

Linear measuring technology

Draw-wire encoder D120 **Robust-Line** **Measuring length max. 10 m**

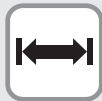


With their extremely robust construction, their high IP69k protection level and their wide temperature range up to -40 °C ... +85 °C the D120 draw-wire encoders are specially developed for outdoor applications.

Their flexibility and adaptability reflects in the wide range of housing and wire types, the long measuring range and the various interfaces. The possibility of redundancy must be particularly pointed out.



Analog output



Long service life



-40° ... +85°C



IP69k



Redundancy



V4A



Integrated swivel



For outdoor applications



3 housing types

Robust

- Protection level up to IP69k and wide temperature range up to -40 °C ... +85 °C.
- The titanium-anodized aluminum housing and the stainless steel wires allow using the mechanics even in harsh conditions.
- Wire diameter (stainless steel, V4A) up to ø 1.5 mm - ideal for outdoor applications.

Versatile

- Measuring length up to 10 m.
- Redundant outputs (mA, V, R, CANopen).
- The right measuring wire and the right wire fastening for every application.
- Linearity up to ±0.1 % of the measuring range.
- Various constructions: open, closed housing or housing with perforated sheet steel cover.

Order code

D8.D120 . **XXXXX** . **XXX X** . **0000**
Type a b c d e f

See also the extended ordering options on page 6

a Measuring length

- 3 = 3 m
- 4 = 4 m
- 5 = 5 m
- 6 = 6 m
- 7 = 7 m
- 8 = 8 m
- 9 = 9 m
- A = 10 m

b Wire types¹⁾

- 1 = V4A, ø 0.5 mm
- 2 = V4A, ø 1.0 mm (measuring length 3 ... 8 m)
- 3 = V4A, ø 1.5 mm (measuring length 3 ... 6 m)

c Linearity

- 1 = standard linearity 0.5 %
- 2 = improved linearity 0.25 %
- 3 = improved linearity 0.1 %

d Housing

- 1 = open housing, open wire guide
- 3 = with perforated sheet metal cover open wire guide
- 4 = with perforated sheet metal cover closed wire guide
- 6 = closed housing, closed wire guide

e Single sensor / Supply voltage

- A11 = 4 ... 20 mA / 12 ... 30 VDC
- A22 = 0 ... 10 V / 12 ... 30 VDC
- A33 = 1 kΩ / max. 30 VDC
- CC1 = CANopen / 8 ... 30 VDC

Redundant sensors / Supply voltage

- R11 = 2 x 4 ... 20 mA / 12 ... 30 VDC
- R22 = 2 x 0 ... 10 V / 12 ... 30 VDC
- R33 = 2 x 1 kΩ / max. 30 V
- RC1 = 2 x CANopen / 8 ... 30 VDC

f Type of connection / protection level sensor

- Cable connection, standard lengths²⁾*
- 1 = radial cable, 2 m [6.56'] TPE / IP69k
 - 2 = radial cable, 2 m [6.56'] TPE / IP67
 - C = radial cable, 5 m [16.40'] TPE / IP69k
 - E = radial cable, 5 m [16.40'] TPE / IP67
 - D = radial cable, 10 m [32.81'] TPE / IP69k
 - F = radial cable, 10 m [32.81'] TPE / IP67

Connector

- 3 = radial M12 connector / IP67
- 4-pin for sensor type A11 ... A33
- 5-pin for sensor type CC1 ... RC1
- 8-pin for sensor type R11 ... R33

Relationship measuring length – wire types – linearity


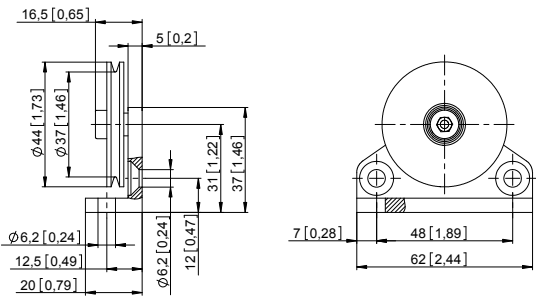

Measuring length	[m]	3 / 4 / 5 / 6			7 / 8			9 / 10			
		order code a	3 / 4 / 5 / 6		7 / 8		9 / A				
Wire type	ø [mm]	order code b	1	2	3	1	2	-	1	-	-
Standard linearity ±0.5 %		order code c = 1	✓	✓	✓	✓	✓	-	✓	-	-
Improved linearity ±0.25 %		order code c = 2	✓	✓	✓	✓	✓	-	✓	-	-
Improved linearity ±0.1 %		order code c = 3	✓	✓	✓	✓	✓	-	✓	-	-

✓ feasible / - not feasible

1) Wire type availability depends on the selected measuring range, refer to the technical data.
 2) Other cable length on request.

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Accessories for draw-wire encoder	Dimensions in mm [inch]	Order no.
<p>Guide pulley for wire type 1 (0.5 mm)</p> 	<p>Technical data:</p> <ul style="list-style-type: none"> - mounting bracket (anodized alum.) - guide pulley (plastic POM) - ball bearing (type 696-2R5) <p>Scope of delivery:</p> <ul style="list-style-type: none"> - 2 x countersunk screws for lateral fixing - 2 x hexagonal screws for fixing on a flat surface 	<p>8.0000.7000.0045</p>
<p>Extension cable (further on request)</p> 	<p>0.5 m with clip</p> <p>1.0 m with clip</p> <p>2.0 m with clip</p>	<p>8.0000.7000.0051</p> <p>8.0000.7000.0052</p> <p>8.0000.7000.0054</p>
Cables and connectors		Order no.
Preassembled cables	<p>M12 female connector with coupling nut, 4-pin, A coded, straight single ended 2 m [6.56'] PUR cable</p> <p>M12 female connector with coupling nut, 5-pin, A coded, straight single ended 2 m [6.56'] PVC cable</p> <p>M12 female connector with coupling nut, 8-pin, A coded, straight single ended 2 m [6.56'] PVC cable</p>	<p>05.00.6061.6211.002M</p> <p>05.00.6081.2211.002M</p> <p>05.00.6041.8211.002M</p>
Connectors	<p>M12 female connector with coupling nut, 4-pin, A coded, straight (plastic)</p> <p>M12 female connector with coupling nut, 5-pin, A coded, straight (metal/plastic)</p> <p>M12 female connector with coupling nut, 8-pin, A coded, straight (metal)</p>	<p>05.B8141-0</p> <p>05.B-8151-0/9</p> <p>05.CMB 8181-0</p>

Further Kübler cables and connectors can be found at: kuebler.com/connection-technology

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Technical data

General technical data	
Linearity	±0.5 %
Improved linearity	±0.25 % or ±0.1 %
Resolution	see electrical characteristics
Sensor element	potentiometer
Output signal (others on request)	4 ... 20 mA, 0 ... 10 V, potentiometer, CANopen
Connection	radial M12 connector or radial cable outlet (TPE cable), standard length 2, 5, 10 m
Protection	M12 connector IP67 cable IP67, IP69k
Humidity	max. 90 % relative, no condensing
Working temperature	standard -20 °C ... +85 °C [-4 °F ... +185 °F] as extended order option (s.page 6) -40 °C ... +85 °C [-40 °F ... +185 °F]
Speed max.	3.0 m/s
Acceleration max.	50 m/s ²
Weight	1300 ... 1600 g [45.87 ... 56.44 oz] depending on measuring range
Housing	aluminum, spring housing PA6
Spring force	min. 7 N / max. 13 N ¹⁾

Interface characteristics CANopen – Sensor type CC1, RC1	
CAN specification	Full CAN 2.0B (ISO11898)
Communication profile	CANopen CiA 301 V 4.2.0
Device profile	encoder, absolute linear; CiA 406 V 3.2.0
Error monitoring	Producer Heartbeat, Emergency Message, Node Guarding
Node ID	default: 7, adjustable via SDO
PDO	1 x TPDO, static mapping
PDO functions	event-triggered, time-triggered, Sync-cyclic, Sync-acyclic
Transmission rate	Default 250 kbit/s, 1 Mbps, 800, 500, 250, 125, 50, 20 kbps adjustable via SDO
Bus connection	M12 connector, 5-pin or axial cable outlet (TPE cable), standard length 2 m
Integrated bus terminating resistor	120 ohms ready-to-activate via SDO
Bus, galvanic isolation	no
Supply voltage	8 ... 30 V DC
Current consumption	typ. 10 mA at 24 V, typ. 20 mA at 12 V
Measuring rate	1 kHz with 16 bit resolution
Resolution	0.002 % of the measuring range
Electrical protection	reverse polarity protection

Electrical characteristics (analog sensor, scaled to measuring range)

Sensor type	A11 / R11	A22 / R22	A33 / R33
Output	4 ... 20 mA	0 ... 10 V	1 kΩ, potentiometer
Output current	max. 50 mA in case of a failure	max. 10 mA, min. load 10 kΩ	–
Max. current consumption	–	22.5 mA (non load)	–
Supply voltage	12 ... 30 V DC	12 ... 30 V DC	max. 30 V DC
Response time	< 1 ms from 0 ... 100 % and 100 ... 0 %	< 3 ms from 0 ... 100 % and 100 ... 0 %	–
Resolution	limited by the noise	limited by the noise	theoretically unlimited
Noise	0.03 mA _{pp} = 6 mV _{pp} at 200 Ω	typ. 3 mV _{pp} , max. 37 mV _{pp}	depending on the supply voltage
Recommended slider current	–	–	< 1 μA
Reverse polarity protection	yes	yes	–
Short circuit proof	–	yes, sustained short-circuit proof	–
Temperature coefficient	0.0079 %/K	0.0037 %/K	±0.0025 %/K

Characteristics measuring wire (plastic coated)

V4A, ø 0.5 mm	measuring range	3 ... 10 m
	no.	1.4401
	breaking force	262 N TK 16 x 10 ⁻⁶ K ⁻¹
V4A, ø 1.0 mm	measuring range	3 ... 8 m
	no.	1.4401
	breaking force	942 N TK 16 x 10 ⁻⁶ K ⁻¹
V4A, ø 1.5 mm	measuring range	3 ... 6 m
	no.	1.4401
	breaking force	1.890 N TK 16 x 10 ⁻⁶ K ⁻¹

Approvals

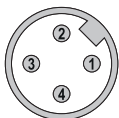
Electromagnetic compatibility	acc. to EN 61326-1, EN 61326-3-1
CE compliant in accordance with	
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU
UKCA compliant in accordance with	
EMC Regulations	S.I. 2016/1091
RoHS Regulations	S.I. 2012/3032

1) Depends on the measuring length.

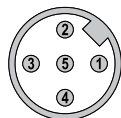
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Robust-Line
Measuring length max. 10 m
Terminal assignment

Analog sensor A11 (4 ... 20 mA)			R/I converter									
	Cable ¹⁾	Signal:	+V	n.c.	I _{out}	n.c.						
	M12 connector, 4-pin	Core color:	BN	WH	BU	BK						
		Pin:	1	2	3	4						
Analog sensor R11 , redundant (2 x 4 ... 20 mA)			R/I converter 1		R/I converter 2							
	Cable ¹⁾	Signal:	+V 1	I _{out 1}	+V 2	I _{out 2}	n.c.	n.c.	n.c.	n.c.		
	M12 connector, 8-pin	Core color:	WH	GN	GY	BU	BN	YE	PK	RD		
		Pin:	1	3	5	7	2	4	6	8		
Analog sensor A22 (0 ... 10 V DC)			R/U converter									
	Cable ¹⁾	Signal:	+V	U _{out}	0 V	0 V _{out}						
	M12 connector, 4-pin	Core color:	BN	WH	BU	BK						
		Pin:	1	2	3	4						
Analog sensor R22 , redundant (2 x 0 ... 10 V DC)			R/U converter 1		R/U converter 2							
	Cable ¹⁾	Signal:	+V 1	U _{out 1}	0 V 1	0 V _{out 1}	+V 2	U _{out 2}	0 V 2	0 V _{out 2}		
	M12 connector, 8-pin	Core color:	WH	BN	GN	YE	GY	PK	BU	RD		
		Pin:	1	2	3	4	5	6	7	8		
Analog sensor A33 (Potentiometer 1 kΩ)			Potentiometer									
	Cable ¹⁾	Signal:	+V	Out	0 V	n.c.						
	M12 connector, 4-pin	Core color:	BN	WH	BU	BK						
		Pin:	1	2	3	4						
Analog sensor R33 , redundant (2 x Potentiometer 1 kΩ)			Potentiometer 1		Potentiometer 2							
	Cable ¹⁾	Signal:	+V 1	Out 1	0 V 1	n.c.	+V 2	Out 2	0 V 2	n.c.		
	M12 connector, 8-pin	Core color:	WH	BN	GN	YE	GY	PK	BU	RD		
		Pin:	1	2	3	4	5	6	7	8		
Digital sensor CC1 (CANopen)			CANopen									
	Cable ¹⁾	Signal:	+V	0 V	CAN_GND	CAN_H	CAN_L					
	M12 connector, 5-pin	Core color:	WH	BU	BN	BK	GY					
		Pin:	2	3	1	4	5					
Digital sensor RC3 , redundant (2 x CANopen)			CANopen 1 + CANopen 2									
	Cable ¹⁾	Signal:	+V	0 V	CAN_GND	CAN_H	CAN_L					
	M12 connector, 5-pin	Core color:	WH	BU	BN	BK	GY					
		Pin:	2	3	1	4	5					

Top view of mating side, male contact base


M12 connector, 4-pin



M12 connector, 5-pin



M12 connector, 8-pin

¹⁾ Isolate unused cores individually before initial start-up.

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Technology in detail

Operating principle

Construction
The core of a draw-wire device is a drum mounted on bearings, onto which a wire is wound. Winding takes place via a spring-loaded device. The single-layer wire winding ensuring the best linearity possible is a specific feature of Kübler draw-wire encoders.

Note
Exceeding the maximum extension length of the draw-wire will lead to damage to the wire and the mechanics.

Wire fastenings

Carabiner ring	M4 thread ¹⁾	eyelet	clip
D8.D120.xxxx.xxxx.xxxx	D8.D120.xxxx.xxxx.xxxx.V001	D8.D120.xxxx.xxxx.xxxx.V002	D8.D120.xxxx.xxxx.xxxx.V007

ball-bearing swivel (no torsion of the measuring wire during installation)

rubber stopper

measuring wire

Wire types

- V4A, \varnothing 0.5 mm, order option **b** = 1
- V4A, \varnothing 1.0 mm, order option **b** = 2
- V4A, \varnothing 1.5 mm, order option **b** = 3

Ideally suited for long-term outdoor use.

Extension wire

For optimum use of the measuring range by extending the wire length, e. g. to allow realizing a pre-extension in the application. Especially combined with analog interfaces (options A11, A22, A33 and R11, R22, R33).

Extended temperature range -40 °C ... +85 °C
(only in combination with the standard linearity 0.5 %)

By using special components.
Order code extensions for the extended temperature range:

With carabiner ring:	D8.D120.xxxx.xxxx.xxxx.V003
With M4 thread ¹⁾ :	D8.D120.xxxx.xxxx.xxxx.V004
With eyelet:	D8.D120.xxxx.xxxx.xxxx.V005
With clip:	D8.D120.xxxx.xxxx.xxxx.V008

Application-specific installation possibilities

guide pulley

guide pulley

1) Not available with wire type V4A, \varnothing 1.5 mm – order option **b** = 3.

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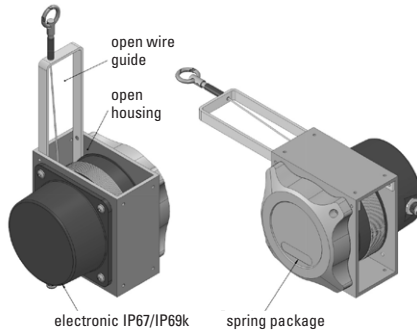
Measuring length max. 10 m

Technology in detail

Housing types (the suitable housing type for every application)

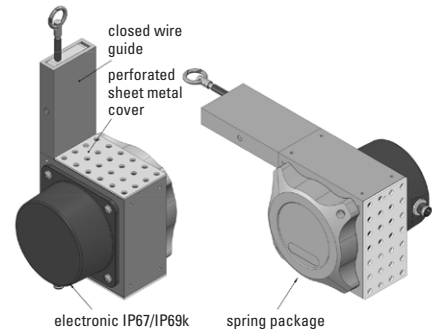
Open housing, open wire guide

For use in the presence of fine dust and liquids.



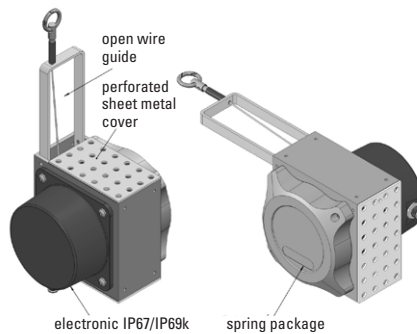
Housing with perforated sheet metal cover, closed wire guide

For use in the presence of dirt, particles size > 2 mm and liquids. Shock protection, wire cleaning device (in preparation).



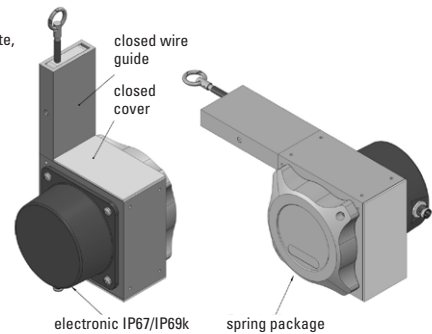
Housing with perforated sheet metal cover, open wire guide

For use in the presence of dirt, particles size > 2 mm and liquids



Closed housing, closed wire guide

For use in the presence of sticky dust, cement, concrete, clay. Shock protection, wire cleaning device (in preparation).



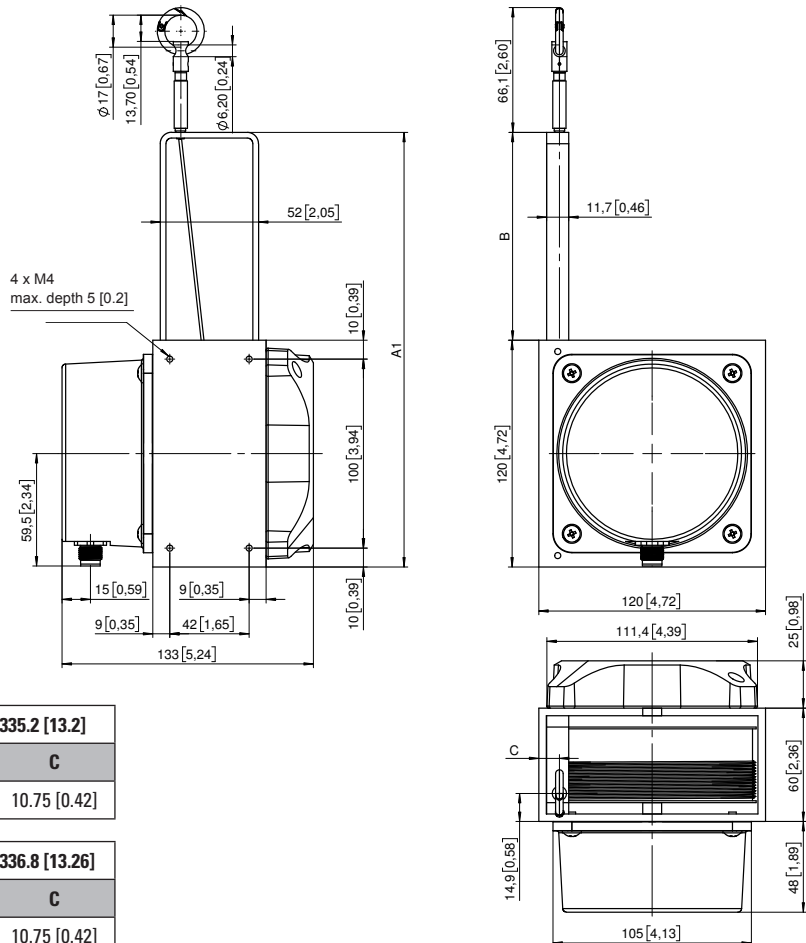
Linear measuring technology

Draw-wire encoder D120 Robust-Line Measuring length max. 10 m

Dimensions

Dimensions in mm [inch]

Open housing,
open wire guide



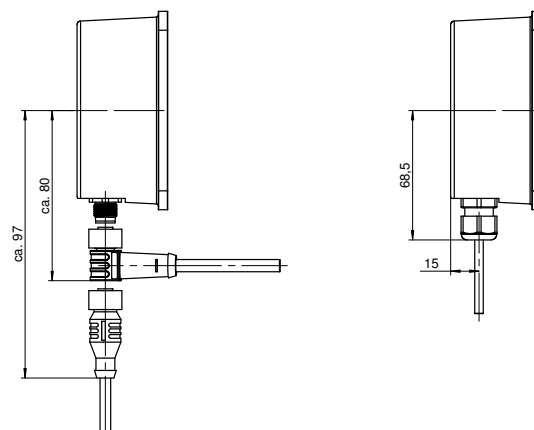
Wire diameter \varnothing 0.5 mm – drum pitch circumference: 335.2 [13.2]			
Measuring length	A1	B	C
3 ... 10 m	230 [9.06]	110 [4.33]	10.75 [0.42]

Wire diameter \varnothing 1.0 mm – drum pitch circumference: 336.8 [13.26]			
Measuring length	A1	B	C
3 ... 5 m	230 [9.06]	110 [4.33]	10.75 [0.42]
6 ... 8 m	320 [12.6]	200 [7.87]	12.25 [0.48]

Wire diameter \varnothing 1.5 mm – drum pitch circumference: 338.3 [13.32]			
Measuring length	A1	B	C
3 ... 4 m	230 [9.06]	110 [4.33]	10.75 [0.42]
5 ... 6 m	320 [12.6]	200 [7.87]	12.25 [0.48]

Connector output / Cable outlet

The cable must be protected in case of steam and high-pressure cleaning.



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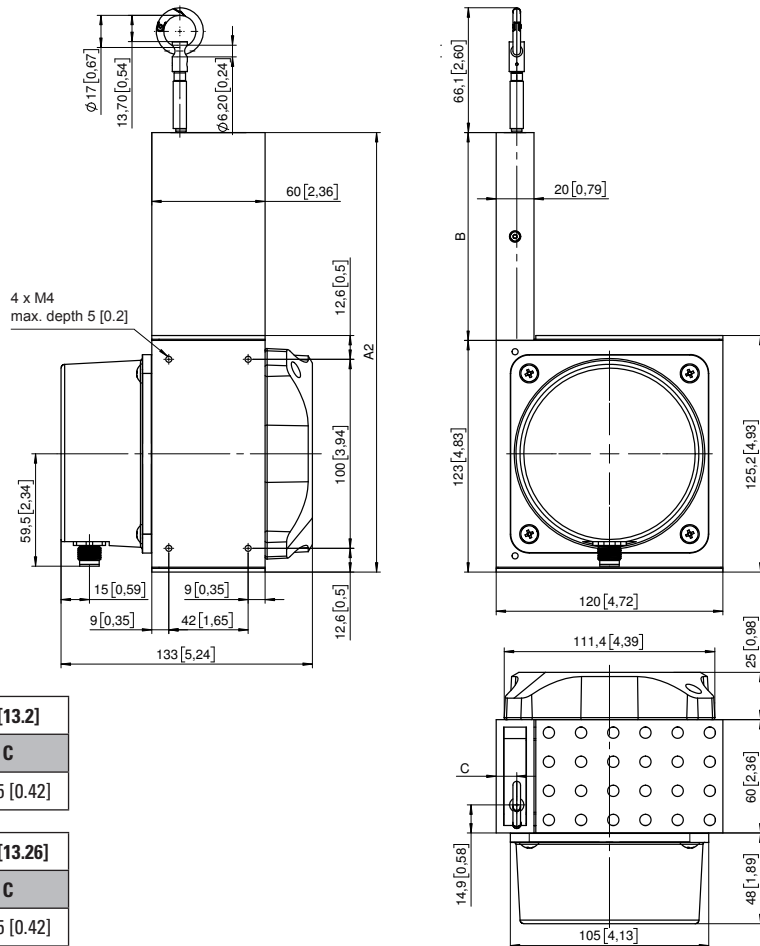
Robust-Line

Measuring length max. 10 m

Dimensions

Dimensions in mm [inch]

Housing with perforated sheet metal cover,
closed wire guide



Wire diameter \varnothing 0.5 mm – drum pitch circumference: 335.2 [13.2]			
Measuring length	A2	B	C
3 ... 10 m	233 [9.17]	110 [4.33]	10.75 [0.42]

Wire diameter \varnothing 1.0 mm – drum pitch circumference: 336.8 [13.26]			
Measuring length	A2	B	C
3 ... 5 m	233 [9.17]	110 [4.33]	10.75 [0.42]
6 ... 8 m	323 [12.7]	200 [7.87]	12.25 [0.48]

Wire diameter \varnothing 1.5 mm – drum pitch circumference: 338.3 [13.32]			
Measuring length	A2	B	C
3 ... 4 m	233 [9.17]	110 [4.33]	10.75 [0.42]
5 ... 6 m	323 [12.7]	200 [7.87]	12.25 [0.48]