket etc.).

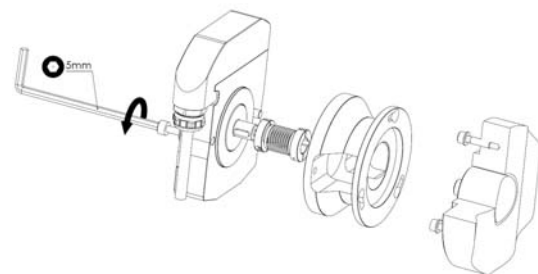
LP35-S shafted – hole pattern “1.2.2.2Flange and shaft configurations”

Use the three M5 captive screws for a safe assembly.



LP35-T shafted – hole pattern “1.2.2.2Flange and shaft configurations”

Use the two M6 captive screws for a safe assembly.



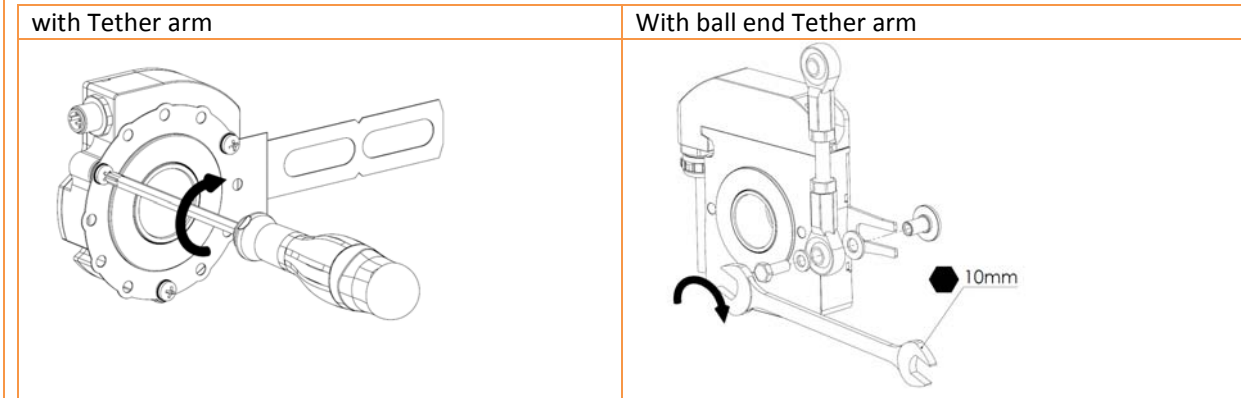
For a safe installation, the screws are used with appropriate washers.

If possible orient the cable or connector downwards.

4.2.1. Through hollow shaft - mounting instructions

1- Preliminary checking
 Check the driving shaft runout and tolerance: diameter X H7.
 Refer to section "1.2.2.2 Flange and shaft configurations"

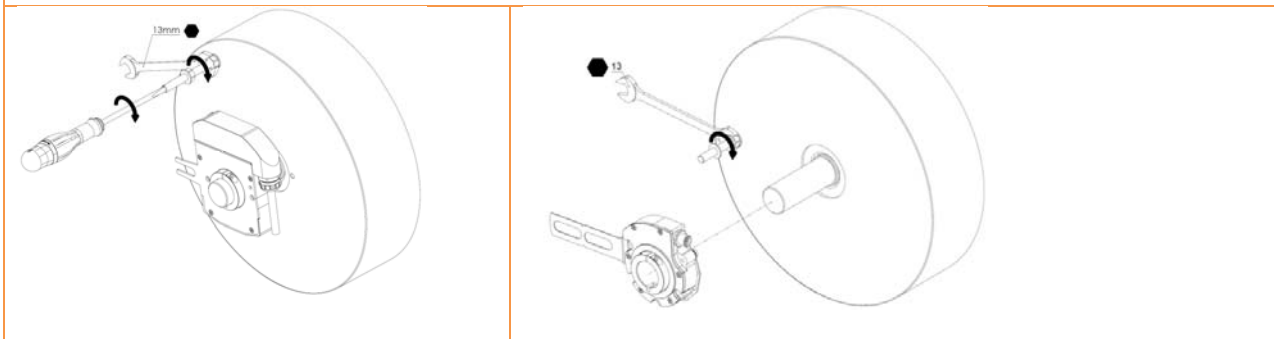
2- Anti rotation device assembly
 Mount the tether arm or ball end arm on the encoder (if delivered separately), secure the screws with the ribbed lock washers and thread locking compound, (Loctite 243 or equivalent).



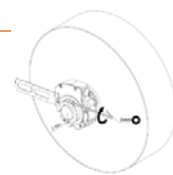
Recommended tightening torques: M5: 4.5 N.m [40 lb-in], M6: 8 N.m [70 lb-in]

3- Connect the encoder cable:	Wire the signals and power supply according to the wiring diagram. For more information refer to section "4.1.2 General Electrical and wiring precautions"
M12 connection:	Be sure the mating connector is fully engaged to ensure good electrical and mechanical contact and avoid loosening of the connection over time.
Terminal box:	Refer to section "4.2.3 Terminal box - connection and mounting instructions"

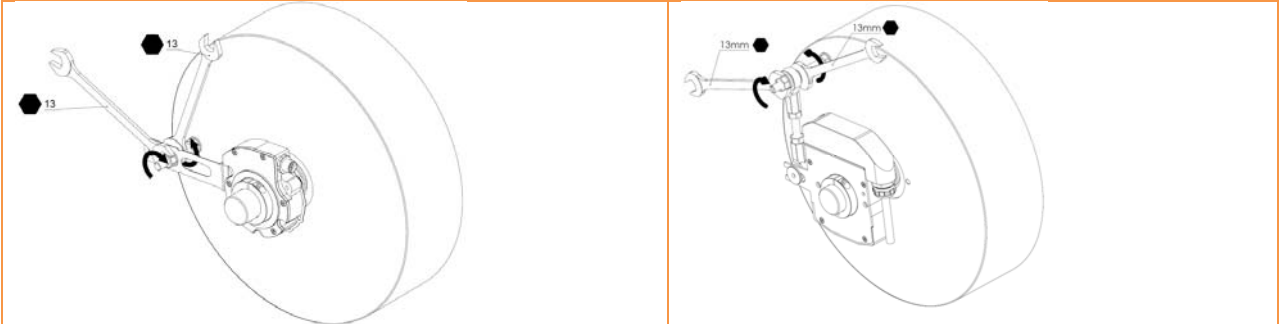
4- Mount the encoder on the shaft
 Before sliding the encoder on the shaft, tighten the threaded rod into the frame and secure it with the fasteners supplied in the tether or ball end arm mounting hardware set.



Slide the encoder onto the shaft by hand.
 For safe clamping verify the driving shaft extends at least 2mm [.06 in.] through encoder.
 Tighten the clamping ring with the M4 screw to: 3.5N.m [31 lb-in]



5- Fasten the encoder on the frame.
 Screw the nuts with the washers on the tether arm. Check the position of the tether arm. Avoid compressing or extending it to insure a minimal load on the bearing block. The mounting must be done without deforming the tether arm



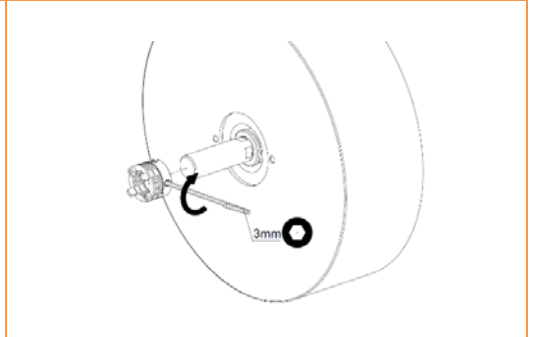
(All fasteners are available in the set)
 If possible, orient the cable or connector downwards.
 If the encoder shaft must be orientated vertically, it is recommended to use a protective cap to avoid liquid retention in sealing areas.

4.2.2. Hollow shaft with integrated coupling - mounting instructions

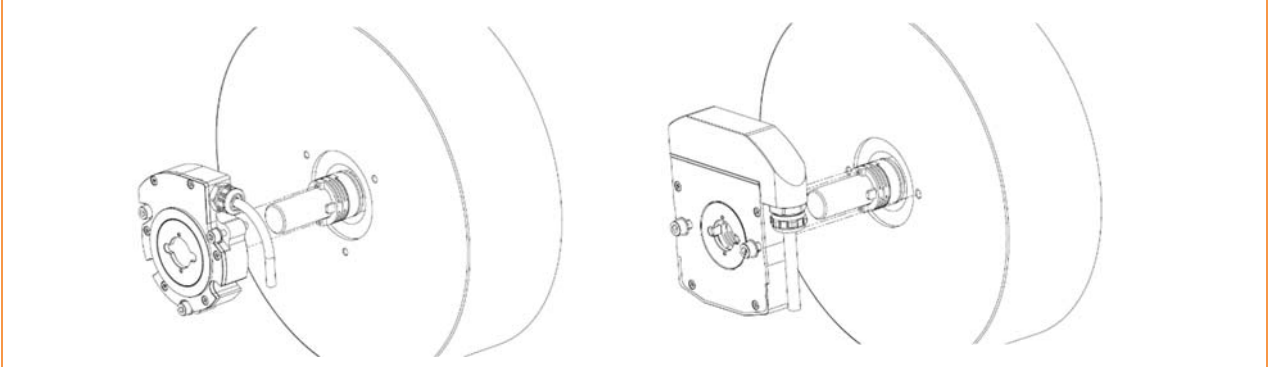
1- Preliminary checking
 Check the driving shaft runout and tolerance: diameter X H7.
 Refer to section “1.2.2.2 Flange and shaft configurations”

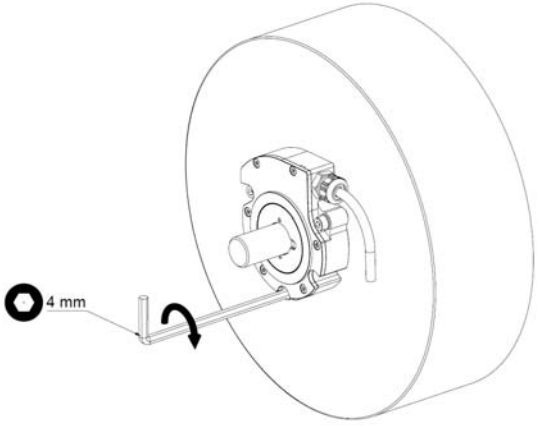
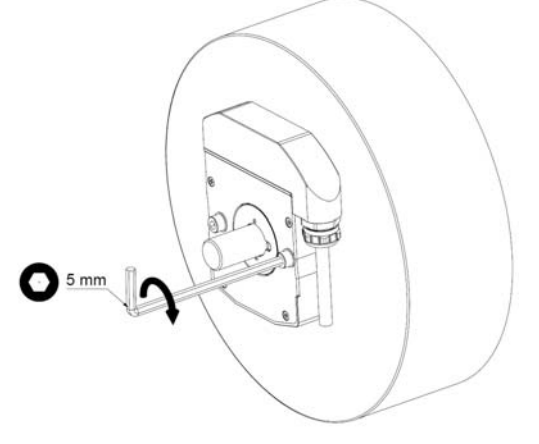
2 - Connect the encoder
 Refer to section “4.2.1 Through hollow shaft - mounting instructions”

3- Coupling mounting
 Mount the clamping ring/coupling assembly onto the shaft. Make sure it is at a position where it will be flush with the end of the LP35 encoder shaft. Apply thread lock compound (Loctite 243 or equivalent) and tighten the two M6 set screws to: 3.5N.m [31 lb-in]
 Optional: Align the set screws with the two flats on the shaft.

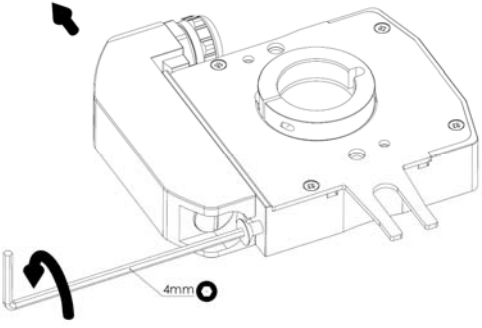
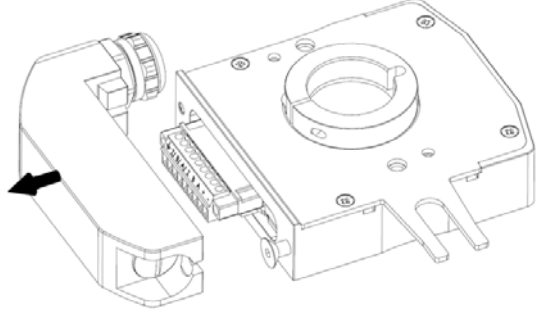
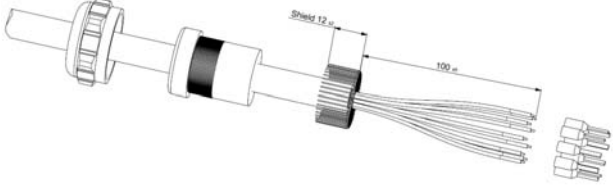
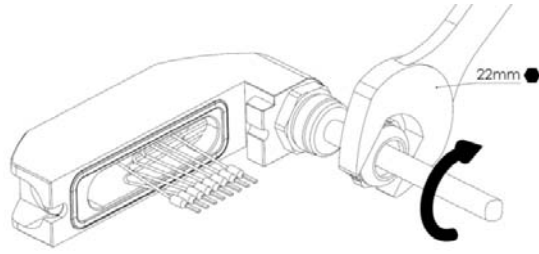
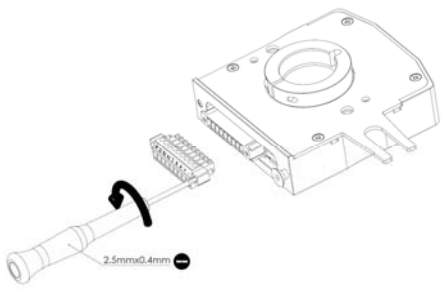
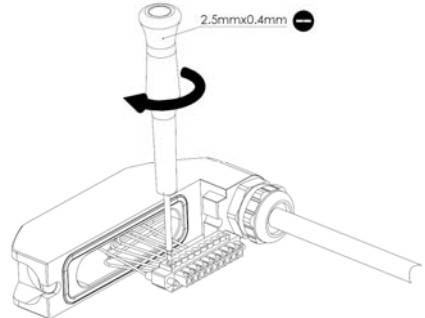


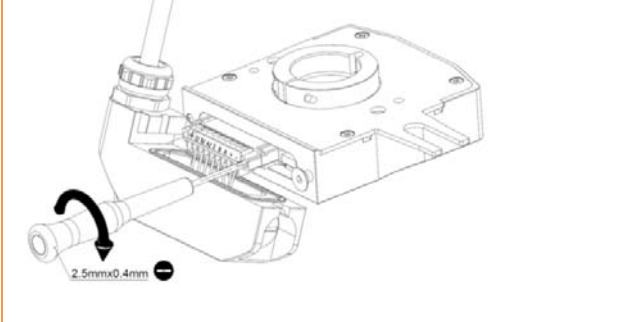
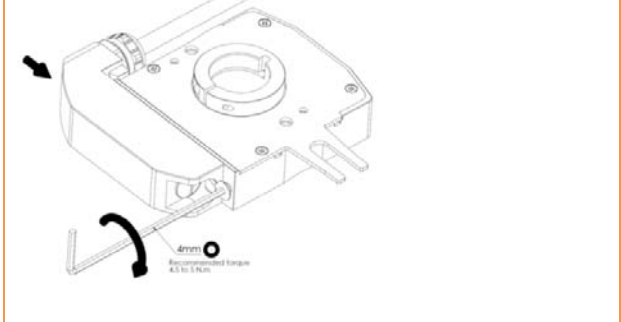
4- Slide the encoder on the shaft by hand.
 Align the 2 guides of the coupling with the two slots of the encoder shaft.
 Plug the encoder into the coupling. It should not require significant force to engage the coupling.



Verify if the guides are fully seated into the slots.	
Fasten the encoder to the frame. (The encoder is supplied with captive screws and washers).	
	
Tighten the three M5 socket screws to the recommended torque: 4.5 N.m [40 lb-in]	Tighten the two M6 socket screws to the recommended torque: 8 N.m [71 lb-in]

4.2.3. Terminal box - connection and mounting instructions

<p>1-Open the terminal box</p>	
<p>Unscrew the M5 by approximately 6 turns, leave the screw in place.</p>	<p>Unplug the terminal box by sliding it out of the tapped slot.</p>
	
<p>2-Prepare the cable</p>	
<p>2.1 Cut the cable jacket, prepare the wires for clamping the ferrules (admissible range: 0.14-0.75mm² or AWG26-AWG22), cut the shield to make a 360° shield connection through the cable gland insulation. Choose the appropriate cable gland sealing sleeve from the three provided with the encoder (Grey: 5 to 8mm, Green: 7 to 10.5mm and Red: 9 to 13mm). Slide the cable gland screw head on the cable, followed by the sealing sleeve. Put the shield over the seal and pay attention to not go over the ribs with the braids. (Detailed drawing N° 6108 on request)</p>	<p>2.2 Slide the cable through the terminal box cable gland. Tighten the cable gland screw head.</p>
	
<p>3-Wire the terminal box</p>	
<p>3.1 Remove the terminal connector from the housing.</p>	<p>3.2 Connect the wires following the functions indicated on the terminals.</p>
	

4-Plug the terminal box	
4.1 Screw the terminals on the housing.	4.2 Slide the box from the side into the tapped slot. Lock the box by pushing on the hard stop and tighten the screw to 4.5 to 5 N-m [40 to 44 lb-in].
	

5. PACKAGING, STORAGE AND TRANSPORT

5.1. BOX CONTENT

Each encoder is delivered in an individual package. Identification of the box is ensured by a label. Each box contains:

- 1 Encoder
- 1 Datasheet
- 1 Quick Installation Manual
- Optional accessories

5.2. STORAGE CONDITIONS

Take into account ambient conditions which are listed in encoders' datasheets.

Storage in original package is recommended. Protect device from dust, humidity and dirty environments. The connectors are protected by a cap. Remove the cap just before connecting the mating connector to avoid any dust or liquid in contact with the connection pins. The IP protection of the encoder is only applicable when it is correctly connected.

5.3. GENERAL CAUTIONS FOR TRANSPORT

Encoders which are not installed on customer applications (i.e. motors, conveyor shafts, etc.) must always be transported carefully and preferably in their original packaging. The package content must be maintained in its original position in the box. Do not remove shaft, coupling or connector protections during transport. Avoid dropping the box as that creates an uncontrolled shock.



CAUTION

If external damage is detected on the box when it is received, closely inspect the encoder before mounting (connector, shaft, stator coupling...). Damage due to transport may lead to dangerous fault. In case of doubt, unit must be replaced.

SERVICE, MAINTENANCE AND RECYCLING

5.4. COMPANY’S CONTACTS

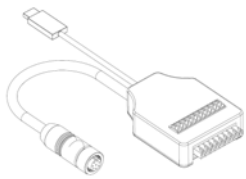

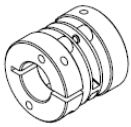
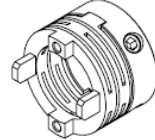
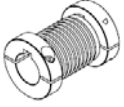
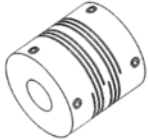
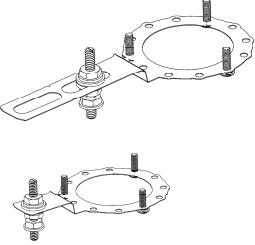
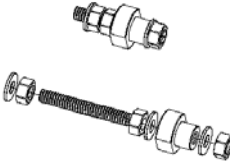
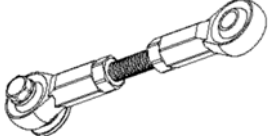
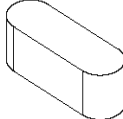
Headquarters	Europe BEI Sensors 9 rue de Copenhague BP 70044 Schiltigheim 67013 Strasbourg Cedex France	North America BEI Sensors 1461 Lawrence Dr Thousand Oaks - CA 91320 United States
Switchboard	+33 3 88 20 80 80	+1 805-716-0322
Customer services	+33 3 88 20 81 00	+1 805 716-0322 Toll Free: +1 800 350 2727
Aftersales services	+33 3 88 20 81 00	Toll Free: +1 800 350 2727

5.5. MAINTENANCE

No specific maintenance is required during encoder’s life time. There are no user serviceable parts inside. In case of any damage or unexpected product behavior, send the part back to factory’s aftersales service for analysis.

5.6. SPARE PARTS

Available spare parts are mainly listed in “2.2.5. Accessories section”. In addition, the following products can be ordered:

Picture	Designation - P/N	Picture	Accessory P/N
	USB Programming Tool EAP-001		Bore Reduction Sleeve 9418/H20 = 20 mm bore 9418/H8E = 1 in. bore 9418/H7E = 7/8 in. bore 9418/H6E = 3/4 in. bore 9418/H5E = 5/8 in. bore 9418/H4E = 1/2 in. bore 9418/H3E = 2/8 in. bore
	Spring Disk Coupling (Bore sizes from 6 mm to 16 mm) 9400/xx-yy 9400/12-10= 12 mm to 10 mm 9400/06-9.52= 6 mm to 3/8 in.		Integrated Coupling kit (includes flex, hub and set screws) M9410/009-14 = 14 mm M9410/009-20 = 20 mm M9410/009-E3 = 1/4 in. M9410/009-E4 = 1/2 in. M9410/009-E6 = 5/8 in.
	Secured Bellows Coupling (Bore sizes from 6 mm to 16 mm) 9403/S/xx-yy 9403/12-10 = 12 mm to 10 mm 9403/06-9.52 = 6 mm to 3/8 in.		Triple Beam Coupling 39074-12-12= 3/8 in. to 3/8 in. 39074-10MM-12= 10 mm to 3/8 in. 39074-12-8= 3/8 in. to 1/4 in.
	Long Tether Arm kit M9445/053= long tether, 8 x 1 mm rod M9445/053-01= long tether, 3/8"-16 rod M9445/053-02= long tether, 1/4"-20 rod Short Tether Arm kit M9455/058= short tether, 8 x 1 mm rod M9455/058-01= short tether, 3/8"-16 rod M9445/053-02= short tether, 1/4"-20 rod		Tether Pin Kit M9445/059 = 10 x 1.5 mm rod and hardware M9445/059-01 = 3/8"-16 rod and hardware M9445/059-02 = 1/4"-20 rod and hardware
	Ball End Tether Arm M9230-04/xxx (xxx= length in mm.; 80 mm to 500 mm) M9230-04/085 = 85 mm length		Key for 12mm slot 9435/006 = 4X4X12 mm key

5.7. Recycling

Devices are constituted of various materials which can be recycled. When they are to be discarded, these products shall be considered electronic waste and shall be handled and disposed of according to local regulations regarding such waste.

WARRANTY

The following warranty is in lieu of all other warranties, expressed, implied, written, oral or statutory, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. All new products manufactured and sold by BEI Sensors, a brand of Sensata Technologies, are warranted against defects in materials and workmanship for two (2) years from the date of original shipment. During the warranty period BEI Sensors will repair or, at its option, replace without charge any BEI Sensors product, providing it is returned to the factory, shipping prepaid, and is proven defective during the subsequent factory examination. Under no circumstances shall the warranties set forth apply to any product which has been customized or modified in the absence of written authority by BEI Sensors, damaged (accidentally or otherwise), subject to normal wear and tear or misused. BEI Sensors' liability arising out of the damaged (accidentally or otherwise), subject to normal wear and tear or misused. BEI Sensors' liability arising out of the manufacture, sale or supplying of its product or its use or disposition shall not exceed the actual purchase price paid for the product. The warranty for products repaired after the expiration of the new product warranty is limited to the portion of the product repaired and is valid for 90 days from the date of its reshipment. In no event shall BEI Sensors be liable to any person or entity for special, incidental or consequential damages (including but not limited to loss of profits, loss of data, or loss of use damages) arising out of the manufacture, sale or supplying of the product, even if BEI Sensors has been advised of the possibility of such damages or losses. Exclusions include: Accessory items such as cables, connectors or couplings and normal wear items such as measuring wheels. These carry a 90 day limited warranty.