Electromechanical Solutions

Position Sensors, Slip rings, Systems

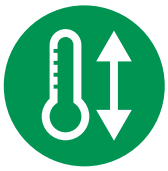
GROUP

EXXELIA

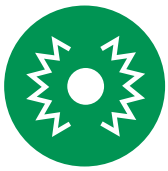
PICTURES DEFINITION

Technologies

Characteristics



High temperature range



Shocks/vibrations resist

BiSS/SSI interface

Low profile

High performances

Light weight

High IP Class

Modular

Miniaturization

Electromechanical Solutions

Position Sensors, Slip rings, Systems

GROUP

EXXELIA

A Worldwide presence

Summary

Selection Guide

HIGH PERFORMANCE CONTACTLESS POSITION SENSORS

High accuracy Optical Encoders

Size 15 (Ø 37 mm)

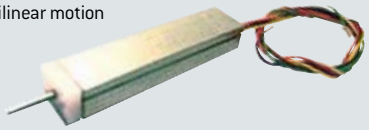
Size 23 (Ø 58 mm)

Size 09 (Ø 22 mm)

Size 11 (Ø 27 mm)

Magnetic sensors

Rectilinear motion



Size 04
(Ø 10 mm)

Pancake type
Size 16 (Ø 40 mm)

PRECISION POTENTIOMETERS

Rectilinear motion
Potentiometer

Rectilinear Joystick

Rotary Potentiometer
single or multi-turn

Space grade Potentiometer

Pancake Potentiometer

SLIP RINGS

Hollow Shaft

Miniature Slip ring

Electrical Slip ring

Fibre Optic
Rotary Joints
(FORJ's)

HYBRID SYSTEMS

Slip ring + FORJ

Electrical and
hydraulic Slip ring

Optical Encoder + FORJ

Slip ring with embedded FORJ,
Optical Encoder and RF Rotary
Joint (RoJo)

Brushless LAT motor

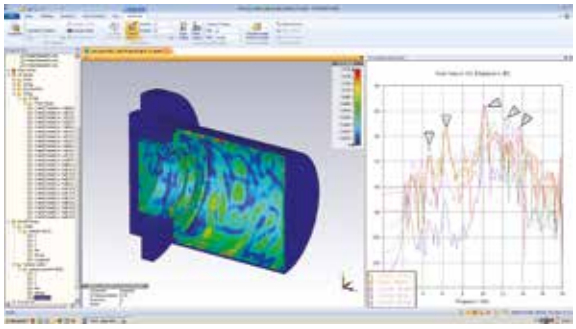
General information

ENGINEERING

Like all other companies of **EXXELIA** GROUP, the **ELECTROMECHANICAL SOLUTIONS SBU** benefits from sophisticated development and test tools:

- Autodesk **AutoCAD**, 2D CAD software.
- Autodesk **INVENTOR**, 3D CAD software.
- Autodesk **Simulation** for thermal and mechanical simulation.
- **ALTIUM**, for PCB design.
- **CST Microwave Studio**, for electromagnetic simulation.

These tools allow **EXXELIA** GROUP highly qualified engineers to design the best solutions against every customer requirement.



CST Studio example

PRODUCTION

ELECTROMECHANICAL SOLUTIONS SBU qualified Engineers and Technicians use up to date production tools such as:

- 5 axes machining centre (WILLEMIN).
- Conventional turning machine (SCHAUBLIN).
- Digital turning machine (SCHAUBLIN).
- Conventional milling machines.
- Injection moulding machine (ARBURG).
- Conventional grinding machines.
- Digital turning machines for substrate machining.
- Plastic track trimming machines (Rotary and Rectilinear potentiometers).
- Custom test benches for micro-linearity and scale factor measurement.
- Ultrahigh Vacuum Chamber.
- Full electroplating line (Au, Ag, Ni...).
- Class 10 000 and 100 000 clean rooms.

Custom made Jig for optical encoders dynamic tests.

R&D AND TEST LABORATORY

The CSA department, like all **EXXELIA** GROUP divisions, benefits from high performance development and test equipment such as:

- Scanning Electron Microscope (SEM).
- Metallographic microscopes.
- Infrared spectrum analyzer.
- Viscosimeter.
- X-ray Inspection Machine.
- Chromatography (gas phase).
- Vibration and shock test equipment.
- Electronic Microscope.
- Durometer.
- Climatic chambers for thermal cycling, thermal shock, humidity and salt fog tests.
- Coordinate Measurement Machine

POSITION SENSORS

EXXELIA GROUP has been developing potentiometric sensors for over 50 years. Our position sensors are available in different technologies and adapted to all types of interface:

CONTACT TECHNOLOGY POSITION SENSORS:

- Linear motion
- Circular
- Multi-turn
- Pancake
- Digital potentiometer
- Switch

CONTACTLESS TECHNOLOGY POSITION SENSORS:

- Magnetic sensor
- Absolute and Incremental optical encoder
- Inductive sensor.

Our position sensors are available in all sizes from miniature (diam. 10mm) to the largest dimensions. We adapt our sensors to all mechanical and thermal interface types.

All **EXXELIA** GROUP products would exist in RoHS compliant version.

Contactless Position Sensors general information

1. INTRODUCING EXXELIA GROUP ENCODERS

Encoders are sensors that generate digital signals in response to movement. Encoders come with two outlines: rotary and linear. Both types sense mechanical motion and translate the information (velocity, position, acceleration) into useful data.

A contactless technology

To address demands for longer service life and with its strong track record in contact technology position sensors (potentiometers), Electromechanical Solutions SBU has been developing own-brand contactless sensors for nearly 10 years. These sensors are absolute and incremental optical encoders, magnetic technology and inductive sensors.

Absolute optical or magnetic encoders: absolute optical encoders are position sensors that use optical signals to identify an absolute angular position. The **EXXELIA GROUP** encoders offer very high performance levels for a very small footprint:

- high precision (<30 arcsec),
- high resolution (up to 21 bits),
- highly thin (10mm),
- EMI EMC compatibility

Incremental optical or magnetic encoders: absolute optical encoders are position sensors that use optical signals to identify an absolute angular position. Incremental encoders have to be initialized by a first turn to produce an absolute position.

Applications: Aeronautics, Defense, Railway, Medical, Oil exploration, Telecommunications

EXXELIA GROUP encoders can also be easily combined with other functions like Slip rings or rotary joints (FORJ, HF...) in complete proprietary systems.

2. SENSING TECHNOLOGY

Encoders can use either optical or magnetic sensing technology.

Optical sensing provides high resolutions, high operating speeds, and reliability, long life operation in most environments.

Magnetic sensing, often used in rugged applications provides good resolution, high operating speeds, and maximum resistance to dust, moisture, and thermal and mechanical shock.

Optical Encoders: principles

Optical encoders' principle of operation is relatively simple; a light source (photo-emitter) sends light through a mobile disk or scale, consisting of a succession of opaque and transparent parts, on photo-receivers. When the disk or the scale moves, it conveys or alternatively blocks the light emitted by the source; the scale or the disk is acts in fact as a beam switch. The photo-receiver generates an electrical signal, which is processed and analyzed in order to allow encoding the system position.

An optical encoder consists of three major subsets:

- Encoder housing.
- Optical block: consisting of an emission system, an optical coding system and a detection system. It generates the position function signal.
- Electronics block: it allows amplifying, converting and processing the signal.

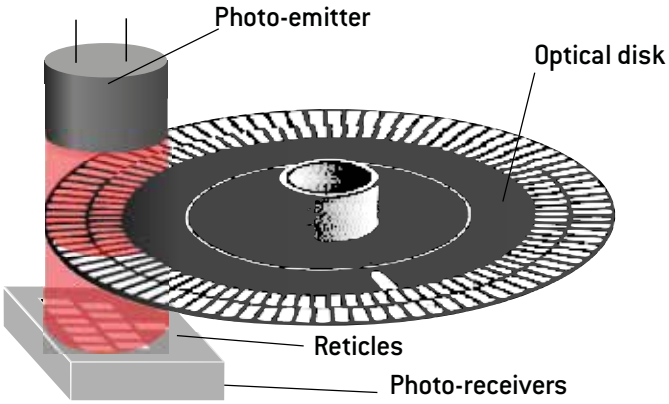


Figure 1: Incremental principle

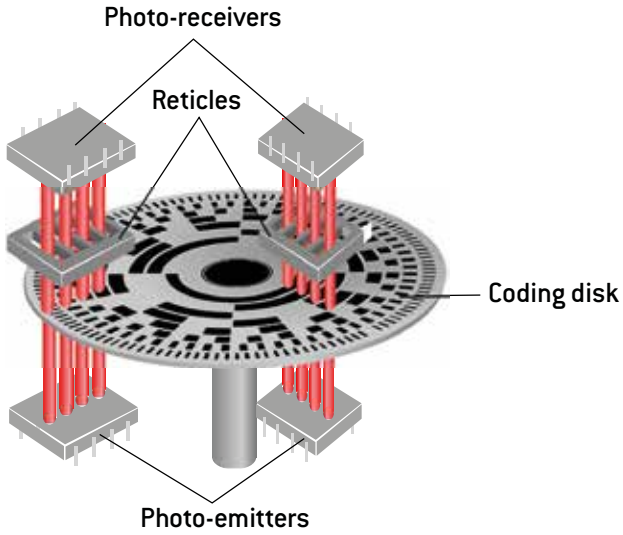


Figure 2: Absolute principle

Contactless Position Sensors general information

Optical encoders use a glass disk with a pattern of lines deposited on it, a metal or plastic disk with slots (in a rotary encoder), or a glass or metal strip (in a linear encoder). Light from a LED shines through the disk or strip onto one or more photodetectors, which produce the encoder's output.

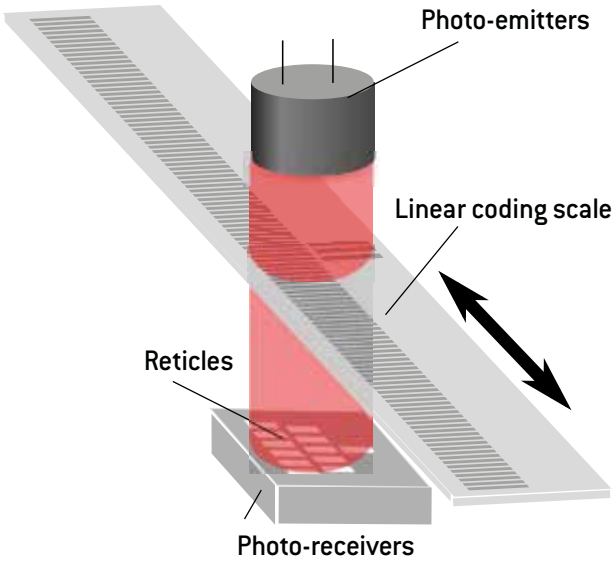


Figure 3: Linear principle

3. MAGNETIC ENCODERS: PRINCIPLES

The position sensors which use the detection of a magnetic field generally work following the same principle:

A magnetic field is generated thanks to a permanent magnet or an electromagnet. The distribution in the space of this magnetic field is not homogeneous. Depending on the relative positions of the magnetic source, the sensors cells and a possible ferromagnetic third element, the magnitude of the field will be different. The measured value is then analysed as a function of the specific geometry in order to recover the information of position.

Among magnetic encoders we can distinguish several technologies which are using this principle to convert magnetic field into a physical quantity useful in electronic devices (typically current or tension). The most common are inductive encoder, magneto-resistive encoder and Hall effect encoder.

Magnetic encoders are typically robust and non-sensitive to environmental stress like shocks, vibrations, and chemical substances. In order to protect the measurement against a variation of the external magnetic field (especially next to motors), it is possible to add a magnetic shielding with specific materials and to carry out differential measurements.

Magnetic encoders constitute miniature long-life cost-effective sensors. Magnetic sensing technology is very resistant to dust, grease, moisture, and other contaminants common in industrial environments, as well to shock and vibrations.

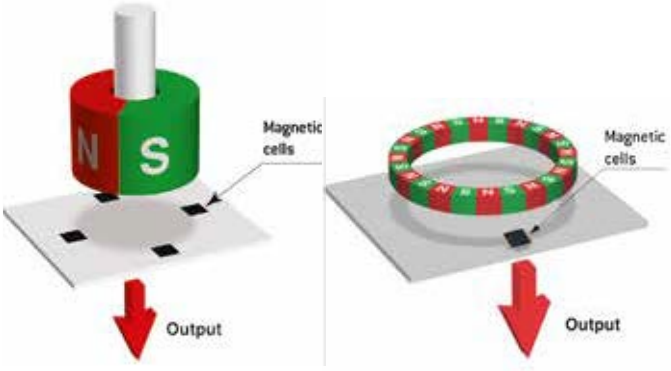


Fig. 4a Fig. 4b

Figure 4: Magnetic Sensor principles:
a) On axis technology with a bipolar magnet
b) odd axis technology with a multipolar ring

4. ABSOLUTE OR INCREMENTAL CODING?

INCREMENTAL CODING

Incremental encoders provide a specific number of equally spaced pulses per revolution (PPR) or per inch or millimeter of linear motion.

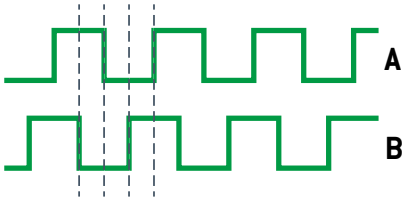


Figure 5: A and B quadrature signals

For applications that do not require detection sensing, a single channel output is used. But in most cases, two channels A and B, 90 electrical degrees out of phase are used. Those two channels allow a detection of the direction of motion (See Figure 6). This is useful for processes that can reverse, or must maintain steady position when standing still or mechanically oscillating.

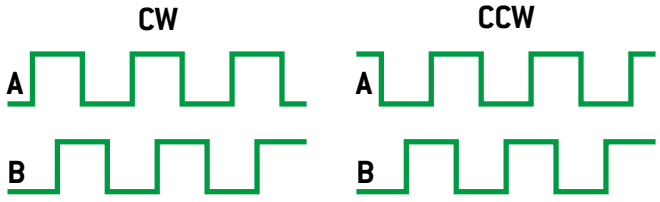


Figure 6: Determination of the direction of movement

The quantity of positions that can be detected depends on electronic processing from channels A and B (see Figure 7). In the case the disk has N periods or "bars":

If processing system only detects leading (or trailing) edges of channel A (or B), then the resolution is equal to the number N.

Contactless Position Sensors general information

If the system detects leading and trailing edges of channel A (or B), or if it detects leading or trailing edges of channels A and B, then the resolution is equal to 2N.

If processing system detects leading and trailing edges of the channels A and B, then the resolution is 4N.

In some configurations, it is even possible to electronically interpolate more precisely this signal and achieve up to 50N resolution.

To determine a position, incremental encoders need an initialization step that is a lap or a movement to find the "zero" reference or home position. After this step, each pulse will be accumulated into a counter. In case of a power interruption or corruption by electrical transients, the count is lost and the initialization step should be done again.

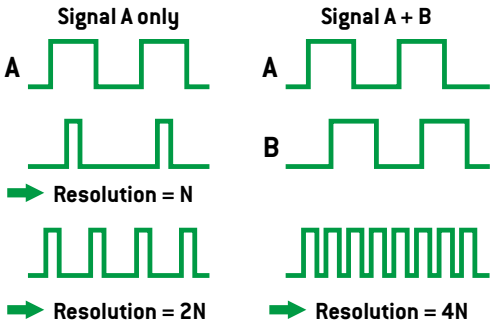


Figure 7: Resolution of incremental encoders

This "zero" or home position may be output as a signal known as the "marker," "index," or "Z channel."

Incremental encoders are principally used in applications where relative movement is required, such as machine or process control, robotics...

ABSOLUTE CODING

Absolute coding is basically different than incremental coding. Every position of an absolute encoder is unique. Unlike an incremental encoder, where position is determined by counting pulses from a zero mark or home base, the absolute encoder reads a system of coded tracks to establish position information.

Absolute encoders do not lose position when power is removed. Since each position is unique, true position verification is available as soon as power is up. It is not necessary to initialize the system by returning to home base.

An absolute encoder's resolution is defined as the number of bits in its output word. This output can be in natural binary or in gray code, which produces only a single bit change at each step to reduce errors.

Absolute encoders will be used when the measurement is critical and the application cannot afford an initializing step for "zeroing" (seekers, flight commands, radar mechanics...).

How to easily understand the difference between incremental and absolute encoders?

A well-known image is that the difference between incremental and absolute encoders is similar to the difference between a stop watch and a clock. A stop watch measures the incremental time that elapses between its start and stop, just like an incremental encoder will provide a known number of pulses relative to a movement. If you knew the actual time when you started the watch, you can tell what time it is later by adding the elapsed time value from the stop watch. For position control, adding incremental pulses to a known starting position will measure the current position. When an absolute encoder is used, the actual position will constantly be transmitted, just as a clock will tell you the current time.

5. SSI / FSSI

SSI is a synchronous, point to point, serial communication channel for digital data transmission. Synchronous data transmission is one in which the data is transmitted by synchronizing the transmission at the receiving and sending ends using a common clock signal. Since start and stop bits are not present, this allows a better use of data transmission bandwidth for more message bits and makes the whole transmission process simpler and easier. The clock needs its own bandwidth and should be included when determining the total bandwidth required for communication between the two devices.

In general, as mentioned earlier, it is a point to point connection from a master (Microcontroller) to a slave (rotary encoders). The master controls the clock sequence and the slave transmits the current data/value through a shift register. When invoked by the master, the data is clocked out from the shift register. The master and slave are synchronized by the common clock of the controller.

The CLOCK and DATA signals are transmitted according to RS-422 standards. RS-422, also known as ANSI/TIA/EIA-422-B, is a technical standard that specifies the electrical characteristics of the balanced voltage digital interface circuit. Data are transmitted using balanced or differential signaling and the CLOCK and DATA lines are basically twisted pair cables.

FSSI is the same synchronous interface but includes a start bit and is more flexible for other options (Alarm bit, ID encoder....). The maximum bandwidth is 4 MHz.

AE09

SINGLE TURN
ABSOLUTE OPTICAL ENCODER

Optical Technology

PRESENTATION

The **AE09** absolute encoder includes **EXXELIA** GROUP state-of-the-art and proprietary optical technology.

With their very compact design, high reliability and high precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

Various output protocols are available in order to match your application.

High temperature up to +115°C

Shocks/Vibrations resist

SSI / FSSI interface

Low profile

High performances

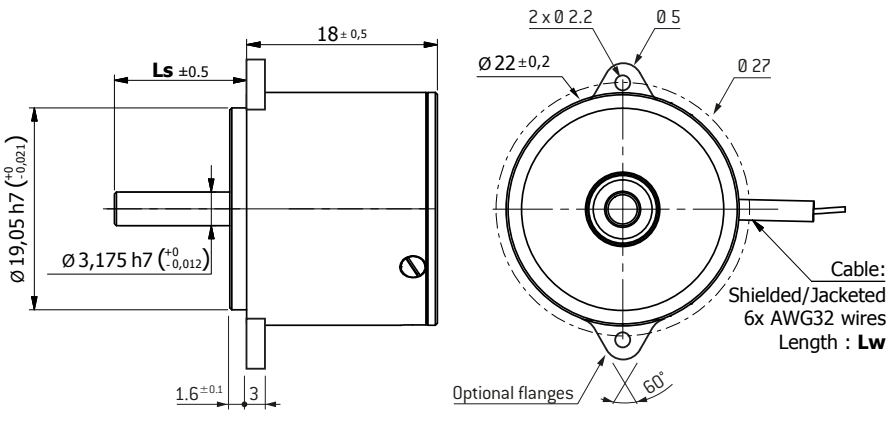
GENERAL DATA	
Resolution	Up to 19 bits
Accuracy	± 1' max.
Maximum rotation speed	300 rpm
Starting torque	≤ 0.2 N.cm
Weight (without cable)	35 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +115°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms

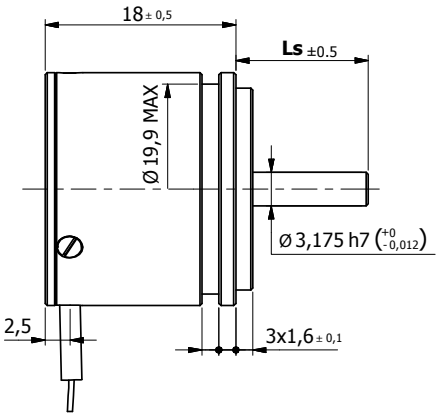
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
ABSOLUTE OPTICAL ENCODER

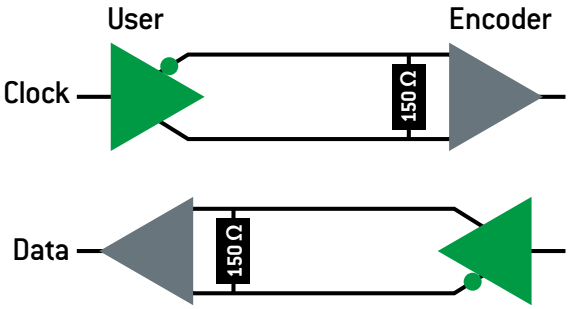
AE09

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	130 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

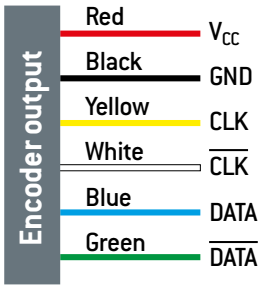
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER								
	Mounting	Resolution	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AE09	•	••	••	••	••	•••	•••	•
	F	13	S1	ST	01	250	125	W
	S	19	FS	MT	02	TBD	TBD	N
				HT	XX			
	F: Flange **S**: Servo	**13** to **16** bits Standard **17** to **19** bits Specific	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**125**: 12.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AE11

SINGLE TURN
ABSOLUTE OPTICAL ENCODER

Optical Technology

PRESENTATION

The **AE11** absolute encoder includes **EXXELIA** GROUP state-of-the-art and proprietary optical technology.

With their very compact design, high reliability and high precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

Various output protocols are available in order to match your application.

High temperature up to +115°C

Shocks/Vibrations resist

SSI / FSSI interface

Low profile

High performances

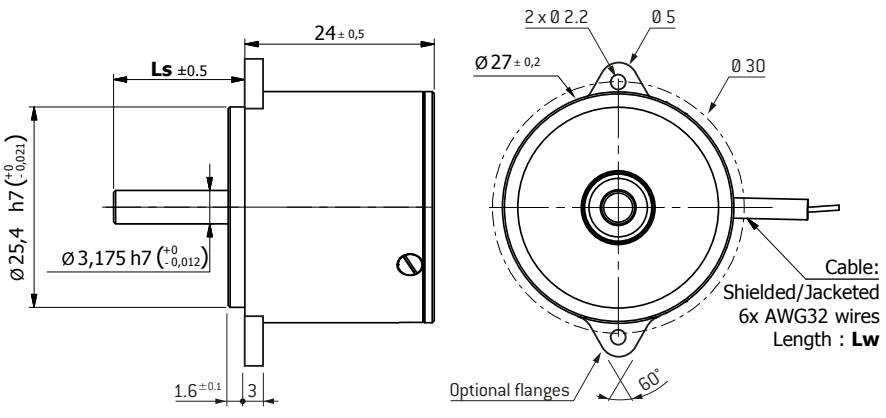
GENERAL DATA	
Resolution	Up to 19 bits
Accuracy	± 1' max.
Maximum rotation speed	300 rpm
Starting torque	≤ 0.2 N.cm
Weight (without cable)	40 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +115°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms

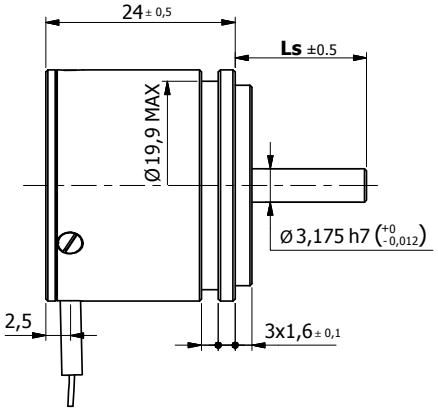
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
ABSOLUTE OPTICAL ENCODER

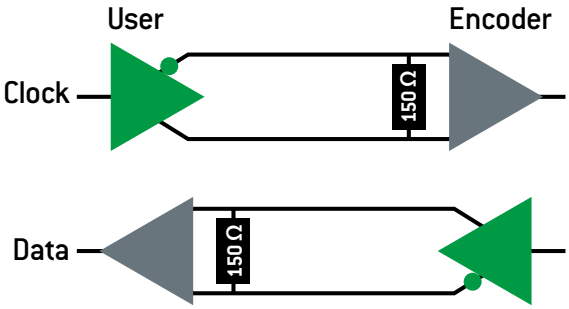
AE11

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	130 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

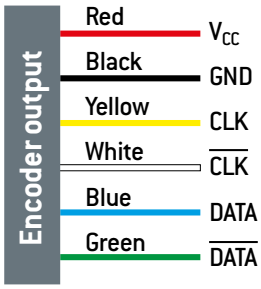
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER								
	Mounting	Resolution	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AE11	•	••	••	••	••	•••	•••	•
	F	13	S1	ST	01	250	125	W
	S	19	FS	MT	02	TBD	TBD	N
				HT	XX			
	F: Flange **S**: Servo	**13** to **16** bits Standard **17** to **19** bits Specific	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**125**: 12.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AE13

SINGLE TURN
ABSOLUTE OPTICAL ENCODER

Optical Technology

PRESENTATION

The **AE13** absolute encoder includes **EXXELIA** GROUP state-of-the-art and proprietary optical technology.

With their very compact design, high reliability and high precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

Various output protocols are available in order to match your application.

High temperature up to +115°C

Shocks/Vibrations resist

SSI / FSSI interface

Low profile

High performances

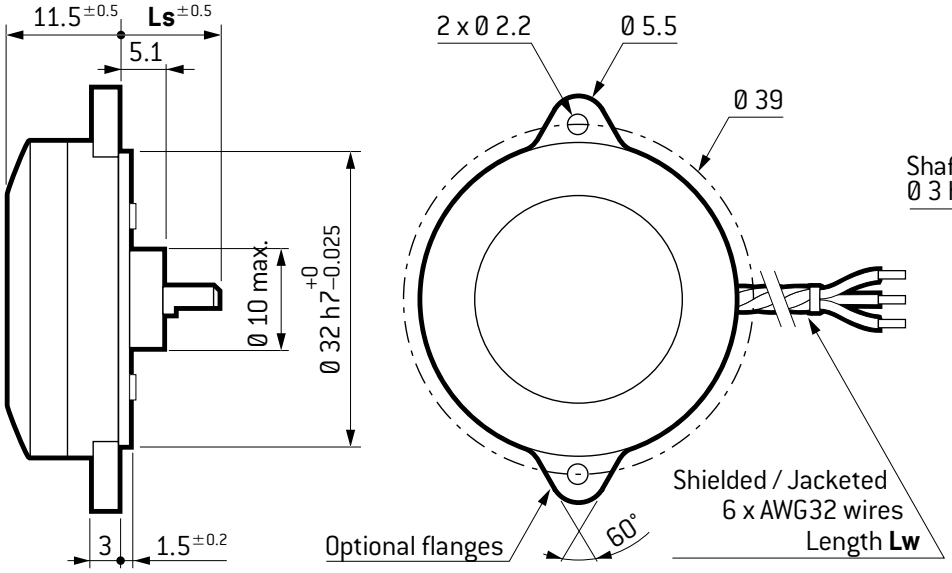
GENERAL DATA	
Resolution	Up to 21 bits
Accuracy	± 40"
Maximum rotation speed	300 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	40 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +115°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms

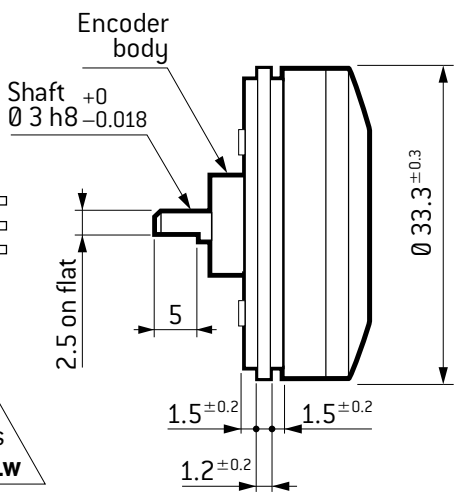
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
ABSOLUTE OPTICAL ENCODER

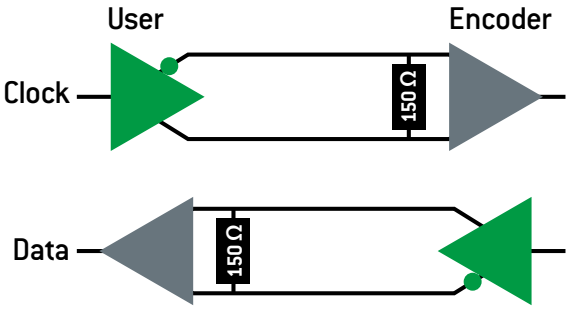
AE13

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	130 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

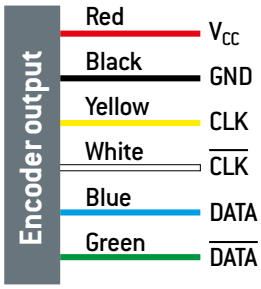
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER								
	Mounting	Resolution	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AE13	•	••	••	••	••	•••	•••	•
	F	13	S1	ST	01	250	115	W
	S	21	FS	MT	02	TBD	TBD	N
				HT	XX			
	F: Flange **S**: Servo	**13** to **16** bits Standard **17** to **21** bits Specific	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AE15

SINGLE TURN
ABSOLUTE OPTICAL ENCODER

Optical Technology

PRESENTATION

The **AE15** absolute encoder includes **EXXELIA** GROUP state-of-the-art and proprietary optical technology.

With their very compact design, high reliability and high precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

Various output protocols are available in order to match your application.

High temperature up to +115°C

Shocks/Vibrations resist

SSI / FSSI interface

Low profile

High performances

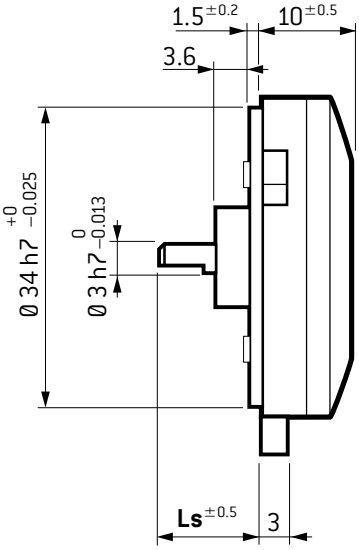
GENERAL DATA	
Resolution	Up to 21bits
Accuracy	± 40"
Maximum rotation speed	300 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	60 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +115°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.

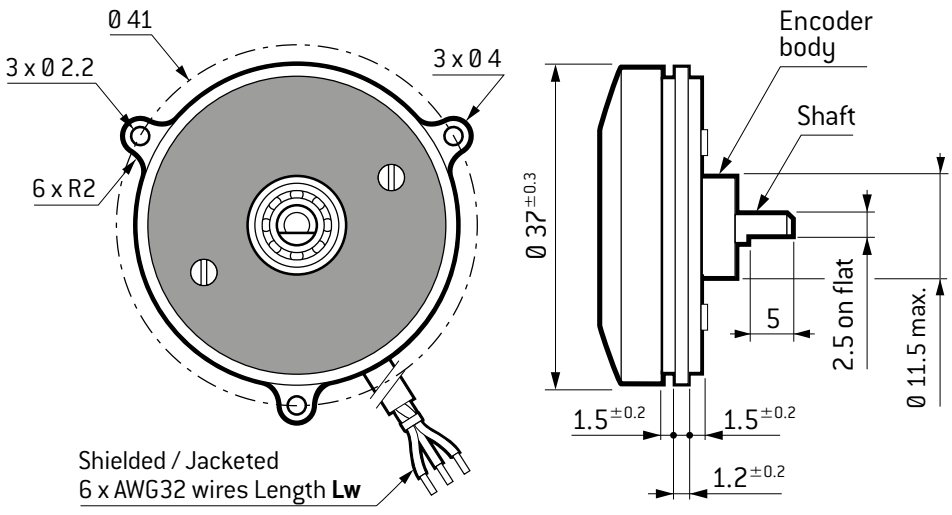
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



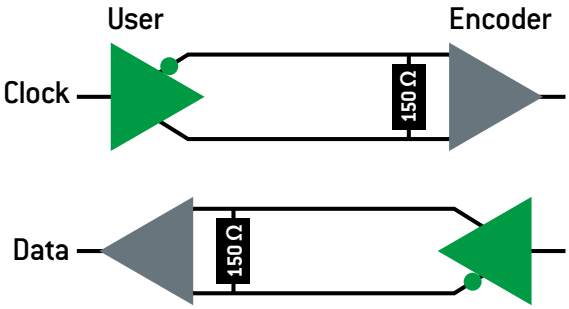
SINGLE TURN
ABSOLUTE OPTICAL ENCODER
AE15

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	130 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

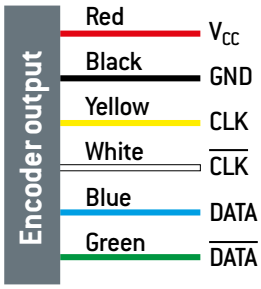
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER								
	Mounting	Resolution	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AE15	•	••	••	••	••	•••	•••	•
	F	13	S1	ST	01	250	115	W
	S	21	FS	MT	02	TBD	TBD	N
				HT	XX			
	F: Flange **S**: Servo	**13** to **16** bits Standard **17** to **21** bits Specific	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AE23

SINGLE TURN
ABSOLUTE OPTICAL ENCODER

Optical Technology

PRESENTATION

The **AE23** absolute encoder includes **EXXELIA** GROUP state-of-the-art and proprietary optical technology.

With their very compact design, high reliability and high precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

Various output protocols are available in order to match your application.

High temperature up to +115°C

Shocks/Vibrations resist

SSI / FSSI interface

Low profile

High performances

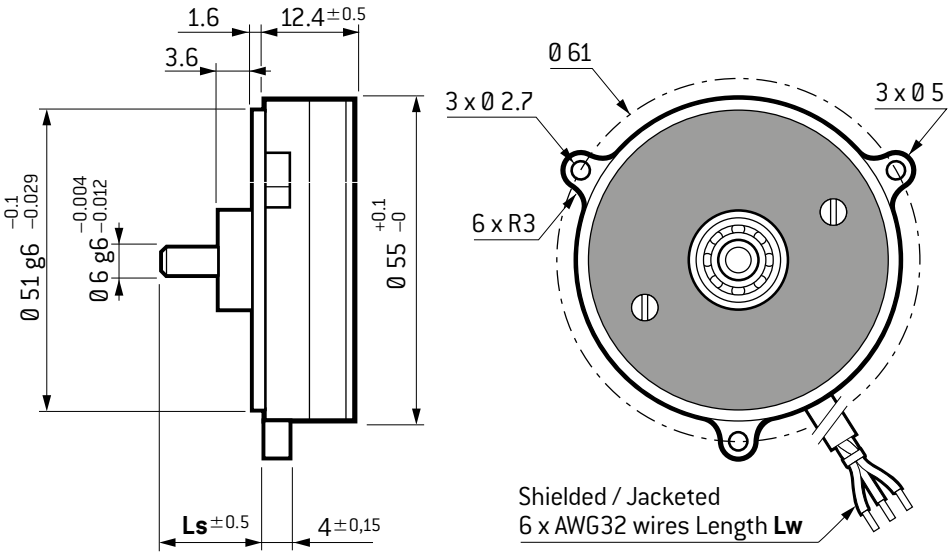
GENERAL DATA	
Resolution	Up to 21bits
Accuracy	± 20"
Maximum rotation speed	300 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	200 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +115°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.

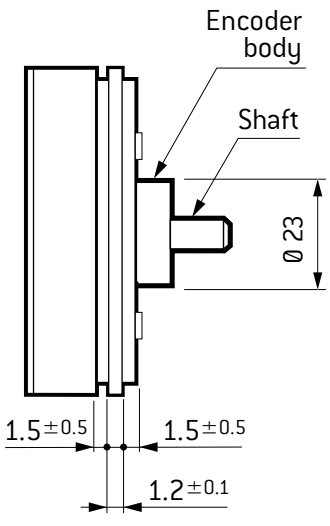
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
ABSOLUTE OPTICAL ENCODER

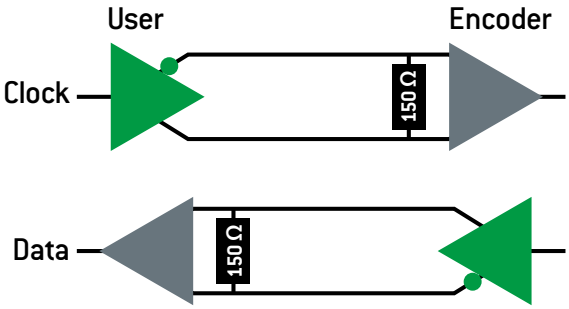
AE23

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	200 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

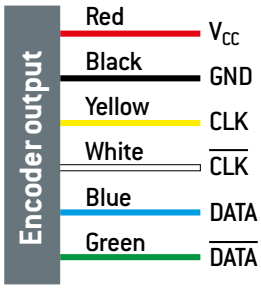
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER								
	Mounting	Resolution	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AE23	•	••	••	••	••	•••	•••	•
	F	13	S1	ST	01	250	115	W
	S	21	FS	MT	02	TBD	TBD	N
				HT	XX			
	F: Flange **S**: Servo	**13** to **16** bits Standard **17** to **21** bits Specific	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AE23H

SINGLE TURN
ABSOLUTE OPTICAL ENCODER

Optical Technology

PRESENTATION

The **AE23H** absolute encoder includes **EXXELIA** GROUP state-of-the-art and proprietary optical technology.

With their very compact design, high reliability and high precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

The presence of the hollow shaft makes possible the integration of a data transmission system (RoJo, FORJ, etc.) through the center of the optical encoder.

High temperature up to +115°C

Shocks/Vibrations resist

SSI / FSSI interface

High performances

Low profile

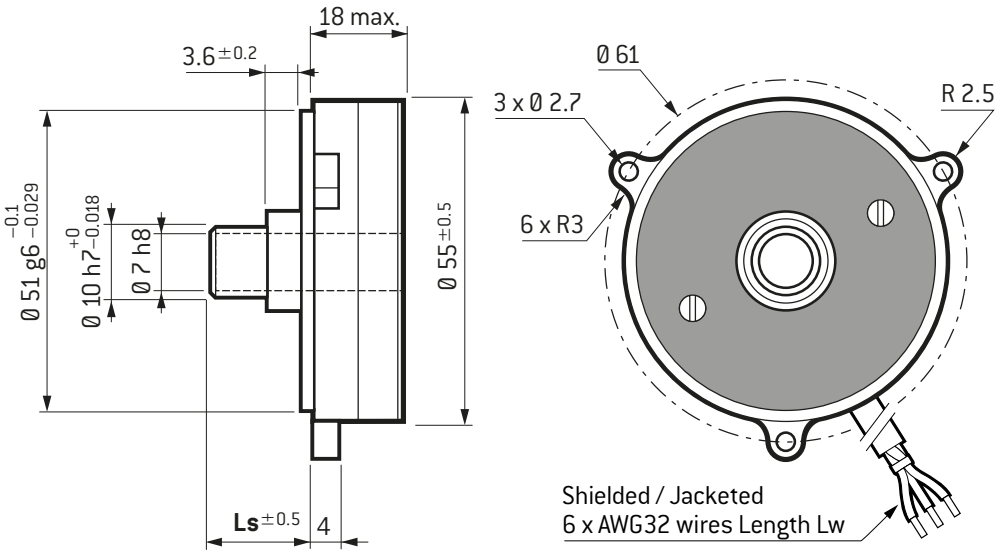
GENERAL DATA	
Resolution	Up to 21bits
Accuracy	± 20"
Maximum rotation speed	300 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	100 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +115°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.

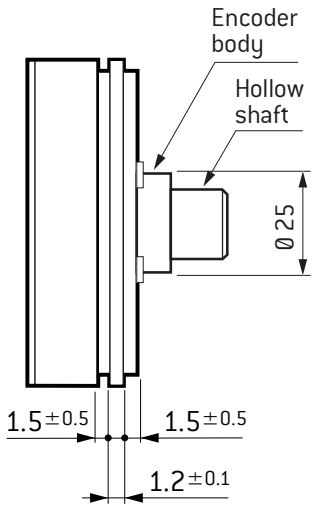
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
ABSOLUTE OPTICAL ENCODER

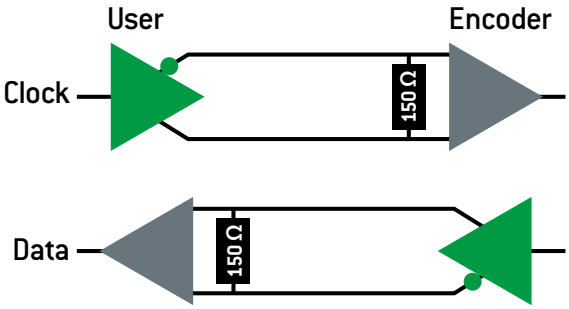
AE23H

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	200 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

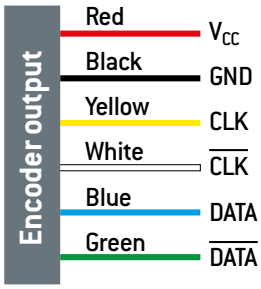
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER

	Mounting	Resolution	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AE23H	•	••	••	••	••	•••	•••	•
	F	13	S1	ST	01	250	115	W
	S	21	FS	MT	02	TBD	TBD	N
				HT	XX			
	F: Flange **S**: Servo	**13** to **16** bits Standard **17** to **21** bits Specific	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

IE09

SINGLE TURN
INCREMENTAL OPTICAL ENCODER

Optical Technology

PRESENTATION

The **IE09** miniature incremental encoder includes **EXXELIA** GROUP state of-the-art and proprietary optical technology.

With their very compact design, high reliability and good precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

High temperature up to +115°C

Shocks/Vibrations resist

High performances

Low profile

Light weight

GENERAL DATA	
Resolution	Up to 65536 CPR [1]
Accuracy	± 2' max.
Maximum rotation speed	3000 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	35 g max.

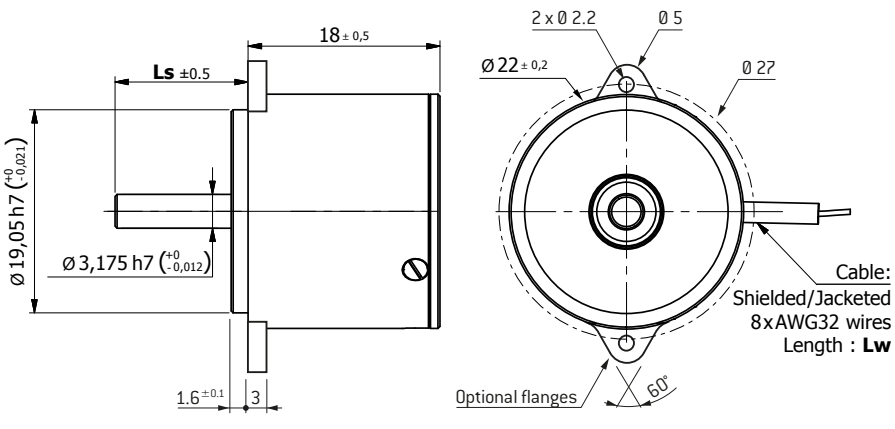
[1] Counts per revolution

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +115°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.

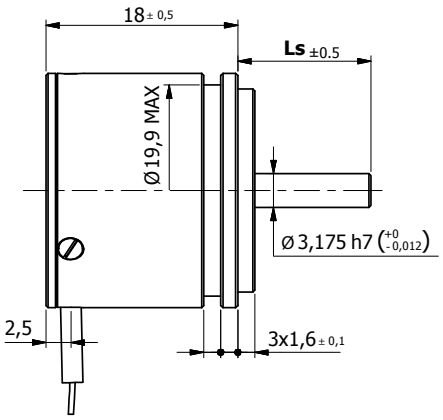
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
INCREMENTAL OPTICAL ENCODER

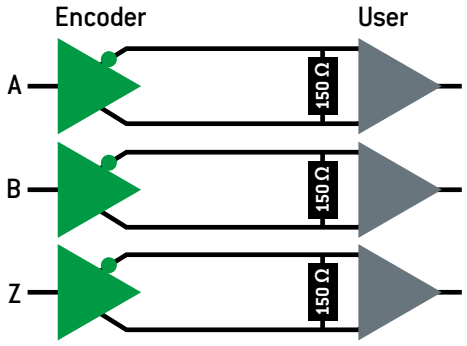
IE09

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	130 mA
Output signals	RS422/TTL
Maximum operating frequency	4 MHz (TTL)

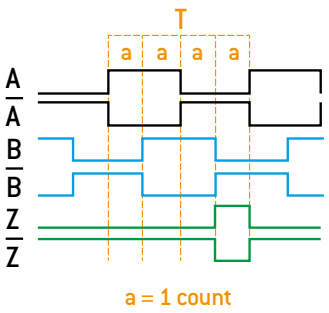
For other specifications, please contact us

ELECTRICAL INTERFACE

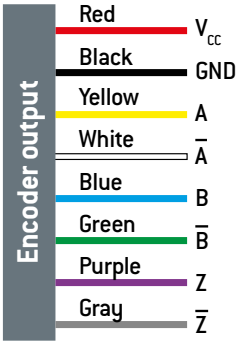
RS422 Interface



Chronogram



Wiring diagram



HOW TO ORDER							
	Mounting	Resolution (CPR)	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
IE09	•	•••••	••	••	•••	•••	•
	F	1024	ST	01	250	115	W
	S	65536	MT	02	TBD	TBD	N
			HT	XX			
	F: Flange **S**: Servo	**1024** to **65536** CPR	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

IE11

SINGLE TURN
INCREMENTAL OPTICAL ENCODER

Optical Technology

PRESENTATION

The **IE11** miniature incremental encoder includes **EXXELIA** GROUP state of-the-art and proprietary optical technology.

With their very compact design, high reliability and good precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

High temperature up to +115°C

Shocks/Vibrations resist

High performances

Low profile

Light weight

GENERAL DATA	
Resolution	Up to 524288 CPR [1]
Accuracy	± 2' max.
Maximum rotation speed	3000 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	35 g max.

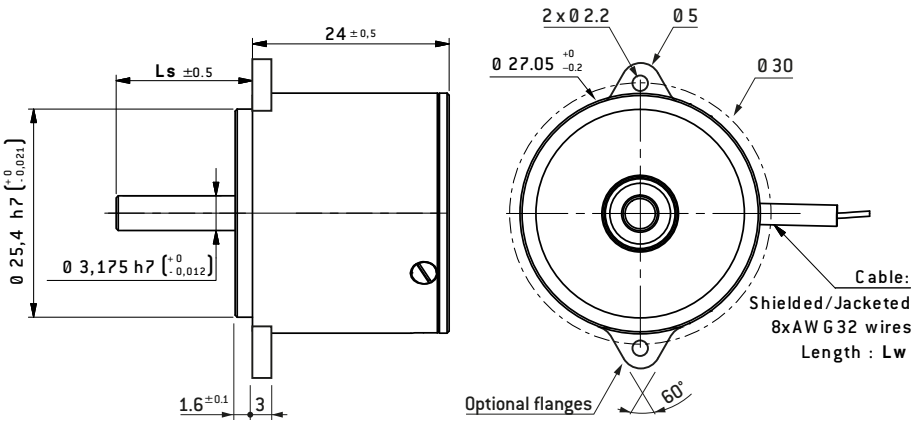
[1] Counts per revolution

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +115°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.

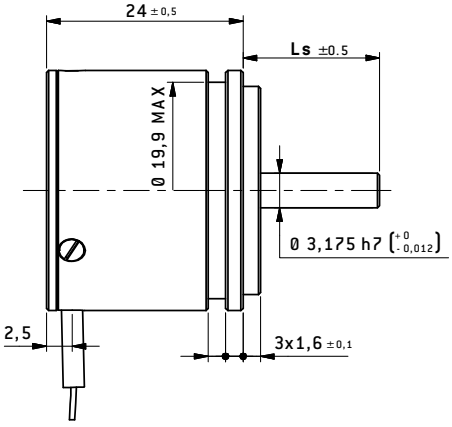
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
INCREMENTAL OPTICAL ENCODER

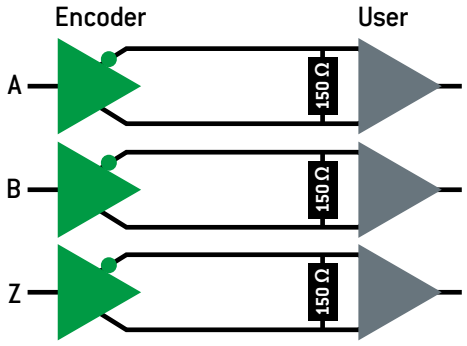
IE11

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	130 mA
Output signals	RS422/TTL
Maximum operating frequency	4 MHz (TTL)

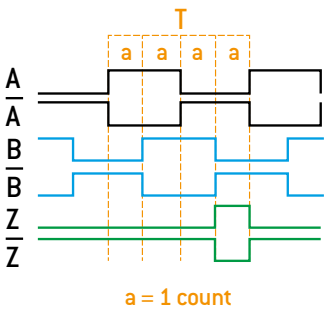
For other specifications, please contact us

ELECTRICAL INTERFACE

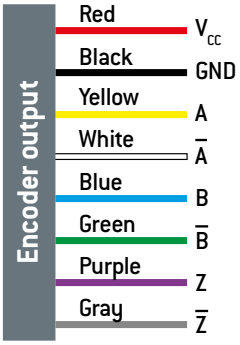
RS422 Interface



Chronogram



Wiring diagram



HOW TO ORDER							
	Mounting	Resolution (CPR)	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
IE11	•	••••••	••	••	•••	•••	•
	F	1024	ST	01	250	115	W
	S	524288	MT	02	TBD	TBD	N
			HT	XX			
	F: Flange **S**: Servo	**1024** to **524288** CPR	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

IE15

SINGLE TURN
INCREMENTAL OPTICAL ENCODER

Optical Technology

PRESENTATION

The **IE15** miniature incremental encoder includes **EXXELIA** GROUP state of-the-art and proprietary optical technology.

With their very compact design, high reliability and good precision, **EXXELIA** GROUP miniature encoders meet the requirements of the most demanding applications (Aerospace, Military, Industrial, Medical industry, Oil & mining industry...).

High temperature up to +125°C

Shocks/Vibrations resist

High performances

Low profile

Light weight

GENERAL DATA	
Resolution	Up to 524288 CPR [1]
Accuracy	± 40"
Maximum rotation speed	3000 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	35 g max.

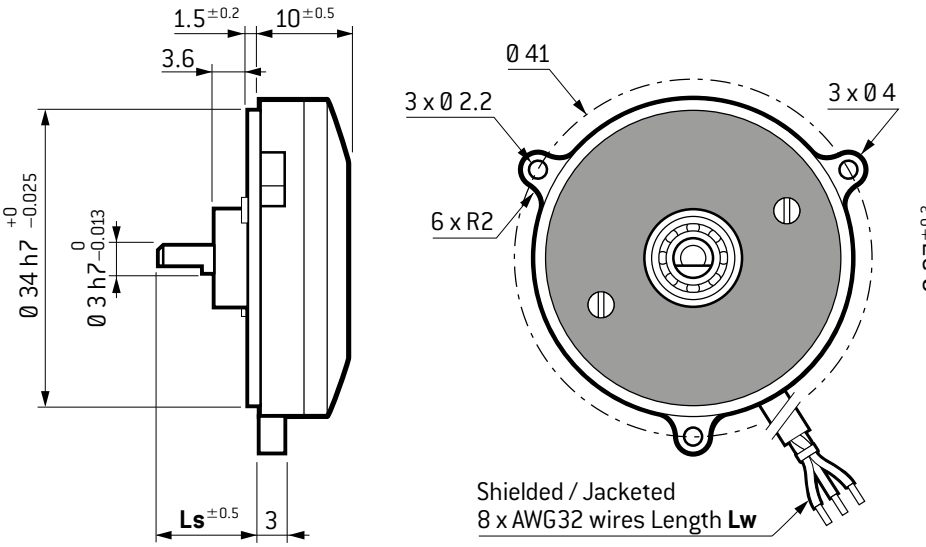
[1] Counts per revolution

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +125°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.

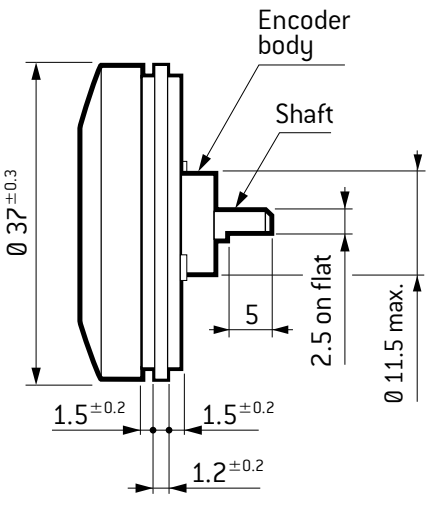
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
INCREMENTAL OPTICAL ENCODER

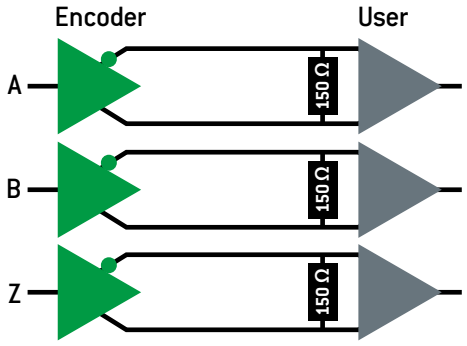
IE15

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	130 mA
Output signals	RS422/TTL
Maximum operating frequency	4 MHz (TTL)

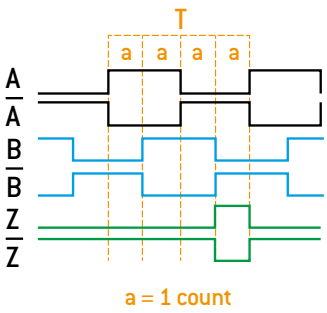
For other specifications, please contact us

ELECTRICAL INTERFACE

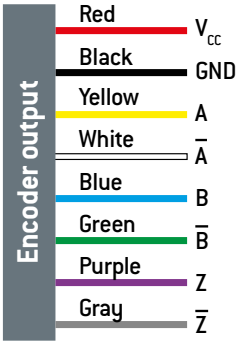
RS422 Interface



Chronogram



Wiring diagram



HOW TO ORDER							
	Mounting	Resolution (CPR)	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
IE15	•	••••••	••	••	•••	•••	•
	F	1024	ST	01	250	115	W
	S	524288	MT	02	TBD	TBD	N
			HT	XX			
	F: Flange **S**: Servo	**1024** to **524288** CPR	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AME04

SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

Magnetic Technology

PRESENTATION

The absolute encoder **AME04** is the smallest rotary sensor based on magnetic technology designed by **EXXELIA** GROUP. Its compactness makes this product a cost-effective solution for applications in confined areas and it can be ideally used for automatic control, on-line gauging, in-process monitoring systems, etc.

Various output protocols are available in order to match most applications.

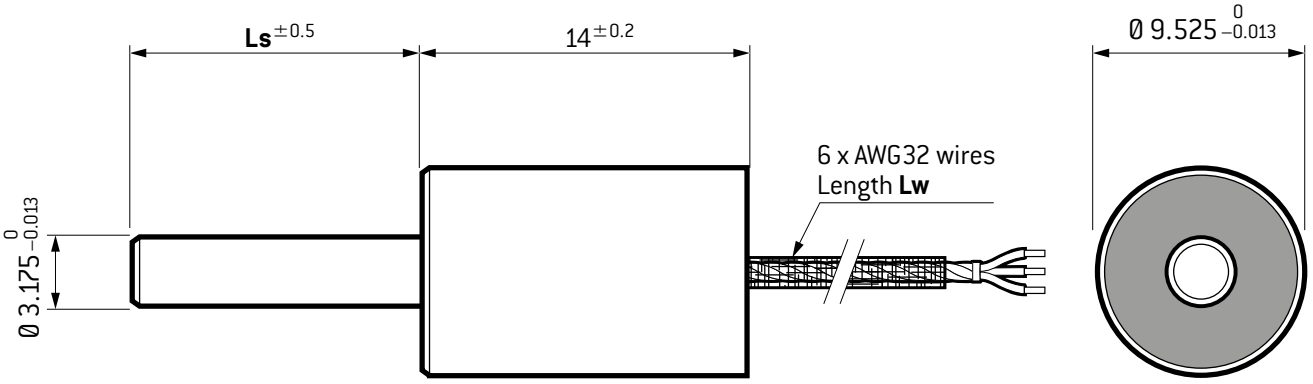
- High temperature up to +125°C
- SSI / FSSI interface
- Miniaturization
- Light weight
- Low profile

GENERAL DATA	
Resolution	Up to 16 bits
Accuracy	Up to ± 20'
Maximum rotation speed	600 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	10 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +125°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.
Magnetic field susceptibility	20 mT max.

For other specifications, please contact us

DIMENSIONS (in mm)



SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

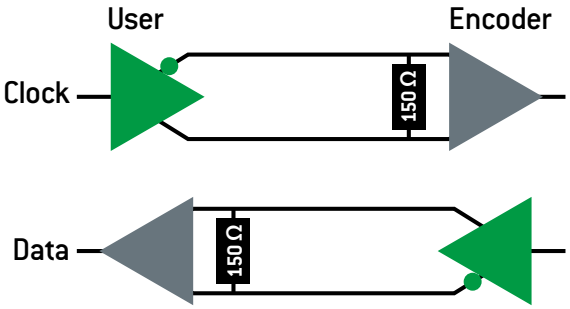
AME04

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	30 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

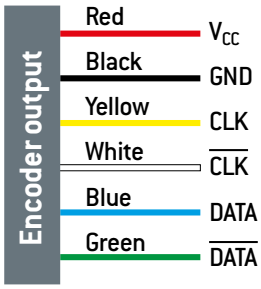
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER

	Resolution	Accuracy	Direction of signals	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AME04	••	•••	••	••	••	••	•••	•••	•
	10	040	CW	S1	ST	01	250	125	W
	16	020	KW	FS	MT	02	TBD	TBD	N
					HT	XX			
					XT				
	10 to **16** bits	**040**: ±40' Standard with coupling **020**: ±20'	**CW**: Clockwise **KW**: Counter clockwise	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C **XT**: Extended Temp. –55°C to +125°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**125**: 12.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AME05

SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

Magnetic Technology

PRESENTATION

The absolute encoder **AME05** is a small rotary sensor based on magnetic technology designed by **EXXELIA** GROUP. Its compactness makes this product a cost-effective solution for applications in confined areas and it can be ideally used for automatic control, on-line gauging, in-process monitoring systems, etc.

Various output protocols are available in order to match your application.

High temperature up to +125°C

Shocks/Vibrations resist

SSI / FSSI interface

Low profile

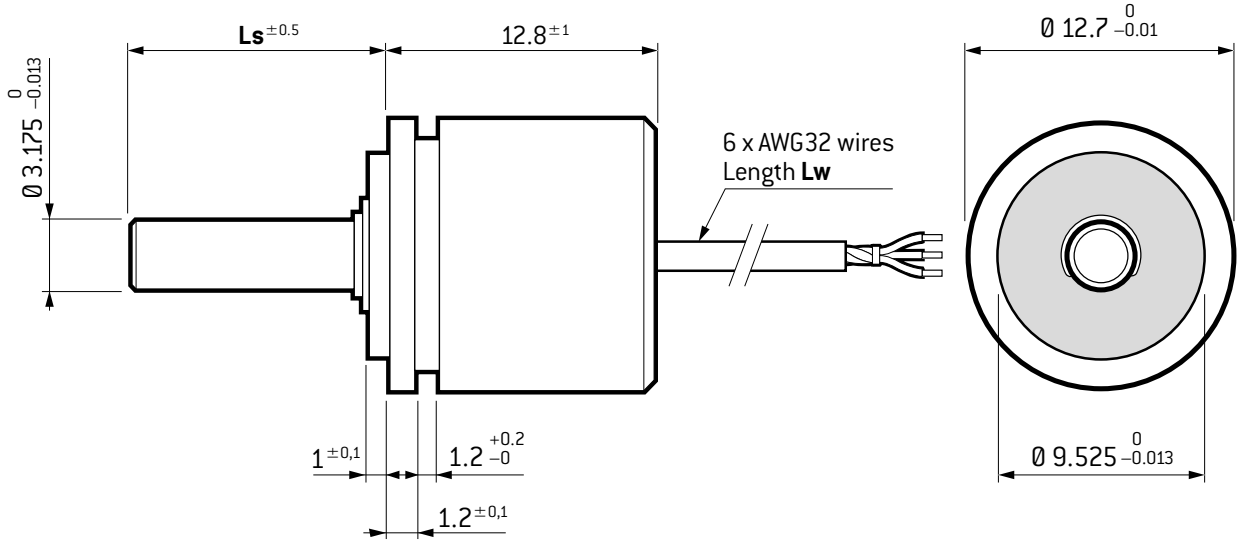
Light weight

GENERAL DATA	
Resolution	Up to 16 bits
Accuracy	Up to ± 20'
Maximum rotation speed	600 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	10 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +125°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.
Magnetic field susceptibility	20 mT max.

For other specifications, please contact us

DIMENSIONS (in mm)



SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

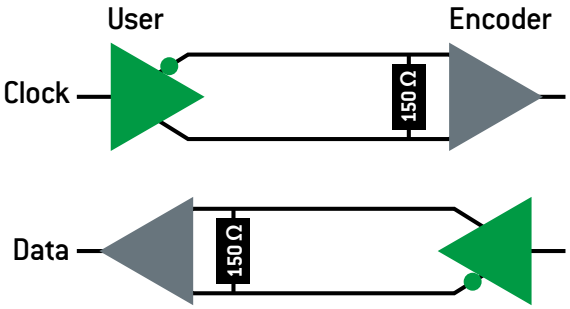
AME05

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	30 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

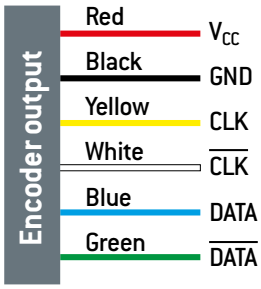
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER

	Resolution	Accuracy	Direction of signals	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AME05	••	•••	••	••	••	••	•••	•••	•
	10	040	CW	S1	ST	01	250	125	W
	16	020	KW	FS	MT	02	TBD	TBD	N
					HT	XX			
					XT				
	10 to **16** bits	**040**: ±40' Standard with coupling **020**: ±20'	**CW**: Clockwise **KW**: Counter clockwise	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C **XT**: Extended Temp. –55°C to +125°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**125**: 12.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AME09

SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

Magnetic Technology

PRESENTATION

AME09 is a magnetic encoder designed by **EXXELIA** GROUP. Its compactness makes this product a cost-effective solution for applications in confined areas and it can be ideally used for automatic control, on-line gauging, in-process monitoring systems, etc.

Various output protocols are available in order to match most applications.

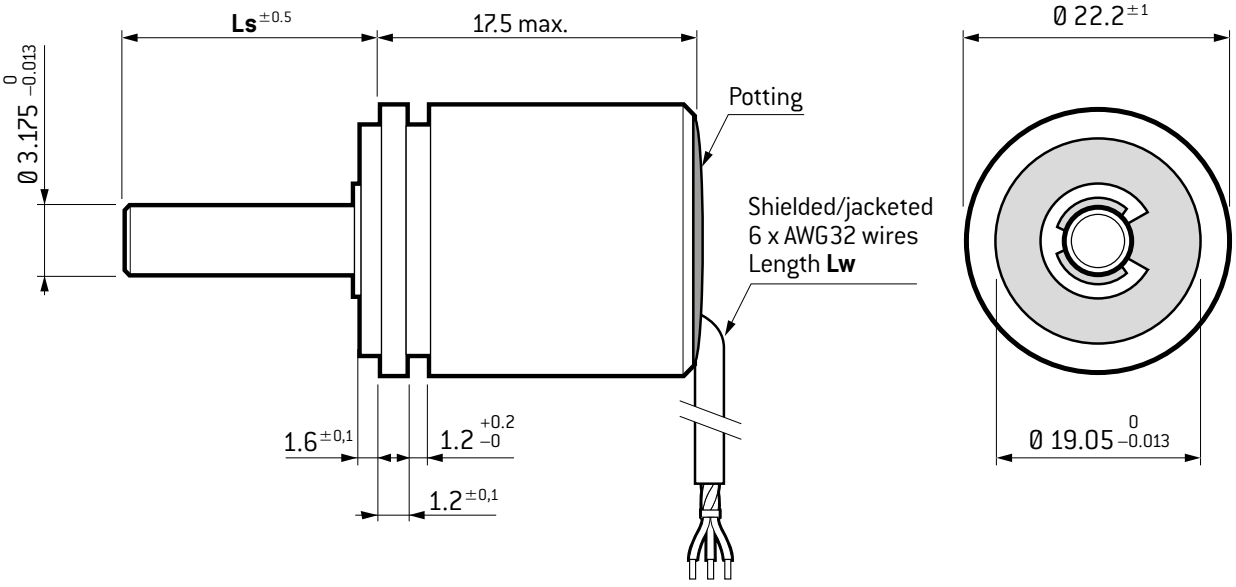
- High temperature up to +125°C
- Shocks/Vibrations resist
- SSI / FSSI interface
- Low profile
- Light weight

GENERAL DATA	
Resolution	Up to 16 bits
Accuracy	Up to ± 10'
Maximum rotation speed	600 rpm
Starting torque	≤ 0.1 N.cm
Weight (without cable)	10 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +125°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.
Magnetic field susceptibility	20 mT max.

For other specifications, please contact us

DIMENSIONS (in mm)



SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

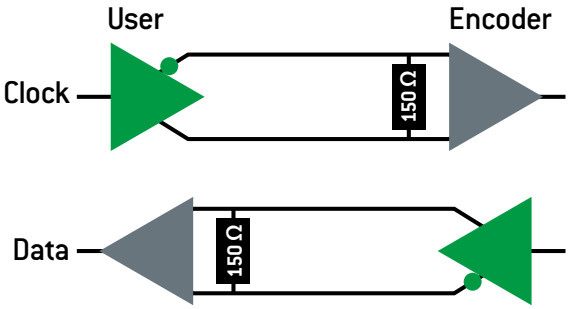
AME09

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5% or +10 V_{DC} optional
Maximum consumed current	30 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

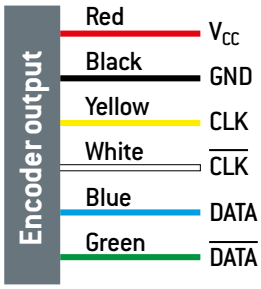
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER									
	Resolution	Accuracy	Direction of signals	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AME09	••	•••	••	••	••	••	•••	•••	•
	10	040	CW	S1	ST	01	250	125	W
	16	020	KW	FS	MT	02	TBD	TBD	N
		010			HT	XX			
					XT				
	10 to **16** bits	**040**: ±40' Standard with coupling **020**: ±20' **010**: ±10'	**CW**: Clockwise **KW**: Counter clockwise	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C **XT**: Extended Temp. –55°C to +125°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**125**: 12.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AME13

SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

Magnetic Technology

PRESENTATION

The absolute encoder **AME13** is a rotary sensor based on magnetic technology. Low profile configuration and high accuracy make it very useful in applications which need axial access: actuators, electromechanical aerospace devices ...

Various output protocols are available in order to match most applications

High temperature up to +125°C

Shocks/Vibrations resist

SSI / FSSI interface

High performances

Low profile

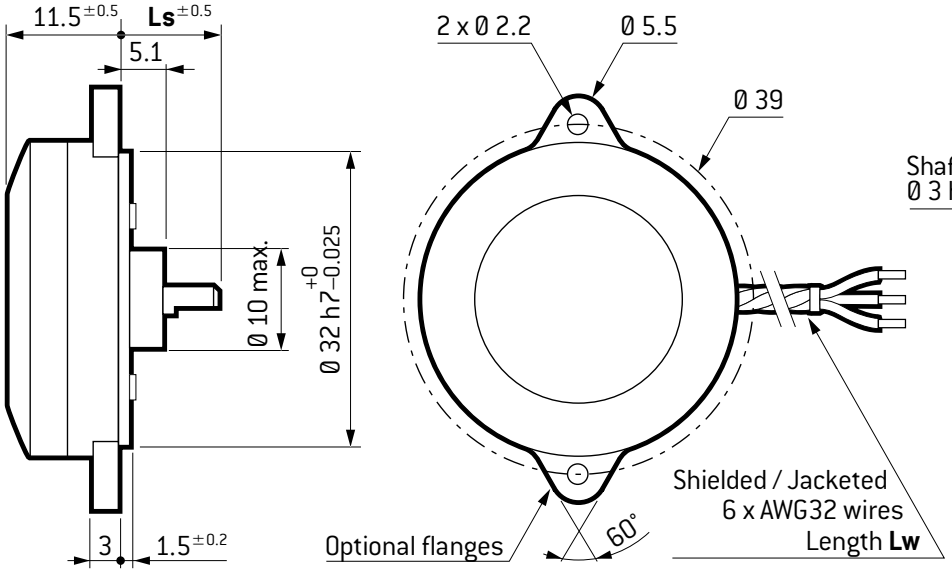
GENERAL DATA	
Resolution	Up to 19 bits
Accuracy	Up to ± 1.5'
Maximum rotation speed	2000 rpm
Weight (without cable)	30 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +125°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.
Magnetic field susceptibility	20 mT max.

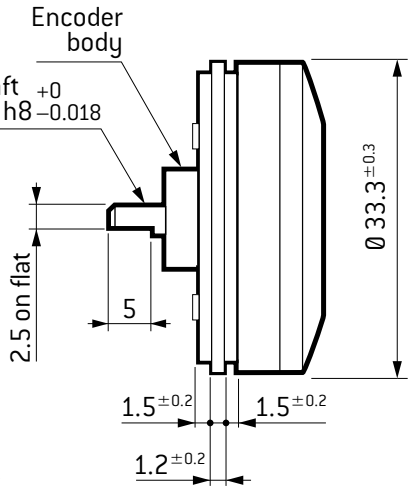
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

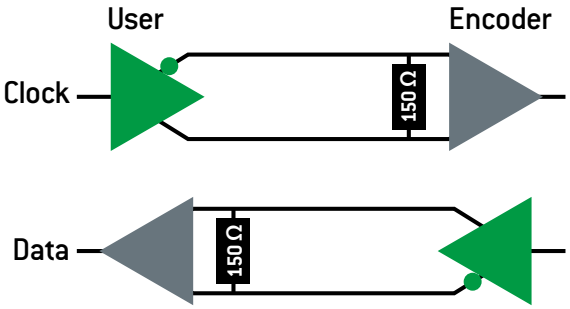
AME13

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	100 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

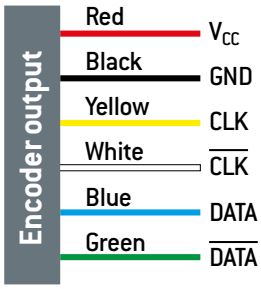
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER										
	Mounting	Resolution	Accuracy	Direction of signals	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AME13	•	••	•••	••	••	••	••	•••	•••	•
	F	10	150	CW	S1	ST	01	250	115	W
	S	19	075	KW	FS	MT	02	TBD	TBD	N
			015			HT	03			
						XT				
	F: Flange **S**: Servo	**10** to **19** bits	**150**: ±15' Standard with coupling **075**: ±7.5' **015**: ±1.5'	**CW**: Clockwise **KW**: Counter clockwise	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C **XT**: Extended Temp. –55°C to +125°C	**01**: Without coupling **02**: Standard coupling [1] **03**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AME15

SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

Magnetic Technology

PRESENTATION

The absolute encoder **AME15** is a rotary sensor based on magnetic technology. Low profile configuration and high accuracy make it very useful in applications which need axial access: actuators, electromechanical aerospace devices ...

Various output protocols are available in order to match most applications.

- High temperature up to +125°C
- Shocks/Vibrations resist
- SSI / FSSI interface
- High performances
- Low profile

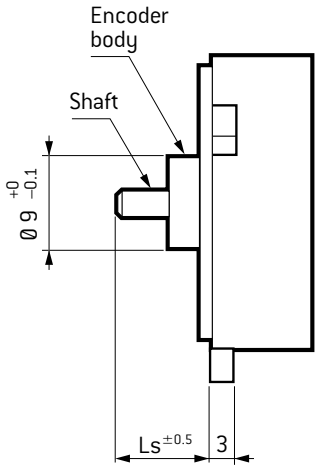
GENERAL DATA	
Resolution	Up to 19 bits
Accuracy	Up to ± 1.5'
Maximum rotation speed	2000 rpm
Weight	30 g max.

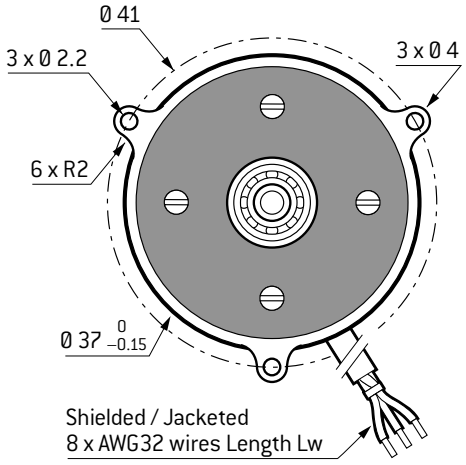
ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +125°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.
Magnetic field susceptibility	20 mT max.

For other specifications, please contact us

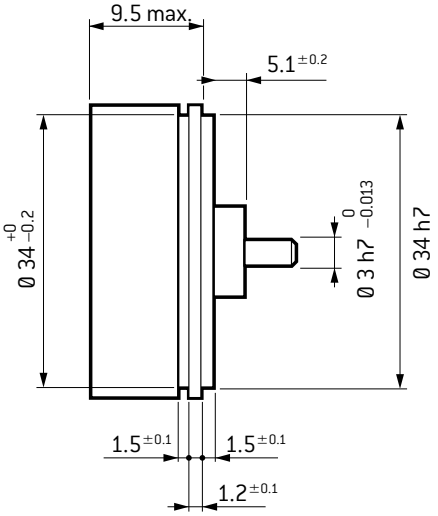
DIMENSIONS (in mm)

Flange mounting (F)





Servo mounting (S)



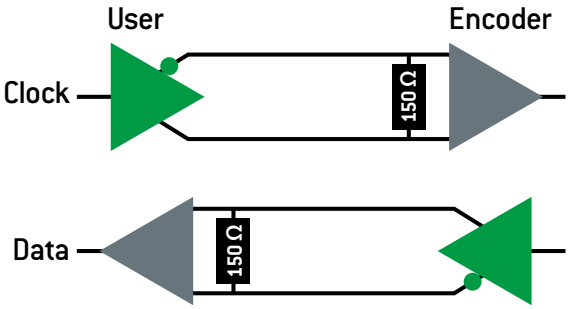
SINGLE TURN
ABSOLUTE MAGNETIC ENCODER
AME15

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	100 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

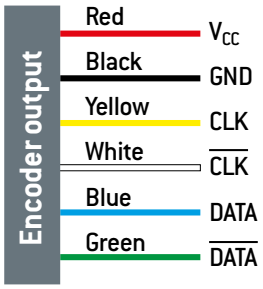
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER										
	Mounting	Resolution	Accuracy	Direction of signals	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
AME15	•	••	•••	••	••	••	••	•••	•••	•
	F	10	150	CW	S1	ST	01	250	115	W
	S	19	075	KW	FS	MT	02	TBD	TBD	N
			015			HT	XX			
						XT				
	F: Flange **S**: Servo	**10** to **19** bits	**150**: ±15' Standard with coupling **075**: ±7.5' **015**: ±1.5'	**CW**: Clockwise **KW**: Counter clockwise	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C **XT**: Extended Temp. –55°C to +125°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

AME16PC

SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

Magnetic Technology

PRESENTATION

The absolute encoder **AME16PC** is a pancake (bearingless) rotary sensor based on magnetic technology. Low profile configuration makes it very useful in applications which need axial access: actuators, electromechanical aerospace devices, etc.

Various output protocols are available in order to match most applications.

High temperature up to +125°C

Shocks/Vibrations resist

SSI / FSSI interface

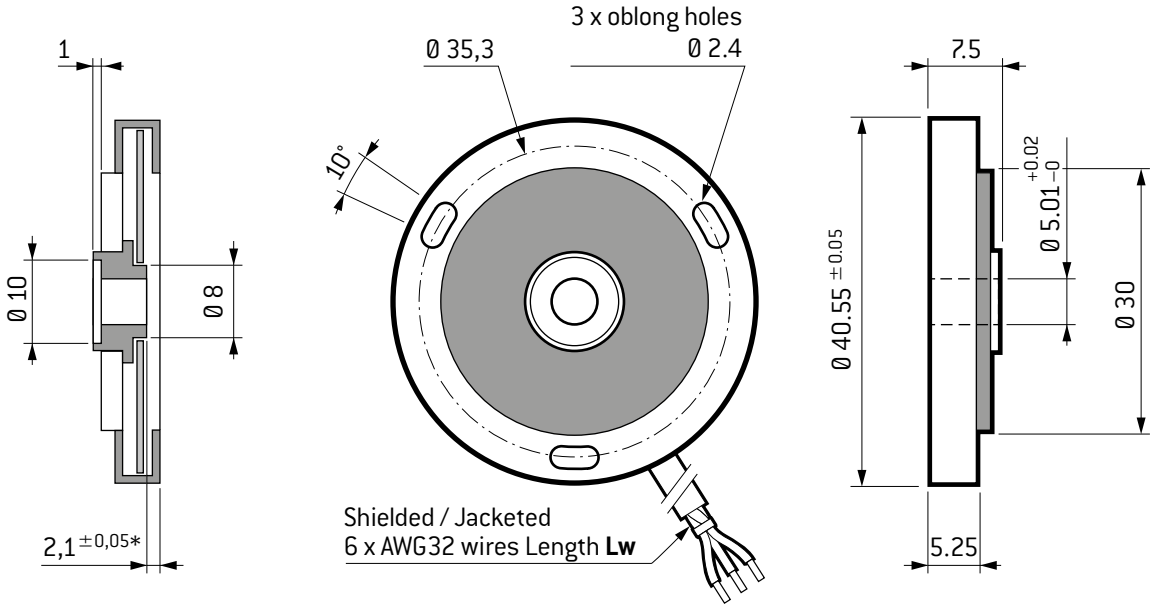
Low profile

GENERAL DATA	
Resolution	Up to 19 bits
Accuracy	Up to ± 1.5'
Maximum rotation speed	2000 rpm
Weight	25 g max.

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +125°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.
Magnetic field susceptibility	20 mT max.

For other specifications, please contact us

DIMENSIONS (in mm)



* For mounting conditions, please contact us.

SINGLE TURN
ABSOLUTE MAGNETIC ENCODER

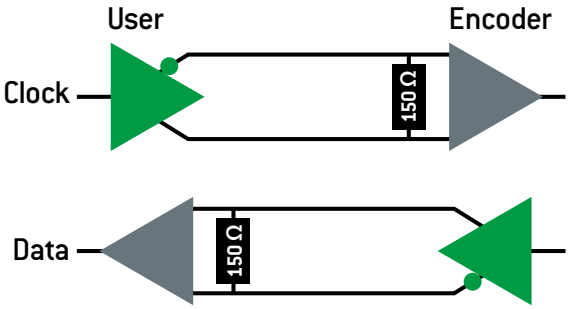
AME16PC

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	100 mA
Output signals	RS422/485
Maximum operating frequency	2 MHz (SSI) / 4 MHz (FSSI)

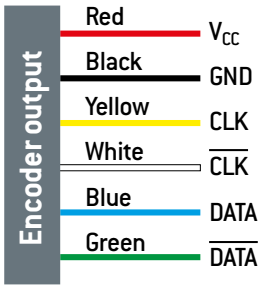
For other specifications, please contact us

ELECTRICAL INTERFACE

RS422/485 Interface



Wiring diagram



HOW TO ORDER

	Resolution	Accuracy in nominal position	Direction of signals	Protocol [1]	Temperature range	Mechanical coupling	Wire length (Lw)	RoHS compliance
AME16PC	••	•••	••	••	••	••	•••	•
	10	150	CW	S1	ST	01	250	W
	19	075	KW	FS	MT	02	TBD	N
		015			HT	XX		
					XT			
	10 to **19** bits	**150**: ±15' Standard with coupling **075**: ±7.5' **015**: ±1.5'	**CW**: Clockwise **KW**: Counter clockwise	**S1**: SSI **FS**: FSSI Standard SSI2 compatible	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C **XT**: Extended Temp. –55°C to +125°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

IME15

SINGLE TURN
INCREMENTAL MAGNETIC ENCODER

Magnetic Technology

PRESENTATION

The incremental encoder **IME15** is a rotary sensor based on magnetic technology. Low profile configuration and high accuracy make it very useful in applications which need axial access: actuators, electromechanical aerospace devices ...

Various output protocols are available in order to match most applications.

High temperature up to +125°C

Shocks/Vibrations resist

High performances

Low profile

GENERAL DATA	
Resolution	Up to 262144 CPR [1]
Accuracy	Up to ± 10'
Maximum rotation speed	2000 rpm
Weight (without cable)	30 g max.

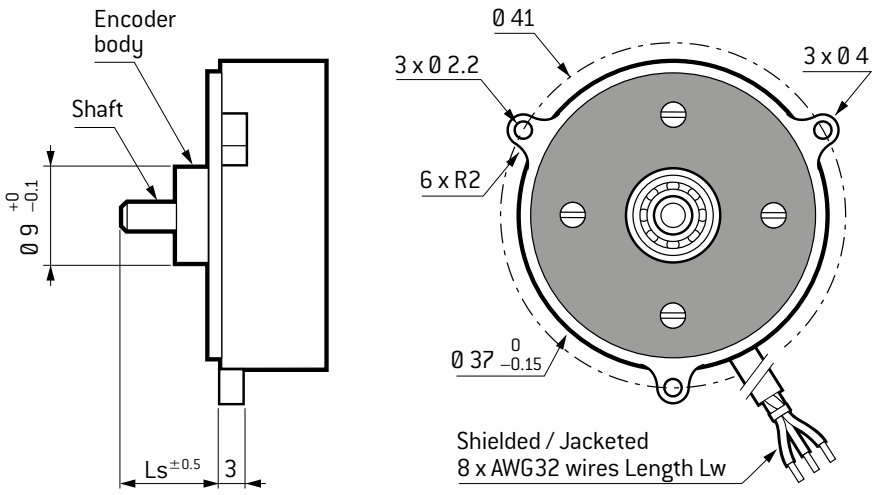
[1] Counts per revolution

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +125°C
Storage temperature	–55°C to +125°C
Sealing	IP 40
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.
Magnetic field susceptibility	20 mT max.

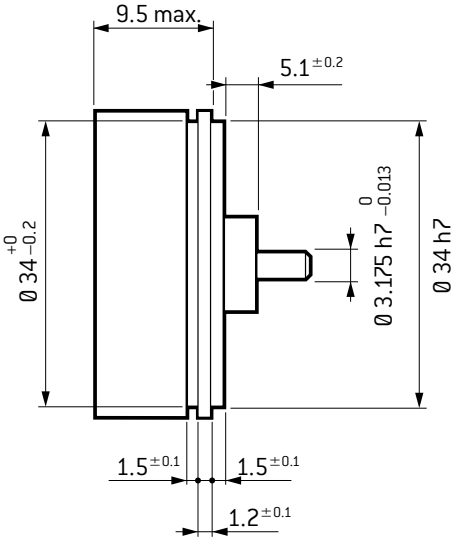
For other specifications, please contact us

DIMENSIONS (in mm)

Flange mounting (F)



Servo mounting (S)



SINGLE TURN
INCREMENTAL MAGNETIC ENCODER

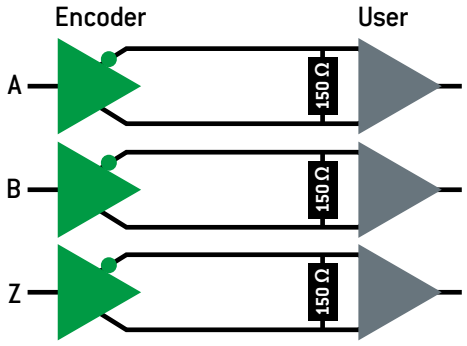
IME15

STANDARD ELECTRICAL DATA	
Power supply	+5 V_{DC} ± 5%
Maximum consumed current	100 mA
Output signals	RS422
Maximum operating frequency	6.25 MHz (TTL)

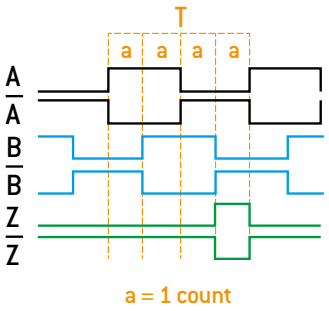
For other specifications, please contact us

ELECTRICAL INTERFACE

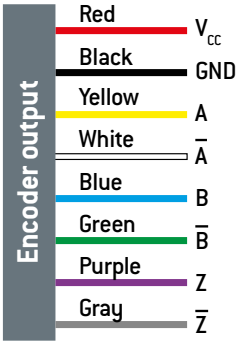
RS422 Interface



Chronogram



Wiring diagram



HOW TO ORDER							
	Mounting	Resolution (CPR)	Temperature range	Mechanical coupling	Wire length (Lw)	Shaft length (Ls)	RoHS compliance
IME15	•	••••••	••	••	•••	•••	•
	B	4	ST	01	250	115	W
	S	262144	MT	02	TBD	TBD	N
			HT	XX			
	B: Bushing **S**: Servo	**4** to **262144** CPR	**ST**: Standard temp. –40°C to +85°C **MT**: Medium temp. –45°C to +105°C **HT**: High Temp. –55°C to +115°C	**01**: Without coupling **02**: Standard coupling [1] **XX**: Custom coupling [2]	**250**: 250 mm Standard **TBD**: To Be Defined by the customer	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**W**: RoHS compliant **N**: Non compliant

1: Please refer to «Encoder Handbook» available on **EXXELIA** GROUP website.
2: For further information, please contact us.

Potentiometers General information

1. INTRODUCING EXXELIA GROUP POTENTIOMETERS

For over 50 years, **EXXELIA GROUP** has been developing potentiometric sensors for civil and spatial applications and for the defense sector. **EXXELIA GROUP** has special know-how in the two basic manufacturing techniques used to produce potentiometer sensor tracks:

- **Conductive film technology**
- **Wirewound technology**

Apart from the different technologies used, these potentiometers break down into several families:

- rotary potentiometers (for copying positions or driving rotary systems),
- single-turn or multi-turn potentiometers
- pancake potentiometers (monobloc with a mobile "wiper" part inseparable from the shaft and no ball bearings),
- Linear motion potentiometers (for copying positions or driving systems with linear translation motion),
- digital potentiometers (equipped with an analog-digital converter –> 16 bits),
- rotary switches providing discrete signals on multiple bits and used for example to define angular sectors (used to set limits for security sectors when mounted on weapon station Slip rings).

Summary definitions of terms related to non-wirewound (conductive polymer) precision potentiometers as per standard **NF C 93255** and **MIL R 39023** and to wirewound potentiometers as per standard **NF C 93265** and **MIL R 12934**:

Nominal resistance (Rn): rated label value of the potentiometer.

Total resistance (Rt): value measured between the input and output, Rt should be between the Rn + and the Rn – tolerances.

Effective electrical travel: value in degrees of angular deviation corresponding to an effective variation in resistance. See fig. 1, which also shows total electrical travel and mechanical travel Two possibilities are presented: fig. 1A for continuous rotation single turn potentiometers and fig. 1B for single or multi-turn potentiometers with stops.

Standardized definitions for mechanical travel and electrical travel:

Fig. 1A - Single or multi-turn potentiometer with stops.

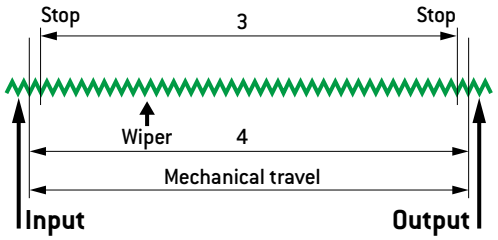
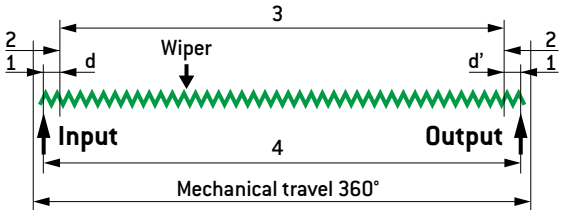


Fig. 1B - Single-turn continuous rotation potentiometer.



1. dead space (electrical discontinuity)

2. non-conformity space (difference between the 360° mechanical travel and the actual electrical travel, fig. 1A

3. effective electrical travel (value corresponding to an effective variation in resistance in which conformity is verified)

4. total electrical travel (in the example in fig. 1B the total electrical travel, or mechanical travel, may be taken for the effective electrical travel)

dd' - overtravel (as in fig. 1A)

- single turn potentiometer: mechanical travel at less than 360°
- n-turns potentiometer mechanical travel greater than n, 360°

Movement: a movement includes the clockwise and counterclockwise travels of the shaft

Backlash: value in degrees of the angle of rotation that does not result in any contact travel during a change in direction

Function: the relationship between the electrical value to be obtained (theoretical function) or obtained (actual function) at the output terminals and the wiper position in the actual electrical travel

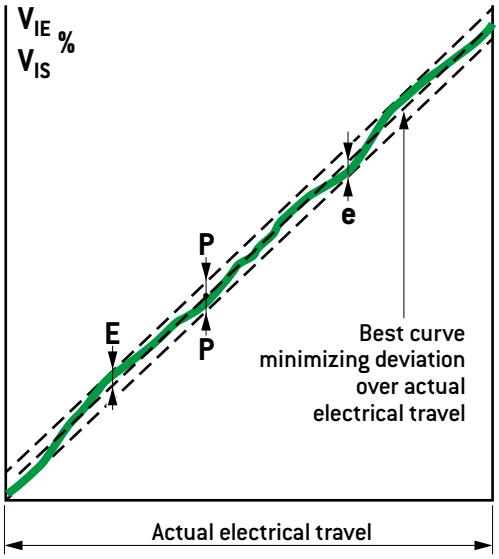
Conformity deviation: positive or negative deviation in the values of the functions desired and obtained for each wiper position linearity deviation for linearity function

Potentiometers General information

Conformity: percentage between the maximum conformity deviation (absolute value) and the maximum electrical value measured between input and output, as in fig. 1A and 1B. linearity, for linearity function.

Corrected deviation: absolute value of the deviation between the best curve of the effective electrical travel minimizing the deviations and the curve representing the desired function.

Fig. 2 - Independent linearity curve



V_{IE} Voltage between input and wiper
V_{IS} Voltage applied to potentiometer terminals
E Upper deviation
e Lower deviation
P Conformity tolerance $\frac{E+e}{2} < P$
– – Authorized deviations

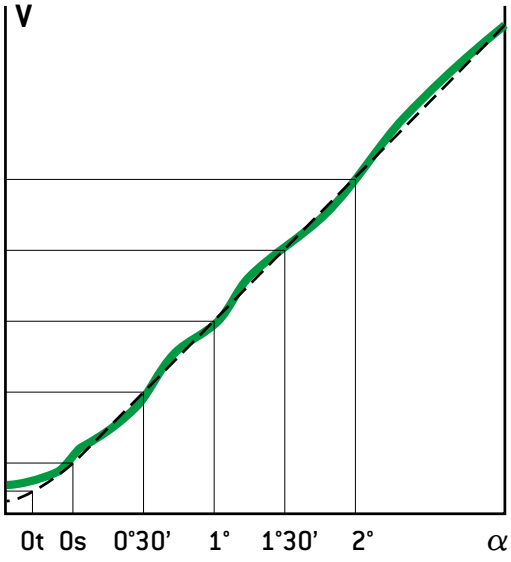
Independent conformity: percentage between the absolute value of the maximum corrected deviation and the maximum electrical value measured between input and output Independent linearity for the linearity function.

Theoretical angular resolution: rotation angle formed by the wiper passing from one turn to the next. For a linear variation law it is the quotient of the total electrical travel over the number of turn. For a non-linear variation law the angle may vary in function of the wiper position. For the conductive polymer technology, the resolution is consider as "infinite".

Equivalent noise resistance (wirewound potentiometers): quotient of the maximum peak voltage (read on an oscilloscope as specified in standards) measured at the output during wiper travel, and the constant DC voltage at the wiper.

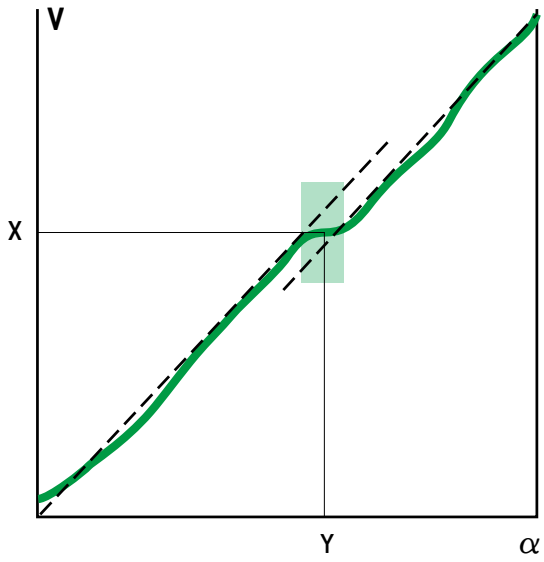
Output smoothness (nonwirewound potentiometers): ratio expressed in percentage of the greatest variation between the output voltage (measured as specified by the standards) and the applied voltage on the input.

Fig. 3 - Plastic Film potentiometer



– – Theoretical curve
Actual curve
0t Theoretical zero
0s Assumed zero

Fig. 4 - Voltage tap effects



– – Theoretical curve
Actual curve
Voltage tap effects zone
X Tap value
Y Tap position

Potentiometers General information

EXXELIA GROUP standard production precision potentiometers are manufactured using the technology wirewound or conductive polymer (norm/virewound).

Conformity to standards is given for each type, but performance after endurance tests is always superior to the even most stringent specifications presently applicable.

The Following specific characteristics of each technology are proceeded, when applicable by one of the followings sign:

NOTE	CHARACTERISTIC
++	Extremely favourable characteristic
+	Favourable characteristic
	Normal characteristic
–	Less favourable characteristic

2. WIREWOUND TECHNOLOGY

The main characteristics of this standard technology are as follows:

+ Low resistance:

The Wirewound technique enables the production of components with low ohmic values (from 100 ohms).

Independent conformity:

In general for the linear function, the independent linearity is maintained when requested, at a value within a range linked to the geometric parameters of the potentiometer (between ±0.5% and 2% for size 05, between ±0.05% and 0.5% for sizes 20 or 30 for single turn potentiometers; between ±0.01% and ±0.25% for multi-turn potentiometers).

++ Contact resistance:

Very low. The metal to metal contact resistance is situated at a value of approximately 200 milliohms.

+ Output current:

Since the contact resistance is very low, the current travelling through the wiper is in large part determined by the wire diameter (lower as the resistance of the potentiometer is higher) and by the size of the potentiometer (10-30mA for a 10 000 ohms potentiometer from size 05 to size 30).

– Theoretical angular resolution:

The turns/degrees ratio indicates output voltage variation by values which are increasingly discrete as the number of turns increases, Resistance is thus higher (0.6 to 1.5 turns/degrees from size 05 to size 18 for a resistance of 100 ohms, 2.3 to 8.5 turns/degrees from size 05 to size 30 for a resistance of 10 kohms; most favorable cases where no turn is “bypassed”).

– Equivalent noise resistance:

Voltage variations which appear during wiper travel from one turn to the next enable determination of the equivalent noise resistance (value set by standard at less than or equal to 25 ohms, may be decreased, for example, to less than or equal to 1 ohm for a 10 kohm potentiometer, size 18).

+ Temperature coefficient:

The potentiometer temperature coefficient strictly speaking is directly a function of the temperature coefficient of the wire used (less than or equal to 20 ppm/°C for average values).

– Performance versus frequency:

The input and output impedances depend on several parameters: coil length, wiper position, resistance value and type of case. The frequency range is limited (quadrature voltage: 0.1% for Rn 1 kohm, With F= 1 kHz, 2% for Rn 100 kohm, with F = 200 Hz).

Life:

The abrasion of the wire produced by the friction between the wiper and the coil has a detrimental effect on the linearity and increases the resistance value, particularly in the frequent case of travel limited to a small portion of the coil (specifications indicated for each type, average endurance at 40 rpm: 10^5 shaft revolutions or 5.10^5 movements). A life exceeding 1.10^7 shaft revolutions may be obtained in certain specific cases. Specific studies upupon request.

Potentiometers General information

3. CONDUCTIVE POLYMER TECHNOLOGY (NON-WIREWOUND)

The principal characteristics of this technology are summarized below.

+ Absolute conformity:

The conformity range linked to the geometric parameters of the potentiometer is more or less comparable to that of Wirewound potentiometers. However, the travel correction principle enables obtention of much superior precision.

– Contact resistance:

Higher than that of a wirewound potentiometer, it varies from tens to several hundred ohms (for example, 80 ohms for a 10 kohm size 18 potentiometer).

– Output current value:

To avoid heating by Joule effect at the contacts and resulting microdestruction of the conductive polymer path, the current flowing through the wiper, or output current, must be limited (milliampere value).

+ Almost infinite resolution:

Because of the perfectly polished nature of the surface of the conductor material with which the conductive polymer is doped (granulation measured in angstroms 1 Å - 10^{-10} m), resolution is practically infinite.

++ Output smoothness:

Linked to the proceeding characteristic, this parameter is related to the surface state, the homogeneity of the conductor and to the wiper design. It is expressed as a percent of the Total Applied Voltage. Operational performance better than the guaranteed value of $2.5^{\pm 0.025}$ % is obtained over the total electrical travel.

++ Low temperature perfonnance:

A noteworthy advantage of this technology is that the output smoothness is maintained at very low temperatures (– 55°C).

+ Temperature coefficient:

Depending upon the potentiometer value, the temperature coefficient is generally negative.

+ Performance versus frequency:

Parameters having an influence on the input and output impedances remain negligible due to the absence of a coil, for frequencies up to 100 kHz, whatever the potentiometer value and wiper position.

++ Life:

Conductive polymer potentiometers have a life superior to that of wirewound potentiometers, reaching 25.10^6 shaft revolutions at 400 rpm, as long as usage conditions are followed (output current value).

7300 Series

SINGLE TURN
PRECISION POTENTIOMETER

BUSHING mounting

Conductive Polymer

Wirewound Technology

PRESENTATION

The potentiometers **7300 models** are available from size 5 to 30. They can be composed of several cups (up to qty 12 - see table in the following pages).

These Precision Potentiometers are manufactured and tested according to **NF C 93265, NF C 93255** and **MIL R 39023** standards. These models are available in Plastic film technology and wirewound technology. A hybrid model (wirewound element covered with conductive polymer) is also available. For each technology, they can be either Servo or Bushing mounting.

Shocks/Vibrations resist

High Performances

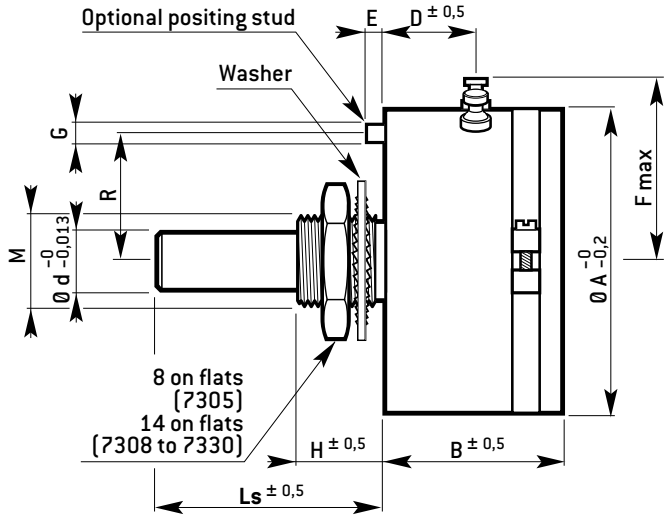
High temperature up to +155°C

Modular

GENERAL DATA	
Linearity	Up to 0.02%
Nominal resistance	470 Ω to 100 kΩ

ENVIRONMENTAL DATA	
Operating temperature	Up to –55°C to +155°C
Storage temperature	–55°C to +155°C
Shocks	50 g, 1/2 sine, 11 ms..
Vibrations	20 g, 1.5 mm, 10 Hz to 500 Hz

DIMENSIONS (in mm)



General tolerance ISO 2768 mk

Size	7305	7308	7309	7311	7313	7315	7318	7320	7330
A	12.7 [1]	19.05	22.35	27.05	33.33	36.5	44.45	51	76.25
B	14	14	14	14	19.5	19.5	19.5	19.5	19.5
Ls	16	25	25	25	25	25	25	25	25
D	8.5	5	5	5	10	10	10	10	10
d	3.175	3.175	3.175	3.175	6.35	6.35	6.35	6.35	6.35
E	-	1.6	1.6	1.6	2	2	2	2	2
F	10	13	13	14.5	17	20	22	26	42
G	-	1.6	1.6	1.6	2	2	2	2	2
H	8	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
M	6x0.75	10x0.75	10x0.75	10x0.75	10x0.75	10x0.75	10x0.75	10x0.75	10x0.75
R	-	8	9	12	14	14	20	20	35
Option [1]	-	315°	320°	320°	330°	330°	340°	340°	350°

[1] Mechanical travel with stops

Summary of the options available are listed below:

Rear shaft - position stud - flats - mechanical stops,
Sealed shaft - sealed fixing,
Low torque - wire outputs,
Radiation strength - EMI /RFI etc.
High temperature (250°C and higher),
Absolute linearity up to 0.02% or 600 µrad (depending on size),
Other resistance value.

Contact our Sales Department for other options.

SINGLE TURN
PRECISION POTENTIOMETER

7300 Series

STANDARD PARAMETERS		Unit	7305	7308	7309	7311	7313	7315	7318	7320	7330
Size			5	8	9	11	13	15	18	20	30
Housing Diameter		(mm)	12.7	19.05	22.35	27.05	33.33	36.05	44.45	51	76.25
Nominal Resistance	B	(Ω)	100/22K	100/47K	100/47K	100/47K	100/47K	100/47K	100/47K	470/22M	470/22M
Nominal Resistance	P	(Ω)	470/22K	1k/47K	1K/47K	1K/47K	1K/47K	1K/47K	1K/100K	1k/22M	1K/47M
Resistance Tolerance	B	(%)	±5	±5	±5	±5	±5	±5	±5	±5	±5
Resistance Tolerance	P	(%)	±10	±10	±10	±10	±10	±10	±10	±10	±10
Independent Linearity		(%)	±1	±0,5	±0,5	±0,5	±0,25	±0,25	±0,25	±0,25	±0,1
Wiper Current	B	(mA)	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10
Wiper Current	P	(mA)	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1
Rated dissipation @ 85°C	B	(W)	0,5	1	1	1,5	2	2,5	4	5	8
Rated dissipation @ 85°C	P	(W)	0,5	0,75	0,75	1	1,5	2	3	4	6
Operating Temperature		(°C)	−55°C +155°C								
Dissip./Temp. ratio for Θ > 85°C	B	(W/°C)	−0,007	−0,014	−0,014	−0,021	−0,028	−0,036	−0,0357	−0,071	−0,114
Dissip./Temp. ratio for Θ > 85°C	P	(W/°C)	−0,007	−0,011	−0,011	−0,014	−0,021	−0,028	−0,043	−0,057	−0,086
Insulation Resistance at 500V		(MΩ)	>1 000	>1 000	>1 000	>1 000	>1 000	>1 000	>1 000	>1 000	>1 000
Withstand voltage (50 Hz, 1 mn)		(V)	750	750	750	750	1 000	1 000	1 000	1 000	1 000
Electrical Travel	B	(°)	$345^{\pm 3}$	$354^{\pm 2}$	$355^{\pm 2}$	$357^{\pm 2}$	$357^{\pm 2}$	$357^{\pm 2}$	$357^{\pm 1}$	$357^{\pm 1}$	$357^{\pm 1}$
Electrical Travel	P	(°)	$340^{\pm 3}$	$340^{\pm 2}$	$340^{\pm 2}$	$350^{\pm 2}$	$350^{\pm 2}$	$350^{\pm 2}$	$350^{\pm 1}$	$350^{\pm 1}$	$350^{\pm 1}$
Equivalent Noise Resistance	B	(Ω)	≤25	≤25	≤25	≤25	≤25	≤25	≤25	≤25	≤25
Output Smoothness	P	(%)	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025
Lifetime	B	(cycles)	Up to 1 000 000								
Lifetime	P	(cycles)	Up to 100 000 000								
Starting torque per cup	B	(Nm)	≤2 10^{-4}	≤4 10^{-4}	≤4 10^{-4}	≤5 10^{-4}	≤5 10^{-4}	≤8 10^{-4}	≤10 10^{-4}	≤15 10^{-4}	≤20 10^{-4}
Starting torque per cup	P	(Nm)	≤3 10^{-4}	≤6 10^{-4}	≤6 10^{-4}	≤8 10^{-4}	≤8 10^{-4}	≤10 10^{-4}	≤12 10^{-4}	≤18 10^{-4}	≤20 10^{-4}
Number of intermediate taps per cup			2 max.	5 max.	6 max.	6 max.	12 max.	12 max.	12 max.	12 max.	12 max.
Tap location tolerance	B	(°)	±3	±1	±1	±1	±1	±1	±0.5	±0.5	±0.5
Tap location tolerance	P	(°)	±3	±1	±1	±1	±1	±1	±1	±1	±1
Number of cups			2 max.	5 max.	6 max.	6 max.	12 max.	2 max.	12 max.	12 max.	12 max.
Unit approximate mass		(g)	10	12	13	18	25	28	50	70	85
Mass per additional cup		(g)	5	5	6	8	12	20	30	40	55

B = Wirewound technology / P = Conductive Polymer technology

HOW TO ORDER

Size	Tracks	Mounting	Nom. resistance in code (Ω)	Linearity in code (±%)	Electrical travel	Shaft length (Ls)	Option* in code	RoHS compliance
73••	•	•	•••	•	•••	•••	••	•
	B	B	100 to 47M	D	340 to 357	250	00	W
	P			...		TBD	01	N

B: Wirewound **P**: Polymer	**B**: Bushing	**100**: 100 Ω **47M**: 47 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1% **G**: ±2%	**340**: $340^{\pm 3}$ **357**: $357^{\pm 2}$ etc.	**250**: 25 mm Standard **TBD**: To Be Defined by the customer	**00**: No option **01**: Option 1 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

CONTACT POSITION SENSORS

7300 Series

SINGLE TURN
PRECISION POTENTIOMETER

SERVO mounting

Conductive Polymer

Wirewound Technology

Shocks/Vibrations resist

High Performances

High temperature up to +155°C

Modular

PRESENTATION

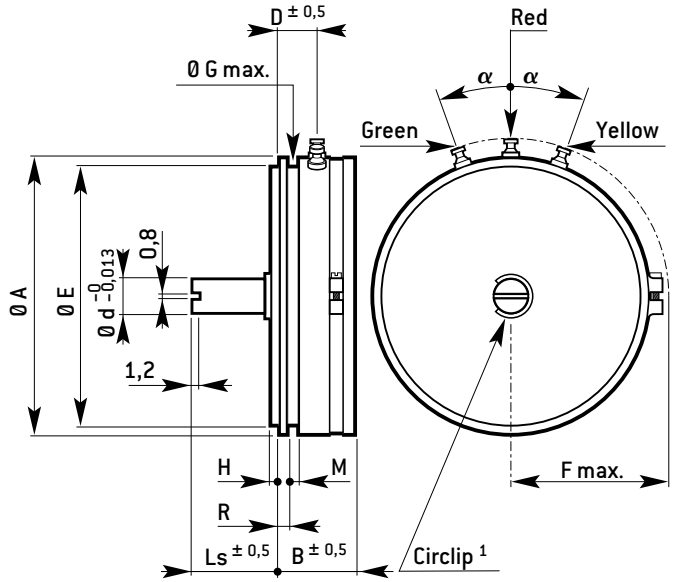
The potentiometers **7300 models** are available from size 5 to 30. They can be composed of several cups (up to qty 12 - see table in the following pages).

These Precision Potentiometers are manufactured and tested according to **NF C 93265, NF C 93255** and **MIL R 39023** standards. These models are available in Plastic film technology and wirewound technology. A hybrid model (wirewound element covered with conductive polymer) is also available. For each technology, they can be either Servo or Bushing mounting.

GENERAL DATA	
Linearity	Up to 0.02%
Nominal resistance	470 Ω to 100 kΩ

ENVIRONMENTAL DATA	
Operating temperature	up to –55°C to +155°C
Storage temperature	–55°C to +155°C
Shocks	50 g, 1/2 sine, 11 ms..
Vibrations	20 g, 1.5 mm, 10 Hz to 500 Hz

DIMENSIONS (in mm)



General tolerance ISO 2768 mk

1 Circlip Ø 4 max protusion 0,5 max (size 5 to 11)
Circlip Ø 8 max protusion 0,8 max (size 13 to 30)

Size	7305	7308	7309	7311	7313	7315	7318	7320	7330
A	12,7 [2]	19,05	22,35 [3]	27,05 [3]	33,33 [3]	36,5 [3]	44,45 [3]	51 [3]	76,25 [3]
B	12	12	12	12	14	14	14	14	14
C	12,5	12,5	12,5	12,5	12,5	16or25	16or25	16or25	25
D	6,5	5	5	5	7	7	7	7	7
d	3,175	3,175	3,175	3,175	6.35	6.35	6.35	6.35	6.35
E	9,525 [2]	12,7 [2]	19,05 [2]	25,4 [2]	30,16 [2]	33,324 [2]	39,674 [2]	47,625**	73,02**
F	10	13	14,5	17	20	22	26	29	42
G	11.45	17,57	19,84	24,9	31	33,4	41,4	47,62	73,1
H	1	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6
M	1,3	1,6	1,6	1,6	1,6	1,9	1,9	1,9	2,3
R	1,2	1,6	1,6	1,6	1,6	1,6	1,6	1,6	2,2
α	60°	30°	30°	30°	30°	30°	20°	20°	20°

[2] Ø A –0 /–0,08 (mm)
[2] Ø E –0 /–0,013 (mm)
[3] Ø A –0 / –0,1 (mm)
[3] Ø E –0 / –0,026 (mm)

Summary of the options available are listed below:

Rear shaft - position stud - flats - mechanical stops,
Sealed shaft - sealed fixing,
Low torque - wire outputs,
Radiation strength - EMI /RFI etc.
High temperature (250°C and higher),
Absolute linearity up to 0.02% or 600 µrad (depending on size),
Other resistance value.

Contact our Sales Department for other options.

SINGLE TURN
PRECISION POTENTIOMETER

7300 Series

STANDARD PARAMETERS		Unit	7305	7308	7309	7311	7313	7315	7318	7320	7330
Size			5	8	9	11	13	15	18	20	30
Housing Diameter		(mm)	12.7	19.05	22.35	27.05	33.33	36.05	44.45	51	76.25
Nominal Resistance	B	(Ω)	100/22K	100/47K	100/47K	100/47K	100/47K	100/47K	100/47K	470/22M	470/22M
Nominal Resistance	P	(Ω)	470/22K	1k/47K	1K/47K	1K/47K	1K/47K	1K/47K	1K/100K	1k/22M	1K/47M
Resistance Tolerance	B	(%)	±5	±5	±5	±5	±5	±5	±5	±5	±5
Resistance Tolerance	P	(%)	±10	±10	±10	±10	±10	±10	±10	±10	±10
Independent Linearity		(%)	±1	±0,5	±0,5	±0,5	±0,25	±0,25	±0,25	±0,25	±0,1
Wiper Current	B	(mA)	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10
Wiper Current	P	(mA)	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1	≤ 1
Rated dissipation @ 85°C	B	(W)	0,5	1	1	1,5	2	2,5	4	5	8
Rated dissipation @ 85°C	P	(W)	0,5	0,75	0,75	1	1,5	2	3	4	6
Operating Temperature		(°C)	−55°C +155°C								
Dissip./Temp. ratio for Θ > 85°C	B	(W/°C)	−0,007	−0,014	−0,014	−0,021	−0,028	−0,036	−0,0357	−0,071	−0,114
Dissip./Temp. ratio for Θ > 85°C	P	(W/°C)	−0,007	−0,011	−0,011	−0,014	−0,021	−0,028	−0,043	−0,057	−0,086
Insulation Resistance at 500V		(MΩ)	>1 000	>1 000	>1 000	>1 000	>1 000	>1 000	>1 000	>1 000	>1 000
Withstand voltage (50 Hz, 1 mn)		(V)	750	750	750	750	1 000	1 000	1 000	1 000	1 000
Electrical Travel	B	(°)	$345^{\pm 3}$	$354^{\pm 2}$	$355^{\pm 2}$	$357^{\pm 2}$	$357^{\pm 2}$	$357^{\pm 2}$	$357^{\pm 1}$	$357^{\pm 1}$	$357^{\pm 1}$
Electrical Travel	P	(°)	$340^{\pm 3}$	$340^{\pm 2}$	$340^{\pm 2}$	$350^{\pm 2}$	$350^{\pm 2}$	$350^{\pm 2}$	$350^{\pm 1}$	$350^{\pm 1}$	$350^{\pm 1}$
Equivalent Noise Resistance	B	(Ω)	≤25	≤25	≤25	≤25	≤25	≤25	≤25	≤25	≤25
Output Smoothness	P	(%)	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025
Lifetime	B	(cycles)	Up to 500 000								
Lifetime	P	(cycles)	Up to 25 000 000								
Starting torque per cup	B	(Nm)	≤2 10^{-4}	≤4 10^{-4}	≤4 10^{-4}	≤5 10^{-4}	≤5 10^{-4}	≤8 10^{-4}	≤10 10^{-4}	≤15 10^{-4}	≤20 10^{-4}
Starting torque per cup	P	(Nm)	≤3 10^{-4}	≤6 10^{-4}	≤6 10^{-4}	≤8 10^{-4}	≤8 10^{-4}	≤10 10^{-4}	≤12 10^{-4}	≤18 10^{-4}	≤20 10^{-4}
Number of intermediate taps per cup			2 max.	5 max.	6 max.	6 max.	12 max.	12 max.	12 max.	12 max.	12 max.
Tap location tolerance	B	(°)	±3	±1	±1	±1	±1	±1	±0.5	±0.5	±0.5
Tap location tolerance	P	(°)	±3	±1	±1	±1	±1	±1	±1	±1	±1
Number of cups			2 max.	5 max.	6 max.	6 max.	12 max.	2 max.	12 max.	12 max.	12 max.
Unit approximate mass		(g)	10	12	13	18	25	28	50	70	85
Mass per additional cup		(g)	5	5	6	8	12	20	30	40	55

B = Wirewound technology / P = Conductive Polymer technology

HOW TO ORDER

Size	Tracks	Mounting	Nom. resistance in code (Ω)	Linearity in code (±%)	Electrical travel	Shaft length (Ls)	Option* in code	RoHS compliance
73••	•	•	•••	•	•••	•••	••	•
	B	S	100 to 47M	D	340 to 357	250	00	W
	P			...		TBD	01	N

B: Wirewound **P**: Polymer	**S**: Servo	**100**: 100 Ω **47M**: 47 MΩ etc.	**Z**: ±0.025% **D**: ±0.5% **A**: ±0.05% **F**: ±1% **B**: ±0.1% **G**: ±2% **C**: ±0.25%	**340**: $340^{\pm 3}$ **357**: $357^{\pm 2}$ etc.	**250**: 25 mm Standard **TBD**: To Be Defined by the customer	**00**: No option **01**: Option 1 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

C0104

SINGLE TURN/PANCAKE
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The rotary potentiometer **C0104** is provided with a bearingless design. This pancake interface, combined with its small size (Ø10 mm), make the **C0104** particularly adapted to applications such as micro-robotics, avionics or measurement devices.

This model offers a wide range of options: mechanical interface, connections, precision, effective electrical travel...

High Performances

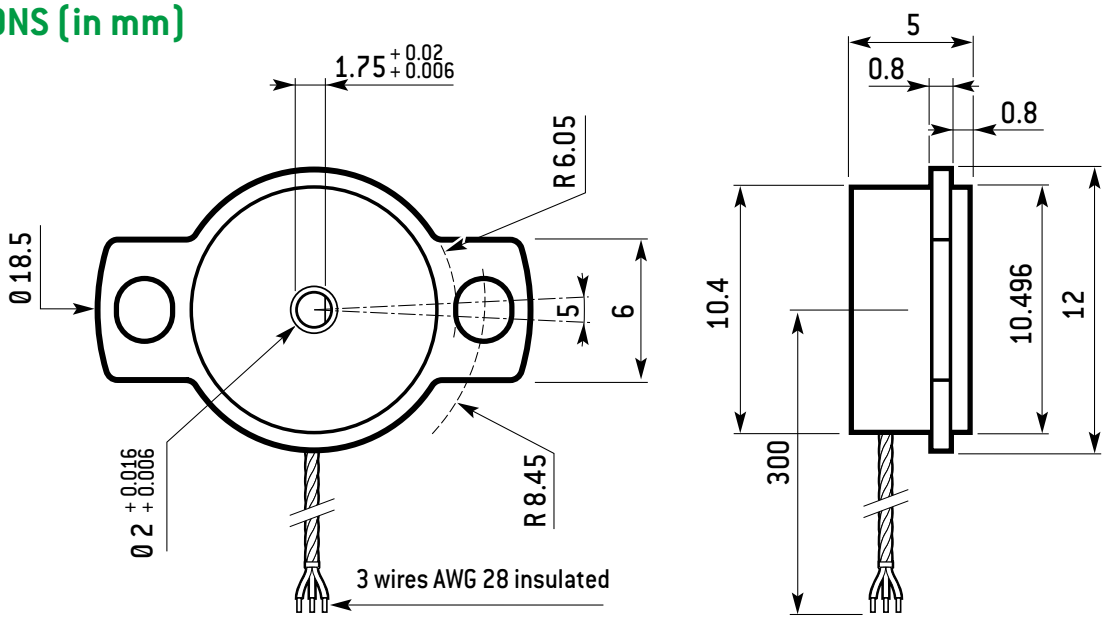
High temperature up to +125°C

Miniaturization

ENVIRONMENTAL DATA	
Operating temperature	–55°C to +125°C
Storage temperature	–55°C to +125°C
Protection index	IP40

OPTIONS	
Other electrical travel	•
Other resistance	•
Other Linearity	•
Medium tap	•
Other mechanical interface	•
Shielded wires	•

DIMENSIONS (in mm)



SINGLE TURN/PANCAKE

PRECISION POTENTIOMETER

C0104

STANDARD ELECTRICAL DATA	
Rated resistance	1 kΩ
Resistance tolerance (Rn) at 20°C	± 10 %
Independent Linearity (other values upupon request)	± 1%
Temperature cœfficient	$-200^{\pm 200}$ x 10^{-6}/°C
Output smoothness	< 0,1%
Insulation resistance at 500 V	≥1 000 MΩ
Voltage supply	0 to 10 V

MECHANICAL CHARACTERISTICS	
Electrical travel (ET)	≤ 170°
Mass	2 g
Lifetime (cycles)	25 x 10^6
Vibrations (sine 3 axes,1.5 mm, 10 to 500 Hz)	20 g
Shocks (3 axes,11 ms, half sine)	50 g

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (°)	Option* in code	RoHS compliance
C0104	•••	•	•••	••	•
	470	Z	020	00	W
	to	to	to	01	N
	10M	F	170	02	
				...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**020**: 20° **170**: 170° etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

C1504

SINGLE TURN - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The potentiometer **C1504** is derived from our miniature **C0104** sensor. This potentiometer is equipped with ball bearing allowing better performance and higher accuracy.

The **C1504** potentiometer is adapted to hard environments such as defense, aeronautics...

Its design allows a wide range of customizations: IP 64 sealing/ 20 000g shock / ...

Shocks/Vibrations resist

High Performances

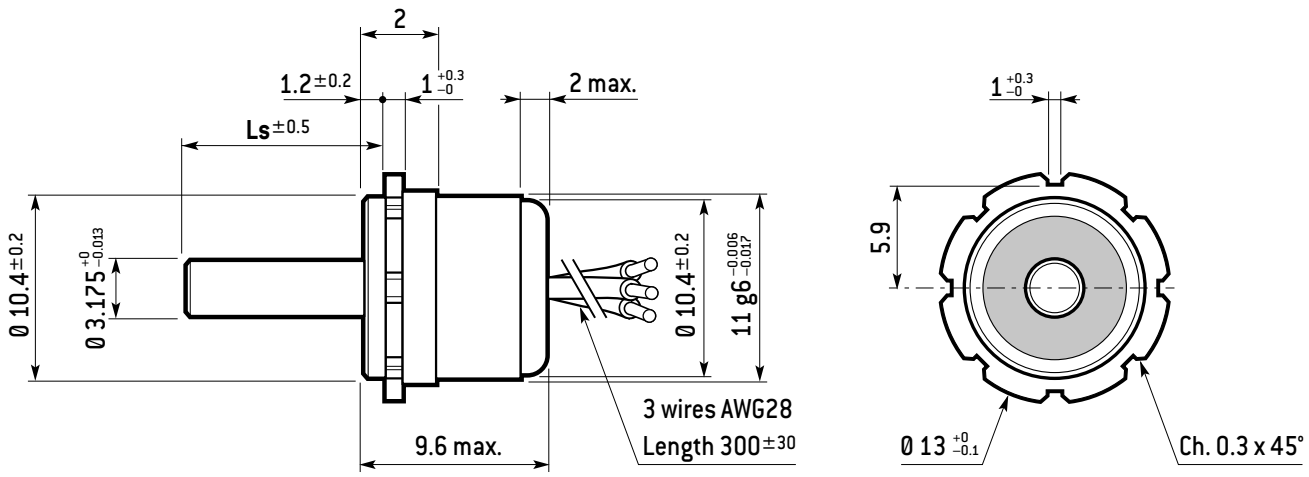
Miniaturization

ENVIRONMENTAL DATA	
Operating temperature	–55°C to +85°C
Storage temperature	–55°C to +85°C
Sealing	IP 40
Vibrations (sinus 3 axis, 1.5 mm)	20 g (10 @ 2 kHz)
Shocks	15 g

OPTIONS	
Other electrical travel	•
Other resistance	•
Other Linearity	•

For other specifications, please contact us

DIMENSIONS (in mm)



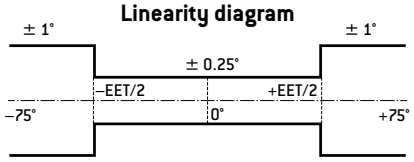
SINGLE TURN - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

C1504

STANDARD ELECTRICAL DATA	
Nominal resistance	10 kΩ
Resistance tolerance (Rn) at 20°C	± 10 %
Linearity centred on the EET	±0.25% (See diagram)
linearity on remaining travel	±1%
Insulation resistance	> 100 MΩ
Withstand voltage (50 Hz - 1 mn)	100 V
Wiper current	≤ 1 mA
Power rating	0.2 W

Linearity diagram



MECHANICAL CHARACTERISTICS	
Effective electrical travel (EET)	Up to ±70°
Total electrical travel (TET)	±75°
Mechanical travel (MT)	±180°
Operating speed	≤ 600 rpm
Starting torque	≤ 10^{-3} N.m
Weight (without wires)	≤ 10 g

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (°)	Shaft length (Ls)	Option* in code	RoHS compliance
C1504	•••	•	•••	•••	••	•
	470	Z	020	115	00	W
	to	to	to	TBD	01	N
	10M	F	170		02	
					...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**020**: 20° **170**: 170° etc.	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

C9405

SINGLE ELEMENT ROTARY - SIZE 05
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The **C9405** conductive polymer potentiometer is manufactured and tested according to **NF C 93255** and **MIL PRF 39023** standards.

The housing is made of aluminum, stainless steel shaft and precious metal wipers.

C9405 terminals are brass soldering pins, located on the rear of housing. These terminals can be replaced with AWG 30 flexible wires, 250 mm length.

High Performances

High temperature up to +125°C

Low profile

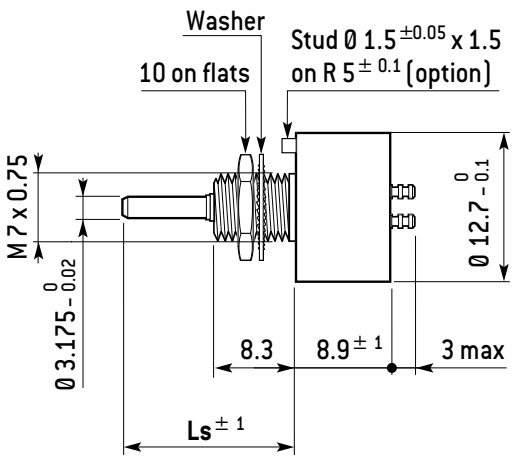
ENVIRONMENTAL DATA	
Operating temperature • Bearing	–25°C to +85°C
• Ball bearing	–55°C to +125°C
Sealing	IP50

OPTIONS	Bushing mounting	Servo mounting
Shaft Ø 3,175 different length	•	•
Antirotation stud	•	
Mech. stops 330° and positioning	•	
Medium tap	•	•
Sealed shaft (IP 54)	•	
Sealed mounting (IP 68)	•	

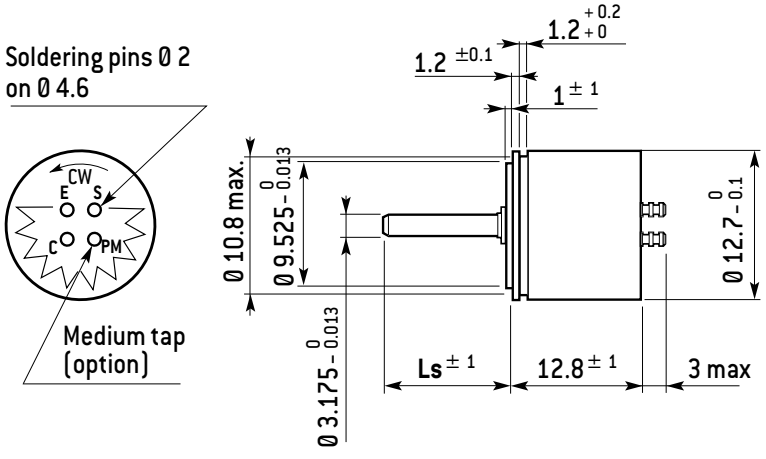
For other specifications, please contact us

DIMENSIONS (in mm)

C9405 B Model - Bushing mounting



C9405 S Model - Servo mounting



SINGLE ELEMENT ROTARY - SIZE 05

PRECISION POTENTIOMETER

C9405

STANDARD ELECTRICAL DATA	
Nominal resistance	10 kΩ
Resistance tolerance (Rn) at 20°C	± 10 %
Independent Linearity	±0.5 %
Maximal dissipation at 70°C	0.5 W
Temperature cœfficient	$-200^{\pm 200} \times 10^{-6}$/°C
Wiper current	≤ 1 mA
Insulation resistance at 500 V	≥ 1 000 MΩ
Withstand voltage (50 Hz, 1 mn)	500 V
Ratio residual voltage/applied voltage	≤ 0,5 %

MECHANICAL CHARACTERISTICS	
Size	05
Housing diameter	12.7 mm max.
Effective electrical travel	Up to $330^{\circ \pm 3}$
Starting torque • Bearings • Ball bearings	≤ 5 x 10^{-3} N.m ≤ 10^{-3} N.m
Torque on bushing	≤ 1 N.m
Approximate mass	≤ 10 g
Lifetime • Bearings • Ball bearings	10 x 10^6 tr 50 x 10^6 tr
Rotation speed	≤ 600 tr/mn

HOW TO ORDER

	Mounting	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (°)	Shaft length (Ls)	Option* in code	RoHS compliance
C9405	•	•••	•	•••	•••	••	•
	B	470	Z	020	125	00	W
	S	to	to	to	TBD	01	N
		10M	F	340		02	
						...	
	B: Bushing **S**: Servo	**470**: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**020**: 20° **340**: 340° etc.	**125**: 12.5 mm Standard **TBD**: To Be Defined by the customer	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

C9209

SINGLE ELEMENT ROTARY - SIZE 09
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The **C9209** plastic potentiometer is manufactured and tested according to **NF C 93255** and **MIL R 39023** standards.

The housing is made of anodized aluminum, shaft of stainless steel and wipers of precious metal alloy.

C9209 terminals are brass soldering pins, located in the rear of housing. These terminals can also be replaced with AWG 26 flexible wires, 250 mm length.

High Performances

High temperature up to +125°C

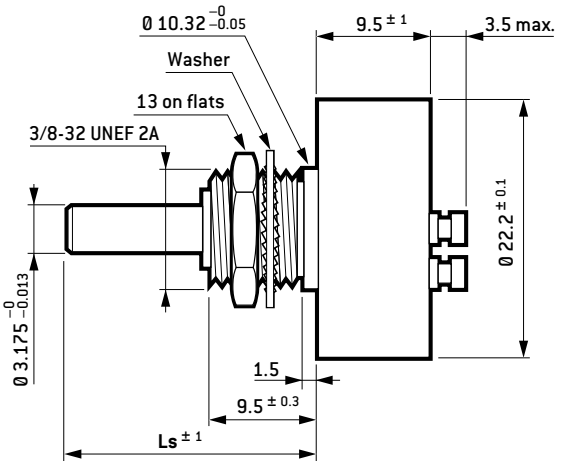
ENVIRONMENTAL DATA	
Operating temperature	–55°C to +125°C
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.

OPTIONS	Bushing mounting		Servo mounting	
	Ball bearings	Bearings	Ball bearings	Bearings
Threaded holes			•	•
Shaft Ø 3.175 - diff. length			•	•
Positioning stud	•	•		
Mechanical stops 340°	•	•		
Medium tap	•	•	•	•
Sealed shaft (IP54)		•		
Sealed mounting (IP68)	•	•		

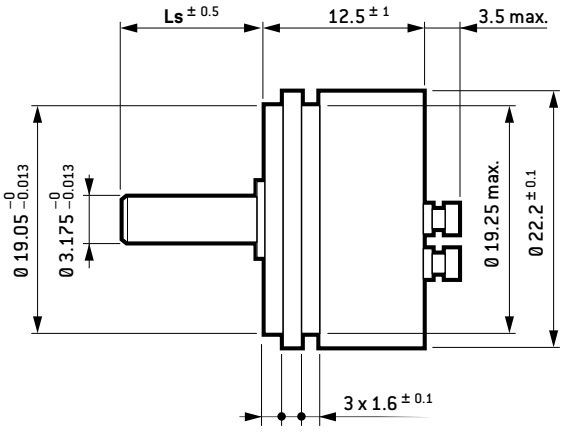
For other specifications, please contact us

DIMENSIONS (in mm)

C9209 B Model - Bushing mounting



C9209 S Model - Servo mounting



SINGLE ELEMENT ROTARY - SIZE 09

PRECISION POTENTIOMETER

C9209

STANDARD ELECTRICAL DATA

Nominal resistance	10 kΩ
Resistance tolerance (Rn) at 20°C	± 20 %
Independent Linearity	±0.5 %
Maximal dissipation at 70°C	1 W
Temperature cœfficient	$-200^{\pm 200}$ x 10^{-6}/°C
Output smoothness	≤ 0,05 %
Wiper current	≤ 1 mA
Insulation resistance at 500 V	≥ 1 000 MΩ
Withstand voltage (50 Hz, 1 mn)	500 V
Ratio residual voltage/applied voltage	≤ 0,5 %

MECHANICAL CHARACTERISTICS

Size	09
Housing diameter	22.3 mm max.
Effective electrical travel	Up to $340^{\circ \pm 3}$
Starting torque • Bearings • Ball bearings	≤ 5 x 10^{-3} N.m ≤ 10^{-3} N.m
Torque on stop	≤ 0.5 N.m
Torque on bushing	≤ 2.5 N.m
Approximate mass	13 g
Lifetime	≥ 20 x 10^6 tr
Rotation speed • Bearings • Ball bearings	≤ 150 tr/mn ≤ 600 tr/mn

HOW TO ORDER

	Mounting	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (°)	Shaft length (Ls)	Option* in code	RoHS compliance
C9209	•	•••	•	•••	•••	••	•
	B	470	Z	020	115	00	W
	S	to	to	to	TBD	01	N
		10M	F	340		02	
						...	
	B: Bushing **S**: Servo	**470**: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**020**: 20° **340**: 340° etc.	**115**: 11.5 mm Standard **TBD**: To Be Defined by the customer	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

C1509

PANCAKE - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The rotary potentiometer **C1509** is provided with a bearingless design. This pancake interface, combined with its small size, make the **C1509** particularly adapted to applications such as micro-robotics, avionics or measurement devices.

This model offers a wide range of options: mechanical interface, connections, precision, effective electrical travel...

High Performances

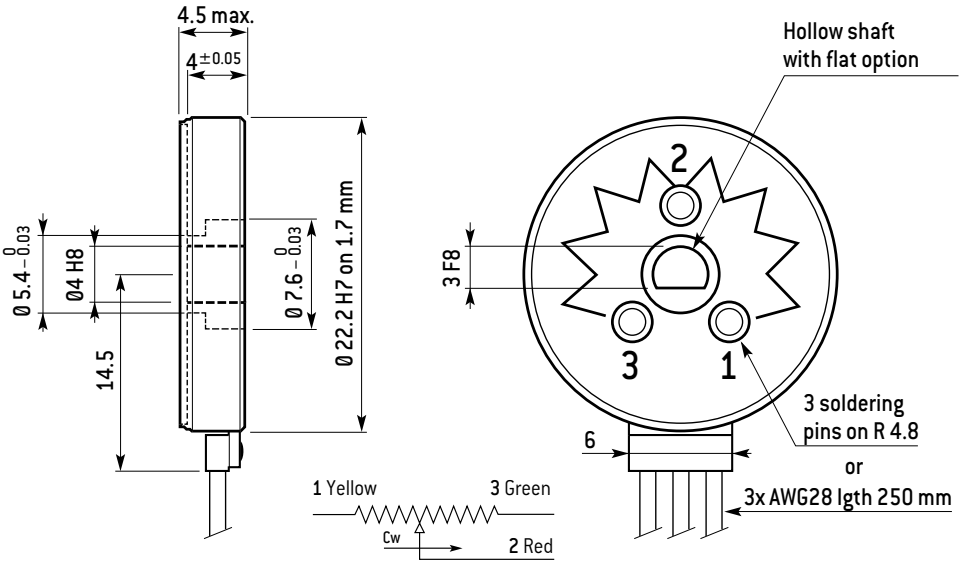
Low profile

ENVIRONMENTAL DATA	
Operating temperature	–55°C to +70°C
Storage temperature	–45°C to +80°C
Vibrations (sine 3 axis, 1.5 mm, 10 @ 2 kHz)	20g
Shocks (1/2 sine, 3 axis, 11 ms)	50 g

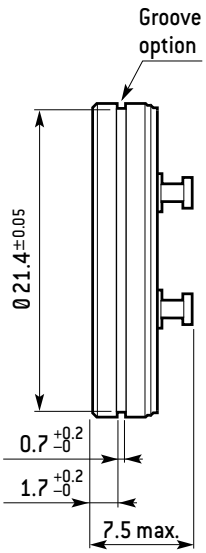
MATERIALS	
Body and shaft	aluminum alloy + anodic oxydation
Bearing	Bearingless (pancake type sensor)

DIMENSIONS (in mm)

Radial wires outlet option



Soldering pin option



PANCAKE - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

C1509

STANDARD ELECTRICAL DATA	
Nominal resistance	5.1 kΩ
Resistance tolerance (Rn) at 20°C	± 10 %
Independent linearity	±0.5 %
Output smoothness	≤ 0.05%
Insulation resistance (500 V_{DC})	> 1 GΩ
Whistand voltage	500 V_{AC} 50 Hz 1 mn
Backlash with 5 V *	≤ 4mv (0.048°) **
Rated dissipation at 70°C	1 W
Wiper current	1 mA max.

* If mounting conditions are respected and not including the mechanical play on the customer installation.
** Tested according to MIL-PRF-39023 except

MECHANICAL CHARACTERISTICS	
Effective electrical travel (EET)	Up to 60°
Mechanical travel (MT)	360°
Starting torque	≤ 0.1 N.cm **
Axial mounting load	5 N max.

** Tested according to MIL-PRF-39023 except

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (°)	Option* in code	RoHS compliance
C1509	•••	•	•••	••	•
	470	Z	020	00	W
	to	to	to	01	N
	10M	F	340	02	
				...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**020**: 20° **340**: 340° etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

C1516

SINGLE TURN - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The rotary potentiometer **C1516** is provided with a bearingless design. This pancake interface, combined with its small size, make the **C1516** particularly adapted to applications such as micro-robotics, avionics or measurement devices.

This model offers a wide range of options: mechanical interface, connections, precision, effective electrical travel...

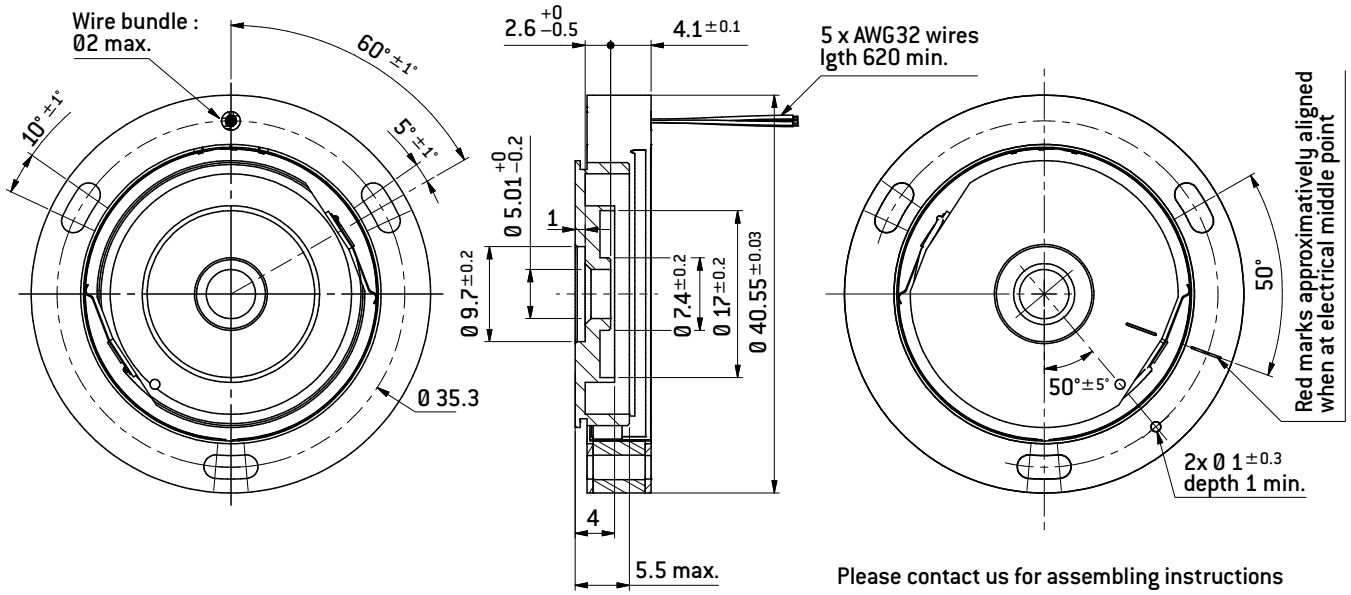
High Performances

Low profile

ENVIRONMENTAL DATA	
Operating temperature	–40°C to +85°C
Storage temperature	–45°C to +85°C
Humidity	5% - 95% (non condensing)
Vibrations (random, 5 @ 2 kHz)	0.01 g²/Hz
Shocks (18 ms, ½ sine)	180 g

MATERIALS	
Structure	Aluminum
Rings	Stainless steel

DIMENSIONS (in mm)



Please contact us for assembling instructions

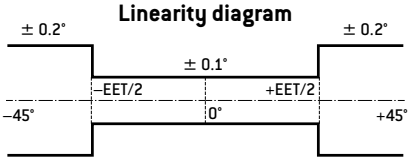
SINGLE TURN - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

C1516

STANDARD ELECTRICAL DATA	
Absolute linearity on EET	See diagram
Voltage gradient on EET	0.2 V/° ±0.2%
Backlash	≤ 0.02°
Power supply	±10 V ±0.02 V
Wiper current	1 mA max.
Insulation resistance (200 V_{DC})	≥ 1 GΩ
Withstand voltage (50 Hz, 1 mn)	200 V_{AC}
Output smoothness	≤0.025%

Linearity diagram



MECHANICAL CHARACTERISTICS	
Effective electrical travel (EET)	Up to ±45° min.
Total electrical travel (TET)	±50° ±1°
Rotating torque	< 0.56 mN.m
Weight	< 15 g

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (°)	Option* in code	RoHS compliance
C1516	•••	•	•••	••	•
	470	Z	020	00	W
	to	to	to	01	N
	10M	F	100	02	
				...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**020**: 20° **100**: 100° etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

M1505

MULTITURN - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The **M1505** precision potentiometer is manufactured and tested according to **NF C 93255** and **MIL PRF 39023** standards.

The housing is made of anodized aluminum and brass/Zn, shaft of stainless steel shaft and precious metal multifinger wipers.

M1505 model is supplied with AWG 26 flexible wires, length 250 mm. It can be equipped with return or extension spring upupon request (see options).

High Performances

High temperature up to +125°C

Miniaturization

ENVIRONMENTAL DATA	
Operating temperature	–45°C to +125°C
Storage temperature	–45°C to +125°C
Sealing	IP 50
Life time	5.10^6 turns

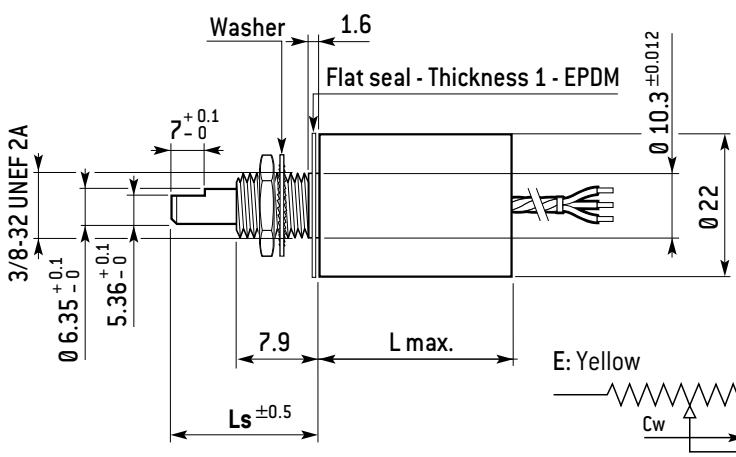
Sealed against Nitrogen (300 mbar) with flat seal.

OPTIONS	
Other electrical travel	•
Other resistance	•
Other Linearity	•

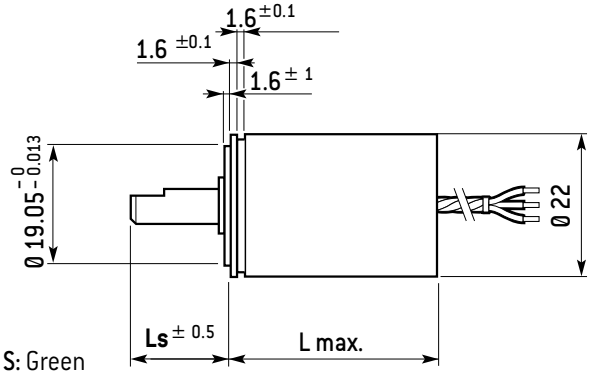
For other specifications, please contact us

DIMENSIONS (in mm)

R1505 B Model - Bushing mounting



R1505 S Model - Servo mounting



MULTITURN - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

M 1505

STANDARD ELECTRICAL DATA	
Nominal resistance	20 kΩ ±20%
Independent Linearity	±0.25 %
Output smoothness	≤ 0.1%
Wiper current	≤ 1 mA
Insulation resistance at 500 V	≥ 1 GΩ
Withstand voltage (50 Hz, 1 mn)	500 V_{AC}
Power rating at 70°C	1 W
Residual voltage	≤ 0.5 %
Supply voltage	0 - 12 V

MECHANICAL CHARACTERISTICS	
Electrical Travel (10 turns)	3600°
Max. torque on end stops	40 N.cm
Mass without wires	< 60 g

HOW TO ORDER

	Mounting	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (°)	Shaft length (Ls)	Option* in code	RoHS compliance
M1505	•	•••	•	•••	•••	••	•
	B	470	Z	3600	125	00	W
	S	to	to		TBD	01	N
		10M	F			02	
						...	
	B: Bushing **S**: Servo	**470**: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**3K6**: 3600° etc.	**125**: 12.5 mm Standard **TBD**: To Be Defined by the customer	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

R9503

RECTILINEAR - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The **R9503** precision potentiometer is manufactured and tested according to **NF C 93255** and **MIL PRF 39023** standards.

The housing is made of anodized aluminum, shaft of stainless steel and wipers of precious metal.

R9503 model is supplied with AWG 28 flexible wires, length 200 mm.

High Performances

High temperature up to +125°C

Miniaturization

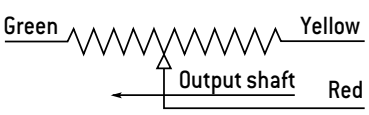
ENVIRONMENTAL DATA	
Operating temperature	–25°C to +125°C
Sealing	IP 50

RESISTANCE (Ω)	ELECTRICAL TRAVEL (mm)		
	10	25	50
1 000	•	•	
2 200	•	•	•
4 700	•	•	•
10 000	•	•	•
L max.	Electrical Travel +28 mm		

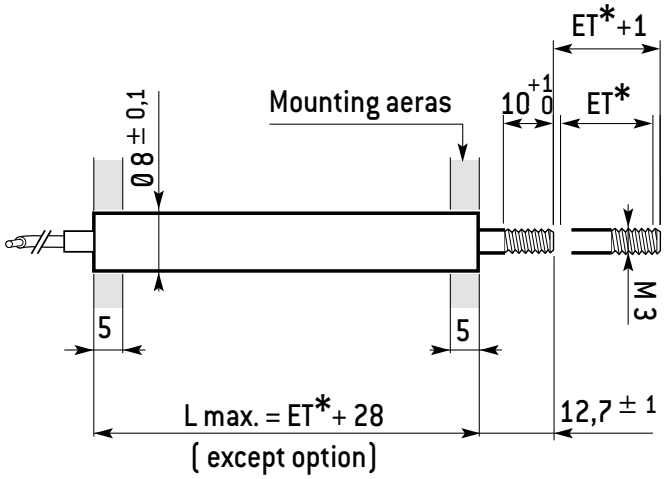
OPTIONS	
Other electrical travel	•
Other resistance	•
Other Linearity	•
4 poles connector output	•

For other specifications, please contact us

DIMENSIONS (in mm)



ET* : See table Electrical Travel



RECTILINEAR - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

R9503

STANDARD ELECTRICAL DATA	
Nominal resistance	4.7 kΩ
Resistance tolerance (Rn) at 20°C	± 10 %
Independent Linearity	±0.5 %
Maximal dissipation at 70°C	0.05 W
Temperature cœfficient	$-200^{\pm 200}$ x 10^{-6}/°C
Output smoothness	≤ 0.1%
Wiper current	≤ 1 mA
Insulation resistance at 500 V	≥ 1 000 MΩ
Withstand voltage (50 Hz, 1 mn)	500 V
Ratio residual voltage/applied voltage	≤ 0,5 %

MECHANICAL CHARACTERISTICS	
Housing diameter	8.1 mm max.
Effective electrical travel (ET)	See table
Starting force	< 0.5 N
Mass	According to ET and options
Lifetime (travels)	> 25 x 10^6
Displacement speed	≤ 1 m/s

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (mm)	Option* in code	RoHS compliance
R9503	•••	•	•••	••	•
	470	Z	010	00	W
	to	to	to	01	N
	10M	F	050	02	
				...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**010**: 10 mm **050**: 50 mm etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

R1504

RECTILINEAR - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The **R1504** precision potentiometer is manufactured and tested according to **NF C 93255** and **MIL PRF 39023** standards.

The housing is made of anodized aluminum, stainless steel shaft and precious metal wipers.

R1504 model is supplied with 3 x AWG 26 shielding wires, length 400 mm min. (60 mm min. from sleeve).

Dedicated to defense applications : weapons, etc.

Shocks/Vibrations resist

High Performances

High temperature up to +125°C

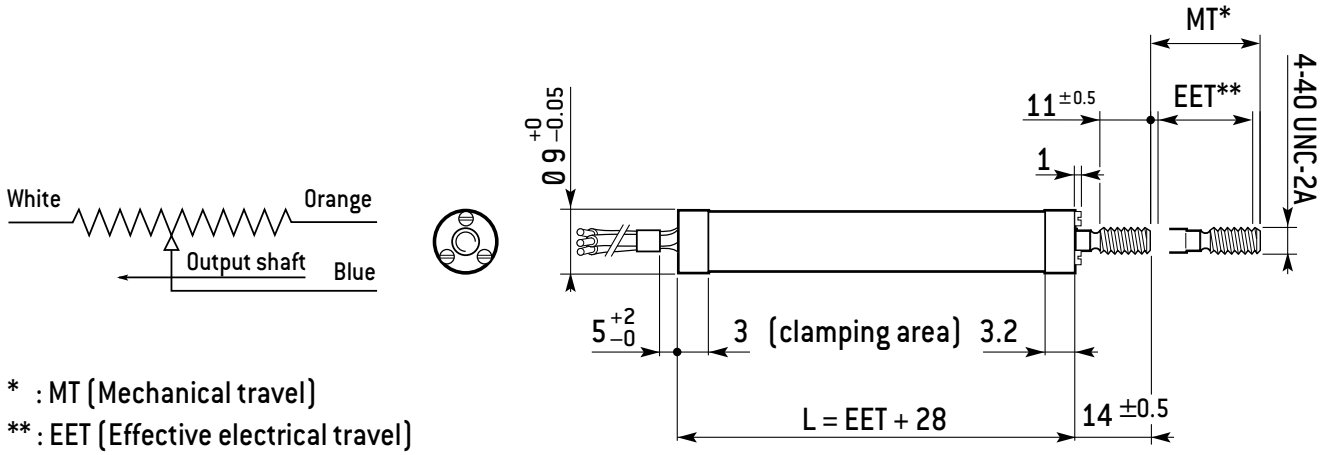
Low profile

ENVIRONMENTAL DATA	
Operating temperature	–45°C to +125°C
Storage temperature	–45°C to +125°C
Sealing	IP50
Vibrations (sinus 3 axis, 1.5 mm)	20 g (10 @ 500 Hz)
Shocks (3 axis, 11ms, 1/2 sinus)	50 g

OPTIONS	
Other electrical travel	•
Other resistance	•
Other Linearity	•

For other specifications, please contact us

DIMENSIONS (in mm)



* : MT (Mechanical travel)
** : EET (Effective electrical travel)

RECTILINEAR - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

R1504

STANDARD ELECTRICAL DATA	
Nominal resistance	10 kΩ
Resistance tolerance (Rn) at 20°C	± 10 %
Independent Linearity on EET	≤ ±0.1 %
Output smoothness	≤ 0.1%
Max. wiper current	≤ 1 mA
Insulation resistance at 500 V	> 1 GΩ
Withstand voltage (50 Hz, 1 mn)	500 V_{AC}
Wires (acc. to M27500-26SB3T23)	3 x AWG26, lgth 400 mm min.

MECHANICAL CHARACTERISTICS	
Effective electrical travel (EET)	Up to 150 mm
Total electrical travel (TET)	TET = EET + 2 mm
Mechanical travel (MT)	MT = EET + 3 mm
Starting force	< 0.5 N
Maximum speed	≤ 1 m/s
Max shaft angular play *	± 0.3°
Maximum clamping force	10 N
Lifetime	> 25 x 10^6 cycles

* Max angular play to be respected by the customer at the installation

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (mm)	Option* in code	RoHS compliance
R1504	•••	•	•••	••	•
	470	Z	10	00	W
	to	to	to	01	N
	10M	F	150	02	
				...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**10**: 10 mm **150**: 150 mm etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

R1604

RECTILINEAR - WIREWOUND
PRECISION POTENTIOMETER

Wirewound Technology

PRESENTATION

The **R1604** precision potentiometer is manufactured and tested according to **NF C 93255** and **MIL PRF 39023** standards.

The housing is made of anodized aluminum, stainless steel shaft and precious metal wipers.

R1604 model is supplied with 3 x AWG 26 shielding wires, length 305 mm min. (60 mm min. from sleeve).

Dedicated to Oil & Gas market.

High Performances

High temperature up to +150°C

Low profile

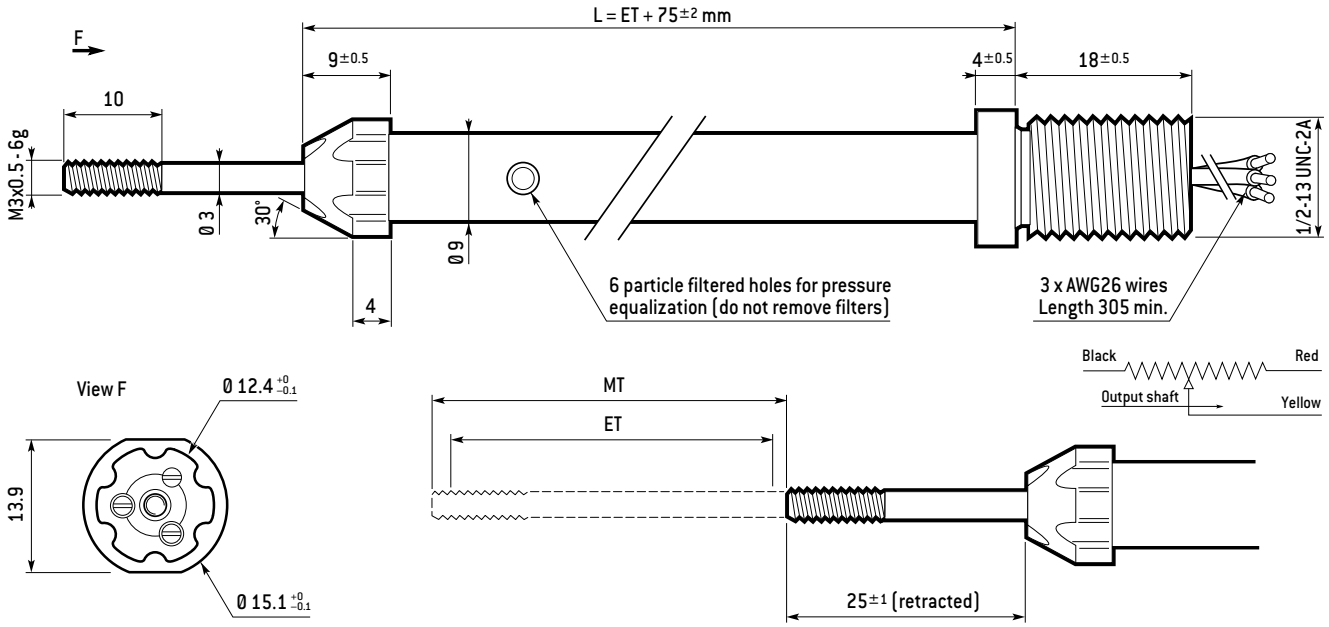
ENVIRONMENTAL DATA	
Operating temperature	–40°C to +150°C
Storage temperature	–55°C to +75°C

In NYCO FH4720 oil or equivalent, hydrostatic pressure 30 kPsi.
Comment: temperature (+150°C) and pressure effects (30 kPsi) are linked.

OPTIONS	
Other electrical travel	•
Other resistance	•
Other Linearity	•

For other specifications, please contact us

DIMENSIONS (in mm)



RECTILINEAR - WIREWOUND

PRECISION POTENTIOMETER

R1604

STANDARD ELECTRICAL DATA	
Nominal resistance	20.6 kΩ
Resistance tolerance (Rn) at 20°C	± 5 %
Independent Linearity	± 0.5 %
Insulation resistance (100 V_{DC})	≥ 100 MΩ
Dielectric strength (50 Hz - 1 mn)	500 V
Insulation resistance at 500 V	> 1 GΩ
Max. dissipation in oil at +150 °C	0.2 W
Wiper current	1 mA max.

MECHANICAL CHARACTERISTICS	
Mechanical operating stroke (MT)	MT = ET + 5mm
Electrical travel (ET)	From 100 mm to 525$^{\pm 1}$ mm
Max. operating speed	50 mm/s
Max. radial force retracted	1 N
Max. force on end stops	10 N
Max. strength on wires	10 N
Maximum clamping force	10 N
Lifetime (10 mm/s) at 25°C	1 x 10^6 cycles

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (mm)	Option* in code	RoHS compliance
R1604	•••	•	•••	••	•
	470	Z	100	00	W
	to	to	to	01	N
	10M	F	525	02	
				...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**100**: 100 mm **525**: 525 mm etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

R9405

RECTILINEAR - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The **R9405** precision potentiometer is manufactured and tested according to **NF C 93255** and **MIL PRF 39023** standards.

The housing is made of anodized aluminum or inox, stainless steel shaft and precious metal wipers. **R 9405** model is supplied with AWG 26 flexible wires, length 400 mm. It can be equipped with return or extension spring upupon request (see options).

Shocks/Vibrations resist

High Performances

High temperature up to +125°C

High IP Class up to IP68

ENVIRONMENTAL DATA	
Operating temperature	–55°C to +125°C
Sealing	IP 50

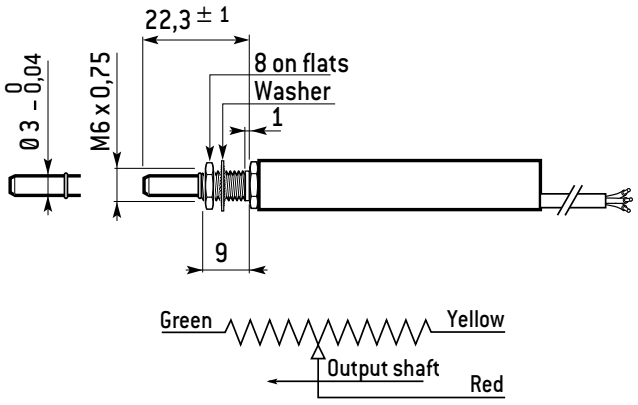
RESISTANCE (Ω)	ELECTRICAL TRAVEL (mm)				
	10	25	50	75	100
1 000	•	•			
2 200	•	•	•		
4 700	•	•	•	•	•
10 000	•	•	•	•	•
L max.	Electrical Travel + 42 mm				

OPTIONS	Bushing	Servo
Other electrical travel	•	•
Other resistance	•	•
Other Linearity	•	•
Medium tap	•	•
Integrated output 4-20 mA	•	•
Output cable gland + cable	•	•
Output 4 poles M 12 locking plug	•	•
IP68	•	•
Return or extension spring	•	•

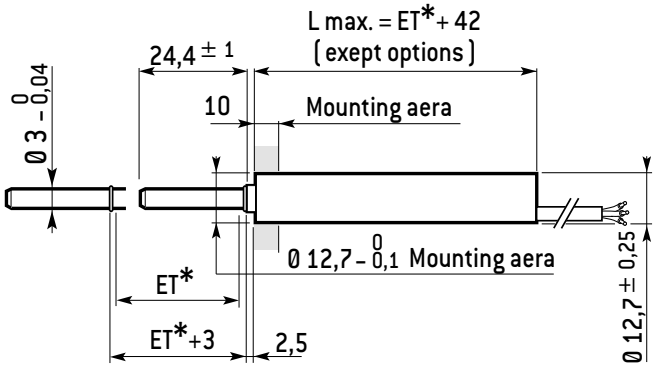
For other specifications, please contact us

DIMENSIONS (in mm)

R9405 B Model - Bushing mounting



R9405 S Model - Servo mounting



*ET : See table Electrical Travel

RECTILINEAR - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

R9405

STANDARD ELECTRICAL DATA	
Nominal resistance	4.7 kΩ
Resistance tolerance (Rn) at 20°C	± 10 %
Independent Linearity	±0.5 %
Maximal dissipation at 70°C	0.05 W
Temperature cœfficient	$-200^{\pm 200}$ x 10^{-6}/°C
Output smoothness	≤ 0.1%
Wiper current	≤ 1 mA
Insulation resistance at 500 V	≥ 1 000 MΩ
Withstand voltage (50 Hz, 1 mn)	500 V
Ratio residual voltage/applied voltage	≤ 0,5 %

MECHANICAL CHARACTERISTICS	
Housing diameter	12.95 mm max.
Effective electrical travel (ET)	See table
Starting force	< 0.5 N
Torque on bushing	≤ 2,5 N.m
Mass	According to ET and options
Lifetime (travels)	> 25 x 10^6
Displacement speed	≤ 1 m/s
Vibrations	20 g, 1.5 mm, 10 Hz to 500 Hz
Shocks	50 g, 1/2 sine, 11 ms.

HOW TO ORDER

	Mounting	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (mm)	Option* in code	RoHS compliance
R9405	•	•••	•	•••	••	•
	B	470	Z	010	00	W
	S	to	to	to	01	N
		10M	F	100	02	
					...	
	B: Bushing **S**: Servo	**470**: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**010**: 10 mm **100**: 100 mm etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

R9306

RECTILINEAR - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The **R9306** precision potentiometer is manufactured and tested according to **NF C 93255** and **MIL PRF 39023** standards.

The housing is made of anodized aluminum or inox, stainless steel shaft and precious metal wipers. **R9306** model is supplied with AWG 26 flexible wires, length 400 mm. It can be equipped with return or extension spring upupon request (see options).

High Performances

High temperature up to +125°C

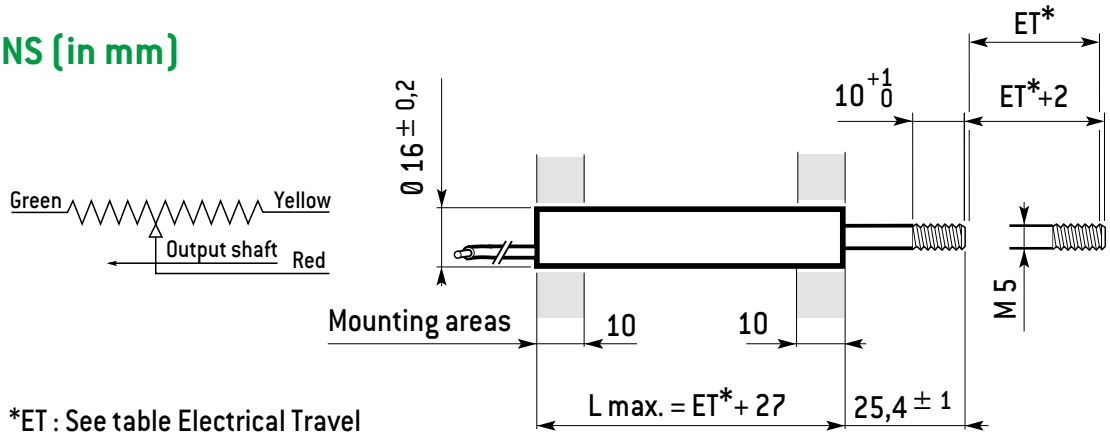
ENVIRONMENTAL DATA	
Operating temperature	–55°C to +125°C
Sealing	IP 50

RESISTANCE (Ω)	ELECTRICAL TRAVEL (mm)				
	100	200	250	300	350
4 700	•				
10 000	•	•	•		
22 000		•	•	•	•
L max.	Electrical Travel + 27 mm				

OPTIONS	
Other electrical travel	•
Other resistance	•
Other Linearity	•
Medium tap	•
Return or extension spring	•

For other specifications, please contact us

DIMENSIONS (in mm)



*ET : See table Electrical Travel

RECTILINEAR - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

R9306

STANDARD ELECTRICAL DATA	
Nominal resistance	4.7 kΩ
Resistance tolerance (Rn) at 20°C	± 10 %
Independent Linearity	±0.5 %
Maximal dissipation at 70°C	0.05 W
Temperature cœfficient	$-200^{\pm 200}$ x 10^{-6}/°C
Output smoothness	≤ 0.1%
Wiper current	≤ 1 mA
Insulation resistance at 500 V	≥ 1 000 MΩ
Withstand voltage (50 Hz, 1 mn)	500 V
Ratio residual voltage/applied voltage	≤ 0,5 %

MECHANICAL CHARACTERISTICS	
Housing diameter	16.2 mm max.
Effective electrical travel (ET)	See table
Starting force	< 2 N
Mass	According to ET and options
Lifetime (travels)	> 25 x 10^6
Displacement speed	≤ 1 m/s

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (mm)	Option* in code	RoHS compliance
R9306	•••	•	•••	••	•
	470	Z	100	00	W
	to	to	to	01	N
	10M	F	350	02	
				...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**100**: 100 mm **350**: 350 mm etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

R9209

RECTILINEAR - CONDUCTIVE POLYMER
PRECISION POTENTIOMETER

Conductive Polymer

PRESENTATION

The **R9209** precision potentiometer is manufactured and tested according to **NF C 93255** and **MIL PRF 39023** standards.

The housing is made of anodized aluminum and brass/Zn, stainless steel shaft and precious metal multifinger wipers.

R9209 model is supplied with AWG 26 flexible wires, length 250 mm. It can be equipped either return or extension spring upon request (see options).

High Performances

High temperature up to +125°C

ENVIRONMENTAL DATA	
Operating temperature	–55°C to +125°C
Vibrations	20 g, 1.5 mm, 10 Hz to 2 kHz
Shocks	50 g, ½ sine, 11 ms.

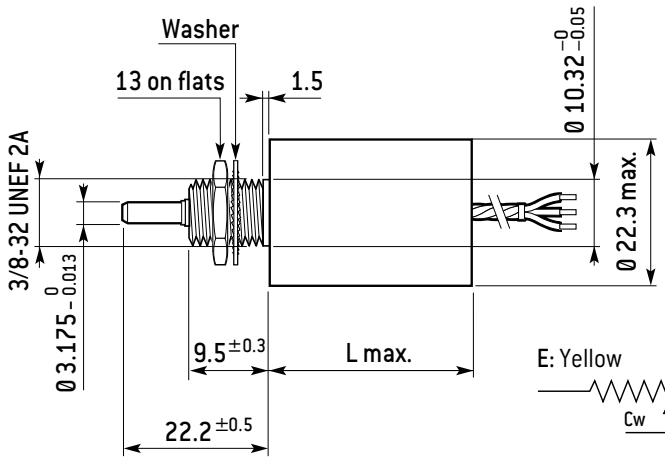
RESISTANCE (Ω)	ELECTRICAL TRAVEL (mm)			
	10	20	50	100
1000	•	•	•	
2200	•	•	•	•
4700	•	•	•	•
10000	•	•	•	•
Bushing L (mm)	33	43	73	123
Servo L (mm)	36	46	76	126

OPTIONS	Bushing	Servo
Threaded holes	•	
Shaft Ø 3,175 - different length	•	•
Sealed shaft (IP54)		•
Medium tap	•	•
Other Resistance	•	•
Other Linearity	•	•
Potentiometer + switch	•	•
Output 4-20 mA 2 wires	•	•
Threaded shaft M 3 x 10	•	•
Other electrical travel	•	•
Ball on shaft's extremity	•	•
Carbide touch head	•	•
Return or extension spring	•	•

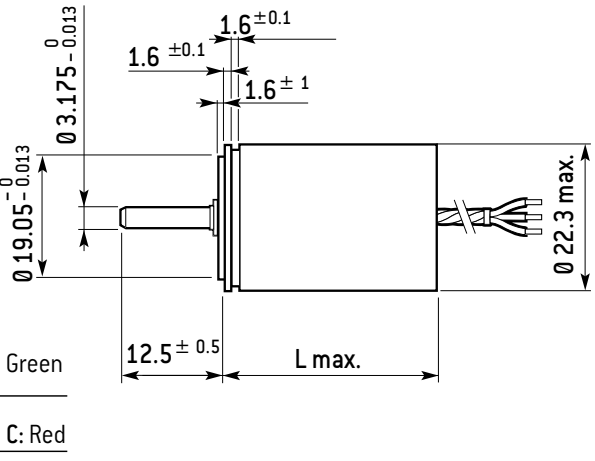
For other specifications, please contact us

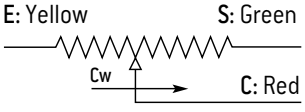
DIMENSIONS (in mm)

R9209 B Model - Bushing mounting



R9209 S Model - Servo mounting





RECTILINEAR - CONDUCTIVE POLYMER

PRECISION POTENTIOMETER

R9209

STANDARD ELECTRICAL DATA	
Nominal resistance	10 kΩ
Resistance tolerance (Rn) at 20°C	± 20 %
Independent Linearity	±1 %
Maximal dissipation at 70°C	0.05 W
Temperature cœfficient	$-200^{\pm 200}$ x 10^{-6}/°C
Output smoothness	≤ 0.1%
Wiper current	≤ 1 mA
Insulation resistance at 500 V	≥ 1 000 MΩ
Withstand voltage (50 Hz, 1 mn)	500 V
Ratio residual voltage/applied voltage	≤ 0,5 %

MECHANICAL CHARACTERISTICS	
Size	09
Housing diameter	22.3 mm max.
Starting force	≤ 2 N
Torque on bushing	≤ 2.5 N.m
Torque on bushing	≤ 1 N.m
Number of elements	2 max.
Lifetime (travels)	≥ 10 x 10^6
Displacement speed	≤ 1 m/s

HOW TO ORDER

	Mounting	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (mm)	Option* in code	RoHS compliance
R9405	•	•••	•	•••	••	•
	B	470	Z	010	00	W
	S	to	to	to	01	N
		10M	F	100	02	
					...	
	B: Bushing **S**: Servo	**470**: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**010**: 10 mm **100**: 100 mm etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

R1505

RECTILINEAR - WIREWOUND
PRECISION POTENTIOMETER

Wirewound Technology

PRESENTATION

The housing of **R1505** precision potentiometer is made of anodized aluminum, stainless steel shaft and precious metal wipers.

R1505 model is supplied with 3 x AWG 26 shielding wires, length 305 mm min. (60 mm min. from sleeve).

Dedicated to Oil & Gas market.

High Performances

High temperature up to +260°C

Low profile

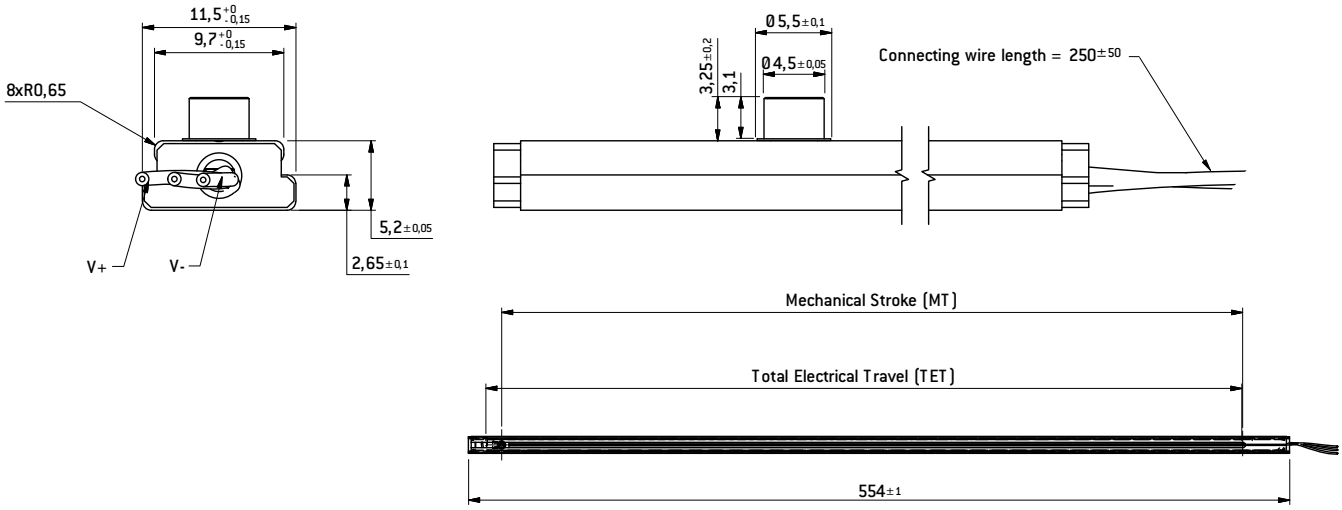
ENVIRONMENTAL DATA	
Operating temperature	–40°C to +260°C
Storage temperature	–55°C to +75°C
Sealing	IP00

In NYCO FH4720 oil or equivalent, hydrostatic pressure 30 kPsi.

OPTIONS	
Other electrical travel	•
Other resistance	•
Other Linearity	•

For other specifications, please contact us

DIMENSIONS (in mm)



RECTILINEAR - WIREWOUND

PRECISION POTENTIOMETER

R1505

STANDARD ELECTRICAL DATA	
Nominal resistance	20.6 kΩ
Resistance tolerance (Rn) at 20°C	± 5 %
Independent Linearity	± 0.5 %
Insulation resistance (100 V_{DC})	≥ 100 MΩ
Dielectric strength (50 Hz - 1 mn)	500 V
Insulation resistance at 500 V	> 1 GΩ
Max. dissipation in oil at +150 °C	0.2 W
Wiper current	1 mA max.

MECHANICAL CHARACTERISTICS	
Mechanical operating stroke (MT)	MT = ET + 5mm
Electrical travel (ET)	From 100 mm to 525$^{\pm 1}$ mm
Max. operating speed	50 mm/s
Max. radial force retracted	1 N
Max. force on end stops	10 N
Max. strength on wires	10 N
Maximum clamping force	10 N
Lifetime (10 mm/s) at 25°C	1 x 10^6 cycles

HOW TO ORDER

	Nominal resistance (in code)	Linearity in code (±%)	Electrical travel (mm)	Option* in code	RoHS compliance
R1505	•••	•	•••	••	•
	470	Z	100	00	W
	to	to	to	01	N
	10M	F	525	02	
				...	
	470: 470 Ω **1K0**: 1 000 Ω **4K7**: 4 700 Ω **10M**: 10 MΩ etc.	**Z**: ±0.025% **A**: ±0.05% **B**: ±0.1% **C**: ±0.25% **D**: ±0.5% **F**: ±1%	**100**: 100 mm **525**: 525 mm etc.	**00**: No option **01**: Option 1 **02**: Option 2 etc.	**W**: RoHS compliant **N**: Non compliant

* For options, please contact us.

Slip rings & Rotary Joints general informations

Slip rings and Rotary joints enable signals and/or power to be transmitted from a fixed part (stator) to a mobile part (rotor).

The Electromechanical Solutions Strategic Business Unit at **EXXELIA** GROUP constantly endeavors to raise performance levels through innovation, and develops high-frequency contact Slip rings (>1 GHz), offering signal transmission capability for new video formats such as HD SDI and 3G SDI and Gigabit Ethernet.

Applications:
Aeronautics, Defense, Oil exploration, Medical, Space, Telecommunications

SLIP RINGS

Slip rings transmit information via electric contacts (brushes rubbing against tracks). For over 40 years, the CSA Business Unit at **EXXELIA** GROUP has developed a wide range of Slip rings available in different versions:

- standard interface,
- hollow shaft interface,
- pancake (monobloc rotor and stator without bearings, rotor guidance being left to the customer),
- rotor and stator sold separately.

EXXELIA GROUP Slip rings can be equipped with different type of position sensors made-in-house (optical encoders, magnetic encoders and precision potentiometric, etc.) to copy positions.

These products can be used in a wide range of applications, from robotic equipment to on-board equipment for civil and military aircraft electronics, armored vehicles, automatic weapon stations, radars, Electro Optronic Systems assemblies, space and exploration instruments used in the Oil and Gas sector.

Applications:
Aeronautics, Defense, Telecommunications, Space, Oil exploration.

EXXELIA GROUP offers a wide range of standard Slip rings. Most of these products are qualidfied and proven solutions in the field of defense, Aeronautics, Space, Railway, Medical, Oil exploration...

EXXELIA GROUP standard Slip rings can be divided in four categories:

- Compact standard Slip ring,
- Small standard Slip ring,
- Wide standard Slip ring,
- Very wide standard Slip ring.

HIGH FREQUENCY ROTARY JOINTS

EXXELIA GROUP also designs and manufactures High Frequency rotary joints (for frequencies > 1 GHz).

These rotary joints can be:

- Coaxial High frequency Rotary Joints.
- IFF Rotary Joint (Identification Friend / Foe).

STANDARD

Slip rings

COMPACT DIMENSION

External diameter = 20 mm.
Up to 125 channels.
Slip ring mainly designed for signal channels.
Possibility to have power channels up to 10 A.
HD-SDI / 3G-SDI compatible.
Ethernet up to 1000Base-T

Applications: Aeronautics, Defense (Electro Optical Systems), Telecommunications, Space...

SMALL DIMENSION

External diameter = 50 mm.
Up to 150 channels.
Slip ring designed for signal & power channels.
Qualified for the transmission of Gigabit Ethernet 1000Base-T.
Hollow shaft option (Ø int. 16 mm).
Possibility to integrate a Fiber Optical Rotary Joint (FORJ).

Applications: Aeronautics, Defense (Electro Optical Systems), Telecommunications, Space, ...

MEDIUM DIMENSION

External diameter = 100 mm.
Slip ring designed according to a modular design technology. Possibility to increase the number of channels without any additional length (very compact solution).

Concentric modules: possibility to integrate inside a small standard module with an Optical Fiber Optical Rotary Joint (FORJ) or a compact module.

Compatible HD-SDI and Gigabit Ethernet 1000Base-T.
Hollow shaft option (Ø int. 50 mm).
Slip ring can be equipped with an optical encoder, a magnetic encoder or a precision potentiometer, a rotary switch, etc.

Applications: Aeronautics, Defense (Electro Optical Systems), Telecommunications, Space, Medical, Transportation...

Slip rings

STANDARD

LARGE DIMENSION

External diameterup to 1200 mm.

Slip ring designed according to a modular design technology possibility to increase the number of channels without any additional length (solution very compact).

Slip ring can be equipped with an optical encoder, a magnetic encoder or a precision potentiometer, a rotary switch, ...

Applications: Aeronautic, Defense (Electro Optical Systems), Telecommunications, Space, Medical, Transportation...

HIGH POWER SLIP RINGS

EXXELIA GROUP designs and manufactures High Power Slip rings based on a long heritage list.

EXXELIA GROUP Slip ring handles high electrical power up to 2000 Amp. and up to 10 kV.

Depending on the application and the requested parameters like running torque, temperature and current, brushes may be made of carbon silver in precious metal alloy.

Applications: Defense (Radars, Turrets...), Naval (Sonar winch) and Industry.

SPECIFIC

Slip rings

SLIP RINGS FOR SPACE USE

EXXELIA GROUP is qualified on a very important number of flight applications (there are a lot of satellites equipped with **EXXELIA** GROUP Slip ring).

All the spatial Slip rings are bearingless to fit the customer's interface which provide weight saving.

They are manufactured in a clean room by respecting the state of the art of the space applications manufacturing.

Applications: SADM (Solar Array Drive Mechanism System) + Rotary actuators.

HOLLOW SHAFT SLIP RING

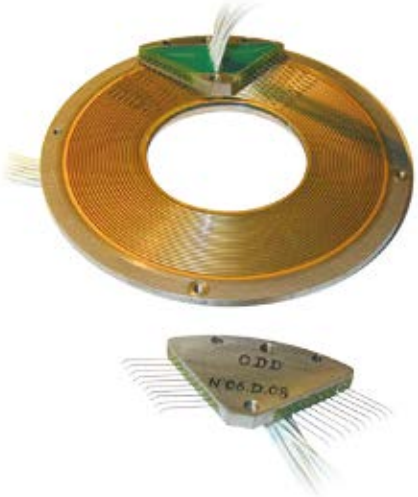
A Hollow Shaft Slip ring (sometimes called through bore) is a Slip ring with a bore through the centre of the slip ring module. The bore enables the slip ring to be mounted on a shaft, offering space for hydraulics, pneumatics (Rotary Union) or integration of an Fibber Optical Rotary Joint (FORJ)

Applications: Aeronautics, Defense (Electro Optical Systems), Telecommunications, Space, Medical, Transportation...

PANCAKE

A Pancake Slip ring is a Slip ring adapted to designs with limited vertical space and no bearing (alignment of the Rotor / Stator must be performed by the customer)..

Applications: Aeronautics, Defense (Electro Optical Systems), Telecommunications, Space, Medical, Transportation...



Slip rings

SPECIFIC

HIGH RPM

EXXELIA GROUP designs and manufactures High speed Slip rings based on a long and rich experience. This experience has been acquired by the development and the manufacturing of Slip Rings for helicopter test flight equipment. These types of Slip rings use a specific patented system called Multi fingers brushes. The advantage of the multi finger system is to limit the noise and the wear while providing high speed capabilities.

Features:
Speeds up to 6.000 rpm,
Signals, power, high data rates (Ethernet, HD SDI Video signals...),
Possibility to have Slip rings equipped with **EXXELIA** GROUP position sensors (Optical encoders, Magnetic Position sensors.

Applications: Aeronautical (Helicopters), Defense (Test benches for missiles), Industry...

HIGH TEMPERATURE/ HIGH PRESSURE

EXXELIA GROUP can propose Slip rings for the field of oil and Gas exploration. Oil & Gas exploration is a sector where the operating conditions are very severe. These harsh conditions can be easily supported without any problem by the **EXXELIA** GROUP Slip rings (High Temperature +200°C, High pressures 200 bars, shocks 100g).

Applications: Oil & gas exploration.

LARGE DENSITY CHANNELS

EXXELIA GROUP can propose Slip rings with any number of channels (> 400 channels) and whatever the application. Outputs can be with flying leads and / or with connectors which can be filtered by **EXXELIA** GROUP's filters.

Applications: Aeronautical, Defense, Industry...

STANDARD
ROTARY JOINTS

ROJO Series

COAXIAL HIGH FREQUENCY ROTARY JOINTS

EXXELIA GROUP designs and manufactures coaxial High Frequency rotary joints (for frequencies > 1 GHz).

These rotary joints use contact technology.

EXXELIA GROUP can propose coaxial rotary joints adapted in impedance 50Ω or 75Ω which allows to have a bandwidth > 3 GHz (DC / > 3 GHz).

The coaxial rotary joints 75Ω allows the transmission of video signals under the format 3G SDI (Norm SMPTE 424M).

Applications: Aeronautics, Defense (Electro Optical Systems), Telecommunications, Space, Medical, ...

L-BAND ROTARY JOINTS

EXXELIA GROUP designs and manufactures L-BAND High Frequency rotary joints for a bandwidth closed to 1 GHz.

These L-BAND High Frequency rotary joints use a contactless technology. They are multi-channels.

They can be integrated in a wide range of products and can be integrated inside the **EXXELIA** GROUP Slip rings.

One of their biggest interests is to be very compact and light compared to their bandwidth and their performances.

Applications: Aeronautics, Defense (Electro Optical Systems), Telecommunications, Space, Medical, Transportation...

Hybrid Systems

SPECIFIC

SERVO MOTORS

EXXELIA GROUP can design and manufacture very specific electrical motors equipped with its own position sensors (Optical encoder, Magnetic position sensors, precision potentiometers).

Most of these products are used on missiles for different applications: missile fin actuator or missile seeker.

Applications: Defense (seeker, actuator...), Industry...

SLIP RING + FORJ (Fiber Optical Rotary Joint)

When the flow of signals is high, or when the quantity of signals is very important (> 3 Gigabit/s), it can necessary to use optical signals.

EXXELIA GROUP Slip rings can be equipped with FORJ which allows transferring these optical signals (number of optical channels: from 1 up to more than 10 channels).

Applications: Defense (EOS, RCWS, Radar...), Industry...

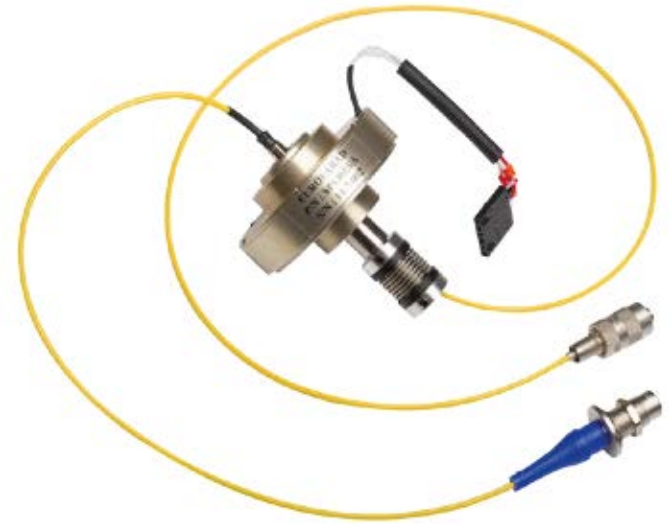
SPECIFIC

Hybrid Systems

ENCODER + FORJ

EXXELIA GROUP's position sensors can be equipped with FORJ (Fiber Optical Rotary Joint). This association allows simultaneously in a low volume the use of a transfer function (transfer of data) with a function of displacement measurement.

Applications: Defense (EOS, RCWS, Radar…), Industry...



HYDRAULIC SLIP RING (ROTARY UNION)

On specific request, **EXXELIA GROUP** can design and manufacture pneumatic or hydraulic transfer functions. This Specific equipment is called a Rotary Union (RU). **EXXELIA GROUP** Rotary Unions have from 1 up to more than 4 channels (for a pressure up to 250 bars). Most of the time, a Rotary Union is a part of a Slip ring.

Applications: Defense (Radar, Turret...), Industry...

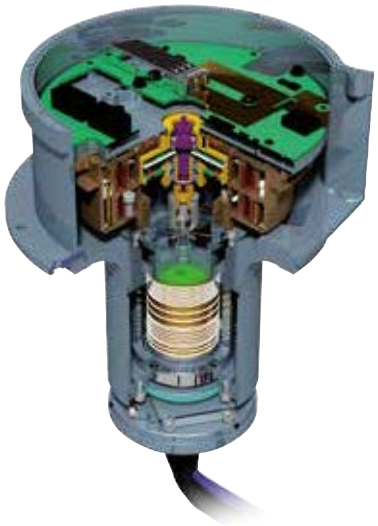
PLUG & PLAY SOLUTIONS

In order to offer the highest integration of the biggest number of functions in the smallest volume, **EXXELIA GROUP** can propose PLUG & PLAY Solutions. These solutions are in fact the possibility to integrate and to combine all together the maximum functions offered by the company.

The interest of such a system is to make it more compact by decreasing the weight and the costs of the global system.

List of functions:

- Slip ring,
- Position sensor: Optical encoder, Magnetic position sensor...
- Fiber Optical Rotary Joint (FORJ) / Rotary Union (RU) / Rotary joint (L-Band),
- Mux/Demux electro optical electronics,
- Flexible coupling.



Customer Request Form

SPECIFIC OPTICAL ENCODER

CUSTOMER INFORMATION

Company name:

Name:

Position:

Address:

Tel.:

E-mail:

Date:

APPLICATION

Program/application:

Project type:

☐ New project

☐ Existing project

☐ Retrofit / replacement

Planning:

☐ ≤ 3 months

☐ ± 6 months

☐ > 1 year

Total quantity estimation:

ENCODER DEFINITION

Encoder type: ☐ Incremental ☐ Absolute | ☐ Single turn ☐ Multi turn ..... turns

Resolution: ..... bits or points

Accuracy: ..... arc min./arc sec.

ELECTRICAL INTERFACE

Power supply: ☐ 5 V_{DC} ± 5% (Standard) ☐ 24 V_{DC} ± 10% **Other:**

Com. protocol: ☐ SSI ☐ FSSI ☐ BiSS **Other:**

Transmission: ☐ RS422 ☐ TTL **Other:**

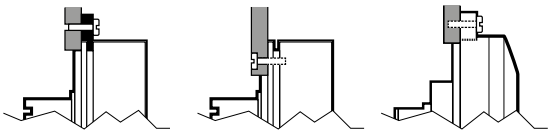
Connection: ☐ Flying lead ☐ Connector **Type:**

MECHANICAL CHARACTERISTICS

Max. dimensions: Length: ..... mm Diameter: ..... mm

DRAWING:

Mounting type: ☐ "Synchro" ☐ "Screw" ☐ "Flange"



Maximum operation speed: ..... RPM

Coupling required: ☐ Yes ☐ No

Housing material:

☐ Aluminum alloy + conversion coating (MIL-STD-5541) (Standard)

☐ Aluminum alloy + black anodic coating (MIL-A-8625)

☐ Stainless steel

☐ Other: .....

ENVIRONMENTAL CONDITIONS

Operating temperature:

☐ –40°C to +85°C ☐ –45°C to +105°C ☐ –55°C to +125°C

Other:

Sealing (CEI 529): ☐ IP51 **Other:**

Other request (Shocks, vibrations, humidity, etc.)**:**

SPECIFIC MAGNETIC ENCODER

Customer Request Form

CUSTOMER INFORMATION

Company name:

Name:

Position:

Address:

Tel.:

E-mail:

Date:

APPLICATION

Program/application:

Project type:
- ☐ New project
- ☐ Existing project
- ☐ Retrofit / replacement

Planning:
- ☐ ≤ 3 months
- ☐ ± 6 months
- ☐ > 1 year

Total quantity estimation:

ENCODER DEFINITION

Encoder type: ☐ Incremental ☐ Absolute ☐ Single turn ☐ Multi turn ..... turns

Resolution: ..... bits or points

Accuracy: ..... arc min./arc sec.

ELECTRICAL INTERFACE

Power supply: ☐ 5 V_{DC} ± 5% (Standard) ☐ 24 V_{DC} ± 10% **Other:**

Com. protocol: ☐ SSI ☐ FSSI ☐ BiSS **Other:**

Transmission: ☐ RS422 ☐ TTL **Other:**

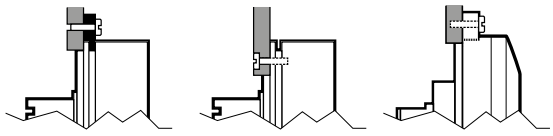
Connection: ☐ Flying lead ☐ Connector **Type:**

MECHANICAL CHARACTERISTICS

Max. dimensions: Length: ..... mm Diameter: ..... mm

DRAWING:

Mounting type: ☐ "Synchro" ☐ "Screw" ☐ "Flange" ☐ "Pancake "



Maximum operation speed: ..... RPM

Coupling required: ☐ Yes ☐ No

Housing material:
- ☐ Aluminum alloy + conversion coating (MIL-STD-5541) (Standard)
- ☐ Aluminum alloy + black anodic coating (MIL-A-8625)
- ☐ Stainless steel
- ☐ Other: .....

ENVIRONMENTAL CONDITIONS

Operating temperature:
☐ –40°C to +85°C ☐ –45°C to +105°C ☐ –55°C to +125°C

Other:

Sealing (CEI 529): ☐ IP51 **Other:**

Other request (Shocks, vibrations, humidity, etc.)**:**

Customer Request Form

SPECIFIC PRECISION POTENTIOMETERS

CUSTOMER INFORMATION

Company name:

Name:

Position:

Address:

Tel.:

E-mail:

Date:

APPLICATION

Program/application:

Project type:

☐ New project

☐ Existing project

☐ Retrofit / replacement

Planning:

☐ ≤ 3 months

☐ ± 6 months

☐ > 1 year

Total quantity estimation:

MECHANICAL CARACTERISTICS

Movement:
(Rotary - multi or single turn, rectilinear)

Maximum Overhaul Dimensions authorized:

Shaft diameter and type for Rotary Sensor:
(Plain shaft or hollow shaft)

Mounting Interface:
(Synchro, Bushing, screws, etc.)

Mechanical Stroke:

Shaft speed:

Starting & Running Torques:

Lifetime (cycles)**:**

ELECTRICAL CHARACTERISTICS

Resistance with tolerance:
(Nominal Resistance)

Effective electrical stroke:

Conformity or Linearity, type and requested value:

Operating Voltage:

Type of electrical connexion:
(Flying leads, connectors, etc.)

ENVIRONMENTAL CONDITIONS

Operating Temperatures:

Storage Temperatures:

Sealing:
(None, water spray, dust, other)

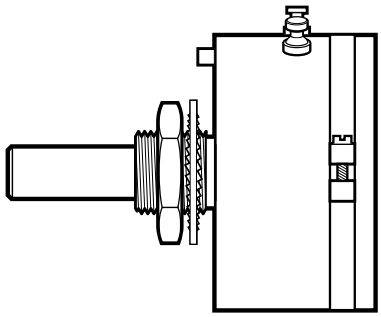
Others:
(Shocks, Vibrations, etc.)

SPECIFIC PRECISION POTENTIOMETERS

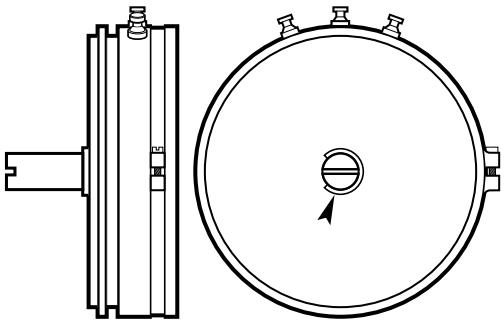
Customer Request Form

STANDARD MOUNTING INTERFACES FOR ROTARY POTENTIOMETERS

Bushing mounting example



Servo mounting example



EXXELIA GROUP POTENTIOMETER INTERFACES

Standard Potentiometers (Rotary or rectilinear):
A standard potentiometer can be either Rotary (multiple or single turn) or Rectilinear.

Hollow Shaft Potentiometer:
A Hollow Shaft Potentiometer is a potentiometer with a bore through the centre of the potentiometer. The bore can enable the potentiometer to be mounted on a shaft.

Separate Elements (Tracks + wipers):
A Separate Element is a potentiometer where the wipers are free, separated of the Potentiometer. The two parts must be fitted by the customer to their system.

Pancake Potentiometer:
A Pancake Potentiometer is a potentiometer in one part where there is no bearing (Alignment of the wipers / tracks must be performed by the customer).

Customer Request Form

SPECIFIC SLIP RINGS

CUSTOMER INFORMATION

Company name:

Name:

Position:

Address:

Tel.:

E-mail:

Date:

APPLICATION

Program/application:

Project type:

☐ New project

☐ Existing project

☐ Retrofit / replacement

Planning:

☐ ≤ 3 months

☐ ± 6 months

☐ > 1 year

Total quantity estimation:

GENERAL INFORMATION

Function of the application and function of the Slip ring:

Option: ☐ Optical encoder ☐ Resolver ☐ Switch ☐ HF Rotary Joint ☐ Fibre Optic Rotary Joint (FORJ) ☐ Hydraulic Rotary Union (HRU)

MECHANICAL CARACTERISTICS

Max. Length: **Max. External Diameter (Øe):** **Max. Internal diameter (Øi):**

Type: (see Slip ring Interfaces here joined) ☐ Standard ☐ Hollow Shaft ☐ separate elements ☐ pancake

Rotation speed:

Vibrations, shocks & acceleration:

Lifetime (cycles)**:**

Slip ring Starting & Running Torques:

ELECTRICAL CHARACTERISTICS

Channel Fonction	Channel Quantity	Current		Working Voltag	Frequency Data rate (*)	Wire gauge Awg	Crosstalk (dB)
		Nominal	Maxi (peak)				

OTHER CARACTERISTICS

Type of electrical output: ☐ Pigtails ☐ Flying leads ☐ Connectors

Specific cables and impedance: ☐ Coax ☐ Twinax ☐ Impedance 50Ω, 75Ω... ☐ To be defined

SPECIFIC SLIP RINGS

Customer Request Form

ENVIRONMENTAL CONDITIONS

Operating Temperatures:

Storage Temperatures:

Sealing:
(None, water sprau, dust, other)

Others:
(Shocks, Vibrations, etc.)

ADDITIONAL CHARACTERISTICS FOR HIGH FREQUENCY ROTARY JOINT (RJ)

Channel Fonction	Bandwith	Average Power	Peak power	VSWR (**)	Insertion loss (dB)	Connector type (WG, coax...)

ADDITIONAL CHARACTERISTICS FOR FIBER OPTIC ROTARY JOINT (FORJ)

Channel Fonction	Optic fiber		Wavelength	Insertion loss
	Monomode	Multimode		

ADDITIONAL CHARACTERISTICS FOR HYDRAULIC ROTARY UNIONS (RU)

Channel Fonction	Channels quantity	Flow rate	Pressure	Type of fluid

(*) If unknown, please, precise protocol or data rate for video channel, please, see “additional information” at the end of this document for ethernet channels, please, precise exactly the type of ethernet (gbit, fast ethernet, ...).

(**) VSWR = Voltage Standard Wave Ratio

Customer Request Form

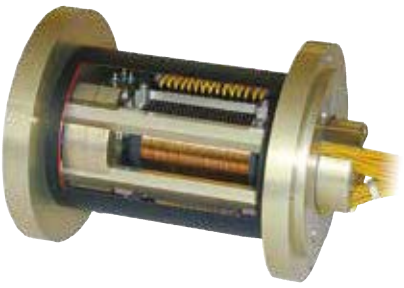
EXXELIA GROUP SLIP RING INTERFACES

Standard Slip ring:
A standard Slip ring is a Slip ring which is not Hollow shaft, separate elements or pancake.

Hollow Shaft Slip:
A Hollow Shaft Slip ring (sometimes called through bore)is a Slip ring with a bore through the centre of the Slip ring module. The bore can enable Slip ring to be mounted on a shaft. It offers space for hydraulics, pneumatics (Rotary Union) or integration of an Fibber Optical Rotary Joint (FORJ).

Separate Elements (Tracks + brush block):
A Separate Element is a Slip ring where the brush block is free, separated from the Slip ring. The two parts must be fitted by the customer to their system.

Pancake:
A Pancake Slip ring is a Slip ring in one part where there is no bearing (Alignment of the Rotor / Stator must be performed by the customer).



SPECIFIC SLIP RINGS

Customer Request Form

ADDITIONAL INFORMATION FOR VIDEO

For video signal:
please precise the type of video format.

SOME EXAMPLE OF CURRENT VIDEO SIGNALS

Video type	Specification	Cable type	Transmission rate
Video monochrome	RS 170	4 wires / 75 Ω system	
NTSC	SMPTE 170M	Coaxial 75 Ω or composite	
SDI	SMPTE 259M	Coaxial cable 75 Ω	270 Mb/s
HD-SDI	SMPTE 292M	Coaxial cable 75 Ω	1485 Mb/s
dual-link HD-SDI	SMPTE 372M	2 Coaxial cables 75 Ω	2970 Mbps
3G-SDI	SMPTE 424M	1 Coaxial cable 75 Ω	2970 Mbps

ADDITIONAL INFORMATION FOR ETHERNET CHANNELS

For ETHERNET channels:
please precise the exact type
of ETHERNET used.

SOME EXAMPLE OF ETHERNET

ETHERNET type	Specification	Cable type	Transmission rate
Ethernet	10 BASE-2	RG58 Coax	
Ethernet	100 BASE-TX	100 Ω - cat 5 (2 pairs)	100 Mb/s
Ethernet	1000 BASE-T	100 Ω - CAT6	1 Gb/s
		100 Ω - cat 5e (4 pairs)	1 Gb/s
Ethernet	1000 BASE-CX	150 Ω Twinax cable	1 Gb/s
		100 Ω - CAT6	10 Gb/s
Ethernet	10G BASE-CX	CAT6a	10 Gb/s
		Optical fiber	10 Gb/s

Other ElectroMechanical Products

EMI-RFI FILTERS

EXXELIA GROUP range of EMI-RFI filters are mainly low-pass filters designed to remove efficiently high-frequency interferences and parasites.

Nowadays filters function are required for:

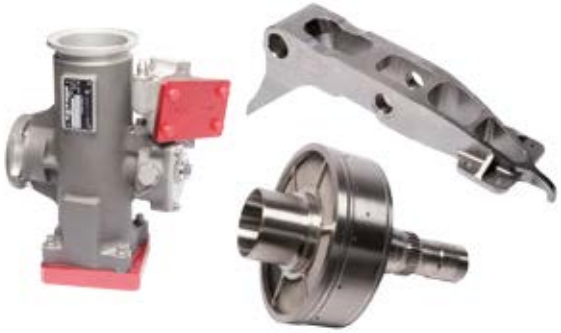
- Data signal integrity,
- Power supply performance,
- EMC standard compliance.

ENERGY FILTERS

Following 50 years heritage in Defense market, **EXXELIA** GROUP offers highly performant, robust and reliable solutions to protect from different EMC phenomenon all kind of signal such as:

- Power supply,
- Control lines,
- Data communication...

PRECISION MECHANICS



EXXELIA GROUP's Precision Mechanics division specialises in machining complex parts, from prototypes to medium series. Our best-in-class palletized-5-axis turning and milling equipment enable us to work with all types of material including titanium, inconel, 35NCD4, etc...

Assembly, high precision manual deburring and hydraulic tests can be carried out in our workshop.

COMPONENTS & SUB-ASSEMBLIES MANUFACTURING

With two production units, separated by less than 10 km and located both in Casablanca (Morocco), **EXXELIA** MAROC offers to its customers a subcontracting capability on its two main competences fields with high technology processes as: wire bonding, vacuum metallization, RF test equipments, reliability test equipment.

Complex electronic modules or components assembly:

- RF diodes packaging,
- RF circulators assembly,
- quartz hybrid oscillators assembly,
- high frequency filters assembly,
- opto electronic components,
- antennas, sensor.

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