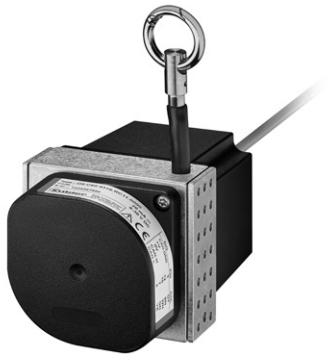
Draw-wire mechanics for outdoor applications | **Draw-wire encoder C60** | **Measuring length up to 4 m Linearity up to ±0.1 %**



Their extremely robust construction, their high IP69k protection level and their wide temperature range up to -40° ... +85°C [1] make these new draw-wire encoders C60 particularly reliable and durable. 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 | Wide temperaturerange | High protection level | Redundancy | V4A

Robust

- Protection level up to IP69k and wide temperature range from -40°C ... +85°C [1].
- 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 538.

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

f *Type of connection / protection level sensor*
1 = axial cable, 2 m [6.56'] TPE / IP69k [2]
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 [m] / 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 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) As optional order code extension see page 538.

2) Other cable length on request.

© Fritz Kübler GmbH, subject to errors and changes. 04/2019

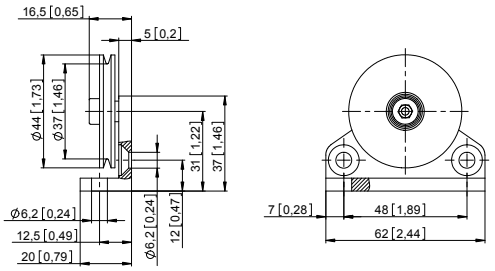
Draw-wire mechanics for outdoor applications | **Draw-wire encoder C60** | **Measuring length up to 4 m**
Linearity up to ±0.1 %

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

Connection technology for analog sensor

Order no.

Cordset, pre-assembled	M12 female connector with coupling nut, 5-pin 2 m [6.56'] PVC cable	**05.00.6081.2211.002M**
	M12 female connector with coupling nut, 8-pin 2 m [6.56'] PVC cable	**05.00.6041.8211.002M**
Connector, self-assembly (straight)	M12 female connector with coupling nut, housing plastic, 4-pin	**05.B8141-0**
	M12 female connector with coupling nut, housing metal/plastic, 5-pin	**05.B-8151-0/9**
	M12 female connector with coupling nut, housing metal, 8-pin	**05.CMB 8181-0**

Additional connectors can be found in the connection technology section or in the connection technology area of our website at: www.kuebler.com/connection_technology..

Technical data

General technical data

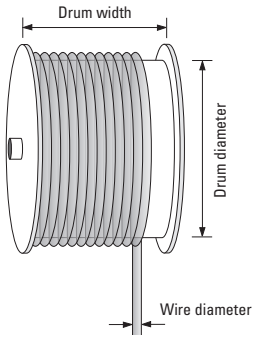
Standard linearity	±0.5 %, ±1 %
Improved linearity	±0.25 % or ±0.1 %
Resolution	see electrical characteristics
Sensor element	potentiometer
Output signal (others on request)	potentiometer, 4 ... 20 mA, 0 ... 10 V CANopen
Redundant output signal	optional for: potentiometer, 4 ... 20 mA, 0 ... 10 V CANopen
Connection	axial M12 connector or axial cable outlet (TPE cable), standard length 2 m
Protection	IP67, optional IP69k (only with cable outlet)
Humidity	max. 90 % relative, no condensing
Wire pull-out speed	max. 3.0 m/s
Acceleration	max. 50 m/s^2
Weight	up to approx. 420 g [14.82 oz] depending on measuring range
Housing	aluminum, spring housing PA6
Spring force	min. 4 N / max. 6 N [1)]

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}

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.



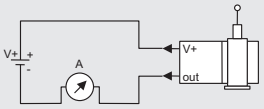
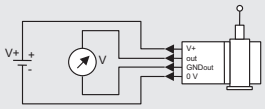
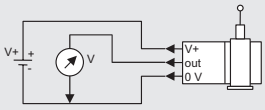
Note
Exceeding the maximum extension length of the draw-wire will lead to damage to the wire and the mechanics.
In addition, snapping of the cable during installation must imperatively be avoided, as this can also lead to damages.

1) Depends on the measuring length.

© Fritz Kübler GmbH, subject to errors and changes. 04/2019

Draw-wire mechanics for outdoor applications | **Draw-wire encoder C60** | **Measuring length up to 4 m**
Linearity up to ±0.1 %

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)	–
Power supply	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	–
Working temperature standard as optional order code extension (s. below)	-20°C ... +85°C [-4°F ... +185°F] -40°C ... +85°C [-40°F ... +185°F]	-20°C ... +85°C [-4°F ... +185°F] -40°C ... +85°C [-40°F ... +185°F]	-20°C ... +85°C [-4°F ... +185°F] -40°C ... +85°C [-40°F ... +185°F]
Short circuit proof	–	yes, sustained short-circuit proof	–
Temperature coefficient	0.0079 %/K	0.0037 %/K	±0.0025 %/K
Connection diagrams			
Electromagnetic compatibility	acc. to EN 61326-1:2013	acc. to EN 61326-1:2013	acc. to EN 61326-1:2013
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

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
Integrated bus terminating resistor	120 ohms ready-to-activate via SDO
Bus, galvanic isolation	no
Power supply	8 ... 30 V DC
Working temperature standard as optional order code extension (s. below)	-20°C ... +85°C [-4°F ... +185°F] -40°C ... +85°C [-40°F ... +185°F]
Current consumption	typ. 10 mA at 24 V, typ. 20 mA at 12 V
Measuring rate	1 kHz with 16 bit resolution
Repeat accuracy	±0.5 %, ±0.25 % or ±0.1 % (according to the selected linearity)
Resolution	0.002 % of the measuring range
Reverse polarity protection	yes
Electromagnetic compatibility	acc. to EN 61326-1:2013
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

Options

Protection class IP69k	All relevant sensor components are entirely encapsulated. Suitable for steam and high-pressure cleaning (only in connection with cable outlet)
Extended temperature range	The use of special components allows an operating temperature of -40°C ... +85°C [-40°F ... +185°F]
Redundant output signal	The use of two potentiometers allows the sensor to provide two independent output signals: • 2 x 4 ... 20 mA • 2 x 0 ... 10 V • 2 x 1 kΩ • 2 x CANopen
Wire fastening (with swivel, on ball bearing)	standard: • straight pin, M6 through hole and snap ring optional: • eyelet, internal diameter 20 mm • M4 thread, length 22 mm • clip (on request)

Order code extensions for the following options

Wire fastening M4	D8.C60.xxxx.xxxx.xxxx.**V001**
Wire fastening eyelet	D8.C60.xxxx.xxxx.xxxx.**V002**
Extended temperature range -40 ... +85°C [-40°F ... +185°F]	D8.C60.xxxx.xxxx.xxxx.**V003**
Wire fastening M4 and -40 ... +85°C [-40°F ... +185°F]	D8.C60.xxxx.xxxx.xxxx.**V004**
Wire fastening eyelet and -40 ... +85°C [-40°F ... +185°F]	D8.C60.xxxx.xxxx.xxxx.**V005**

© Fritz Kübler GmbH, subject to errors and changes. 04/2019

Draw-wire mechanics for outdoor applications | **Draw-wire encoder C60** | **Measuring length up to 4 m Linearity up to ±0.1 %**

Terminal assignment

Type of connection	Sensor type	M12 connector, 4-pin					
3	A11 (4 ... 20 mA)	Signal:	+V	n.c.	Signal	n.c.	⏚
	A22 (0 ... 10 V)	Signal:	+V	Signal	0 V	0 V Signal	⏚
	A33 (1 kΩ)	Signal:	+V	Slider	0 V	n.c.	⏚
		Pin:	1	2	3	4	PH

Type of connection	Sensor type	M12 connector, 5-pin					
3	CC1, RC1	Signal:	+V	0 V	CAN_GND	CAN-H	CAN-L
		Pin:	2	3	1	4	5

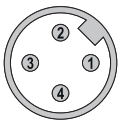
Type of connection	Sensor type	M12 connector, 8-pin								
3	R11 (4 ... 20 mA)	Signal:	$+V_1$	n.c.	Signal 1	n.c.	$+V_2$	n.c.	Signal 2	n.c.	⏚
	R22 (0 ... 10 V)	Signal:	$+V_1$	Signal 1	$0\ V_1$	0 V Signal 1	$+V_2$	Signal 2	$0\ V_2$	0 V Signal 2	⏚
	R33 (1 kΩ)	Signal:	$+V_1$	Slider 1	$0\ V_1$	n.c.	$+V_2$	Slider 2	$0\ V_2$	n.c.	⏚
		Pin:	1	2	3	4	5	6	7	8	PH

Type of connection	Sensor type	Cable (isolate unused cores individually before initial start-up)					
1	A11 (4 ... 20 mA)	Signal:	+V	n.c.	Signal	n.c.	⏚
	A22 (0 ... 10 V)	Signal:	+V	Signal	0 V	0 V Signal	⏚
	A33 (1 kΩ)	Signal:	+V	Slider	0 V	n.c.	⏚
		Core color:	BN	WH	BU	BK	shield

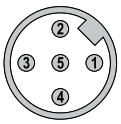
Type of connection	Sensor type	Cable (isolate unused cores individually before initial start-up)					
1	CC1, RC1	Signal:	+V	0 V	CAN_GND	CAN-H	CAN-L
		Core color:	WH	BU	BN	BK	GY

Type of connection	Sensor type	Cable (isolate unused cores individually before initial start-up)								
1	R11 (4 ... 20 mA)	Signal:	$+V_1$	n.c.	Signal 1	n.c.	$+V_2$	n.c.	Signal 2	n.c.	⏚
	R22 (0 ... 10 V)	Signal:	$+V_1$	Signal 1	$0\ V_1$	0 V Signal 1	$+V_2$	Signal 2	$0\ V_2$	0 V Signal 2	⏚
	R33 (1 kΩ)	Signal:	$+V_1$	Slider 1	$0\ V_1$	n.c.	$+V_2$	Slider 2	$0\ V_2$	n.c.	⏚
		Core color:	WH	BN	GN	YE	GY	PK	BU	RD	shield

Top view of mating side, male contact base



M12 connector, 4-pin



M12 connector, 5-pin

M12 connector, 8-pin

© Fritz Kübler GmbH, subject to errors and changes. 04/2019

Draw-wire mechanics for outdoor applications | **Draw-wire encoder C60** | **Measuring length up to 4 m**
Linearity up to ±0.1 %

Technology in detail

Various wire types and wire fastenings

Wire types:

- V4A plastic coated, ø 0.5 mm, order option ⓑ = 1 (standard)
- V4A plastic coated, ø 0.7 mm, order option ⓑ = 2
- V4A plastic coated, ø 1.0 mm, order option ⓑ = 3

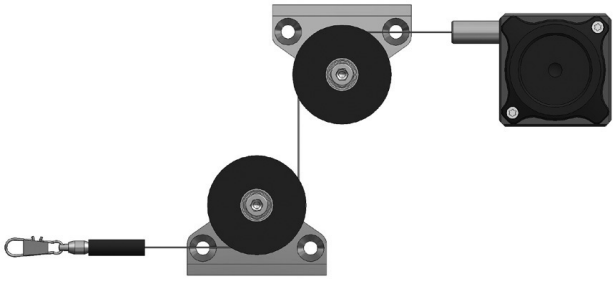
Wire fastenings:

straight pin with snap ring (standard)	eyelet (order code extension V002)	M4 thread (order code extension V001)	clip (on request)

Extension wire

available on request with all wire fastening types
(straight pin with snap ring, eyelet, M4 thread, clip)

Application-specific installation possibilities



Housing types (the suitable housing type for every application)

Open housing,
order option ⓓ = 1 (standard)

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

Closed housing,
order option ⓓ = 6

© Fritz Kübler GmbH, subject to errors and changes. 04/2019

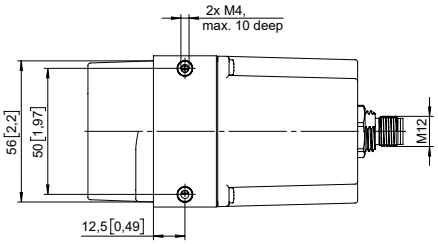
Draw-wire mechanics for outdoor applications | **Draw-wire encoder C60** | **Measuring length up to 4 m Linearity up to ±0.1 %**

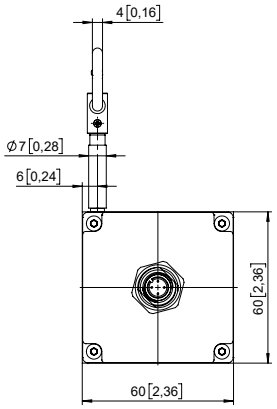
Dimensions

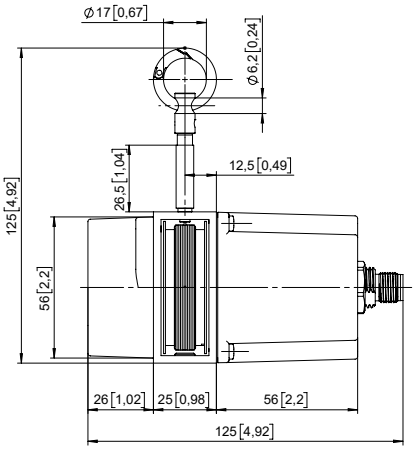
Dimensions in mm [inch]

With standard linearity (without wire guide)

order option C = 1

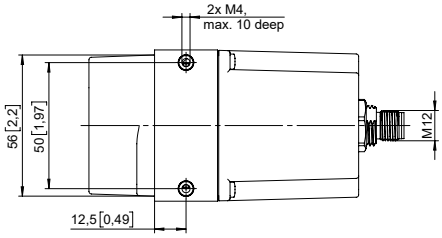


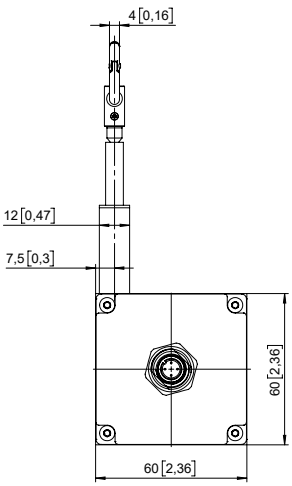


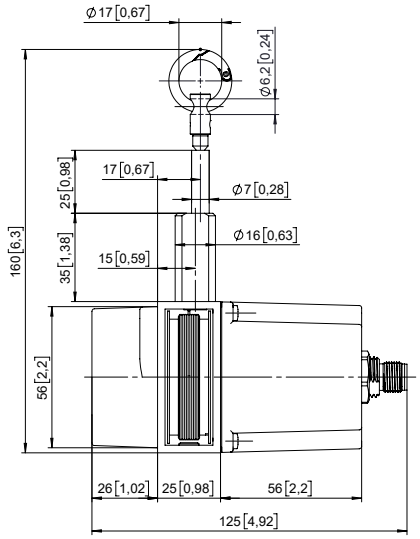


With improved linearity (with wire guide)

order option C = 2, 3







© Fritz Kübler GmbH, subject to errors and changes. 04/2019