Draw-wire encoder C60 | Robust-Line | Measuring length max. 4 m

With its extremely robust design, the high protection class IP69k and the wide temperature range up to -40 °C ... +85 °C the draw-wire encoders C60 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.

RoHS
Analog output
CANopen

Long service life | -40°... +85°C Wide temperaturerange | IP69k High protection level | Redundancy | V4A 1.4404 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 mm - ideal for outdoor applications.

Versatile

- Measuring length up to 4 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.C60 . X X X X . XXX X . 0000
Type a b c d e f

See also extended order options on page 6.

a *Measuring length*
2 = 1.0 m
3 = 1.5 m
4 = 2.0 m
5 = 2.5 m
6 = 3.0 m
7 = 3.5 m
8 = 4.0 m

b *Wire types (plastic coated)*
1 = V4A, ø 0.5 mm
2 = V4A, ø 0.7 mm
3 = V4A, ø 1.0 mm

c *Linearity*
1 = standard linearity 0.5 %
2 = improved linearity 0.25 %
3 = improved linearity 0.1 %

d *Housing*
1 = open housing
3 = housing with perforated sheet metal cover
6 = closed housing

e *Single sensor / supply voltage*
A11 = 4 ... 20 mA / 12 ... 30 V DC
A22 = 0 ... 10 V / 12 ... 30 V DC
A33 = 1 kΩ / max. 30 V DC
CC1 = CANopen / 8 ... 30 V DC

Redundant sensor / supply voltage
R11 = 2 x 4 ... 20 mA / 12 ... 30 V DC
R22 = 2 x 0 ... 10 V / 12 ... 30 V DC
R33 = 2 x 1 kΩ / max. 30 V DC
RC1 = 2 x CANopen / 8 ... 30 V DC

f *Type of connection / protection level sensor*

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

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

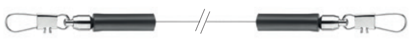
Relationship measuring length – wire types – linearity

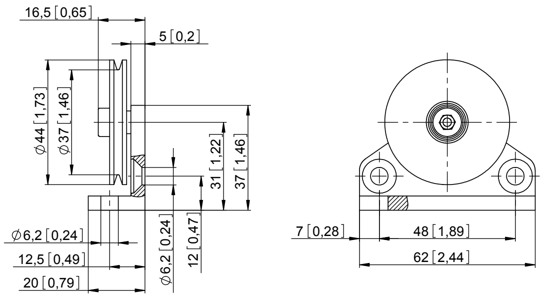
Measuring length [m] / order code a	1.0 (2)			1.5 (3)			2.0 (4)			2.5 (5)			3.0 (6)			3.5 (7)		4.0 (8)	
Wire type ø [mm] / order code b	0.5 (1)	0.7 (2)	1.0 (3)	0.5 (1)	0.7 (2)	1.0 (3)	0.5 (1)	0.7 (2)	1.0 (3)	0.5 (1)	0.7 (2)	1.0 (3)	0.5 (1)	0.7 (2)	1.0 (3)	0.5 (1)	0.7 (2)	0.5 (1)	0.7 (2)
Standard linearity ± 0.5 % order code c = 1	±0.5 %			±0.5 %			±0.5 %		±1 %	±0.5 %	±1 %		±0.5 %	±1 %		±0.5 %	±1 %	±0.5 %	±1 %
Improved linearity ±0.25 % order code c = 2	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	–	–	✓	–	–	–	–	–	–
Improved linearity ±0.1 % order code c = 3	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	–	–	✓	–	–	–	–	–	–

✓ feasible / – not feasible

1) Other cable length on request.

Draw-wire encoder C60	Robust-Line	Measuring length max. 4 m

Accessories for draw-wire encoder	Dimensions in mm [inch]		Order no.
Guide pulley for wire type 1 (0.5 mm) 	Technical data: - mounting bracket (anodized alum.) - guide pulley (plastic POM) - ball bearing (type 696-2R5)	Scope of delivery: - 2 x countersunk screws for lateral fixing - 2 x hexagonal screws for fixing on a flat surface	**8.0000.7000.0045**
Extension cable (further on request) 	0.5 m with clip 1.0 m with clip 2.0 m with clip		**8.0000.7000.0051** **8.0000.7000.0052** **8.0000.7000.0054**



Cables and connectors		Order no.
Preassembled cables	M12 female connector with coupling nut, 4-pin, A coded, straight single ended 2 m [6.56'] PUR cable	**05.00.6061.6211.002M**
	M12 female connector with coupling nut, 5-pin, A coded, straight single ended 2 m [6.56'] PVC cable	**05.00.6081.2211.002M**
	M12 female connector with coupling nut, 8-pin, A coded, straight single ended 2 m [6.56'] PVC cable	**05.00.6041.8211.002M**
Connectors	M12 female connector with coupling nut, 4-pin, A coded, straight (plastic)	**05.B8141-0**
	M12 female connector with coupling nut, 5-pin, A coded, straight (metal/plastic)	**05.B-8151-0/9**
	M12 female connector with coupling nut, 8-pin, A coded, straight (metal)	**05.CMB 8181-0**

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

Draw-wire encoder C60 | Robust-Line | Measuring length max. 4 m

Technical data

General technical data

Standard linearity		±0.5 %, ±1 %
Improved linearity		±0.25 % or ±0.1 %
Resolution		see electrical characteristics
Sensor element		potentiometer
Output signal (others on request)		potentiometer, 4 ... 20 mA, 0 ... 10 V CANopen
Connection		axial M12 connector or axial 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/s²
Weight		up to approx. 420 g [14.82 oz] depending on measuring range and measuring wire diameter
Housing		aluminum, spring housing PA6
Spring force		min. 4 N / max. 6 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)

Version	**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	no.	1.4401
	breaking force	130 N
	TK	16 x 10^{-6} K^{-1}
V4A, ø 0.7 mm	no.	1.4401
	breaking force	216 N
	TK	16 x 10^{-6} K^{-1}
V4A, ø 1.0 mm	no.	1.4401
	breaking force	478 N
	TK	16 x 10^{-6} K^{-1}

Approvals

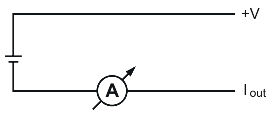
Electromagnetic compatibility	acc. to EN 61326-1, EN 61326-3-1
CE compliant in accordance with	
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU
UKCA compliant in accordance with	
EMC Regulations	S.I. 2016/1091
RoHS Regulations	S.I. 2012/3032

1) Depends on the measuring length.

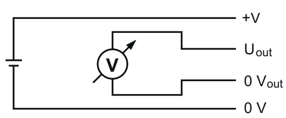
Draw-wire encoder C60 | Robust-Line | Measuring length max. 4 m

Terminal assignment

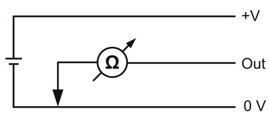
Analog sensor **A11** (4 ... 20 mA)			R/I converter							
		Signal:	+V	n.c.	I_{out}	n.c.				
	Cable [1]	Core color:	BN	WH	BU	BK				
	M12 connector, 4-pin	Pin:	1	2	3	4				
Analog sensor **R11**, redundant (2 x 4 ... 20 mA)			R/I-Wandler 1		R/I-Wandler 2					
		Signal:	$+V_1$	$I_{out\,1}$	$+V_2$	$I_{out\,2}$	n.c.	n.c.	n.c.	n.c.
	Cable [1]	Core color:	WH	GN	GY	BU	BN	YE	PK	RD
	M12 connector, 8-pin	Pin:	1	3	5	7	2	4	6	8



Analog sensor **A22** (0 ... 10 V DC)			R/U converter							
		Signal:	+V	U_{out}	0 V	0 V_{out}				
	Cable [1]	Core color:	BN	WH	BU	BK				
	M12 connector, 4-pin	Pin:	1	2	3	4				
Analog sensor **R22**, redundant (2 x 0 ... 10 V DC)			R/U converter 1				R/U converter 2			
		Signal:	$+V_1$	$U_{out\,1}$	0 V_1	0 $V_{out\,1}$	$+V_2$	$U_{out\,2}$	0 V_2	0 $V_{out\,2}$
	Cable [1]	Core color:	WH	BN	GN	YE	GY	PK	BU	RD
	M12 connector, 8-pin	Pin:	1	2	3	4	5	6	7	8

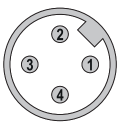


Analog sensor **A33** (potentiometer 1 kΩ)			Potentiometer							
		Signal:	+V	Out	0 V	n.c.				
	Cable [1]	Core color:	BN	WH	BU	BK				
	M12 connector, 4-pin	Pin:	1	2	3	4				
Analog sensor **R33**, redundant (2 x potentiometer 1 kΩ)			Potentiometer 1				Potentiometer 2			
		Core color:	$+V_1$	Out_1	0 V_1	n.c.	$+V_2$	Out_2	0 V_2	n.c.
	Cable [1]	Core color:	WH	BN	GN	YE	GY	PK	BU	RD
	M12 connector, 8-pin	Pin:	1	2	3	4	5	6	7	8

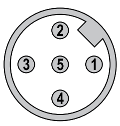


Digital sensor **CC1** (CANopen)			CANopen				
		Signal:	+V	0 V	CAN_GND	CAN_H	CAN_L
	Cable [1]	Core color:	WH	BU	BN	BK	GY
	M12 connector, 5-pin	Pin:	2	3	1	4	5
Digital sensor **RC3**, redundant (2 x CANopen)			CANopen 1 + CANopen 2				
		Core color:	+V	0 V	CAN_GND	CAN_H	CAN_L
	Cable [1]	Core color:	WH	BU	BN	BK	GY
	M12 connector, 5-pin	Pin:	2	3	1	4	5

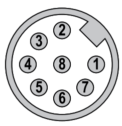
Top view of mating side, male contact base



M12 connector, 4-pin



M12 connector, 5-pin



M12 connector, 8-pin

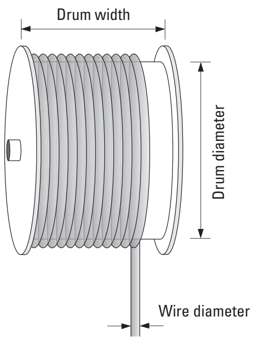
1) Isolate unused cores individually before initial start-up.

Draw-wire encoder C60	Robust-Line	Measuring length max. 4 m

Technology in detail

Operating principle

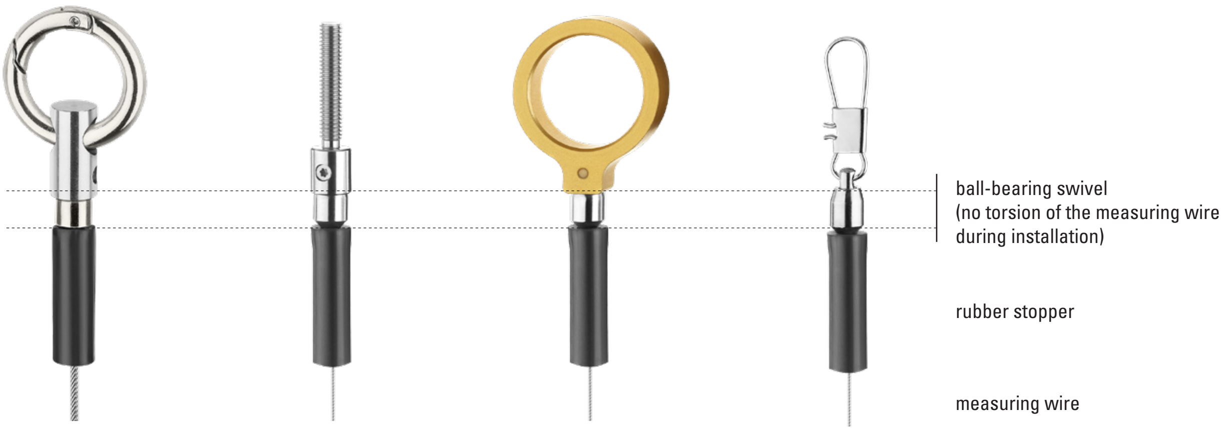
Construction
The core of a draw-wire device is a drum mounted on bearings, onto which a wire is wound. Winding takes place via a spring-loaded device. A specific feature of Kübler draw-wire mechanics is the single-layer wire winding (for short wire lengths) to ensure best possible linearity.
Depending on the required linearity, a multi-layer winding may however be accepted for the C60 draw-wire encoder.



Note
Exceeding the maximum extension length of the draw-wire will lead to damage to the wire and the mechanics.
In addition, snapping of the cable during installation must imperatively be avoided, as this can also lead to damages.

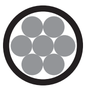
Wire fastenings

Carabiner ring	M4 thread [1]	eyelet	clip
D8.C60.xxxx.xxxx.xxxx	D8.C60.xxxx.xxxx.xxxx.**V001**	D8.C60.xxxx.xxxx.xxxx.**V002**	D8.C60.xxxx.xxxx.xxxx.**V007**



Wire types

- V4A plastic coated, ø 0.5 mm, order option **b** = 1
- V4A plastic coated, ø 1.0 mm, order option **b** = 2
- V4A plastic coated, ø 1.5 mm, order option **b** = 3



Ideally suited for long-term outdoor use.
The plastic coating has a dirt-repellent effect and has in the same time optimum sliding properties.

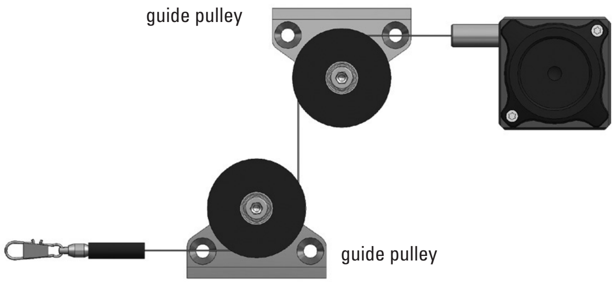
Extension wire

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).

Draw-wire encoder C60 | **Robust-Line** | **Measuring length max. 4 m**

Technology in detail

Application-specific installation possibilities



Extended temperature range -40 °C ... +85 °C

(only in combination with the standard linearity 0.5 %)

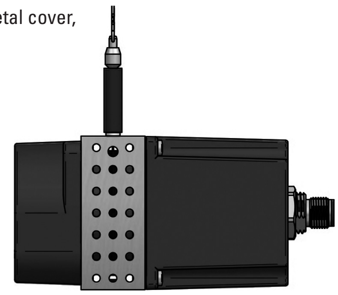
By using special components.
Order code extensions for the extended temperature range:

With carabiner ring:	D8.C60.xxxx.xxxx.xxxx.**V003**
With M4 thread:	D8.C60.xxxx.xxxx.xxxx.**V004**
With eyelet:	D8.C60.xxxx.xxxx.xxxx.**V005**
With clip:	D8.C60.xxxx.xxxx.xxxx.**V008**

Housing types (the suitable housing type for every application)

Open housing,
order option ⓓ = 1

Housing with perforated sheet metal cover,
order option ⓓ = 3



Closed housing,
order option ⓓ = 6

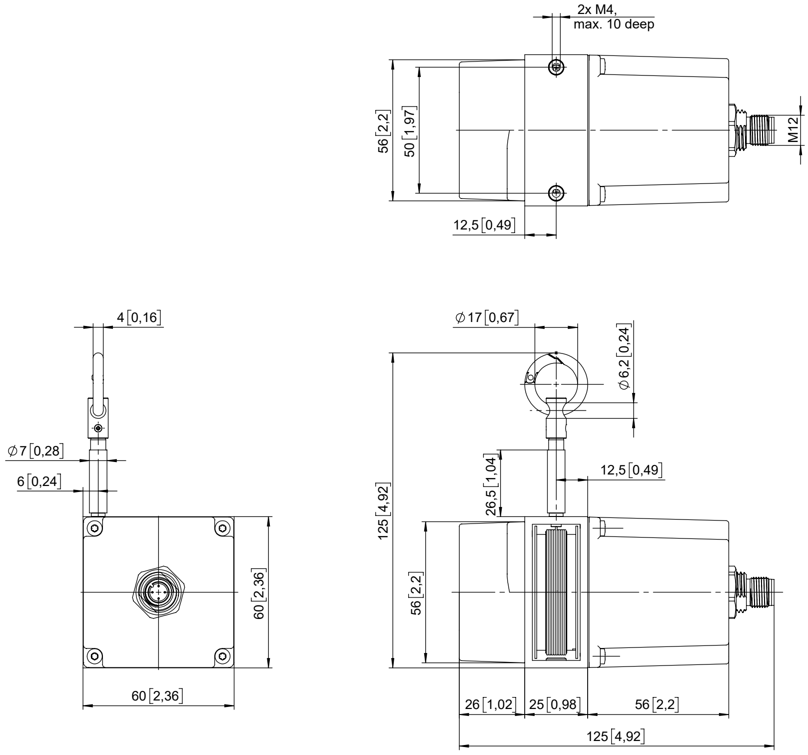
Draw-wire encoder C60	Robust-Line	Measuring length max. 4 m

Dimensions

Dimensions in mm [inch]

With standard linearity (without wire guide)

order option C = 1



With improved linearity (with wire guide)

order option C = 2, 3