Absolute Encoders – Multiturn

Large hollow shaft programmable, optical / magnetic	9081 (Hollow shaft)	SSI / RS485

The multiturn encoder 9081, with SSI interface and combined optical / mechanical sensor technology, is also available with additional incremental track RS422 or RS485 interface.

This encoder has a through hollow shaft with a diameter up to 28 mm and offers resolutions up to 25 bits.

High rotational speed

Temperature range -20°... +70°C

High protection level IP65

Shock / vibration resistant

Short-circuit proof

Reverse polarity protection

Optimised dimensions

- Hollow shaft up to max. 28 mm with an installation depth of just 47 mm
- Outer diameter 90 mm

Flexible

- Various torque stops available
- Large selection of hollow shafts, interfaces and resolutions

Order code Hollow shaft

8.9081 . XXX2 . XXXX
Type   a b c d   e

ⓐ *Flange*
1 = without mounting aid
2 = with spring element short
3 = with spring element long
4 = with mounting flange
5 = with tether arm long

ⓑ *Hollow shaft*
1 = ø 12 mm [0.47"]
2 = ø 15 mm [0.59"]
3 = ø 20 mm [0.79"]
4 = ø 24 mm [0.94"]
5 = ø 28 mm [1.10"]
6 = ø 5/8"
7 = ø 1"
Further hollow shafts on request

ⓒ *Interface / Power supply*
2 = SSI with 4 status outputs / 5 ... 30 V DC
5 = SSI with incremental tracks A, B, $\overline{A}$, $\overline{B}$ 2048 PPR/ 5 ... 30 V DC
9 = SSI with 2 status outputs and 2 sensor outputs for monitoring the power supply on the encoder/ 4.75 ... 30 V DC
3 = RS485, half-duplex, internal termination / 5 ... 30 V DC
7 = RS485, half-duplex, external termination / 5 ... 30 V DC

ⓓ *Type of connection*
2 = M23 connector, 12 pin, radial without mating connector

ⓔ *SSI interface* [1]
2001 = 4096 x 4096 (24 bit), Binary
2002 = 8192 x 4096 (25 bit), Binary
2003 = 4096 x 4096 (24 bit), Gray
2004 = 8192 x 4096 (25 bit), Gray

RS485-Interface, half-duplex mode
3001 = ESC-protocol max. 38400 baud

---

1) This factory set (default) resolution can be re-programmed by using the Ezturn® software.

Large hollow shaft programmable, optical / magnetic	9081 (Hollow shaft)	SSI / RS485

Mounting accessory for hollow shaft encoders | Order No.

Cylindrical pin, long

for torque stops

With fixing thread — **8.0010.4700.0003**

14 [0.55] · 9 [0.35] · Ø 6 [0.24] · 10 [0.39] · Ø 6 ᵐᵈ [0.24] · SW10 · M6 · 40 [1.57]

Connection technology

Connector, self-assembly (straight)	M23 female connector with coupling nut	8.0000.5012.0000
Cordset, pre-assembled	M23 female connector with coupling nut, 2 m [6.56'] PVC cable	8.0000.6901.0002.0031

Programming set

Including:
- Interface converter USB-CAN
- Connection cable from interface converter to encoder
- Power supply 90 ... 250 V AC
- DVD with Ezturn® software

Minimum system requirements:
Operating system: WinXP SP3 or higher
Processor: 1 GHz
RAM: 512 MB
Required disk space: 500 MB

8.0010.9000.0004

Further accessories can be found in the accessories section or in the accessories area of our website at: www.kuebler.com/accessories

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

Mechanical characteristics

Max. speed	6 000 min^{-1}, 3 000 min^{-1} (continuous)
Moment of inertia	approx. 65 x 10^{-6} kgm^2
Starting torque - at 20°C [68°F]	< 0.2 Nm
Weight	approx. 0.7 kg
Protection acc. to EN 60529	IP65
Working temperature range	-20°C ... +70°C [-4°F ... +158°F]
Materials hollow shaft	stainless steel H7
Shock resistance acc. EN 60068-2-27	2500 m/s^2, 6 ms
Vibration resistance acc. EN 60068-2-6	100 m/s^2, 55 ... 2000 Hz

Electrical characteristics

Power supply (+V)		5.0 ... 30 V DC [4]
Power consumption	typ	89 mA
(no load)	max	138 mA
Short circuit proof outputs [2]		yes [3]
Reverse polarity protection of the power supply +V		yes
Performance against magnetic influence acc. to		EN 61000-4-8, Severity level 5
UL approval		File 224618
CE compliant acc. to		EMC guideline 2004/108/EC
RoHS compliant acc. to		guideline 2011/65/EU

Control inputs (V/R, SET)

Voltage		5 ... 30 V DC = +V
Response time		10 ms
Switching level	LOW	max. 25% +V
	HIGH	min. 60% +V, max. +V
Max. current load		≤ 0.5 mA

SSI interface

Output driver		RS485
Permissible load/channel		max. +/- 20 mA
Update rate for position data		approx. 1600/s
SSI clock rate	min. / max.	100 kHz / 500 kHz
Signal level	HIGH	typ. 3.8 V
	LOW (I$_{Load}$ = 20 mA)	typ. 1.3 V
Resolution Singleturn		13 bit programmable 1 ... 8192
Number of revolutions		12 bit programmable 1 ... 4096
Falling edge time t$_f$ (without cable)		max. 100 ns
Rising edge time t$_r$ (without cable)		max. 100 ns

Control outputs

Output driver		Push-Pull
max. current output		± 10.0 mA
Signal level	HIGH	min. +V - 2.8 V
	LOW	max. 1.8 V
Falling edge time t$_f$ (without cable)		max. 1 µs
Rising edge time t$_r$ (without cable)		max. 1 µs

Incremental outputs (A/B)

Output driver		RS422-compatible
SSI clock rate min. / max. / Pulse frequency		200 kHz
Signal level	HIGH	4.5 V
	LOW (I$_{Load}$ = 20 mA)	0.5 V
Falling edge time t$_f$ (without cable)		max. 200 ns
Rising edge time t$_r$ (without cable)		max. 200 ns

[1] For shaft version only (at shaft end)
[2] If power supply +V correctly applied
[3] Only one channel allowed to be shorted-out:
    at +V = 5 V DC short circuit to channel, 0 V, or +V is permitted.
    at +V ≥ 5 ... 30 V DC short circuit to channel or 0 V is permitted.
[4] The power supply at the encoder input must not be less than 4.75 V (5 V - 5%)

Large hollow shaft programmable, optical / magnetic	9081 (Hollow shaft)	SSI / RS485

Control inputs

V/R input for change of direction

The encoder can output increasing code values when the shaft is rotated either clockwise or counter-clockwise (when looking from the shaft side).

There are two methods for selecting the appropriate option:

1. Via a hardware configuration of the V/R input BEFORE powering up the encoder

2. By programming the device using the Kübler „Ezturn®" programming tool.

The following table shows the function selection dependent on hardware and software settings:

Hardware configuration of the V/R input:	Programmed selection using the „EzTurn" programming tool	Function: increasing code value when the shaft is in the following direction
„LOW" (0V) on the V/R input (=cw)	cw	cw
„HIGH" (+V) on the V/R input (= ccw)	cw	ccw
„LOW" (0V) on the V/R input (=cw)	ccw	ccw
„HIGH" (+V) on the V/R input (= ccw)	ccw	ccw

Note:

- Any hardware configuration of the V/R input must take place BEFORE powering up the encoder!

- If the V/R input is not configured, then a 0 V configuration will apply (default condition)!

- If the direction of rotation is changed due to the V/R configuration, without activating the SET function again, and if the encoder is also then powered up again, a new position value may be outputted, even if the physical shaft position of the encoder has not moved! This is due to internal conversion processes.

- The start-up procedure for the encoder should therefore follow this sequence:

  1. Determine the count direction of the encoder either via the V/R input or via programming

  2. Apply power to the encoder

  3. Activate the SET function, if desired (see SET input below)

- If using a cable wire to configure the V/R input, then for EMC reasons the wire should not remain open but should be tied either to 0 V or +V!

- The response time of the V/R input with +V = 5 ... 30 V DC power supply is 10 ms.

SET input

This input is used for a one-time alignment (zeroing) of the encoder immediately after installation. A high control pulse (+V) applied to this input for a minimum of 10 ms will reset the current encoder position to the pre-programmed setpoint value.

The programming of the setpoint can be carried out with Kübler's Ezturn® programming software or can, on request, be done in advance at the factory. The default value is zero. However any value within the encoder's measuring range can be defined.

Notes:

- The SET function should only be implemented when the encoder shaft is at rest.

- For the duration of the SET pulse the SSI interface does not function and therefore does not output any valid position values! In order to avoid malfunctions, no SSI clock pulse should occur during the SET pulse.

- If a cable wire is used to configure the SET input, then for EMC reasons the wire should not remain open but should if at all possible be tied to 0 V, provided no SET pulse is triggered!

- The response time of the SET input with +V = 5 ... 30 V DC power supply is 10 ms.

Outputs [1]

Output	Default-function [2]
A1	battery control
A2	not activated
A3	not activated [3]
A4	not activated [3]

The outputs are not activated in the factory setting (default). They can be activated and defined with the optional Ezturn® programming software e.g. limit switch, overspeed and temperature control etc.

Functionality of the Ezturn® software

- Setting of the communication parameters
- Configuration function
- Setting of a drive factor by means of the modification of the resolution per revolution, the number of revolutions and the total resolution
- Programming of the direction of rotation and code type
- Setting of a preset/electronic zero point

- Setting of diagnostic functions
- Setting of the outputs A1 ... A4
  - Limit switch values, max. 2
  - Alarm and status information
  - Battery monitoring
- Limiting max. number of bit to interface with PLCs
- Diagnostics and information for the set-up operation

- Data transmission from the PC to the encoder and inversely, also during operation
- Print-out of the current data and set parameters
- Convenient position output with the current set data
- Terminal operation for direct instructions via the keyboard
- Diagnostics of the encoder connected

1) Not available for versions with incremental track
2) Programmable with the optional programming software Ezturn®
3) With the order code Interface 9 assigned to the sense outputs.

Absolute Encoders – Multiturn

Large hollow shaft programmable, optical / magnetic	9081 (Hollow shaft)	SSI / RS485

Terminal assignment (SSI Synchronous Serial Interface with 12 pin connector)

Interface	Type of connection	Features	M23 connector												
2, 9	2	SET Up/down input	Signal:	0 V	+V	C+	C-	D+	D-	ST	VR	A1	A2	A3 [1] 0 V sens	A4 [1] +V sens	⏚
			Pin:	1	2	3	4	5	6	7	8	9	10	11	12	PH
			Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY-PK	RD-BU	

Terminal assignment (RS485 interface with 12 pin connector)

Interface	Type of connection	Features	M23 connector												
3, 7	2	Up/down input	Signal:	0 V	+V	T/R-	T/R+	Term [2]	Term2 [2]		VR				⏚
			Pin:	1	2	3	4	5	6	7 [2]	8	9	10	11	12	PH
			Cable colour:	WH	BN	GN	YE				RD					

Terminal assignment (SSI interface with incremental track (A/B))

Interface	Type of connection	Features	M23 connector												
5	2	SET Up/down input	Signal:	0 V	+V	C+	C-	D+	D-	ST	VR	$\overline{B}$	B	$\overline{A}$	A	⏚
			Pin:	1	2	3	4	5	6	7	8	9	10	11	12	PH

+V: Encoder power supply +V DC
0 V: Encoder power supply ground GND (0 V)
C+, C-: Clock signal
D+, D-: Data signal
A, $\overline{A}$: Incremental output channel A
B, $\overline{B}$: Incremental output channel B
ST: Set input. The current position becomes defined as position zero.
VR: Up/down input. As long as this input (High-Level = +V) is active, decreasing code values are transmitted when shaft turning clockwise.
R: Receive channel
T: Transmit channel
A1, A2, A3, A4: Outputs, can be modified using Ezturn
PH ⏚: Plug connector housing (Shield)
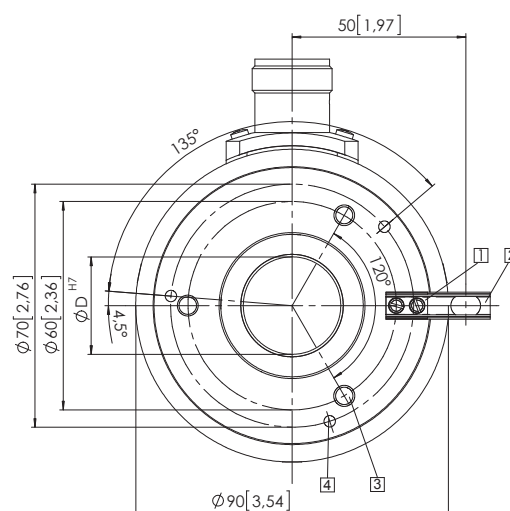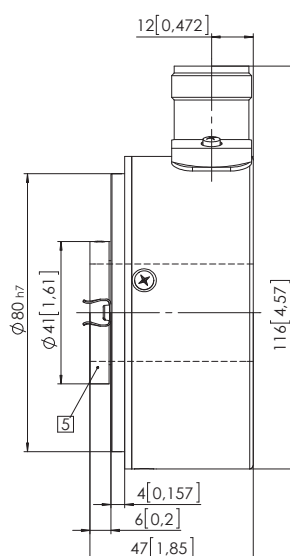
Top view of mating side, male contact base
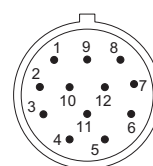
M23 connector, 12 pin

Dimensions

Dimensions in mm [inch]

1 Spring element short (flange No. 2) Cylindrical pin DIN 6325, ø 6 [0.24]
2 Spring element long (flange No. 3) Cylindrical pin DIN 6325, ø 6 [0.24]
3 3 x M6, 10 [0.39] deep
4 3 x M4, 7 [0.28] deep
5 Recommended torque for the clamping ring 1.0 Nm

1) With the order code Interface 9 these outputs are assigned to the sense outputs. The sensor circuits are internally tied to the power supply. Special power supply units control the voltage drop in long cable runs via the voltage feedback. If the circuits are not being used, then they should be individually isolated and not connected.

2) For the version with external termination: if the termination is desired (terminating resistor 120 Ohm), then both connections are to be tied together by means of a jumper (0 Ohm).