# MAGNETIC ABSOLUTE MULTITURN

<table>
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<tr>
<th>Type</th>
<th>Description</th>
<th>Connection Type</th>
<th>Page</th>
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<tr>
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<td>Standard, Magnetic</td>
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<td>RM-118</td>
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</tr>
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<td></td>
<td>RM-121</td>
<td>CANopen</td>
<td>F37</td>
</tr>
</tbody>
</table>

![Images of compact, robust, and standard magnetic absolute multiturn sensors](image)

**Find on page F2**

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

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.

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: Without shaft seal (IP65): | 6000 RPM |
| Shaft or blind hollow shaft version: With shaft seal (IP67): | 3000 RPM (continuous) |
| Shaft or blind hollow shaft version: With shaft seal (IP67): | 4000 RPM |
| Shaft load capacity: | 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 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)

### 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

#### Measuring range:
- **Factory setting:** 2⁴ revolutions up to 2¹⁶ revolutions
- **Optionally scalable:**

#### 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

#### 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

### General Characteristics Voltage Interface 0 - 10 V / 0 - 5 V:
- **Power supply:** output 0 - 5 V 10 - 30 VDC
- **Output:** 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

#### Measuring range:
- **Factory setting:** 2⁴ revolutions up to 2¹⁶ revolutions
- **Optionally scalable:**

#### 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

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* = when the power supply is correctly applied.
Rotary Position Technology
Absolute Encoders, Multiturn

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):

Clockwise (CW) version

Scalable version without limit switch function

Counter Clockwise (CCW) version

Scalable version with limit switch function

Example (output signal profile):

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

Note: Limit switch function:

<table>
<thead>
<tr>
<th>Version</th>
<th>0 - 10 V</th>
<th>0 - 5 V</th>
<th>4 - 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit switch low</td>
<td>0.25 V</td>
<td>0.25 V</td>
<td>3.60 mA</td>
</tr>
<tr>
<td>Limit switch high</td>
<td>9.75 V</td>
<td>4.75 V</td>
<td>22.00 mA</td>
</tr>
</tbody>
</table>

Reference display (LED)
# Rotary Position Technology
## Absolute Encoders, Multiturn

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

**Part Number Key: RS-97 Shaft Version**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-97S</td>
<td>6</td>
<td>C</td>
<td>-</td>
<td>7A</td>
<td>AL</td>
</tr>
</tbody>
</table>

**Type**

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

**Shaft (Ø × L)**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Ø 6 mm × 12.5 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ø 8 mm × 15 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Ø 10 mm × 20 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A0</td>
<td>Ø 1/4&quot; × 1/2&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Flange**

- **C**: Ø 36 mm Clamping Flange
- **S**: Ø 36 mm Servo Flange

**Voltage Supply and Output Type**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7A</td>
<td>10 - 30 VDC, 4 - 20 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8B</td>
<td>15 - 30 VDC, 0 - 10 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BA</td>
<td>10 - 30 VDC, 0 - 5 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Measuring Range

- **AL**: 16 Turns, Count Direction CCW* (Increasing code values when shaft turning in direction listed. Top view on shaft)
- **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

**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)

### Part Number Key: RM-98 Blind Hollow Shaft Version

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-98B</td>
<td>6</td>
<td>E</td>
<td>-</td>
<td>7A</td>
<td>AL</td>
</tr>
</tbody>
</table>

**Type**

- **RM-98B**: Ø 36 mm, Blind Hollow Shaft, IP67 Shaft Seal
- **RM-98C**: Ø 36 mm, Blind Hollow Shaft, IP65 Shaft Seal

**Bore (18.5 mm insertion depth)**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Ø 6 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ø 8 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Ø 10 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A0</td>
<td>Ø 1/4&quot; × 1/2&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Flange**

- **E**: Ø 46 mm Flange w/ Slotted Flex Mount
- **T**: Flange w/ Long Torque Stop

**Voltage Supply and Output Type**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
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<tr>
<td>7A</td>
<td>10 - 30 VDC, 4 - 20 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8B</td>
<td>15 - 30 VDC, 0 - 10 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BA</td>
<td>10 - 30 VDC, 0 - 5 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Measuring Range

- **AL**: 16 Turns, Count Direction CCW* (Increasing code values when shaft turning in direction listed. Top view on shaft)
- **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

**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)

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* = increasing code values when shaft turning in direction listed. Top view on shaft.
### Rotary Position Technology

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

**Dimensions: RM-97 Shaft Version**

**RM-97 Flange C**
Connection H1151 & H1451

![Diagram of RM-97 Flange C]

**RM-97 Flange S**
Connection H1151 & CA1M

![Diagram of RM-97 Flange S]

**Dimensions: RM-98 Blind Hollow Shaft Version**

**RM-98 Flange T**
Connection C1M & CA1M

![Diagram of RM-98 Flange T]

**RM-98 Flange E**
Connection H1151 & H1451

![Diagram of RM-98 Flange E]

**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)

**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.

**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).

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

**Mechanical Characteristics:**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. speed:</td>
<td>6000 RPM (Shaft or blind hollow shaft version)</td>
</tr>
<tr>
<td></td>
<td>3000 RPM (continous) (Without shaft seal (IP65))</td>
</tr>
<tr>
<td></td>
<td>4000 RPM (Shaft or blind hollow shaft version)</td>
</tr>
<tr>
<td></td>
<td>2000 RPM (continous) (With shaft seal (IP67))</td>
</tr>
<tr>
<td>Starting torque (68 °F</td>
<td>20 °C):</td>
</tr>
<tr>
<td></td>
<td>&lt; 1.4 oz - in (0.01 Nm) (With shaft seal (IP67))</td>
</tr>
<tr>
<td>Shaft load capacity:</td>
<td>Radial: 9 lbs (40 N)</td>
</tr>
<tr>
<td></td>
<td>Axial: 4.5 lbs (20 N)</td>
</tr>
<tr>
<td>Weight:</td>
<td>approx. 0.44 lbs (0.2 kg)</td>
</tr>
<tr>
<td>Protection acc. to EN 60529:</td>
<td>IP65/IP67</td>
</tr>
<tr>
<td>Working temperature:</td>
<td>−40 to +185 °F (−40 to +85 °C)</td>
</tr>
<tr>
<td>Materials:</td>
<td>Shaft / Hollow shaft: stainless steel</td>
</tr>
<tr>
<td></td>
<td>Flange: aluminum</td>
</tr>
<tr>
<td></td>
<td>Housing: zinc die-cast</td>
</tr>
<tr>
<td></td>
<td>Cable: PUR</td>
</tr>
<tr>
<td>Shock resistance acc. to EN 60068-2-27:</td>
<td>250 g (2,500 m/s²), 6 ms</td>
</tr>
<tr>
<td>Vibration resistance acc. to EN 60068-2-6:</td>
<td>30 g (300 m/s²), 10 - 2,000 Hz</td>
</tr>
</tbody>
</table>
Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft)

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
- 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

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

Interface Characteristics SSI:
- Output driver: RS485 transceiver type
- Permissible load / channel: max. +/-30 mA
- Signal high: typ 3.8 V
- Signal level low with \( I_{\text{load}} = 20 \text{ mA} \): typ 1.3 V
- Resolution singleturn: 10 - 14 bit
- Absolute accuracy\(^\text{2)}\): ±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.

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.

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.

**Wiring Diagrams:**

<table>
<thead>
<tr>
<th>Connection Type</th>
<th>GND (0 V)</th>
<th>V+</th>
<th>+Clock</th>
<th>−Clock</th>
<th>+Data</th>
<th>−Data</th>
<th>SET</th>
<th>DIR</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable:</td>
<td>WH</td>
<td>BN</td>
<td>GN</td>
<td>YE</td>
<td>GY</td>
<td>PK</td>
<td>BU</td>
<td>RD</td>
<td>Shield</td>
</tr>
<tr>
<td>M12 pin:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>PH</td>
</tr>
</tbody>
</table>

\(^1\) = short circuit protection to 0V or to output when power supply correctly applied.

\(^2\) = over the entire temperature range.
### Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft) SSI

**Part Number Key: RM-99 Shaft Version**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E1</th>
<th>E2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-99S</td>
<td>6</td>
<td>C</td>
<td>-</td>
<td>3C</td>
<td>10S</td>
<td>12M</td>
</tr>
</tbody>
</table>

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

**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”

**Flange**
- C: Ø 36 mm Clamping Flange
- S: Ø 36 mm Servo Flange

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

**Resolution (singleturn)**
- 10S: 10 bit
- 12S: 12 bit
- 13S: 13 bit
- 14S: 14 bit

**Resolution (multiturn)**
- 12M: 12 bit
- 16M: 16 bit
- 20M: 20 bit
- 24M: 24 bit

### Part Number Key: RM-100 Blind Hollow Shaft Version

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E1</th>
<th>E2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-100B</td>
<td>6</td>
<td>E</td>
<td>-</td>
<td>3C</td>
<td>10S</td>
<td>12M</td>
</tr>
</tbody>
</table>

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

**Bore (18.5mm insertion depth)**
- 6: Ø 6 mm
- 8: Ø 8 mm
- 10: Ø 10 mm
- A0: Ø 1/4”

**Flange**
- E: Ø 46 mm Flange w/ Slotted Flex Mount
- T: Flange w/ Long Torque Stop

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

**Resolution (singleturn)**
- 10S: 10 bit
- 12S: 12 bit
- 13S: 13 bit
- 14S: 14 bit

**Resolution (multiturn)**
- 12M: 12 bit
- 16M: 16 bit
- 20M: 20 bit
- 24M: 24 bit

**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)

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).
Rotary Position Technology
Absolute Encoders, Multiturn

**Absolute, Multiturn Type RM-101 (Shaft) / RM-102 (Blind Hollow Shaft)**

- **Bearing-Lock**
- **High rotational speed**
- **Temperature range** 40 to 185 °C
- **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.

**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).

---

**Insensitive**

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

---

**Mechanical Characteristics:**

**Max. speed:**
- Shaft or blind hollow shaft version: 6000 RPM
  - Without shaft seal (IP65): 3000 RPM (continuous)
  - With shaft seal (IP67): 4000 RPM
    - 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
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 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.

**Standard Wiring:**

<table>
<thead>
<tr>
<th>Connection Type:</th>
<th>+V</th>
<th>Common (0 V)</th>
<th>CAN GND</th>
<th>CAN High</th>
<th>CAN Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M12 Eurofast:</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

LSS layer setting services DS305 V2.0

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

**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.
- Configuration Management:
  - Program download
  - Program start
  - Program erase

**Bootloader functionality DS302-3**

**Wiring Diagram:**

Click for Table of Content
### Rotary Position Technology
#### Absolute Encoders, Multiturn

**Absolute, Multiturn Type RM-101 (Shaft) / RM-102 (Blind Hollow Shaft)**

**Part Number Key: RM-101 Shaft Version**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-101S</td>
<td>6</td>
<td>C</td>
<td>-</td>
<td>9D38D</td>
</tr>
<tr>
<td>RM-101T</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>H1151</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-101S</td>
<td>Ø 39 mm, Shaft w/ Flat, IP67 Shaft Seal</td>
</tr>
<tr>
<td>RM-101T</td>
<td>Ø 39 mm, Shaft w/ Flat, IP65 Shaft Seal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Shaft (Ø × L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Ø 6 mm × 12.5 mm</td>
</tr>
<tr>
<td>8</td>
<td>Ø 8 mm × 15 mm</td>
</tr>
<tr>
<td>10</td>
<td>Ø 10 mm × 20 mm</td>
</tr>
<tr>
<td>A0</td>
<td>Ø 1/4” × 1/2”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Ø 36 mm Clamping Flange</td>
</tr>
<tr>
<td>S</td>
<td>Ø 36 mm Servo Flange</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Voltage Supply and Output Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>9D38B</td>
<td>10 - 30 VDC, CANopen DS 406 V4.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>Type of Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1151</td>
<td>Radial 5-pin M12 Eurofast Connector</td>
</tr>
<tr>
<td>H1451</td>
<td>Axial 5-pin M12 Eurofast Connector</td>
</tr>
<tr>
<td>C1M</td>
<td>Radial Cable (1 m PVC)</td>
</tr>
<tr>
<td>CA1M</td>
<td>Radial Cable (1 m PVC)</td>
</tr>
</tbody>
</table>

**Part Number Key: RM-102 Blind Hollow Shaft Version**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-102B</td>
<td>6</td>
<td>E</td>
<td>-</td>
<td>9D38D</td>
</tr>
<tr>
<td>RM-102C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>H1151</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-102B</td>
<td>Ø 39 mm, Blind Hollow Shaft, IP67 Shaft Seal</td>
</tr>
<tr>
<td>RM-102C</td>
<td>Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Bore (18.5 mm insertion depth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Ø 6 mm</td>
</tr>
<tr>
<td>8</td>
<td>Ø 8 mm</td>
</tr>
<tr>
<td>10</td>
<td>Ø 10 mm</td>
</tr>
<tr>
<td>A0</td>
<td>Ø 1/4”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Ø 46 mm Flange w/ Slotted Flex Mount</td>
</tr>
<tr>
<td>T</td>
<td>Flange w/ Long Torque Stop</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Voltage Supply and Output Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>9D38B</td>
<td>10 - 30 VDC, CANopen DS 406 V4.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>Type of Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1151</td>
<td>Radial 5-pin M12 Eurofast Connector</td>
</tr>
<tr>
<td>H1451</td>
<td>Axial 5-pin M12 Eurofast Connector</td>
</tr>
<tr>
<td>C1M</td>
<td>Radial Cable (1 m PVC)</td>
</tr>
<tr>
<td>CA1M</td>
<td>Radial Cable (1 m PVC)</td>
</tr>
</tbody>
</table>
Rotary Position Technology
Absolute Encoders, Multiturn

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).
# Rotary Position Technology
Absolute Encoders, Multiturn

## Absolute, Multiturn Type RM-115 Series

### 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.

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

### Mechanical Characteristics:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. speed</td>
<td>4000 RPM</td>
</tr>
<tr>
<td></td>
<td>2000 RPM (continuous)</td>
</tr>
<tr>
<td>Starting torque (68 °F</td>
<td>20 °C):</td>
</tr>
<tr>
<td>Shaft load capacity:</td>
<td></td>
</tr>
<tr>
<td>Radial:</td>
<td>18 lbs (80 N)</td>
</tr>
<tr>
<td>Axial:</td>
<td>9 lbs (40 N)</td>
</tr>
<tr>
<td>Weight:</td>
<td>approx. 0.44 lbs (0.2 kgs)</td>
</tr>
<tr>
<td>Protection acc. to EN 60529/ DIN 40050-9:</td>
<td>IP66, IP67, IP69k</td>
</tr>
<tr>
<td>Working temperature range:</td>
<td>−40 to +185 °F (−40 to +85 °C)</td>
</tr>
<tr>
<td>Materials:</td>
<td></td>
</tr>
<tr>
<td>Shaft:</td>
<td>Standard stainless steel:</td>
</tr>
<tr>
<td>Flange:</td>
<td>V2A(304)</td>
</tr>
<tr>
<td>Housing:</td>
<td>V4A (316)</td>
</tr>
<tr>
<td>Cable:</td>
<td>zinc die-cast</td>
</tr>
<tr>
<td>Shock resistance acc. to EN 60068-2-27:</td>
<td>500 g (5000 m/s²), 4 ms</td>
</tr>
<tr>
<td>Vibration resistance acc. to EN 60068-2-6:</td>
<td>30g (300 m/s²), 10 - 2000 Hz</td>
</tr>
</tbody>
</table>

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

---

Click for Table of Content
Rotary Position Technology

Absolute, Multiturn

Absolute, Multiturn Type RM-115 Series

Electrical Characteristics Current Interface 4 - 20mA:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>10 - 30 VDC</td>
</tr>
<tr>
<td>Current consumption (no load)</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Reverse polarity protection at power supply (+V)</td>
<td>yes</td>
</tr>
<tr>
<td>Short-circuit protected outputs</td>
<td>yes¹</td>
</tr>
<tr>
<td>Measuring range:</td>
<td>2⁴ revolutions up to 2¹⁶ revolutions</td>
</tr>
<tr>
<td>DA converter resolution</td>
<td>12 bit</td>
</tr>
<tr>
<td>Singleturn accuracy, at 77 °F</td>
<td>25 °C:</td>
</tr>
<tr>
<td>Temperature coefficient:</td>
<td>&lt; 100 ppm/K</td>
</tr>
<tr>
<td>Repeat accuracy at 77 °F</td>
<td>25 °C:</td>
</tr>
<tr>
<td>Output load:</td>
<td>max. 200 0hm at 10 VDC</td>
</tr>
<tr>
<td></td>
<td>max. 300 0hm at 24 VDC</td>
</tr>
<tr>
<td></td>
<td>max. 1200 0hm at 30 VDC</td>
</tr>
<tr>
<td>Setting time:</td>
<td>&lt; 1 ms, Rload= 900 0hm, 77 °F</td>
</tr>
<tr>
<td>Options:</td>
<td></td>
</tr>
<tr>
<td>Teach inputs:</td>
<td>level= +V for 1 s min</td>
</tr>
<tr>
<td>PowerON time:</td>
<td>&lt; 1 s</td>
</tr>
<tr>
<td>Update Rate:</td>
<td>1 ms</td>
</tr>
<tr>
<td>e1 compliant acc. to (pending):</td>
<td>EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)</td>
</tr>
<tr>
<td>UL approval:</td>
<td>file 224618</td>
</tr>
<tr>
<td>CE compliant acc. to:</td>
<td>EMC guideline 2014/30/EU RoH5 guideline 2011/65/EU</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>output 0 - 5 V 10 - 30 VDC</td>
</tr>
<tr>
<td>Current consumption (no load)</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Reverse polarity protection at power supply (+V)</td>
<td>yes</td>
</tr>
<tr>
<td>Short-circuit protected outputs</td>
<td>yes¹</td>
</tr>
<tr>
<td>Measuring range:</td>
<td>2⁴ revolutions up to 2¹⁶ revolutions</td>
</tr>
<tr>
<td>DA converter resolution</td>
<td>0 - 10V 12 bit 0 - 5 V 11 bit</td>
</tr>
<tr>
<td>Singleturn accuracy, at 25°C</td>
<td>77°F:</td>
</tr>
<tr>
<td>Temperature coefficient:</td>
<td>&lt; 100 ppm/K</td>
</tr>
<tr>
<td>Repeat accuracy at 25°C</td>
<td>77°F:</td>
</tr>
<tr>
<td>Current output:</td>
<td>max. 10 mA</td>
</tr>
<tr>
<td>Setting time:</td>
<td>&lt; 1 ms, Rload= 1000 0hm, 77 °F</td>
</tr>
<tr>
<td>Options:</td>
<td></td>
</tr>
<tr>
<td>Teach inputs:</td>
<td>level= +V for 1 s min</td>
</tr>
<tr>
<td>PowerON time:</td>
<td>&lt; 1 s</td>
</tr>
<tr>
<td>Update Rate:</td>
<td>1 ms</td>
</tr>
<tr>
<td>e1 compliant acc. to (pending):</td>
<td>EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)</td>
</tr>
<tr>
<td>UL approval:</td>
<td>file 224618</td>
</tr>
<tr>
<td>CE compliant acc. to:</td>
<td>EMC guideline 2014/30/EU RoH5 guideline 2011/65/EU</td>
</tr>
</tbody>
</table>

¹ = when the power supply is correctly applied.

Measuring Range 'AL' or 'AR':

<table>
<thead>
<tr>
<th>Connection Type:</th>
<th>Common (0 V)</th>
<th>+V</th>
<th>Output</th>
<th>Set 1</th>
<th>Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable:</td>
<td>BU</td>
<td>BN</td>
<td>WH</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>M12 pin:</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

Measuring Range 'NS' or 'WL':

<table>
<thead>
<tr>
<th>Connection Type:</th>
<th>Common (0 V)</th>
<th>+V</th>
<th>Output</th>
<th>Set 1</th>
<th>Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable:</td>
<td>BU</td>
<td>BN</td>
<td>WH</td>
<td>BK</td>
<td>GY</td>
</tr>
<tr>
<td>M12 pin:</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

UL approval: file 224618
CE compliant acc. to: EMC guideline 2014/30/EU RoH5 guideline 2011/65/EU

Wiring Diagram:

Male encoder view

Mating cordset: RKC 4.5T-*/S618

* Length in meters.
Rotary Position Technology
Absolute Encoders, Multiturn

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):**

Clockwise (CW) version

![Graph of Analog Signal Profile for Clockwise Version]

Scalable version without limit switch function

![Graph of Scalable Signal Profile without Limit Switch Function]

Counter Clockwise (CCW) version

![Graph of Analog Signal Profile for Counter Clockwise Version]

Scalable version with limit switch function

![Graph of Scalable Signal Profile with Limit Switch Function]

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

**Note:** Limit switch function:

<table>
<thead>
<tr>
<th>version</th>
<th>0 - 10 V</th>
<th>0 - 5 V</th>
<th>0 - 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>limit switch low:</td>
<td>0.25 V</td>
<td>0.25 V</td>
<td>3.60 mA</td>
</tr>
<tr>
<td>limit switch high:</td>
<td>9.75 V</td>
<td>4.75 V</td>
<td>22.00 mA</td>
</tr>
</tbody>
</table>
## Absolute, Multiturn Type RM-115 Series

### Part Number Key: RM-115 Shaft Version

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-115S</td>
<td>6 C</td>
<td>-</td>
<td>7A</td>
<td>AL</td>
<td>-</td>
<td>H1151</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-115S</td>
<td>Ø 39 mm, Shaft w/Flat, IP69K Shaft Seal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Shaft (Ø × L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Ø 6 mm × 12.5 mm</td>
</tr>
<tr>
<td>8</td>
<td>Ø 8 mm × 15 mm</td>
</tr>
<tr>
<td>10</td>
<td>Ø 10 mm × 20 mm</td>
</tr>
<tr>
<td>A0</td>
<td>Ø 1/4” × 1/2”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Ø 42 mm Clamping Flange</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Voltage Supply and Output Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>7A</td>
<td>10 - 30 VDC, 4 - 20 mA</td>
</tr>
<tr>
<td>8B</td>
<td>15 - 30 VDC, 0 - 10 V</td>
</tr>
<tr>
<td>8A</td>
<td>10 - 30 VDC, 0 - 5 V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>16 Turns, Count Direction CCW*</td>
</tr>
<tr>
<td>AR</td>
<td>16 Turns, Count Direction CW*</td>
</tr>
<tr>
<td>NS</td>
<td>Scalable to 16-bit Turns, w/o Limit Switch</td>
</tr>
<tr>
<td>WL</td>
<td>Scalable to 16-bit Turns, w/ Limit Switch</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>F</th>
<th>Type of Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1151</td>
<td>Radial 5-pin M12 Eurofast Connector</td>
</tr>
<tr>
<td>C1M</td>
<td>Radial Cable (1m PVC)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>G</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Blank)</td>
<td>No Options</td>
</tr>
<tr>
<td>N72</td>
<td>Stainless Steel Flange and Shaft1</td>
</tr>
</tbody>
</table>

1 = only available with shaft '10'.
Absolute, Multiturn Type RM-115 Series

Dimensions: RM-115 Shaft Version

RM-115 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).
**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.

**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).

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

---

**Mechanical Characteristics:**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. speed</td>
<td>4000 RPM (continous)</td>
</tr>
<tr>
<td>Starting torque (68 °F</td>
<td>20 °C):</td>
</tr>
<tr>
<td>Shaft load capacity:</td>
<td></td>
</tr>
<tr>
<td>Radial</td>
<td>18 lbs (80 N)</td>
</tr>
<tr>
<td>Axial</td>
<td>9 lbs (40 N)</td>
</tr>
<tr>
<td>Weight:</td>
<td>approx. 0.44 lbs (0.2 kgs)</td>
</tr>
<tr>
<td>Protection acc. to EN 60529:</td>
<td>IP66, IP67, IP69K</td>
</tr>
<tr>
<td>Working temperature:</td>
<td>–40 to +185 °F (–40 to +85 °C)</td>
</tr>
<tr>
<td>Materials:</td>
<td></td>
</tr>
<tr>
<td>Shaft</td>
<td>Standard stainless steel: V2A (304)</td>
</tr>
<tr>
<td>Flange</td>
<td>aluminum</td>
</tr>
<tr>
<td>Housing</td>
<td>zinc die-cast</td>
</tr>
<tr>
<td>Cable</td>
<td>PUR</td>
</tr>
<tr>
<td></td>
<td>/N72 (stainless steel)</td>
</tr>
<tr>
<td>Shock resistance acc. to EN 60068-2-27:</td>
<td>500 g (5000 m/s²) 4 ms</td>
</tr>
<tr>
<td>Vibration resistance acc. to EN 60068-2-6:</td>
<td>30 g (300 m/s²), 10 - 2000 Hz</td>
</tr>
</tbody>
</table>
## Rotary Position Technology
### Absolute Encoders, Multiturn

#### Absolute, Multiturn Type RM-117

**General Electrical Characteristics:**
- **Power supply:** 10 - 30 VDC
- **Current consumption (no load):** max. 30 mA
- **Reverse polarity protection at power supply (+V):** yes
- **Short-circuited protected outputs:** yes¹
- **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<sub>Load</sub> = 20 mA:** typ. 1.3 V
- **Resolution singleturn:** 10 - 14 bit
- **Absolute accuracy:** ±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

**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.

**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.

**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.

### Wiring Diagrams:

#### Male Encoder View

<table>
<thead>
<tr>
<th>Connection Type</th>
<th>GND (0 V)</th>
<th>V+</th>
<th>+Clock</th>
<th>–Clock</th>
<th>+Data</th>
<th>–Data</th>
<th>SET</th>
<th>DIR</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable:</td>
<td>WH</td>
<td>BN</td>
<td>GN</td>
<td>YE</td>
<td>YE</td>
<td>PK</td>
<td>BU</td>
<td>RD</td>
<td>Shield</td>
</tr>
<tr>
<td>M12 pin:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>PH</td>
</tr>
</tbody>
</table>

* Length in meters.
## Absolute, Multiturn Type RM-117

**Part Number Key: RM-117 Shaft Version**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E1</th>
<th>E2</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-117</td>
<td>6</td>
<td>C</td>
<td>-</td>
<td>3C</td>
<td>10S</td>
<td>12M</td>
<td>H1181</td>
</tr>
</tbody>
</table>

### 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 = only available with shaft '10' and connection 'H1181'
Absolute, Multiturn Type RM-117

Dimensions: RM-117 Shaft Version

RM-117 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).
### Rotary Position Technology
#### Absolute Encoders, Multiturn

**Absolute, Multiturn Type RM-109**

![Image](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.

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

---

#### Mechanical Characteristics:

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

---

#### 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).

---

Click for Table of Content
Rotary Position Technology
Absolute Encoders, Multiturn

Absolute, Multiturn Type RM-109

General Electrical Characteristics:

**Sensor:**
- Power supply: 10 - 30 VDC
- Current consumption (no load): max. 30 mA
- Reverse polarity protection: yes
- Short-circuit protected outputs: yes
- 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

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.

CANopen 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.

Standard Wiring:

<table>
<thead>
<tr>
<th>Connection Type</th>
<th>+V</th>
<th>Common (0 V)</th>
<th>CAN GND</th>
<th>CAN High</th>
<th>CAN Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable:</td>
<td>BN</td>
<td>WH</td>
<td>GY</td>
<td>GN</td>
<td>YE</td>
</tr>
<tr>
<td>M12 Eurofast:</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Interface Characteristics CANopen:

| Resolution singleturn: | 1 - 16384 (14 bit), scalable default: 8192 (13 bit) |
| Absolute accuracy:| ±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 |
| 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 |

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
- 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

Wiring Diagram:

**Male Encoder View**

<table>
<thead>
<tr>
<th>Mating Cordset</th>
<th>RKC 572-*M/S3117</th>
</tr>
</thead>
<tbody>
<tr>
<td>* = Length in meters.</td>
<td>*See page J3 for corresponding cable color code.</td>
</tr>
</tbody>
</table>

Click for Table of Content
## Absolute, Multiturn Type RM-109

### Part Number Key: RM-109 Shaft Version

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-109S</td>
<td>6</td>
<td>C</td>
<td>9D38B</td>
<td>H1151</td>
<td>/</td>
</tr>
</tbody>
</table>

### 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 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 = only available with shaft '10' and connection 'H1151'

---

**Click for Table of Content**
Rotary Position Technology
Absolute Encoders, Multiturn

Absolute, Multiturn Type RM-109

Dimensions: RM-109 Shaft Version

RM-109 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).
### Rotary Position Technology

**Absolute, Multiturn Type RM-116 Series**

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

**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.

**Mechanical Characteristics:**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. speed</td>
<td>4000 RPM</td>
</tr>
<tr>
<td></td>
<td>2000 RPM (continuous)</td>
</tr>
<tr>
<td>Starting torque (68 °F</td>
<td>20 °C):</td>
</tr>
<tr>
<td>Shaft load capacity:</td>
<td></td>
</tr>
<tr>
<td>Radial:</td>
<td>18 lbs (80 N)</td>
</tr>
<tr>
<td>Axial:</td>
<td>9 lbs (40 N)</td>
</tr>
<tr>
<td>Weight:</td>
<td>approx. 0.44 lbs (0.2 kgs)</td>
</tr>
<tr>
<td>Protection acc. to EN 60529/ DIN 40050-9:</td>
<td>IP65</td>
</tr>
<tr>
<td>Working temperature range:</td>
<td>−40 to +185 °F (−40 to +85 °C)</td>
</tr>
<tr>
<td>Materials:</td>
<td></td>
</tr>
<tr>
<td>Shaft:</td>
<td>stainless steel: V2A(304)</td>
</tr>
<tr>
<td>Flange:</td>
<td>aluminum</td>
</tr>
<tr>
<td>Housing:</td>
<td>zinc die-cast</td>
</tr>
<tr>
<td>Cable:</td>
<td>PVC</td>
</tr>
<tr>
<td>Shock resistance acc. to EN 60068-2-27:</td>
<td>500 g (5000 m/s²), 4 ms</td>
</tr>
<tr>
<td>Vibration resistance acc. to EN 60068-2-6:</td>
<td>30 g (300 m/s²), 10 - 2000 Hz</td>
</tr>
</tbody>
</table>
### Absolute Encoders, Multiturn

#### Electrical Characteristics Interface 4 - 20mA:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>10 - 30 VDC</td>
</tr>
<tr>
<td>Current consumption (no load)</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Reverse polarity protection at power supply (+V)</td>
<td>yes</td>
</tr>
<tr>
<td>Short-circuit protected outputs</td>
<td>yes¹</td>
</tr>
<tr>
<td>Measuring range:</td>
<td>2⁴ revolutions up to 2¹⁶ revolutions</td>
</tr>
<tr>
<td>DA converter resolution</td>
<td>12 bit</td>
</tr>
<tr>
<td>Singleturn accuracy, at 77 °F</td>
<td>25 °C:</td>
</tr>
<tr>
<td>Temperature coefficient:</td>
<td>&lt; 100 ppm/K</td>
</tr>
<tr>
<td>Repeat accuracy at 77 °F</td>
<td>25 °C:</td>
</tr>
<tr>
<td>Output load:</td>
<td>max. 200 Ω at 10 VDC</td>
</tr>
<tr>
<td>Setting time:</td>
<td>&lt; 1 ms, R&lt;sub&gt;Load&lt;/sub&gt; = 900 Ω, 77 °F</td>
</tr>
<tr>
<td>Options:</td>
<td>system status</td>
</tr>
<tr>
<td></td>
<td>current loop interruption— input load too high</td>
</tr>
<tr>
<td></td>
<td>reference point display (only with factory settings) at cw: betw. 0 ° and 1 ° at ccw: betw. 0 ° and −1 °</td>
</tr>
<tr>
<td></td>
<td>status in teach mode</td>
</tr>
<tr>
<td>Teach inputs:</td>
<td>level = +V for 1 s min</td>
</tr>
<tr>
<td>PowerON time:</td>
<td>&lt; 1 s</td>
</tr>
<tr>
<td>Update Rate:</td>
<td>1 ms</td>
</tr>
<tr>
<td>UL approval:</td>
<td>file 224618</td>
</tr>
<tr>
<td>CE compliant acc. to:</td>
<td>EMC guideline 2014/30/EU RoHS guideline 2011/65/EU</td>
</tr>
</tbody>
</table>

#### Characteristics Voltage Interface:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>output 0 - 5 V 10 - 30 VDC</td>
</tr>
<tr>
<td>Current consumption (no load)</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Reverse polarity protection at power supply (+V)</td>
<td>yes</td>
</tr>
<tr>
<td>Short-circuit protected outputs</td>
<td>yes¹</td>
</tr>
<tr>
<td>Measuring range:</td>
<td>2⁴ revolutions up to 2¹⁶ revolutions</td>
</tr>
<tr>
<td>DA converter resolution</td>
<td>0 - 10 V 12 bit</td>
</tr>
<tr>
<td>Singleturn accuracy, at 25°C</td>
<td>77°F:</td>
</tr>
<tr>
<td>Temperature coefficient:</td>
<td>&lt; 100 ppm/K</td>
</tr>
<tr>
<td>Repeat accuracy at 25°C</td>
<td>77°F:</td>
</tr>
<tr>
<td>Current output:</td>
<td>max. 10 mA</td>
</tr>
<tr>
<td>Setting time:</td>
<td>&lt; 1 ms, R&lt;sub&gt;Load&lt;/sub&gt; = 1000 Ω, 77 °F</td>
</tr>
<tr>
<td>Options:</td>
<td>system status</td>
</tr>
<tr>
<td></td>
<td>reference point display (only with factory settings) at cw: betw. 0 ° and 1 ° at ccw: betw. 0 ° and −1 °</td>
</tr>
<tr>
<td></td>
<td>status in teach mode</td>
</tr>
<tr>
<td>Teach inputs:</td>
<td>level = +V for 1 s min</td>
</tr>
<tr>
<td>PowerON time:</td>
<td>&lt; 1 s</td>
</tr>
<tr>
<td>Update Rate:</td>
<td>1 ms</td>
</tr>
<tr>
<td>UL approval:</td>
<td>file 224618</td>
</tr>
<tr>
<td>CE compliant acc. to:</td>
<td>EMC guideline 2014/30/EU RoHS guideline 2011/65/EU</td>
</tr>
</tbody>
</table>

¹ = when the power supply is correctly applied.

---

### Wiring Diagram:

#### Male encoder view

<table>
<thead>
<tr>
<th>Connection Type:</th>
<th>Common (0 V)</th>
<th>+V</th>
<th>Output</th>
<th>Set 1</th>
<th>Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable:</td>
<td>BU</td>
<td>BN</td>
<td>WH</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>M12 pin:</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

#### Mating cordset:

RKC 4.5T-*/S618

*Length in meters.

---

Click for Table of Content
Absolute, Multiturn Type RM-116 Series

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):

Clockwise (CW) version

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

Roll-over

Reference display (LED)

Scalable version without limit switch function

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

no reference point display (LED)

Example (output signal profile):

Counter Clockwise (CCW) version

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

Roll-over

Reference display (LED)

Scalable version with limit switch function

- 22 mA/9.75 V
- 20 mA/9.50 V
- 4.75 V
- 4.50 V
- 4.0 mA
- 3.6 mA
- 0.50 V
- 0.25 V
- 0 V

no reference point display

Note: Factory-set measuring range: \(2^n\) 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
# Rotary Position Technology
## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-116 Series

**Part Number Key: RM-116 Shaft Version**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-116T</td>
<td>6</td>
<td>C</td>
<td>-</td>
<td>7A</td>
<td>AL</td>
</tr>
</tbody>
</table>

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

#### B
- Shaft (Ø x 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
  - 8A: 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)

---

Click for Table of Content
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).
Rotary Position Technology
Absolute Encoders, Multiturn

Absolute, Multiturn Type RM-118

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.

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).

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

Mechanical Characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. speed</td>
<td>4000 RPM</td>
</tr>
<tr>
<td></td>
<td>2000 RPM (continuous)</td>
</tr>
<tr>
<td>Starting torque (68 °F</td>
<td>20 °C):</td>
</tr>
<tr>
<td>Shaft load capacity:</td>
<td>18 lbs (80 N)</td>
</tr>
<tr>
<td>Radial:</td>
<td>9 lbs (40 N)</td>
</tr>
<tr>
<td>Weight:</td>
<td>approx. 0.44 lbs (0.2 kg)</td>
</tr>
<tr>
<td>Protection acc. to EN 60529:</td>
<td>IP65</td>
</tr>
<tr>
<td>Working temperature:</td>
<td>−40 to +185 °F (−40 to +85 °C)</td>
</tr>
<tr>
<td>Materials:</td>
<td></td>
</tr>
<tr>
<td>Shaft:</td>
<td>stainless steel: V2A(304)</td>
</tr>
<tr>
<td>Flange:</td>
<td>aluminum</td>
</tr>
<tr>
<td>Housing:</td>
<td>zinc die-cast</td>
</tr>
<tr>
<td>Cable:</td>
<td>PUR</td>
</tr>
<tr>
<td>Shock resistance acc. to EN 60068-2-27:</td>
<td>500g (5000 m/s²), 4 ms</td>
</tr>
<tr>
<td>Vibration resistance acc. to EN 60068-2-6:</td>
<td>30g (300 m/s²), 10 - 2000 Hz</td>
</tr>
</tbody>
</table>
### Rotary Position Technology
#### Absolute Encoders, Multiturn

**Absolute, Multiturn Type RM-118**

**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
- **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 high with \( I_{\text{sel}} = 20 \text{ mA} \):** typ 1.3 V
- **Resolution singleturn:** 10 - 14 bit
- **Absolute accuracy:** \( \pm 1^\circ \)
- **Repeat accuracy:** \( \pm 0.2^\circ \)
- **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:** \( \leq 15 \mu s \)

**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:** \(< 0.5 \text{ mA} \)
- **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.

**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):** WH, BN
- **V+:** GN, YE, GY, PK, BU, RD, Shield
- **+Clock:** 1
- **−Clock:** 3
- **+Data:** 2
- **−Data:** 4
- **SET:** 5
- **DIR:** 6
- **PE:** 7, 8, PH

**Wiring Diagrams:**
- **Male Encoder View**

---

1\(^\circ\) = when power supply is currently applied
2\(^\circ\) = over the entire temperature range
## Absolute, Multiturn Type RM-118

### Part Number Key: RM-118 Shaft Version

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E1</th>
<th>E2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RM-118T</td>
<td>6</td>
<td>C</td>
<td>-</td>
<td>3C</td>
<td>10S</td>
<td>12M</td>
</tr>
</tbody>
</table>

### A  Type

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

### B  Shaft (Ø x L)

<table>
<thead>
<tr>
<th></th>
<th>6</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 6 mm x 12.5 mm</td>
<td>Ø 10 mm x 20 mm</td>
<td></td>
</tr>
</tbody>
</table>

### C  Flange

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 58 mm Clamping Flange</td>
<td>Ø 58 mm Servo Flange</td>
<td></td>
</tr>
</tbody>
</table>

### D  Voltage Supply and Output Type

<table>
<thead>
<tr>
<th></th>
<th>3C</th>
<th>5C</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 - 30VDC, SSI (Gray Code)</td>
<td>10 - 30VDC, SSI (Binary Code)</td>
<td></td>
</tr>
</tbody>
</table>

### E1  Resolution (singleturn)

<table>
<thead>
<tr>
<th></th>
<th>10S</th>
<th>12S</th>
<th>13S</th>
<th>14S</th>
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</thead>
<tbody>
<tr>
<td>10 bit</td>
<td>12 bit</td>
<td>13 bit</td>
<td>14 bit</td>
<td></td>
</tr>
</tbody>
</table>

### E2  Resolution (multiturn)

<table>
<thead>
<tr>
<th></th>
<th>12M</th>
<th>16M</th>
<th>20M</th>
<th>24M</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 bit</td>
<td>16 bit</td>
<td>20 bit</td>
<td>24 bit</td>
<td></td>
</tr>
</tbody>
</table>

### F  Type of Connection

<table>
<thead>
<tr>
<th></th>
<th>H1181</th>
<th>C1M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial 8-pin M12 Eurofast Connector</td>
<td>Radial Cable (1 m PUR)</td>
<td></td>
</tr>
</tbody>
</table>
**Absolute, Multiturn Type RM-118**

**Dimensions: RM-118 Shaft Version**

RM-118 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).
Rotary Position Technology
Absolute Encoders, Multiturn

Absolute, Multiturn Type RM-121

**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.

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

**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: 18 lbs (80 N)
  - Axial: 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: stainless steel: V2A(304)
  - Flange: aluminum
  - Housing: zinc die-cast
  - Cable: 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

**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).

Click for Table of Content
### 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
- UL approval file 24618
- 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:** ±1 °
**Repeat accuracy:** ±0.2 °
**Number of revolutions (multiturn):** max. 16,777,216 (24 bit)
**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

### 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

### 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

### Wiring Diagram:

![Wiring Diagram](Image)

**Male Encoder View**

| Mating Cordset¹⁾ | RKC 572-*M/S3117
|------------------|------------------
| Length in meters. | See page J3 for corresponding cable color code.

---

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

---

**Standard Wiring:**

<table>
<thead>
<tr>
<th>Connection Type</th>
<th>+V</th>
<th>Common (0 V)</th>
<th>CAN GND</th>
<th>CAN High</th>
<th>CAN Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable</td>
<td>BN</td>
<td>WH</td>
<td>GY</td>
<td>GN</td>
<td>YE</td>
</tr>
<tr>
<td>M12 Eurofast</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
## Absolute, Multiturn Type RM-121

### Part Number Key: RM-121 Shaft Version

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-121T</td>
<td>6</td>
<td>C</td>
<td>9D38B</td>
<td>H1151</td>
</tr>
</tbody>
</table>

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

### Specifications:

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

**Shaft (Ø × L)**
- 6 mm × 10 mm
- 10 mm × 20 mm

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

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

**Type of Connection**
- H1151 Radial 1 × M12 Eurofast Connector
- C1M Radial Cable (1 m PUR)
Rotary Position Technology
Absolute Encoders, Multiturn

Dimensions: RM-121 Shaft Version

RM-121 Flange C
Connection H1151

RM-121 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).