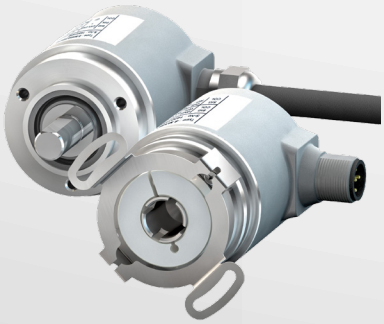
MAGNETIC ABSOLUTE MULTITURN

Compact



Find on page F2

Robust

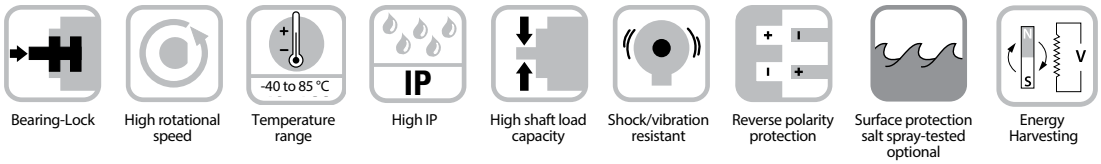
Find on page F15

Standard

Find on page F28

TURCK

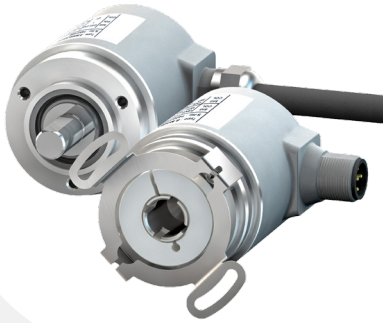
Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft) — Analog



Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Surface protection salt spray-tested optional | Energy Harvesting

Reliable

- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Without gear and without battery, thanks to the Energy Harvesting technology.



Absolute

RoHS compliant

c UL us

RoHS

Insensitive

- Reduced number of components ensures magnetic insensitivity.
- IP67 protection and wide temperature range –40 °C to+85 °C.

Application Oriented

- Current output 4 - 20 mA.
- Voltage output 0 - 10 V or 0 - 5 V.
- Measuring range scalable.
- Limit switch function.

Mechanical Characteristics:

Max. speed:	
Shaft or blind hollow shaft version:	6000 RPM
Without shaft seal (IP65):	3000 RPM (continous)
Shaft or blind hollow shaft version:	4000 RPM
With shaft seal (IP67):	2000 RPM (continous)
Starting torque (68 °F | 20 °C):	
Without shaft seal (IP65):	< 1.0 oz - in (< 0.007 Nm)
With shaft seal (IP67):	< 1.4 oz - in (< 0.01 Nm)
Shaft load capacity:	
Radial:	9.0 lbs (40 N)
Axial:	4.5 lbs (20 N)
Weight:	approx. 0.44 lbs (0.2 kg)
Protection acc. to EN 60529:	IP65 / IP67
Working temperature range:	–40 to +185 °F (–40 to+85 °C)
Materials:	
Shaft / Hollow shaft:	stainless steel
Flange:	aluminium
Housing:	zinc die-cast
Cable:	PVC
Shock resistance acc. to EN 60068-2-27:	250g (2500 m/s²), 6 ms
Vibration resistance acc. to EN 60060-2-6:	30g (300 m/s²), 10 - 2000 Hz

Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft) — Analog

General Electrical Characteristics Interface 4 - 20mA:

Power supply:	10 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
Measuring range: Factory setting: Optionally scalable:	 2^4 revolutions up to 2^{16} revolutions
DA converter resolution:	12 bit
Singleturn accuracy, at 77 °F | 25 °C:	±1 °
Temperature coefficient:	< 100 ppm/K
Repeat accuracy at 77 °F | 25 °C:	±0.2 °
Output load:	max. 200 0hm at 10 VDC max. 900 0hm at 24 VDC max. 1200 0hm at 30 VDC
Setting time:	< 1 ms, R_{Load} = 900 0hm, 77 °F | 25 °C
LEDs (green/red):	• system status • current loop interruption— input load too high • reference point display (only with factory settings) at cw: betw. 0 ° and 1 ° at ccw: betw. 0 ° and –1 ° • status in teach mode
Options:	• output signal scalable via the teach inputs • output signal scalable via the teach inputs + limit switch function
Teach inputs:	level= +V for 1 s min
PowerON time:	< 1 s
Update Rate:	1 ms
e1 compliant acc. to (pending):	EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

General Characteristics Voltage Interface 0 - 10 V / 0 - 5 V:

Power supply:	output 0 - 5 V 10 - 30 VDC output 0 - 10 V 15 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
Measuring range: Factory setting: Optionally scalable:	 2^4 revolutions up to 2^{16} revolutions
DA converter resolution:	0 - 10 V 12 bit 0 - 5 V 11 bit
Singleturn accuracy, at 77°F | 25°C:	±1 °
Temperature coefficient:	< 100 ppm/K
Repeat accuracy at 77°F | 25°C:	±0.2 °
Current output:	max. 10 mA
Setting time:	< 1 ms, R_{Load} = 1000 0hm, 77 °F | 25 °C
LEDs (green/red):	• system status • reference point display (only with factory settings) at cw: betw. 0 ° and 1 ° at ccw: betw. 0 ° and –1 ° • status in teach mode
Options:	• output signal scalable via the teach inputs • output signal scalable via the teach inputs + limit switch function
Teach inputs:	level= +V for 1 s min
PowerON time:	< 1 s
Update Rate:	1 ms
e1 compliant acc. to (pending):	EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

[1)] = when the power supply is correctly applied.

Measuring Range 'AL' or 'AR':

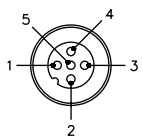
Connection Type:	Common (0V)	+V	Output	Set 1	Set 2
Cable:	WH	BN	GN	N/C	N/C
M12 pin:	3	1	2	N/C	N/C

Measuring Range 'NS' or 'WL':

Connection Type:	Common (0V)	+V	Output	Set 1	Set 2
Cable:	WH	BN	GN	GY	PK
M12 pin:	3	1	2	4	5

Wiring Diagram:

Male encoder view



Mating cordset:
RKC 4.5T-*/S618

* Length in meters.

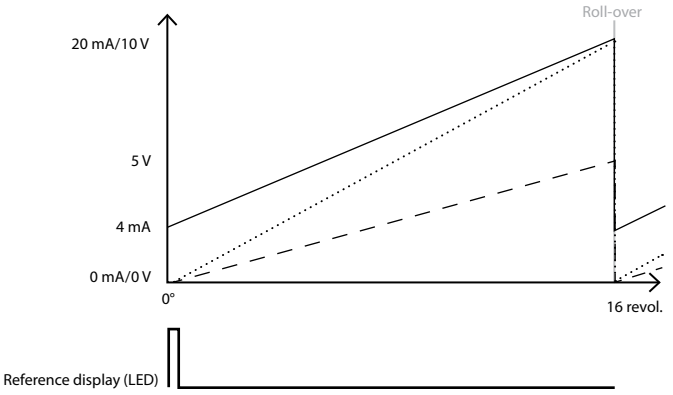
Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft) — Analog

Note: Encoders must be ordered with a clockwise or counterclockwise profile. This determines whether the analog output increases or decreases in the given direction.

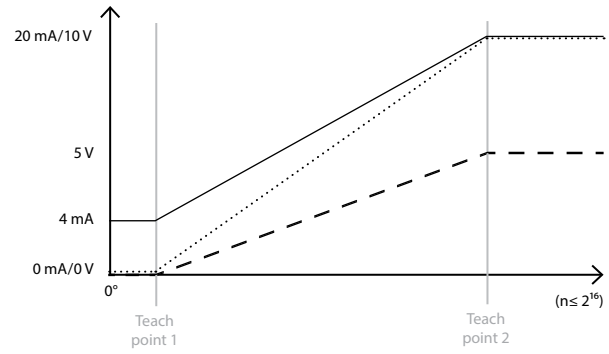
Example (output signal profile):

version 4 - 20 mA
version 0 - 10 V
version 0 - 5 V

Clockwise (CW) version



Scalable version without limit switch function

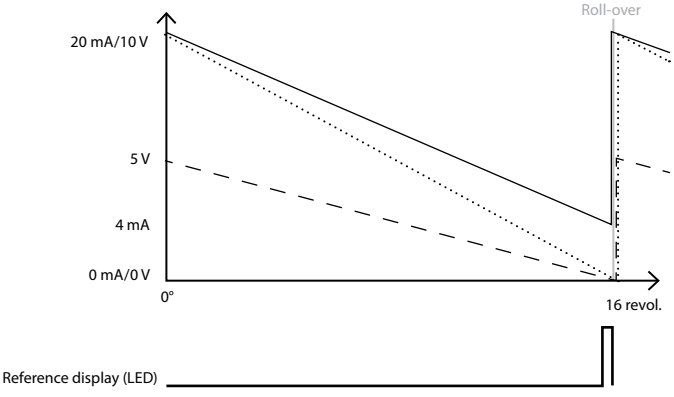


No reference point display

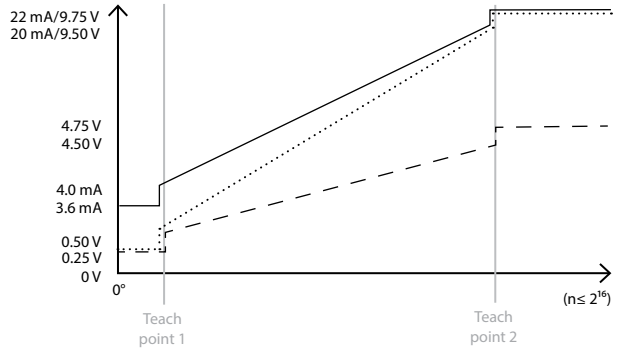
Example (output signal profile):

version 4…20 mA
version 0…10 V
version 0…5 V

Counter Clockwise (CCW) version



Scalable version with limit switch function



No reference point display

Note: Factory-set measuring range: 2^4 revolutions with roll-over

Note: Limit switch function:

version:	**0 - 10 V**	**0 - 5 V**	**4 - 20 mA**
limit switch low:	0.25 V	0.25 V	3.60 mA
limit switch high:	9.75 V	4.75 V	22.00 mA

Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft) — Analog

Part Number Key: RS-97 Shaft Version

A	B	C		D	E		F
RM-97S	6	C	-	7A	AL	-	H1151

A	Type
RM-97S	Ø 39 mm, Shaft w/Flat, IP67 Shaft Seal
RM-97T	Ø 39 mm, Shaft w/Flat, IP65 Shaft Seal

B	Shaft (Ø × L)
6	Ø 6 mm × 12.5 mm
8	Ø 8 mm × 15 mm
10	Ø 10 mm × 20 mm
A0	Ø 1/4" × 1/2"

C	Flange
C	Ø 36 mm Clamping Flange
S	Ø 36 mm Servo Flange

D	Voltage Supply and Output Type
7A	10 - 30 VDC, 4 - 20 mA
8B	15 - 30 VDC, 0 - 10 V
BA	10 - 30 VDC, 0 - 5 V

E	Measuring Range
AL	16 Turns, Count Direction CCW*
AR	16 Turns, Count Direction CW*
NS	Scalable to 16-bit Turns, w/o Limit Switch
WL	Scalable to 16-bit Turns, w/ Limit Switch

F	Type of Connection
H1151	Radial 5-pin M12 Eurofast Connector
H1451	Axial 5-pin M12 Eurofast Connector
C1M	Radial Cable (1m PVC)
CA1M	Axial Cable (1m PVC)

* = increasing code values when shaft turning in direction listed. Top view on shaft.

Part Number Key: RM-98 Blind Hollow Shaft Version

A	B	C		D	E		F
RM-98B	6	E	-	7A	AL	-	H1151

A	Type
RM-98B	Ø 36 mm, Blind Hollow Shaft, IP67 Shaft Seal
RM-98C	Ø 36 mm, Blind Hollow Shaft, IP65 Shaft Seal

B	Bore (18.5 mm insertion depth)
6	Ø 6 mm
8	Ø 8 mm
10	Ø 10 mm
A0	Ø 1/4" × 1/2"

C	Flange
E	Ø 46 mm Flange w/ Slotted Flex Mount
T	Flange w/ Long Torque Stop

D	Voltage Supply and Output Type
7A	10 - 30 VDC, 4 - 20 mA
8B	15 - 30 VDC, 0 - 10 V
BA	10 - 30 VDC, 0 - 5 V

E	Measuring Range
AL	16 Turns, Count Direction CCW*
AR	16 Turns, Count Direction CW*
NS	Scalable to 16-bit Turns, w/o Limit Switch
WL	Scalable to 16-bit Turns, w/ Limit Switch

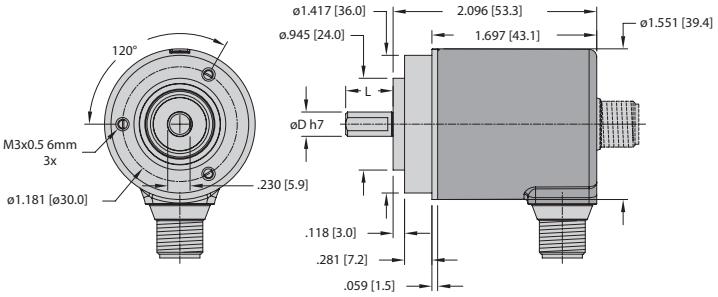
F	Type of Connection
H1151	Radial 5-pin M12 Eurofast Connector
H1451	Axial 5-pin M12 Eurofast Connector
C1M	Radial Cable (1m PVC)
CA1M	Axial Cable (1m PVC)

* = increasing code values when shaft turning in direction listed. Top view on shaft.

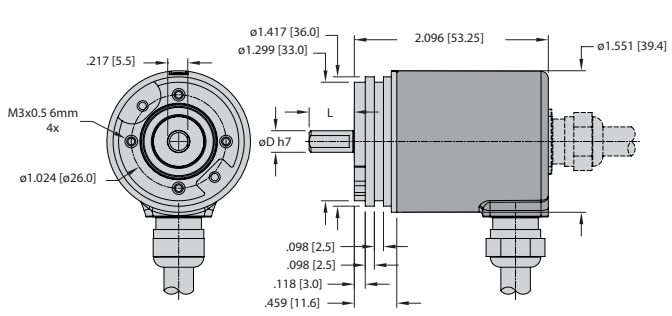
Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft) — Analog

Dimensions: RM-97 Shaft Version

RM-97 Flange C
Connection H1151 & H1451

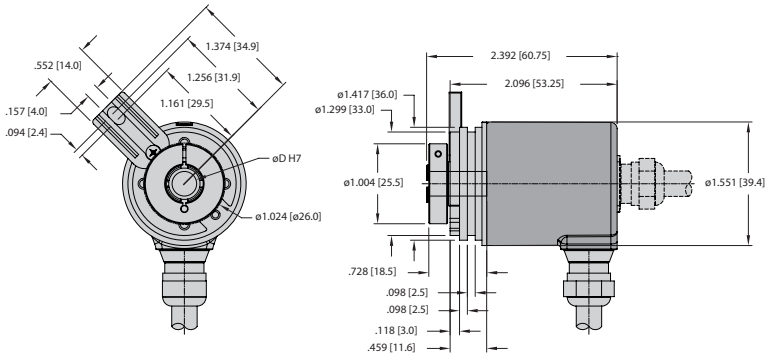


RM-97 Flange S
Connection C1M & CA1M

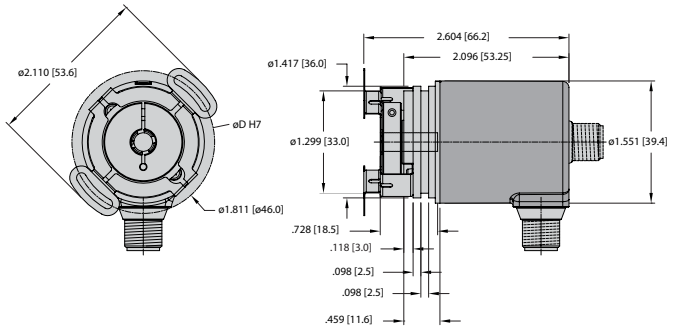


Dimensions: RM-98 Blind Hollow Shaft Version

RM-98 Flange T
Connection C1M & CA1M

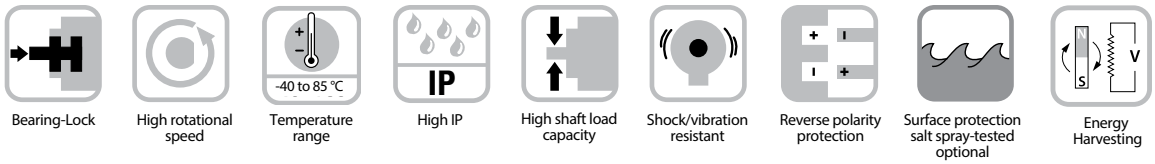


RM-98 Flange E
Connection H1151 & H1451



Mounting advice:
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

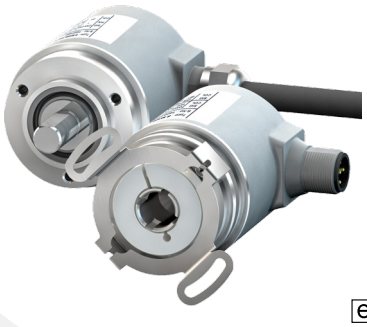
Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft) SSI



Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Surface protection salt spray-tested optional | Energy Harvesting

Reliable

- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Without gear and without battery, thanks to the Energy Harvesting technology



Absolute

RoHS compliant

BiSS INTERFACE

SSI

e1 pending | c UL us | RoHS

Insensitive

- Reduced number of components ensures magnetic insensitivity.
- IP67 protection and wide temperature range –40 °C to +85 °C.

Application Oriented

- Absolute accuracy ±1 °.
- Repeat accuracy ±0.2 °.
- Short control cycles, clock frequency with SSI up to 2 MHz.
- Max. resolution 38 bit (14 bit ST + 24 bit MT).

Mechanical Characteristics:

Max. speed:	
Shaft or blind hollow shaft version:	6000 RPM
Without shaft seal (IP65):	3000 RPM (continous)
Shaft or blind hollow shaft version:	4000 RPM
With shaft seal (IP 67):	2000 RPM (continous)
Starting torque (68 °F | 20 °C):	
Without shaft seal (IP65):	< 1.0 oz - in (0.007 Nm)
With shaft seal (IP67):	< 1.4 oz - in (0.01 Nm)
Shaft load capacity:	
Radial:	9 lbs (40 N)
Axial:	4.5 lbs (20 N)
Weight:	approx. 0.44 lbs (0.2 kg)
Protection acc. to EN 60529:	IP65/IP67
Working temperature:	–40 to +185 °F (–40 to +85 °C)
Materials:	
Shaft / Hollow shaft:	stainless steel
Flange:	aluminum
Housing:	zinc die-cast
Cable:	PUR
Shock resistance acc. to EN 60068-2-27:	250 g (2,500 m/s²), 6 ms
Vibration resistance acc. to EN 60068-2-6:	30 g (300 m/s²), 10 - 2,000 Hz

Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft) SSI

General Electrical Characteristics:

Power supply	10 - 30 VDC
Current consumption (no load):	max. 40 mA,
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
e1 compliant acc. to (pending):	EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

[1)] = short circuit protection to **0**V or to output when power supply correctly applied.

Interface Characteristics SSI:

Output driver:	RS485 transceiver type
Permissible load / channel:	max. +/– 30 mA
Signal high:	typ 3.8 V
Signal level low with I_{Load} = 20 mA:	typ 1.3 V
Resolution singleturn:	10 - 14 bit
Absolute accuracy [2)]:	±1 °
Repeat accuracy:	±0.2 °
Number of revolutions (multiturn):	max. 24 bit
Code:	binary or gray
SSI clock rate:	50 kHz - 2 MHz
Data refresh rate:	2 ms
Monoflop time:	≤ 15 µs

Note: If the clock cycle starts within the monoflop time a second data transfer begins with the same data. If the clock cycle starts after the monoflop time the cycle begins with the new values. The update rate is dependent on the clock speed, data length and monoflop time.

[2)] = over the entire tempetature range.

SET Input:

Input characteristics:	active HIGH
Input type:	comparator
Signal level high:	min. 60% of +V (supply voltage), max: +V
Signal level low:	max. 30% of +V (supply voltage)
Input current:	< 0.5 mA
Min. pulse duration (SET):	10 ms
Input delay:	1 ms
New position data readable after:	1 ms
Internal processing time:	200 ms

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET in put has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.

The SET function should be carried out while the encoder is at rest.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

DIR Input:

Direction input: A HIGH signal switches the direction of rotation from the default cw to ccw. This inverted function can also be factory-programmed. If this input is not used, it should be connected to 0 V (Encoder ground GND)in order to avoid interferences.

Response time (DIR input)	1ms

Power-On Delay:

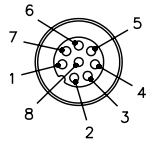
After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

Hot plugging of the encoder should be avoided.

Connection Type:	GND (0 V)	V+	+Clock	–Clock	+Data	– Data	SET	DIR	PE
Cable:	WH	BN	GN	YE	GY	PK	BU	RD	Shield
M12 pin:	1	2	3	4	5	6	7	8	PH

Wiring Diagrams:

Male Encoder View



M12 Eurofast Pinout

Mating Cordset:
E-RKC 8T-264-*

* Length in meters.

Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft) SSI

Part Number Key: RM-99 Shaft Version

A	B	C		D	E1	E2		F
RM-99S	6	C	-	3C	10S	12M	-	H1181

A	Type
RM-99S	Ø 39 mm, Shaft w/ Flat, IP67 Shaft Seal
RM-99T	Ø 39 mm, Shaft w/ Flat, IP65 Shaft Seal

B	Shaft (Ø x L)
6	Ø 6 mm x 12.5 mm
8	Ø 8 mm x 15 mm
10	Ø 10 mm x 20 mm
A0	Ø 1/4" x 1/2"

C	Flange
C	Ø 36 mm Clamping Flange
S	Ø 36 mm Servo Flange

D	Voltage Supply and Output Type
3C	10 - 30 VDC, SSI (Gray Code)
5C	10 - 30 VDC, SSI (Binary Code)

E1	Resolution (singleturn)
10S	10 bit
12S	12 bit
13S	13 bit
14S	14 bit

E2	Resolution (multiturn)
12M	12 bit
16M	16 bit
20M	20 bit
24M	24 bit

F	Type of Connection
H1181	Radial 8-pin M12 Eurofast Connector
H1481	Axial 8-pin M12 Eurofast Connector
C1M	Radial Cable (1m PUR)
CA1M	Axial Cable (1m PUR)

Part Number Key: RM-100 Blind Hollow Shaft Version

A	B	C		D	E1	E2		F
RM-100B	6	E	-	3C	10S	12M	-	H1181

A	Type
RM-100B	Ø 39 mm, Blind Hollow Shaft, IP67 Shaft Seal
RM-100C	Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal

B	Bore (18.5mm insertion depth)
6	Ø 6 mm
8	Ø 8 mm
10	Ø 10 mm
A0	Ø 1/4"

C	Flange
E	Ø 46 mm Flange w/ Slotted Flex Mount
T	Flange w/ Long Torque Stop

D	Voltage Supply and Output Type
3C	10 - 30 VDC, SSI (Gray Code)
5C	10 - 30 VDC, SSI (Binary Code)

E1	Resolution (singleturn)
10S	10 bit
12S	12 bit
13S	13 bit
14S	14 bit

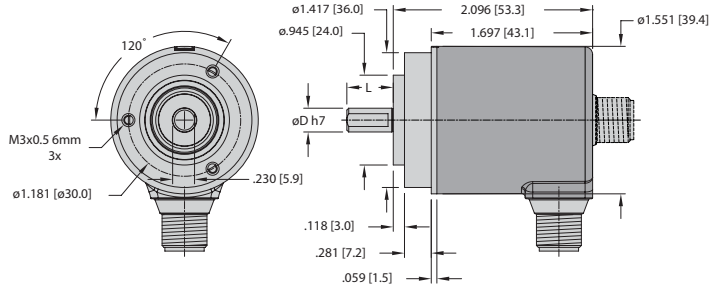
E2	Resolution (multiturn)
12M	12 bit
16M	16 bit
20M	20 bit
24M	24 bit

F	Type of Connection
H1181	Radial 8-pin M12 Eurofast Connector
H1481	Axial 8-pin M12 Eurofast Connector
C1M	Radial Cable (1m PUR)
CA1M	Axial Cable (1m PUR)

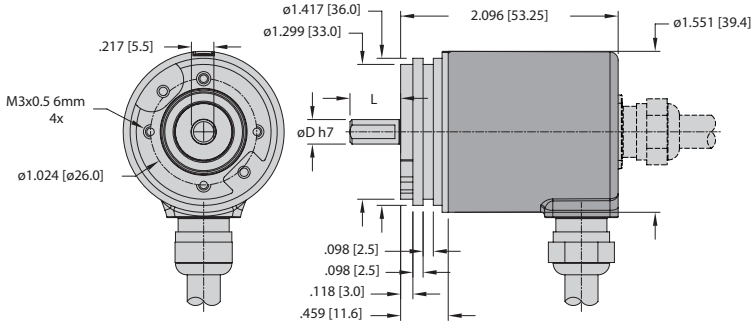
Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft) SSI

Dimensions: RM-99 Shaft Version

RM-99 Flange C
Connection H1181 & H1481

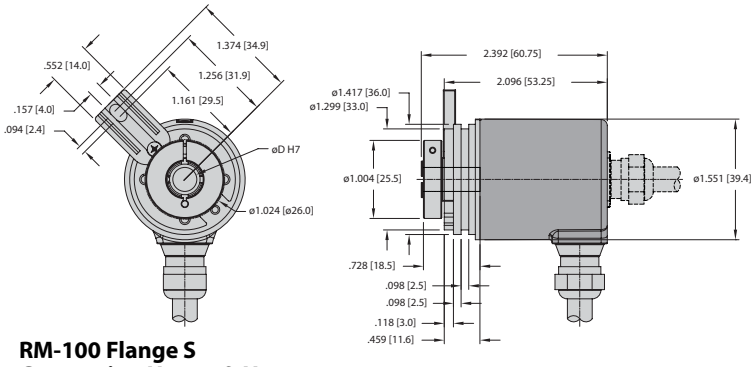


RM-99 Flange S
Connection C1M & CA1M

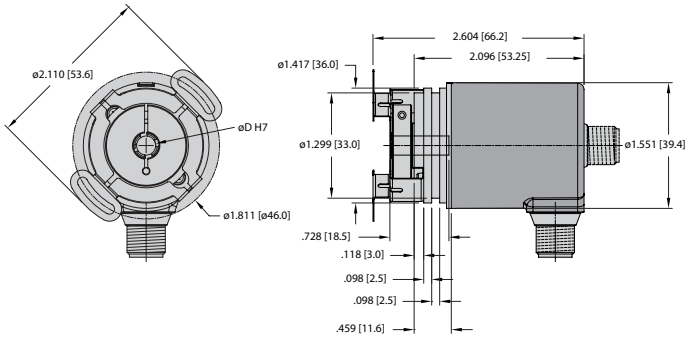


Dimensions: RM-100 Blind Hollow Shaft Version

RM-100 Flange T
Connection C1M & CA1M



RM-100 Flange S
Connection H1181 & H1481

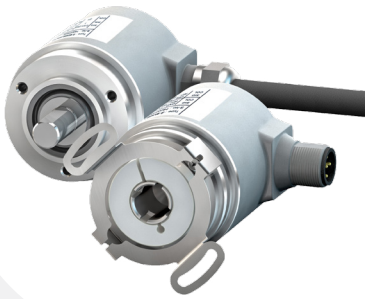


Mounting Advice:
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

Absolute, Multiturn Type RM -101 (Shaft) / RM-102 (Blind Holllow Shaft) CANopen

Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Surface protection salt spray-tested optional | Energy Harvesting

Reliable
- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Without gear and without battery, thanks to the Energy Harvesting technology.



Absolute

RoHS compliant

CANopen

e1 pending | cULus | RoHS

Insensitive
- Reduced number of components ensures magnetic insensitivity.
- IP67 protection and wide temperature range –40 °C to+85 °C.

Up-To-The-Minute Fieldbus Performance
- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- Universal scaling function.
- Configuration management (bootloader).

Mechanical Characteristics:

Max. speed:	
Shaft or blind hollow shaft version:	6000 RPM
Without shaft seal (IP65):	3000 RPM (continuous)
Shaft or blind hollow shaft version:	4000 RPM
With shaft seal (IP67):	2000 RPM (continuous)
Starting torque (68 °F | 20 °C):	
Without shaft seal (IP65):	< 1.0 oz - in (0.007 Nm)
With shaft seal (IP67):	< 1.4 oz - in (0.01 Nm)
Shaft load capacity:	
Radial:	9.0 lbs (40 N)
Axial:	4.5 lbs (20 N)
Weight:	approx. 0.44 kgs (0.2 kg)
Protection acc. to EN 60529:	IP65 / IP67
Working temperature range:	–40 to +185 °F (–40 to +85 °C)
Materials:	
Shaft / Hollow shaft:	stainless steel
Flange:	aluminium
Housing:	zinc die-cast
Cable:	PVC
Shock resistance acc. to EN 60068-2-27:	250 g (2,500 m/s²), 6 ms
Vibration resistance acc. to EN 60068-2-6:	30 g (300 m/s²), 10 - 2,000 Hz

Absolute, Multiturn Type RM -101 (Shaft) / RM-102 (Blind Holllow Shaft) CANopen

General Electrical Characteristics:

Sensor:	
Power supply:	10 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs	yes[1)]
e1 compliant acc. to (pending):	EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)
UL approval	file 224618
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

Interface Characteristics CANopen:

Resolution singleturn:	1 - 16384 (14 bit), (scalable default: 8192 (13 bit)
Absolute accuracy[2)]:	±1 °
Repeat accuracy:	±0.2 °
Number of revolutions (multiturn):	max. 16.777.216 (24 bit) scalable only via the total resolution
Total resolution:	1…274,877,906,944 (38 bit), scalable default: 33,554,432 (25 bit)
Code:	binary
Interface:	CAN high-speed acc. to ISO 11898, Basic- and Full-CAN, CAN specification 2.0 B
Protocol:	CANopen profile DS406 V4.0 with manufacturer-specific add-ons, LSS-Service, bootloader
Power-ON time:	< 1200 ms
SDO timeout:	< 1000 ms
Baud rate:	10 - 1000 k bit/s software configurable
Node address:	1 - 127 software configurable
Termination:	software configurable
LSS protocol:	CIA LSS protocol DS305, global command support for node address and baud rate, selective commands via attributes of the identity object
Bootloader:	configuration management CIA DS 302-3

[1)] = short circuit protected to 0V or to output when power supply correctly applied.
[2)] = over the entire temperature range.

General Information about CANopen

The CANopen encoders support the latest CANopen communication profile according to DS301 V4.02 . In addition, device-specific profiles like the encoder profile DS406 V3.2, DS305 (LSS) and DS302 (Bootloader) are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

The following output values may be combined in a freely variable way as PDO(PDO mapping): **position**, **speed, acceleration** as well as the **status of the working area.**

The encoders are available with a connector or a cable connection.

The device address and baud rate can be set/ modified by means of the software.

The two-color LED located on the back indicates the operating or fault status of the CAN-bus, as well as the status of the internal diagnostics.

CANbus connection

The CANopen encoders are equipped with a bus trunk line in various lengths or a M12 connector and can be terminated in the device.

The devices do not have an integrated T-coupler nor are they looped internally and must therefore only be used as end devices.

LSS layer setting services DS305 V2.0

- Global support of node-ID and baud rate.
- Selective protocol via identity object (1018h).

CANopen Communication Profile DS301 V4.2

Among others, the following functionality is integrated (Class C2 functionality):

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 3 Sending PDO's.
- Node address, baud rate and CANbus / programmable termination.

CANopen encoder profile DS406 V4.0

The following parameters can be programmed:

- Event mode, start optional.
- 1 work area with upper and lower limit and the corresponding output states variable PDO mapping for position, speed, work area status, error and acceleration.
- Extended failure management for position sensing.
- User interface with visual display of bus and failure status 1 LED two colors.
- Customer-specific protocol.
- "Watchdog controlled" device.

Bootloader functionality DS302-3

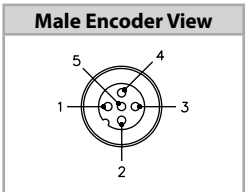
Configuration Management:

- Program download
- Program start
- Program erase

Standard Wiring:

Connection Type:	+V	Common (0 V)	CAN GND	CAN High	CAN Low
Cable:	BN	WH	GY	GN	YE
M12 Eurofast :	2	3	1	4	5

Wiring Diagram:



Mating Cordset[1)]:
RKC 572-*M/S3117

* Length in meters.
[1)] See page J3 for corresponding cable color code.

Absolute, Multiturn Type RM -101 (Shaft) / RM-102 (Blind Holllow Shaft) CANopen

Part Number Key: RM-101 Shaft Version

A	B	C		D		E
RM-101S	6	C	-	9D38D	-	H1151

A	Type
RM-101S	Ø 39 mm, Shaft w/ Flat, IP67 Shaft Seal
RM-101T	Ø 39 mm, Shaft w/ Flat, IP65 Shaft Seal

B	Shaft (Ø × L)
6	Ø 6 mm × 12.5 mm
8	Ø 8 mm × 15 mm
10	Ø 10 mm × 20 mm
A0	Ø 1/4" × 1/2"

C	Flange
C	Ø 36 mm Clamping Flange
S	Ø 36 mm Servo Flange

D	Voltage Supply and Output Type
9D38B	10 - 30 VDC, CANopen DS 406 V4.0

E	Type of Connection
H1151	Radial 5-pin M12 Eurofast Connector
H1451	Axial 5-pin M12 Eurofast Connector
C1M	Radial Cable (1 m PVC)
CA1M	Radial Cable (1 m PVC)

Part Number Key: RM-102 Blind Hollow Shaft Version

A	B	C		D		E
RM-102B	6	E	-	9D38D	-	H1151

A	Type
RM-102B	Ø 39 mm, Blind Hollow Shaft, IP67 Shaft Seal
RM-102C	Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal

B	Bore (18.5 mm insertion depth)
6	Ø 6 mm
8	Ø 8 mm
10	Ø 10 mm
A0	Ø 1/4"

C	Flange
E	Ø 46 mm Flange w/ Slotted Flex Mount
T	Flange w/ Long Torque Stop

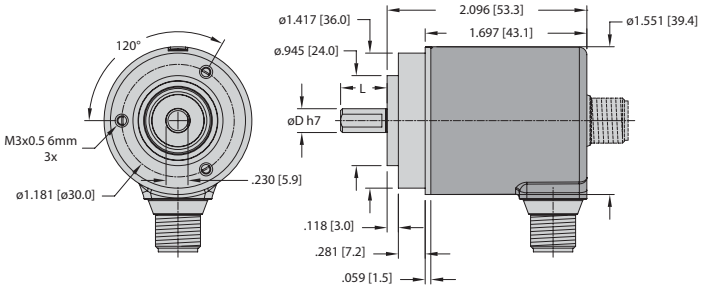
D	Voltage Supply and Output Type
9D38B	10 - 30 VDC, CANopen DS 406 V4.0

E	Type of Connection
H1151	Radial 5-pin M12 Eurofast Connector
H1451	Axial 5-pin M12 Eurofast Connector
C1M	Radial Cable (1 m PVC)
CA1M	Radial Cable (1 m PVC)

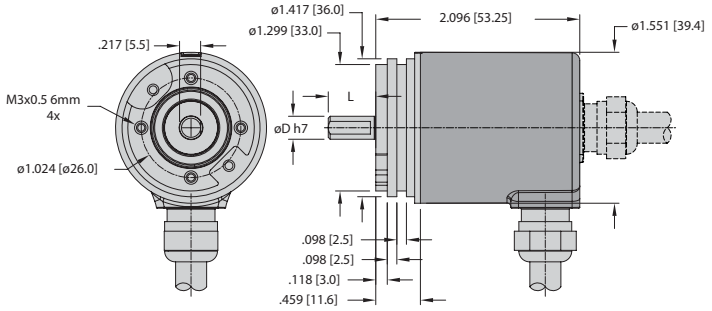
Absolute, Multiturn Type RM -101 (Shaft) / RM-102 (Blind Holllow Shaft) CANopen

Dimensions: RM-101 Shaft Version

RM-101 Flange C
Connection H1151 & H1451

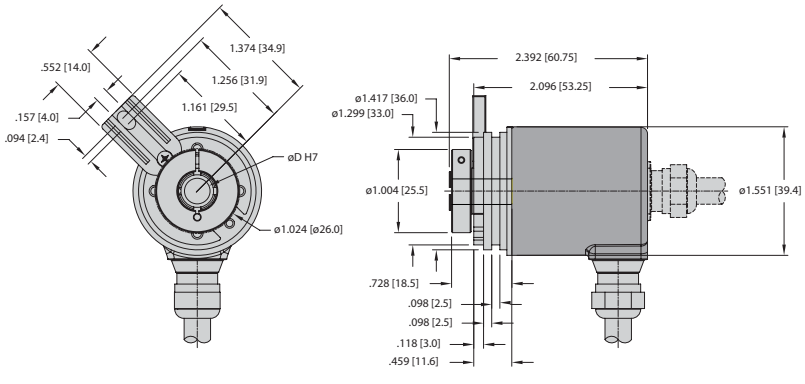


RM-101 Flange S
Connection C1M & CA1M

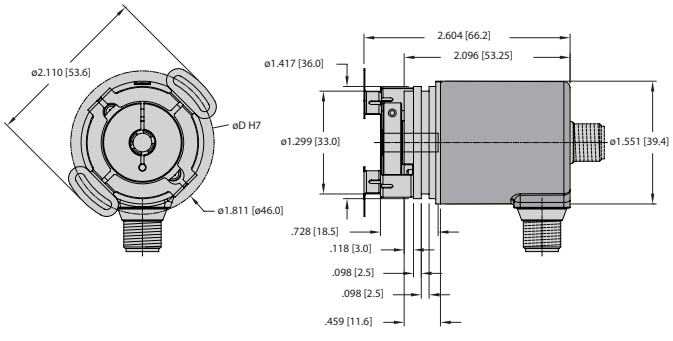


Dimensions: RM-102 Blind Hollow Shaft Version

RM-102 Flange T
Connection C1M & CA1M

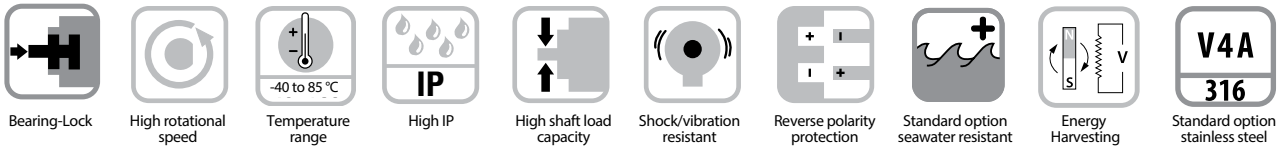


RM-102 Flange E
Connection H1181 & H1481



Mounting Advice:
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

Absolute, Multiturn Type RM-115 Series — Analog



Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Standard option seawater resistant | Energy Harvesting | Standard option stainless steel

Highest Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Protection level IP66, IP67 and IP69k in one device.
- Wide temperature range –40 °C to +85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology.

e1 pending

Compact

- Can be used where space is tight: overall diameter is 36 mm.

Application Oriented

- Current output 4 - 20 mA.
- Voltage output 0 - 10 V or 0 - 5 V.
- Measuring range scalable.
- Limit switch function.

Mechanical Characteristics:

Max. speed:	4000 RPM 2000 RPM (continous)	
Starting torque (68 °F | 20 °C):	< 1.4 oz - in (0.01 Nm)	
Shaft load capacity: Radial: Axial:	 18 lbs (80 N) 9 lbs (40 N)	
Weight:	approx. 0.44 lbs (0.2 kgs)	
Protection acc. to EN 60529/ DIN 40050-9:	IP66, IP67, IP69k	
Working temperature range:	–40 to +185 °F (–40 to +85 °C)	
Materials: Shaft: Flange: Housing: Cable:	Standard stainless steel: V2A(304) aluminum zinc die-cast PVC	/N72 (stainless steel) V4A (316) V4A (316) V4A (316) —
Shock resistance acc. to EN 60068-2-27:	500 g (5000 m/s²), 4 ms	
Vibration resistance acc. to EN 60068-2-6:	30g (300 m/s²), 10 - 2000 Hz	

Absolute, Multiturn Type RM-115 Series — Analog

Electrical Characteristics Current Interface 4 - 20mA:

Power supply:	10 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
Measuring range: factory setting: Optionally scalable:	2^4 revolutions up to 2^{16} revolutions
DA converter resolution:	12 bit
Singleturn accuracy, at 77 °F | 25 °C:	±1 °
Temperature coefficient:	< 100 ppm/K
Repeat accuracy at 77 °F | 25 °C:	±0.2 °
Output load:	max. 200 0hm at 10 VDC max. 900 0hm at 24 VDC max. 1200 0hm at 30 VDC
Setting time:	< 1 ms, R_{Load} = 900 0hm, 77 °F | 25 °C
LEDs (green/red):	• system status • current loop interruption— input load too high • reference point display (only with factory settings) at cw: betw. 0 ° and 1 ° at ccw: betw. 0 ° and –1 ° • status in teach mode
Options:	• output signal scalable via the teach inputs • output signal scalable via the teach inputs + limit switch function
Teach inputs:	level= +V for 1 s min
PowerON time:	< 1 s
Update Rate:	1 ms
e1 compliant acc. to (pending):	EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

Characteristics Voltage Interface 0 - 10 V / 0 - 5 V:

Power supply:	output 0 - 5 V 10 - 30 VDC output 0 - 10 V 15 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
Measuring range: factory setting: Optionally scalable:	2^4 revolutions up to 2^{16} revolutions
DA converter resolution:	0 - 10 V 12 bit 0 - 5 V 11 bit
Singleturn accuracy, at 25°C | 77°F:	±1 °
Temperature coefficient:	< 100 ppm/K
Repeat accuracy at 25°C | 77°F:	±0.2 °
Current output:	max. 10 mA
Setting time:	< 1 ms, R_{Load} = 1000 0hm, 77 °F | 25 °C
LEDs (green/red):	• system status • reference point display (only with factory settings) at cw: betw. 0 ° and 1 ° at ccw: betw. 0 ° and –1 ° • status in teach mode
Options:	• output signal scalable via the teach inputs • output signal scalable via the teach inputs + limit switch function
Teach inputs:	level= +V for 1 s min
PowerON time:	< 1 s
Update Rate:	1 ms
e1 compliant acc. to (pending):	EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

[1)] = when the power supply is correctly applied.

Measuring Range 'AL' or 'AR':

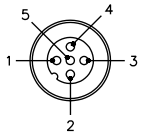
Connection Type:	Common (0 V)	+V	Output	Set 1	Set 2
Cable:	BU	BN	WH	N/C	N/C
M12 pin:	3	1	2	N/C	N/C

Measuring Range 'NS' or 'WL':

Connection Type:	Common (0 V)	+V	Output	Set 1	Set 2
Cable:	BU	BN	WH	BK	GY
M12 pin:	3	1	2	4	5

Wiring Diagram:

Male encoder view



Mating cordset:
RKC 4.5T-*/S618

* Length in meters.

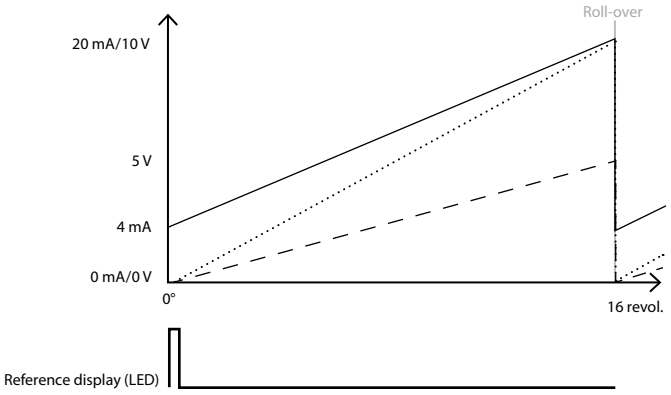
Absolute, Multiturn Type RM-115 Series — Analog

Note: Encoders must be ordered with a clockwise or counterclockwise profile. This determines whether the analog output increases or decreases in the given direction.

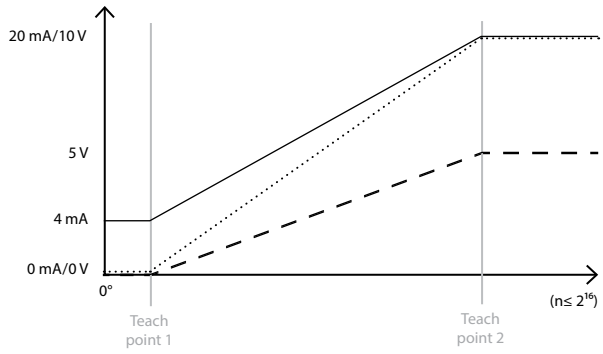
Example (output signal profile):

version 4 - 20 mA
version 0 - 10 V
version 0 - 5 V

Clockwise (CW) version



Scalable version without limit switch function

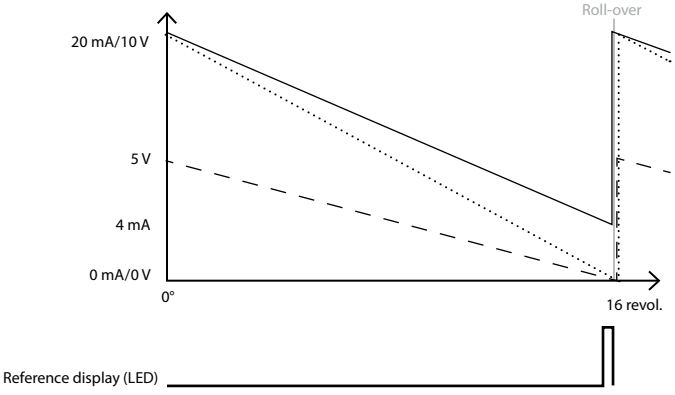


no reference point display (LED)

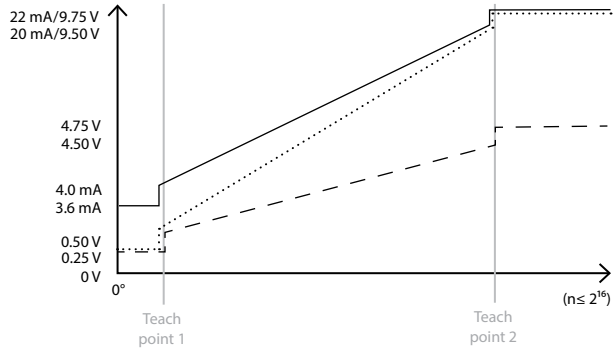
Example (output signal profile):

version 4 - 20 mA
version 0 - 10 V
version 0 - 5 V

Counter Clockwise (CCW) version



Scalable version with limit switch function



no reference point display

Note: Factory-set measuring range: 2^4 revolutions with roll-over

Note: Limit switch function:

version:	0 - 10 V	0 - 5 V	4 - 20 mA
limit switch low:	0.25 V	0.25 V	3.60 mA
limit switch high:	9.75 V	4.75 V	22.00 mA

Absolute, Multiturn Type RM-115 Series — Analog

Part Number Key: RM-115 Shaft Version

A	B	C		D	E		F		G
RM-115S	6	C	-	7A	AL	-	H1151	/	

A	Type
RM-115S	Ø 39 mm, Shaft w/Flat, IP69K Shaft Seal

B	Shaft (Ø × L)
6	Ø 6 mm × 12.5 mm
8	Ø 8 mm × 15 mm
10	Ø 10 mm × 20 mm
A0	Ø 1/4" × 1/2"

C	Flange
C	Ø 42 mm Clamping Flange

D	Voltage Supply and Output Type
7A	10 - 30 VDC, 4 - 20 mA
8B	15 - 30 VDC, 0 - 10 V
BA	10 - 30 VDC, 0 - 5 V

E	Measuring Range
AL	16 Turns, Count Direction CCW*
AR	16 Turns, Count Direction CW*
NS	Scalable to 16-bit Turns, w/o Limit Switch
WL	Scalable to 16-bit Turns, w/ Limit Switch

* = increasing code values when shaft turning in direction listed. Top view on shaft.

F	Type of Connection
H1151	Radial 5-pin M12 Eurofast Connector
C1M	Radial Cable (1m PVC)

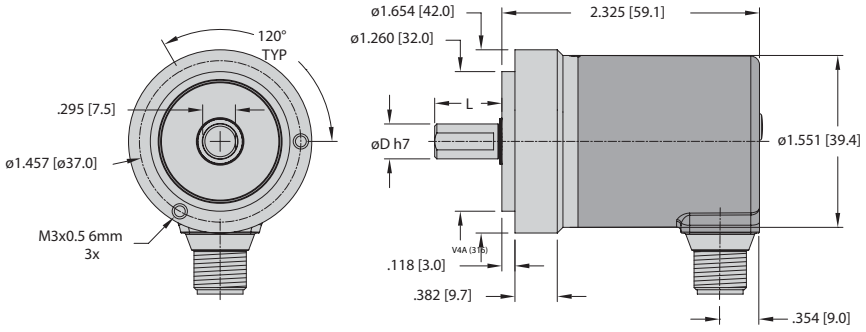
G	Options
(Blank)	No Options
N72	Stainless Steel Flange and Shaft[1]

[1] = only available with shaft '10'.

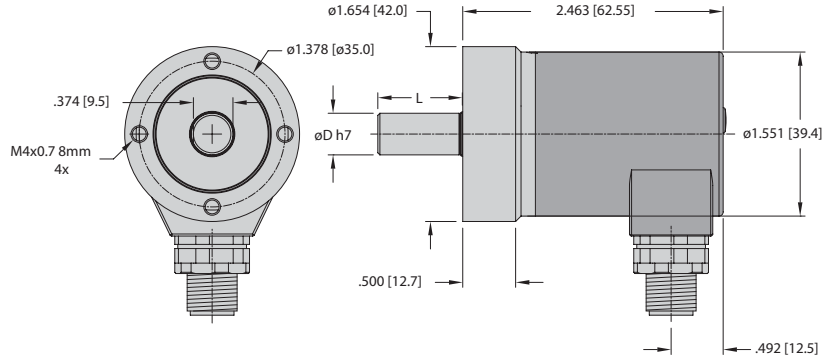
Absolute, Multiturn Type RM-115 Series — Analog

Dimensions: RM-115 Shaft Version

RM-115 Flange C
Connection H1151

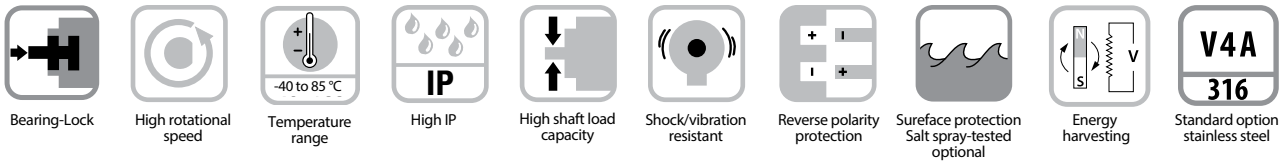


RM-115 /N72 Flange C
Connection H1151



Mounting advice:
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

Absolute, Multiturn Type RM-117 SSI



Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Sureface protection Salt spray-tested optional | Energy harvesting | Standard option stainless steel

High Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Protection level IP66, IP67 and IP69k in one device.
- Wide temperature range –40 °C to +85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology.

Compact

- Can be used where space is tight: overall diameter is 39 mm.

Application Oriented

- Absolute accuracy ±1 °.
- Repeat accuracy ±0.2 °.
- Short control cycles, clock frequency with SSI up to 2 MHz.
- Max. resolution 38 bit (14 bit ST + 24 bit MT).

Mechanical Characteristics:

Max. speed:	4000 RPM 2000 RPM (continous)	
Starting torque (68 °F | 20 °C):	< 1.4 oz - in (0.01 Nm)	
Shaft load capacity: Radial: Axial:	 18 lbs (80 N) 9 lbs (40 N)	
Weight:	approx. 0.44 lbs (0.2 kgs)	
Protection acc. to EN 60529:	IP66, IP67, IP69K	
Working temperature:	–40 to +185 °F (–40 to +85 °C)	
Materials: Shaft: Flange: Housing: Cable:	Standard stainless steel: V2A (304) aluminum zinc die-cast PUR	/N72 (stainless steel) V4A (316) V4A (316) V4A (316) —
Shock resistance acc. to EN 60068-2-27:	500 g (5000 m/s²) 4 ms	
Vibration resistance acc. to EN 60068-2-6:	30 g (300 m/s²), 10 - 2000 Hz	

Absolute, Multiturn Type RM-117 SSI

General Electrical Characteristics:

Power supply	10 - 30 VDC
Current consumption (no load):	max. 30 mA,
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
e1 compliant acc. to (pending):	EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

Interface Characteristics SSI:

Output driver:	RS485 transceiver type
Permissible load / channel:	max +/– 30 mA
Signal high:	typ 3.8 V
Signal level low with I_{Load} = 20 mA:	typ 1.3 V
Resolution singleturn:	10 - 14 bit
Absolute accuracy [2)]:	±1 °
Repeat accuracy:	±0.2 °
Number of revolutions (multiturn):	max 24 bit
Code:	binary or gray
SSI clock rate:	50 kHz - 2 MHz
Data refresh rate:	2 ms
Monoflop time:	≤ 15 µs

Note: If the clock cycle starts within the monoflop time a second data transfer begins with the same data. If the clock cycle starts after the monoflop time the cycle begins with the new values. The update rate is dependent on the clock speed, data length and monoflop time.

SET Input:

Input characteristics:	active HIGH
Input type:	comparator
Signal level high:	min. 60% of +V (power supply), max: +V
Signal level low:	max. 30% of +V (power supply)
Input current:	< 0.5 mA
Min. pulse duration (SET):	10 ms
Input delay:	1 ms
New position data readable after:	1 ms
Internal processing time:	200 ms

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET input has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.

The SET function should be carried out while the encoder is at rest.

If this input is not used, it should be connected to 0 V (Encoder ground GND)in order to avoid interferences.

DIR Input:

Direction input: A HIGH signal switches the direction of rotation from the default cw to ccw. This inverted function can also be factory-programmed.

If this input is not used, it should be connected to 0 V (Encoder ground GND)in order to avoid interferences.

Response time (DIR input)	1ms

Power-On Delay:

After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

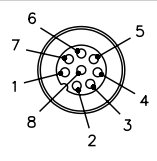
Hot plugging of the encoder should be avoided.

[1)] = short circuit protected to **0**v or to output when power supply correctly applied.
[2)] = over the entire temperature range.

Connection Type:	GND (0 V)	V+	+Clock	–Clock	+Data	– Data	SET	DIR	PE
Cable:	WH	BN	GN	YE	GY	PK	BU	RD	Shield
M12 pin:	1	2	3	4	5	6	7	8	PH

Wiring Diagrams:

Male Encoder View



Mating Cordset:
E-RKC 8T-264-*

* Length in meters.

Absolute, Multiturn Type RM-117 SSI

Part Number Key: RM-117 Shaft Version

A	B	C		D	E1	E2		F		G
RM-117S	6	C	-	3C	10S	12M	-	H1181	/	

A	Type
RM-117S	Ø 39 mm, Shaft w/ Flat, IP69K Shaft Seal

B	Shaft (Ø x L)
6	Ø 6 mm x 12.5 mm
8	Ø 8 mm x 15 mm
10	Ø 10 mm x 20 mm
A0	Ø 1/4" x 1/2"

C	Flange
C	Ø 42 mm Clamping Flange

D	Voltage Supply and Output Type
3C	10 - 30VDC, SSI (Gray Code)
5C	10 - 30VDC, SSI (Binary Code)

E1	Resolution (singleturn)
10S	10 bit
12S	12 bit
13S	13 bit
14S	14 bit

E2	Resolution (multiturn)
12M	12 bit
16M	16 bit
20M	20 bit
24M	24 bit

F	Type of Connection
H1181	Radial 8-pin M12 Eurofast Connector
C1M	Radial Cable (1 m PUR)

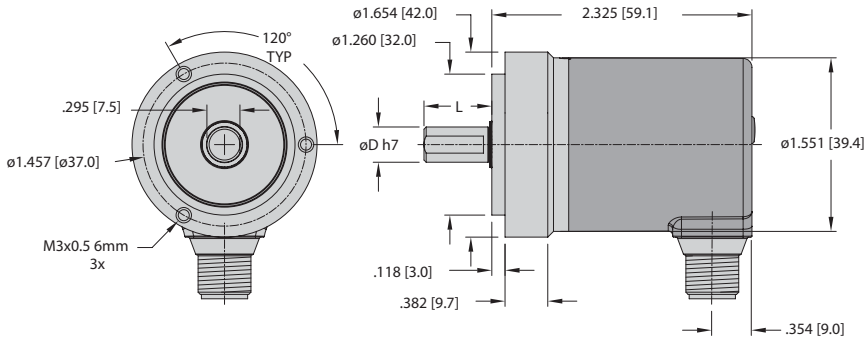
G	Options
(BLANK)	No Options
N72	Stainless Steel Flange and Shaft[1]

[1] = only available with shaft '10' and connection 'H1181'

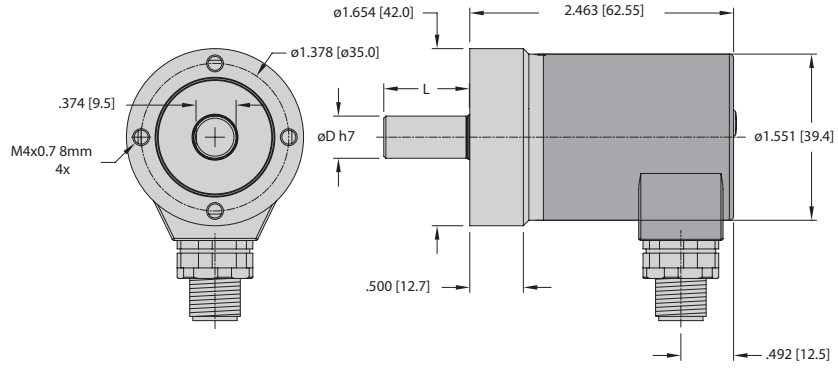
Absolute, Multiturn Type RM-117 SSI

Dimensions: RM-117 Shaft Version

RM-117 Flange C
Connection H1181



RM-117 /N72 Flange C
Connection H1181



Mounting Advice:
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

Absolute, Multiturn Type RM-109 — CANopen

Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Standard option seawater resistantl | Energy Harvesting | Standard option stainless steel

Highest Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Protection level IP66, IP67 and IP69k in one device.
- Wide temperature range –40 °C to +85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology.

Absolute

RoHS compliant

CANopen

e1 pending | cULus | RoHS

Compact

- Can be used where space is tight: overall diameter is 36 mm.

Up-To-The-Minute Fieldbus Performance

- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- Universal scaling function.
- Configuration management (bootloader).

Mechanical Characteristics:

Max. speed:	4000 RPM 2000 RPM (continuous)	
Starting torque (68 °F | 20 °C):	< 1.4 oz - in (0.01 Nm)	
Shaft load capacity: Radial: Axial:	 18 lbs (80 N) 9 lbs (40 N)	
Weight:	approx. 0.44 lbs (0.2 kg)	
Protection acc. to EN 60529/DIN 40050-9:	IP66, IP67, IP69K	
Working temperature range:	–40 to +185 °F (–40 to +85 °C)	
Materials: Shaft: Flange: Housing: Cable:	Standard stainless steel: V2A(304) aluminum zinc die-cast PVC	/N72 (stainless steel) V4A (316) V4A (316) V4A (316) —
Shock resistance acc. to EN 60068-2-27:	500 g (5000 m/s²), 4 ms	
Vibration resistance acc. to EN 60068-2-6:	30 g (300 m/s²), 10 - 2,000 Hz	

Absolute, Multiturn Type RM-109 — CANopen

General Electrical Characteristics:

Sensor:	
Power supply:	10 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs	yes[1)]
e1 compliant acc. to (pending):	EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)
RUL approval	file 224618
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

Interface Characteristics CANopen:

Resolution singleturn:	1 - 16384 (14 bit), scalable default: 8192 (13 bit)
Absolute accuracy[2)]:	±1 °
Repeat accuracy:	±0.2 °
Number of revolutions (multiturn):	max. 16,777,216 (24 bit) scalable only via the total resolution
Total resolution:	1 - 274,877,906,944 (38 bit), scalable default: 33,554,432 (25 bit)
Code:	binary
Interface:	CAN high-speed acc. to ISO 11898, Basic- and Full-CAN, CAN specification 2.0 B
Protocol:	CANopen profile DS406 V4.0 with manufacturer-specific add-ons, LSS-Service, bootloader
Power-ON time:	< 1200 ms
SDO timeout:	< 1000 ms
Baud rate:	10 - 1000 kbit/s software configurable
Node address:	1 - 127 software configurable
Termination:	software configurable
LSS protocol:	CIA LSS protocol DS305, global command support for node address and baud rate, selective commands via attributes of the identity object
Bootloader:	configuration management CIA DS 302-3

[1)] = short circuit protected to **0**v or to output when power supply correctly applied.
[2)] = over the entire temperature range.

General Information about CANopen

The CANopen encoders support the latest CANopen communication profile according to DS301 V4.02 . In addition, device-specific profiles like the encoder profile DS406 V3.2, DS305 (LSS) and DS302 (Bootloader) are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

The following output values may be combined in a freely variable way as PDO(PDO mapping): **position**, **speed, acceleration** as well as the **status of the working area.**

The encoders are available with a connector or a cable connection.

The device address and baud rate can be set/ modified by means of the software.

The two-color LED located on the back indicates the operating or fault status of the CAN-bus, as well as the status of the internal diagnostics.

CANbus connection

The CANopen encoders are equipped with a bus trunk line in various lengths or a M12 connector and can be terminated in the device.

The devices do not have an integrated T-coupler nor are they looped internally and must therefore only be used as end devices.

LSS layer setting services DS305 V2.0

- Global support of node-ID and baud rate
- Selective protocol via identity object (1018h)

CANopen Communication Profile DS301 V4.2

Among others, the following functionality is integrated. (Class C2 functionality):

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 3 Sending PDO's
- Node address, baud rate and CANbus / programmable termination

CANopen encoder profile DS406 V4.0

The following parameters can be programmed:

- Event mode, start optional
- 1 work area with upper and lower limit and the corresponding output states variable PDO mapping for position, speed, work area status, error and acceleration
- Extended failure management for position sensing
- User interface with visual display of bus and failure status 1 LED two colors
- Customer-specific protocol
- "Watchdog controlled" device

Bootloader functionality DS302-3

Configuration Management:

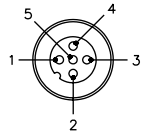
- Program download
- Program start
- Program erase

Standard Wiring:

Connection Type:	+V	Common (0 V)	CAN GND	CAN High	CAN Low
Cable:	BN	WH	GY	GN	YE
M12 Eurofast:	2	3	1	4	5

Wiring Diagram:

Male Encoder View



Mating Cordset[1)]:
RKC 572-*M/S3117

* Length in meters.
[1)] See page J3 for corresponding cable color code.

Absolute, Multiturn Type RM-109 — CANopen

Part Number Key: RM-109 Shaft Version

A	B	C		D		E		F
RM-109S	6	C	-	9D38B	-	H1151	/	

A	Type
RM-109S	Ø 39 mm, Shaft w/ Flat, IP69K Shaft Seal

B	Shaft (Ø × L)
6	Ø 6 mm × 12.5 mm
8	Ø 8 mm × 15 mm
10	Ø 10 mm × 20 mm
A0	Ø 1/4" × 1/2"

C	Flange
C	Ø 42 mm Clamping Flange

D	Voltage Supply and Output Type
9D38B	10 - 30 VDC, CANopen DS 406 V4.0

E	Type of Connection
H1151	Radial 1 × M12 Eurofast Connector
C1M	Radial Cable (1 m PVC)

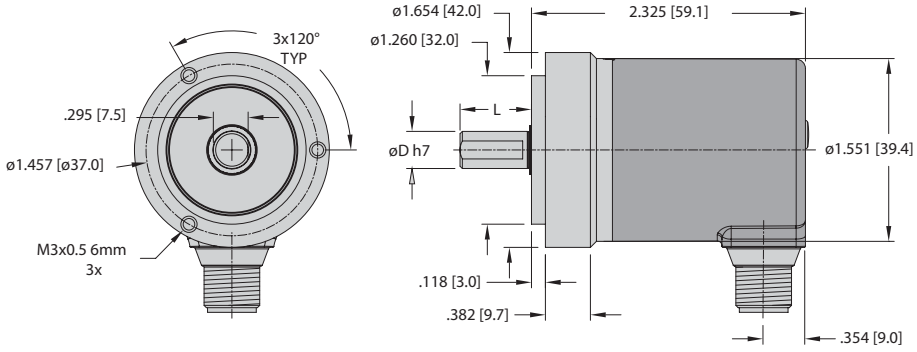
F	Options
(BLANK)	No Options
N72	Stainless Steel Flange and Shaft[1]

[1] = only available with shaft '10' and connection 'H1151'

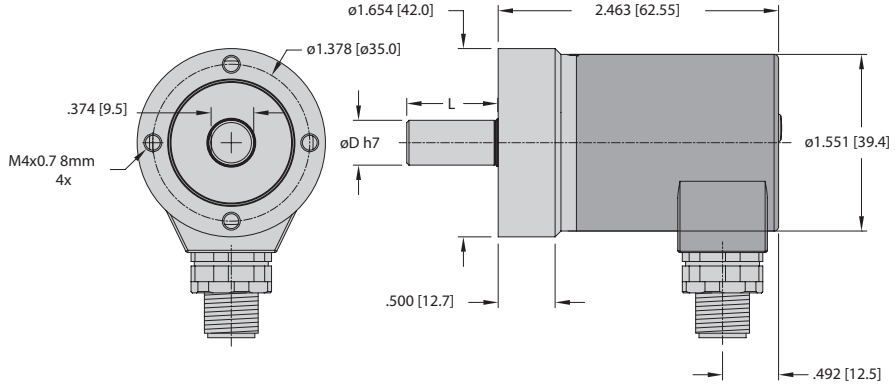
Absolute, Multiturn Type RM-109 — CANopen

Dimensions: RM-109 Shaft Version

RM-109 Flange C
Connection H1151

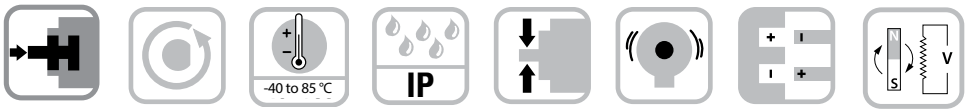


RM-109/N72 Flange C
Connection H1151



Mounting Advice:
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

Absolute, Multiturn Type RM-116 Series — Analog



Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Energy harvesting

Highest Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Wide temperature range –40 °C to +85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology.

Compact Housing

- Can be used where space is tight: 39 mm housing with 58 mm flange.

Application Oriented

- Current output 4 - 20 mA.
- Voltage output 0 - 10 V or 0 - 5 V.
- Measuring range scalable.
- Limit switch function.

Mechanical Characteristics:

Max. speed:	4000 RPM 2000 RPM (continous)
Starting torque (68 °F | 20 °C):	< 1.4 oz - in (0.01 Nm)
Shaft load capacity: Radial: Axial:	 18 lbs (80 N) 9 lbs (40 N)
Weight:	approx. 0.44 lbs (0.2 kgs)
Protection acc. to EN 60529/ DIN 40050-9:	IP65
Working temperature range:	–40 to +185 °F (–40 to +85 °C)
Materials: Shaft: Flange: Housing: Cable:	 stainless steel: V2A(304) aluminum zinc die-cast PVC
Shock resistance acc. to EN 60068-2-27:	500 g (5000 m/s²), 4 ms
Vibration resistance acc. to EN 60068-2-6:	30 g (300 m/s²), 10 - 2000 Hz

Absolute, Multiturn Type RM-116 Series — Analog

Electrical Characteristics Interface 4 - 20mA:

Power supply:	10 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
Measuring range: factory setting: Optionally scalable:	 2^4 revolutions up to 2^{16} revolutions
DA converter resolution:	12 bit
Singleturn accuracy, at 77 °F | 25 °C:	±1 °
Temperature coefficient:	< 100 ppm/K
Repeat accuracy at 77 °F | 25 °C:	±0.2 °
Output load:	max. 200 0hm at 10 VDC max. 900 0hm at 24 VDC max. 1200 0hm at 30 VDC
Setting time:	< 1 ms, R_{Load} = 900 0hm, 77 °F | 25 °C
LEDs (green/red):	• system status • current loop interruption— input load too high • reference point display (only with factory settings) at cw: betw. 0 ° and 1 ° at ccw: betw. 0 ° and –1 ° • status in teach mode
Options:	• output signal scalable via the teach inputs • output signal scalable via the teach inputs + limit switch function
Teach inputs:	level= +V for 1 s min
PowerON time:	< 1 s
Update Rate:	1 ms
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

Characteristics Voltage Interface:

Power supply:	output 0 - 5 V 10 - 30 VDC output 0 - 10 V 15 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
Measuring range: factory setting: Optionally scalable:	 2^4 revolutions up to 2^{16} revolutions
DA converter resolution:	0 - 10 V 12 bit 0 - 5 V 11 bit
Singleturn accuracy, at 25°C | 77°F:	±1 °
Temperature coefficient:	< 100 ppm/K
Repeat accuracy at 25°C | 77°F:	±0.2 °
Current output:	max. 10 mA
Setting time:	< 1 ms, R_{Load} = 1000 0hm, 77 °F | 25 °C
LEDs (green/red):	• system status • reference point display (only with factory settings) at cw: betw. 0 ° and 1 ° at ccw: betw. 0 ° and –1 ° • status in teach mode
Options:	• output signal scalable via the teach inputs • output signal scalable via the teach inputs + limit switch function
Teach inputs:	level= +V for 1 s min
PowerON time:	< 1 s
Update Rate:	1 ms
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

[1)] = when the power supply is correctly applied.

Measuring Range 'AL' or 'AR':

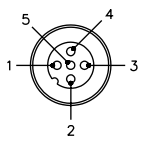
Connection Type:	Common (0 V)	+V	Output	Set 1	Set 2
Cable:	BU	BN	WH	N/C	N/C
M12 pin:	3	1	2	N/C	N/C

Measuring Range 'NS' or 'WL':

Connection Type:	Common (0 V)	+V	Output	Set 1	Set 2
Cable:	BU	BN	WH	BK	GY
M12 pin:	3	1	2	4	5

Wiring Diagram:

Male encoder view



Mating cordset:
RKC 4.5T-*/S618

* Length in meters.

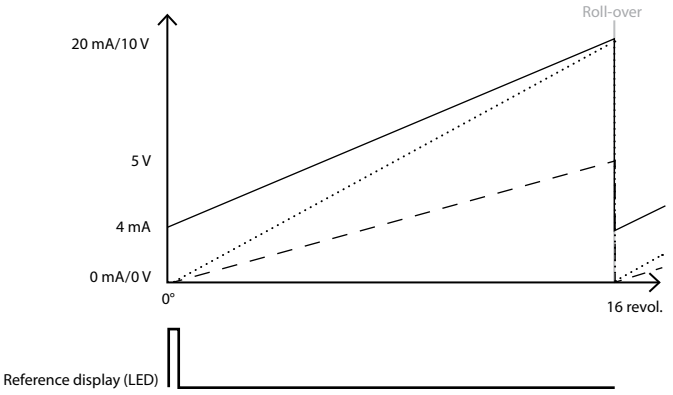
Absolute, Multiturn Type RM-116 Series — Analog

Note: Encoders must be ordered with a clockwise or counterclockwise profile. This determines whether the analog output increases or decreases in the given direction.

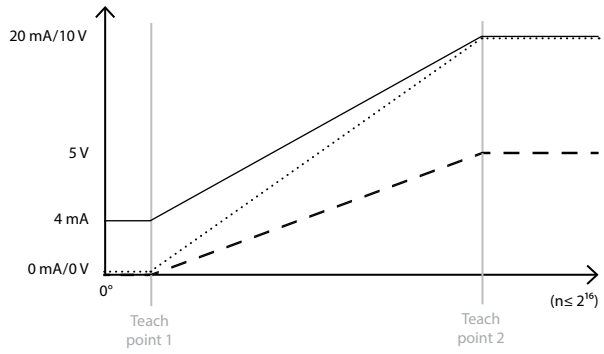
Example (output signal profile):

version 4 - 20 mA
version 0 - 10 V
version 0 - 5 V

Clockwise (CW) version



Scalable version without limit switch function

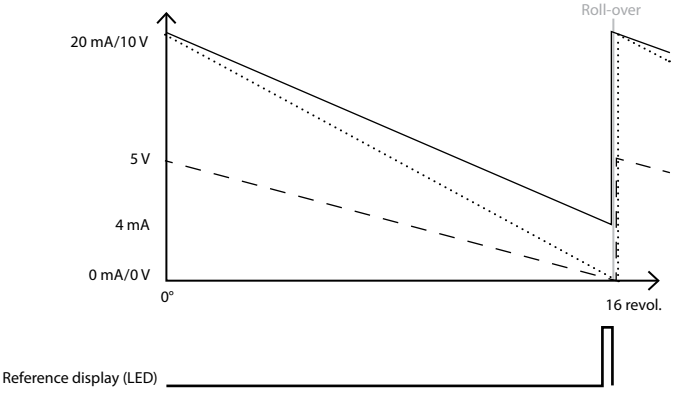


no reference point display (LED)

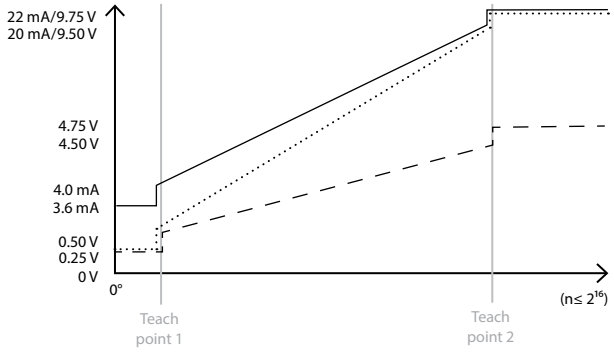
Example (output signal profile):

version 4 - 20 mA
version 0 - 10 V
version 0 - 5 V

Counter Clockwise (CCW) version



Scalable version with limit switch function



no reference point display

Note: Factory-set measuring range: 2^4 revolutions with roll-over

Note: Limit switch function:

version:	0 - 10 V	0 - 5 V	4 - 20 mA
limit switch low:	0.25 V	0.25 V	3.60 mA
limit switch high:	9.75 V	4.75 V	22.00 mA

Absolute, Multiturn Type RM-116 Series — Analog

Part Number Key: RM-116 Shaft Version

A	B	C		D	E		F
RM-116T	6	C	-	7A	AL	-	H1151

A	Type
RM-116T	Ø 39 mm, Shaft w/Flat, IP65 Shaft Seal

B	Shaft (Ø × L)
6	Ø 6 mm × 12.5 mm
10	Ø 10 mm × 20 mm

C	Flange
C	Ø 58 mm Clamping Flange
S	Ø 58 mm Servo Flange

D	Voltage Supply and Output Type
7A	10 - 30 VDC, 4 - 20 mA
8B	15 - 30 VDC, 0 - 10 V
BA	10 - 30 VDC, 0 - 5 V

E	Measuring Range
AL	16 Turns, Count Direction CCW*
AR	16 Turns, Count Direction CW*
NS	Scalable to 16-bit Turns, w/o Limit Switch
WL	Scalable to 16-bit Turns, w/ Limit Switch

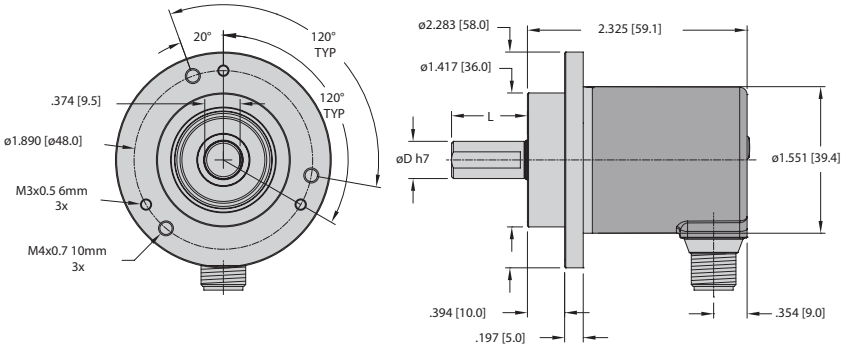
* = increasing code values when shaft turning in direction listed. Top view on shaft.

F	Type of Connection
H1151	Radial 5-pin M12 Eurofast Connector
C1M	Radial Cable (1m PVC)

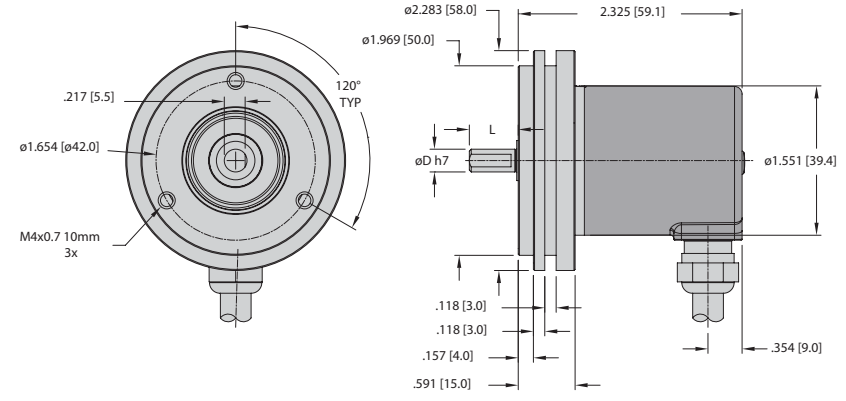
Absolute, Multiturn Type RM-116 Series — Analog

Dimensions: RM-116 Shaft Version

RM-116 Flange C
Connection H1151

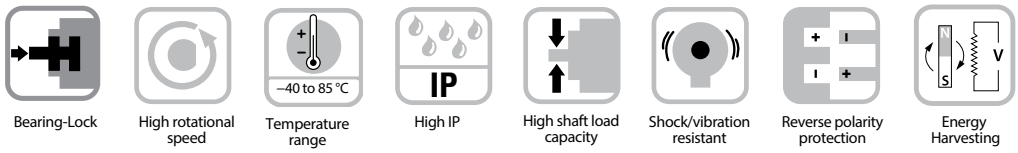


RM-116 Flange S
Connection C1M



Mounting advice:
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

Absolute, Multiturn Type RM-118 SSI



Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Energy Harvesting

High Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Wide temperature range −40 °C to +85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology..

Compact Housing

- Can be used where space is tight: 39 mm housing with 58 mm flange

Application Oriented

- Absolute accuracy ±1 °.
- Repeat accuracy ±0.2 °.
- Short control cycles, clock frequency with SSI up to 2 MHz.
- Max. resolution 38 bit (14 bit ST + 24 bit MT).

Mechanical Characteristics:

Max. speed:	4000 RPM 2000 RPM (continuous)
Starting torque (68 °F | 20 °C):	< 1.4 oz - in (0.01 Nm)
Shaft load capacity: Radial: Axial:	 18 lbs (80 N) 9 lbs (40 N)
Weight:	approx. 0.44 lbs (0.2 kg)
Protection acc. to EN 60529:	IP65
Working temperature:	−40 to +185 °F (−40 to +85 °C)
Materials: Shaft: Flange: Housing: Cable:	 stainless steel: V2A(304) aluminum zinc die-cast PUR
Shock resistance acc. to EN 60068-2-27:	500g (5000 m/s²), 4 ms
Vibration resistance acc. to EN 60068-2-6:	30g (300 m/s²), 10 - 2000 Hz

Absolute, Multiturn Type RM-118 — SSI

General Electrical Characteristics:

Power supply	10 - 30 VDC
Current consumption (no load):	max. 30 mA,
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs:	yes[1)]
UL approval:	file 224618
CE compliant acc. to:	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

Interface Characteristics SSI:

Output driver:	RS485 transceiver type
Permissible load / channel:	max +/– 30 mA
Signal high:	typ 3.8 V
Signal level low with I_{Load} = 20 mA:	typ 1.3 V
Resolution singleturn:	10 - 14 bit
Absolute accuracy [2)]:	±1 °
Repeat accuracy:	±0.2 °
Number of revolutions (multiturn):	max 24 bit
Code:	binary or gray
SSI clock rate:	50 kHz - 2 MHz
Data refresh rate:	2 ms
Monoflop time:	≤ 15 µs

Note: If the clock cycle starts within the monoflop time a second data transfer begins with the same data. If the clock cycle starts after the monoflop time the cycle begins with the new values. The update rate is dependent on the clock speed, data length and monoflop time.

SET Input:

Input characteristics:	active HIGH
Input type:	comparator
Signal level high:	min. 60% of +V (power supply), max: +V
Signal level low:	max. 30% of +V (power supply)
Input current:	< 0.5 mA
Min. pulse duration (SET):	10 ms
Input delay:	1 ms
New position data readable after:	1 ms
Internal processing time:	200 ms

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET in put has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.

The SET function should be carried out while the encoder is at rest.

If this input is not used, it should be connected to 0 V (Encoder ground GND)in order to avoid interferences.

DIR Input:

Direction input: A HIGH signal switches the direction of rotation from the default cw to ccw. This inverted function can also be factory-programmed.

If this input is not used, it should be connected to 0 V (Encoder ground GND)in order to avoid interferences.

Response time (DIR input) 1 ms

Power-On Delay:

After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

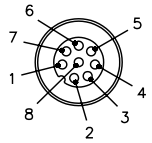
Hot plugging of the encoder should be avoided.

[1)] = when power supply is currently applied
[2)] = over the entire temperature range

Connection Type:	GND (0 V)	V+	+Clock	–Clock	+Data	– Data	SET	DIR	PE
Cable:	WH	BN	GN	YE	GY	PK	BU	RD	Shield
M12 pin:	1	2	3	4	5	6	7	8	PH

Wiring Diagrams:

Male Encoder View



Mating Cordset:
E-RKC 8T-264-*

* Length in meters.

Absolute, Multiturn Type RM-118 SSI

Part Number Key: RM-118 Shaft Version

A	B	C		D	E1	E2		F
RM-118T	6	C	-	3C	10S	12M	-	H1181

A	Type
RM-118T	Ø 39 mm, Shaft w/ Flat, IP65 Shaft Seal

B	Shaft (Ø x L)
6	Ø 6 mm x 12.5 mm
10	Ø 10 mm x 20 mm

C	Flange
C	Ø 58 mm Clamping Flange
S	Ø 58 mm Servo Flange

D	Voltage Supply and Output Type
3C	10 - 30VDC, SSI (Gray Code)
5C	10 - 30VDC, SSI (Binary Code)

E1	Resolution (singleturn)
10S	10 bit
12S	12 bit
13S	13 bit
14S	14 bit

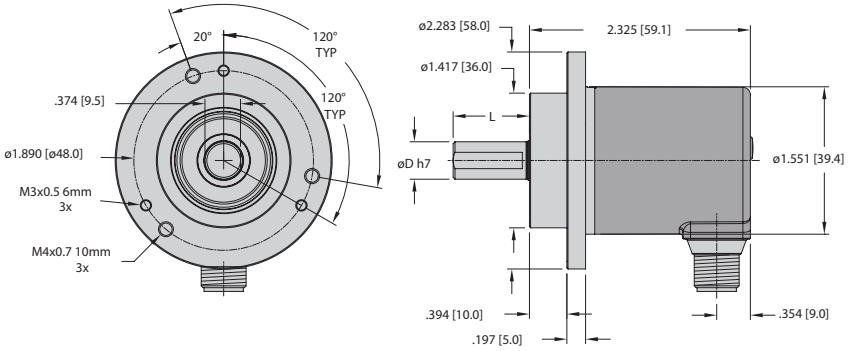
E2	Resolution (multiturn)
12M	12 bit
16M	16 bit
20M	20 bit
24M	24 bit

F	Type of Connection
H1181	Radial 8-pin M12 Eurofast Connector
C1M	Radial Cable (1 m PUR)

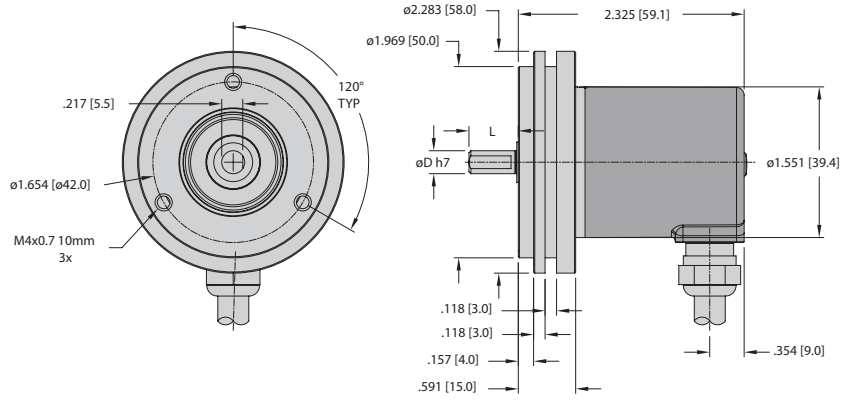
Absolute, Multiturn Type RM-118 SSI

Dimensions: RM-118 Shaft Version

RM-118 Flange C
Connection H1181

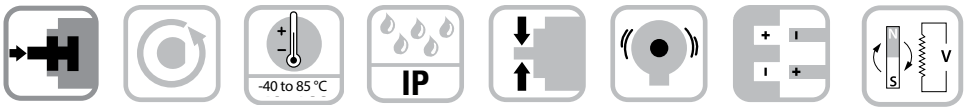


RM-118 Flange S
Connection C1M



Mounting Advice:
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

Absolute, Multiturn Type RM-121 — CANopen



Bearing-Lock | High rotational speed | Temperature range | High IP | High shaft load capacity | Shock/vibration resistant | Reverse polarity protection | Energy Harvesting

Highest Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Wide temperature range –40 °C + 85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology.

Absolute

RoHS compliant

CANopen

Compact Housing

- Can be used where space is tight: 39 mm housing with 58 mm flange.

Up-To-The-Minute Fieldbus Performance

- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- Universal scaling function.
- Configuration management (bootloader).

Mechanical Characteristics:

Max. speed:	4000 RPM 2000 RPM (continuous)
Starting torque (68 °F | 20 °C):	< 1.4 oz - in (0.01 Nm)
Shaft load capacity: Radial: Axial:	 18 lbs (80 N) 9 lbs (40 N)
Weight:	approx. 0.44 lbs (0.2 kg)
Protection acc. to EN 60529/DIN 40050-9:	IP65
Working temperature range:	–40 to +185 °F (–40 to +85 °C)
Materials: Shaft: Flange: Housing: Cable:	 stainless steel: V2A(304) aluminum zinc die-cast PVC
Shock resistance acc. to EN 60068-2-27:	500 g (5000 m/s²), 4 ms
Vibration resistance acc. to EN 60068-2-6:	30 g (300 m/s²), 10 - 2,000 Hz

Absolute, Multiturn Type RM-121 — CANopen

General Electrical Characteristics:

Sensor:	
Power supply:	10 - 30 VDC
Current consumption (no load):	max. 30 mA
Reverse polarity protection at power supply (+V):	yes
Short-circuit protected outputs	yes[1)]
UL approval	file 224618
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU

Interface Characteristics CANopen:

Resolution singleturn:	1 - 16384 (14 bit), scalable default: 8192 (13 bit)
Absolute accuracy[2)]:	±1 °
Repeat accuracy:	±0.2 °
Number of revolutions (multiturn):	max. 16,777,216 (24 bit) scalable onl via the total resolution
Total resolution:	1…274,877,906,944 (38 bit), scalable default: 33,554,432 (25 bit)
Code:	binary
Interface:	CAN high-speed acc. to ISO 11898, Basic- and Full-CAN, CAN specification 2.0 B
Protocol:	CANopen profile DS406 V4.0 with manufacturer-specific add-ons, LSS-Service, bootloader
Power-ON time:	< 1200 ms
SDO timeout:	< 1000 ms
Baud rate:	10 - 1000 kbit/s software configurable
Node address:	1 - 127 software configurable
Termination:	software configurable
LSS protocol:	CIA LSS protocol DS305, global command support for node address and baud rate, selective commands via attributes of the identity object
Bootloader:	configuration management CIA DS 302-3

[1)] = short circuit protected to **0**v of to output when power supply currently applied
[2)] = over the entire temperature range

General Information about CANopen

The CANopen encoders support the latest CANopen communication profile according to DS301 V4.02 . In addition, device-specific profiles like the encoder profile DS406 V3.2, DS305 (LSS) and DS302 (Bootloader) are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

The following output values may be combined in a freely variable way as PDO(PDO mapping): **position**, **speed, acceleration** as well as the **status of the working area.**

The encoders are available with a connector or a cable connection.

The device address and baud rate can be set/ modified by means of the software.

The two-color LED located on the back indicates the operating or fault status of the CAN-bus, as well as the status of the internal diagnostics.

CANbus connection

The CANopen encoders are equipped with a bus trunk line in various lengths or a M12 connector and can be terminated in the device.

The devices do not have an integrated T-coupler nor are they looped internally and must therefore only be used as end devices.

LSS layer setting services DS305 V2.0

- Global support of node-ID and baud rate configuration.
- Selective protocol via identity object (1018h)

CANopen Communication Profile DS301 V4.2

Among others, the following functionality is integrated. (Class C2 functionality):

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 3 Sending PDO's
- Node address, baud rate and CANbus / programmable termination
- Variable PDO mapping for position, speed, work area status, error and acceleration
- Extended failure management for position sensing
- User interface with visual display of bus and failure status 1 LED two colors
- Customer-specific protocol
- "Watchdog controlled" device

Bootloader functionality DS302-3

Configuration Management:

- Program download
- Program start
- Program erase

CANopen encoder profile DS406 V4.0

The following parameters can be programmed:

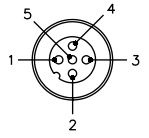
- Event mode, start optional
- 1 work area with upper and lower limit and the corresponding output states

Standard Wiring:

Connection Type:	+V	Common (0 V)	CAN GND	CAN High	CAN Low
Cable:	BN	WH	GY	GN	YE
M12 Eurofast :	2	3	1	4	5

Wiring Diagram:

Male Encoder View



Mating Cordset[1)]:
RKC 572-*M/S3117

* Length in meters.
[1)] See page J3 for corresponding cable color code.

Absolute, Multiturn Type RM-121 CANopen

Part Number Key: RM-121 Shaft Version

A	B	C		D		E
RM-121T	6	C	-	9D38B	-	H1151

A	Type
RM-121T	Ø 39 mm, Shaft, IP65 Shaft Seal

D	Voltage Supply and Output Type
9D38B	10 - 30 VDC, CANopen DS301 V4.02

B	Shaft (Ø × L)
6	Ø 6 mm × 10 mm
10	Ø 10 mm × 20 mm

E	Type of Connection
H1151	Radial 1 × M12 Eurofast Connector
C1M	Radial Cable (1 m PUR)

C	Flange
C	Ø 58 mm Clamping Flange
S	Ø 58 mm Servo Flange

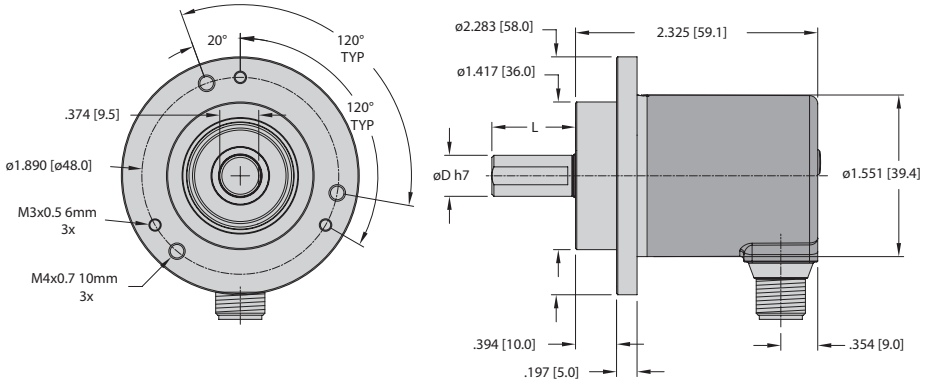
Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

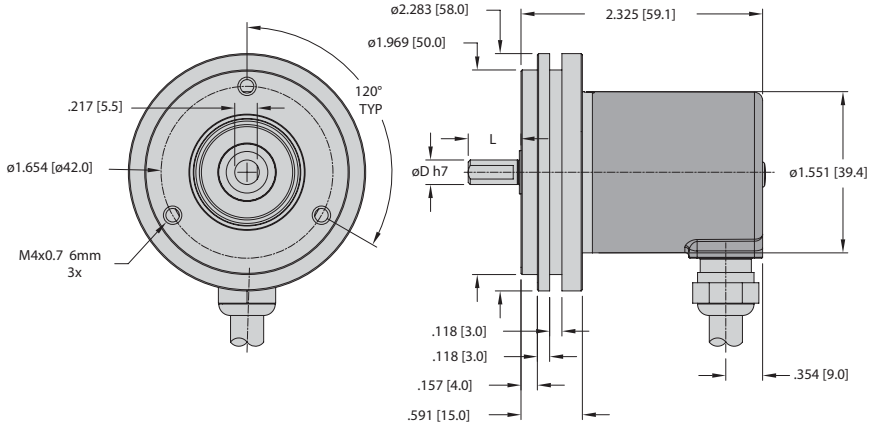
Absolute, Multiturn Type RM-121 CANopen

Dimensions: RM-121 Shaft Version

RM-121 Flange C
Connection H1151



RM-121 Flange S
Connection C1M



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