MOTORS

USER MANUAL

Orbital Motor, EMD Speed Sensor

WHITE

together in motion

White is a leading global provider of motor and steering solutions that power the evolution of mobile and industrial applications around the world.

Contents

Chapter 1
Product overview

Topics:

Warning:

Please note that the EMD speed sensor may fail. Output signals may not represent correct rotation speed or direction.

Any application of the EMD speed sensor should be subjected to appropriate hazard and risk assessment, according to relevant safety standards for the application.

Reliability data MTBF for the EMD speed sensor are available on request.

Description

The function of the speed sensor is to detect shaft speed and the direction of rotation. The sensor is mounted to the end cover of an LSHT Orbital Motor and senses the speed from a magnet that is rotating inside the motor.

The magnet is connected to the cardan shaft (spool valve motor) or valve drive (disc valve motor) by a shaft.

Rotation of the magnet generates a rotating magnetic field that is a function of motor speed and direction.

EMD-Speed sensor converts this magnetic field into output signal of speed and direction.

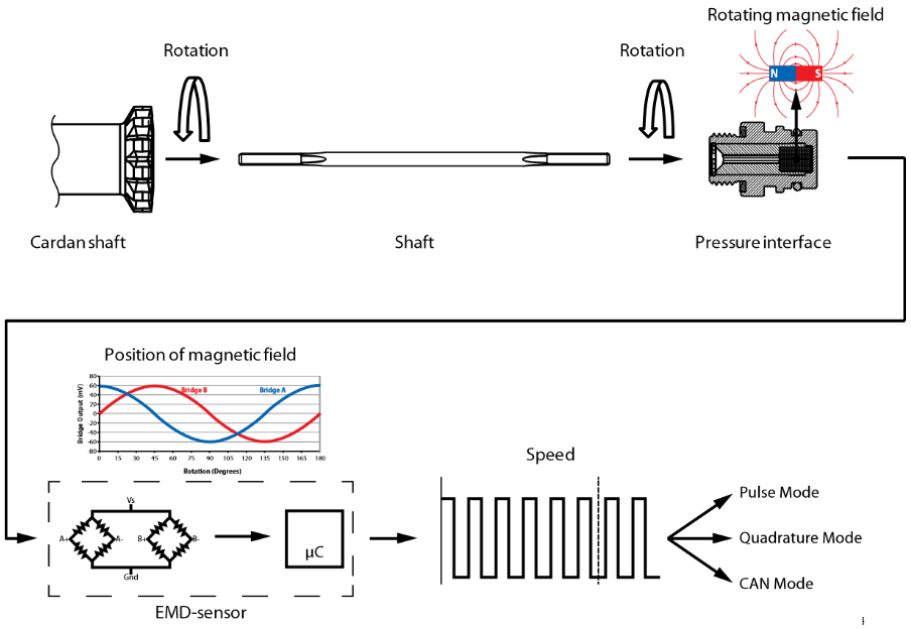


Figure 1 Sensor principle

> ***Note:***
> *After each Power-Up the shaft must rotate 1-2 revolutions before an output signal is generated.*

Because of the digital output signals for speed and direction and a non-speed dependent output voltage level, the sensor is ideal for high and low speed measurements.
The speed sensor is designed for rugged outdoor, mobile or heavy industrial speed sensing applications.
The detection of the speed is contactless. It is a “plug and perform” device that does not need any calibration or adjustments.

Mounting with a snap/click lock and can be adjusted in 36 different positions.

- Available for following LSHT-motors: OMM, OMP, OMR, OMS.
- Speed and Direction output.
- Highest resolution in the market.
- Sensor is not in contact with oil making it robust and exchangeable in the field.

EMD Speed Sensor for Orbital Motors

- Flexible and adaptable speed sensor solution that covers many application needs
- Speed and Direction output
- Highest resolution in the market
- Easy mounting
- Sensor is not in contact with oil making it robust and exchangeable in the field
- Compact design
- Patented Design
- IP 69K

EMD Speed Sensor features

- EMD speed sensor up to 180 pulses/rev
- Rotation speed and direction output available
- Speed range up to 2500 rpm
- Push-pull amplifier
- CAN output signal
- DEUTSCH DT connector – 6 pin

EMD Speed Sensor dimensions

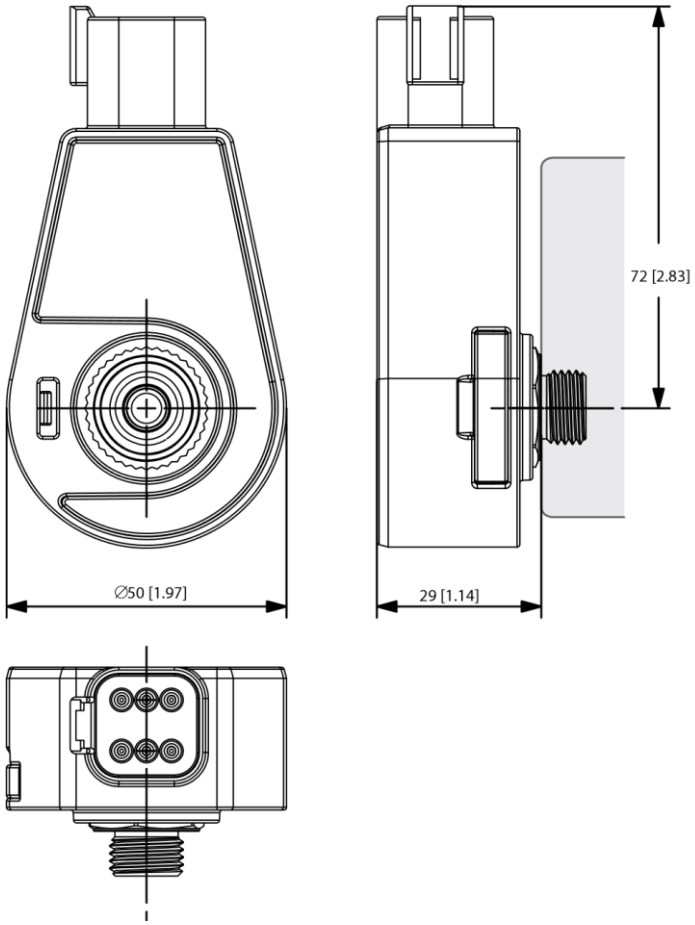


Figure 2 Speed sensor dimensions mm[in]

EMD Speed Sensor pinout

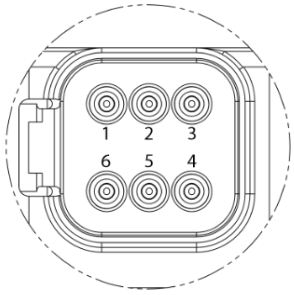


Figure 3 Pin location

Pin	Description
1	Power supply 9 - 36 Vdc
2	Power ground
3	D1 (configurable output)
4	CAN L
5	CAN H
6	D2 (configurable output)

Table 1 Pinout description

EMD Speed Sensor mating connector

Deutsch® DT connector 6 pin mating connector assembly

Pcs	Description	Deutsch® part number	Color
1	Plug	DT06-6S-PO12	black
1	Wedge lock	W6S-PO12	green
6	Solid contacts	0462-209-16141	nickel
Options			
1	Boot compl.	DT6S-BT-BK	black

Table 2 Deutsch® DT connector 6 pin mating connector assembly

For correct mounting please see Deutsch® homepage: www.deutsch.net

EMD Speed Sensor specifications

			D1	D2
Output signal	**Pulse mode**	Push-pull output. Direction = CCW: high, CW: low Configurable up to 180 pulse/revolutions	Square Wave	Direction
	Quadrature mode	2 channels with 90° phase shift each with 90 pulses/revolution Push-pull output	Square Wave Phase A	Square Wave Phase B
	CAN mode	Supports CAN 2.0B with SAE J1939 Message Protocol with Proprietary Messages Baud rate: 250 kbaud (fixed) Shaft velocity: ± 2500 rpm		
Speed range		0 - 2500 rpm		
Supply voltage		9 - 36 Vdc		
Maximum power		0.8 W		
Temperature range (ambient)		-30 °C to 60 °C		
EMC-Immunity (EMI)		100 V/m ISO 13766		
Grade of enclosure		IP 69 K *(According to IEC 529)*		
Vibration		30 G (294 m/s²)		
Shock		50 G (490 m/s²)		

Table 3 Speed sensor specifications

EMD speed sensor ordering information

Part number	Description	Output parameter	Default setting
11094003	Standard pulse mode	Pulse/rev (PPR)	180
11193031	90 pulse mode	Pulse/rev (PPR)	90
11101202	Quadrature mode	2 channels 90° phase shift	90
11287025 *(legacy part number **11101205**)*	CAN mode	Node address Message transmission rate	0x51 50 ms
11287032 *(legacy part number **11114575**)*	OEM configurable sensor	2 channels 90° phase shift	90
11101188	Compatibility OMS	Pulse/rev (PPR)	55
11101182	Compatibility OMM	Pulse/rev (PPR)	22
11287010 *(legacy part number **11101186**)*	Compatibility OMP/R	Pulse/rev (PPR)	35

Table 4 EMD speed sensor ordering information

Order information

Orbital Motor prepared for EMD speed sensor is ordered separately.

Pulse mode

The sensor generates a speed dependent pulse on D1 and a direction signal on D2.

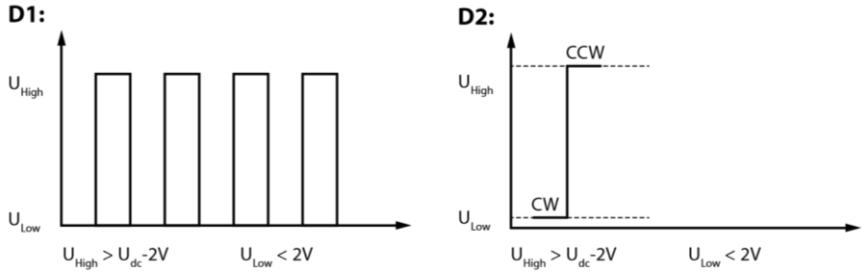


Figure 4 Pulse mode

Quadrature mode

The sensor generates a speed dependent pulse on D1 and D2 with a 90° phase shift.

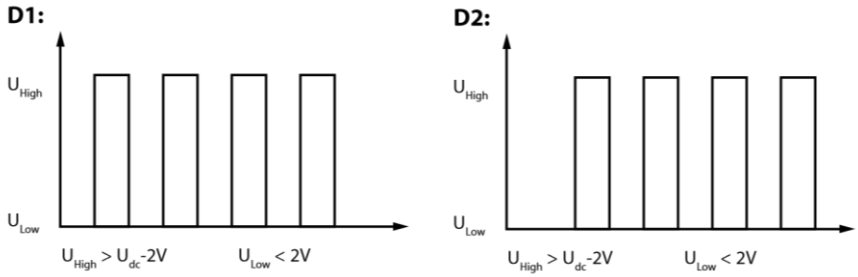


Figure 5 Quadrature mode

***Note**:*
It's not recommended to use quadrature mode for OMM orbital motors.

CAN mode

Cyclic message specification

Interface: CAN 2.0 B
Baud rate: 250 kBaud
Transmit rate: 10, 20, 50 (default), 100 or 200 ms (cyclic message transmission)

Proprietary B 29 bit	**Data**							
	0 (LSB)	1 (MSB)	2	3 (LSB)	4 (MSB)	5	6 (LSB)	7 (MSB)
CAN ID	Reserved		Sequence number	Angular velocity		Reserved	CRC-16	
CAN ID:	J1939 proprietary B. Programmable 29 bit message id. ID = $18FF20XX (source address XX is programmable, default value is $51)							
Sequence no.:	byte (0-255) Increments 1 for each message							
Angular velocity:	Angular velocity of the shaft. 16 bit integer with 2's complementary encoding for negative values (-25,000 to 25,000). -25,000 = -2,500 RPM (CCW) 0 = 0 RPM 25,000 = 2,500 RPM (CW)							
CRC-16:	The standard CRC16 polynomial is used to calculate the checksum for byte 0 – 5. ($x^{16}+x^{15}+x^2+1$)							

Table 5 CAN Mode

EMD Speed Sensor wiring diagrams

Wiring diagram: CAN mode

Figure 6 CAN mode

Wiring diagram: Pulse and quadrature mode

Figure 7 Pulse and quadrature mode

Conversion Diagram

It is possible to replace an Orbital Motor with EM-sensor with PNP or NPN open collector output with an Orbital Motor with EMD-sensor. Conversion diagrams show how it is possible to replace present sensor with EMD-sensor.

The resistor R_L which is used in the current NPN/PNP diagram is not needed but can under certain conditions remain in the circuit:

- If $R_L < U_{DC}/10$ mA remove or increase the size of the resistor.
- If $R_L > U_{DC}/10$ mA no change needed.

In case the EM-sensor and the controller have different power supply, it is needed to modify the circuit so that the EMD-sensor has the same power supply as the controller.

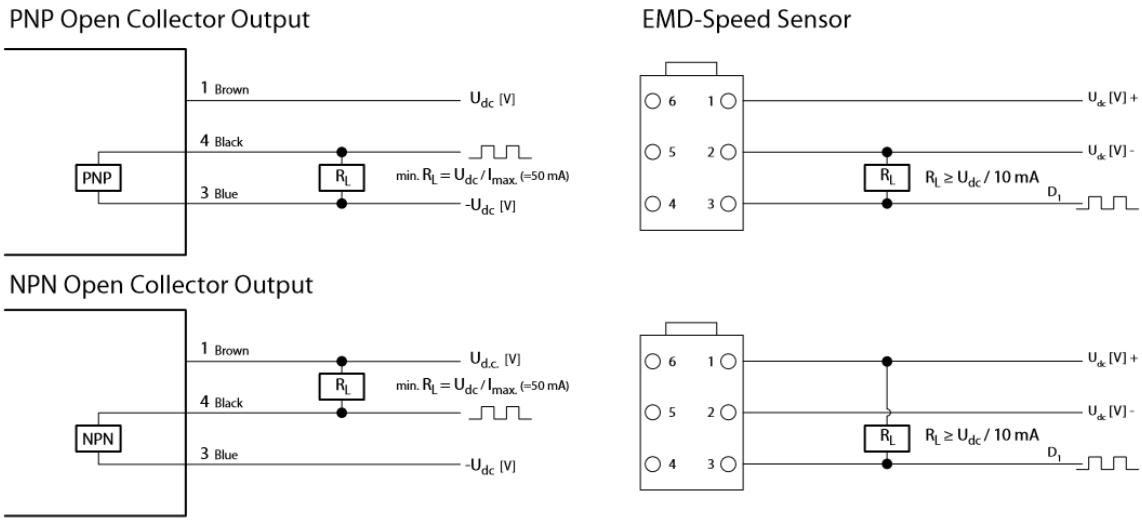


Figure 8 Conversion Diagram

Chapter 2
Sectional drawings

Topics:

- *OMM EMD*
- *OMP/OMR EMD*
- *OMS EMD*

OMM EMD

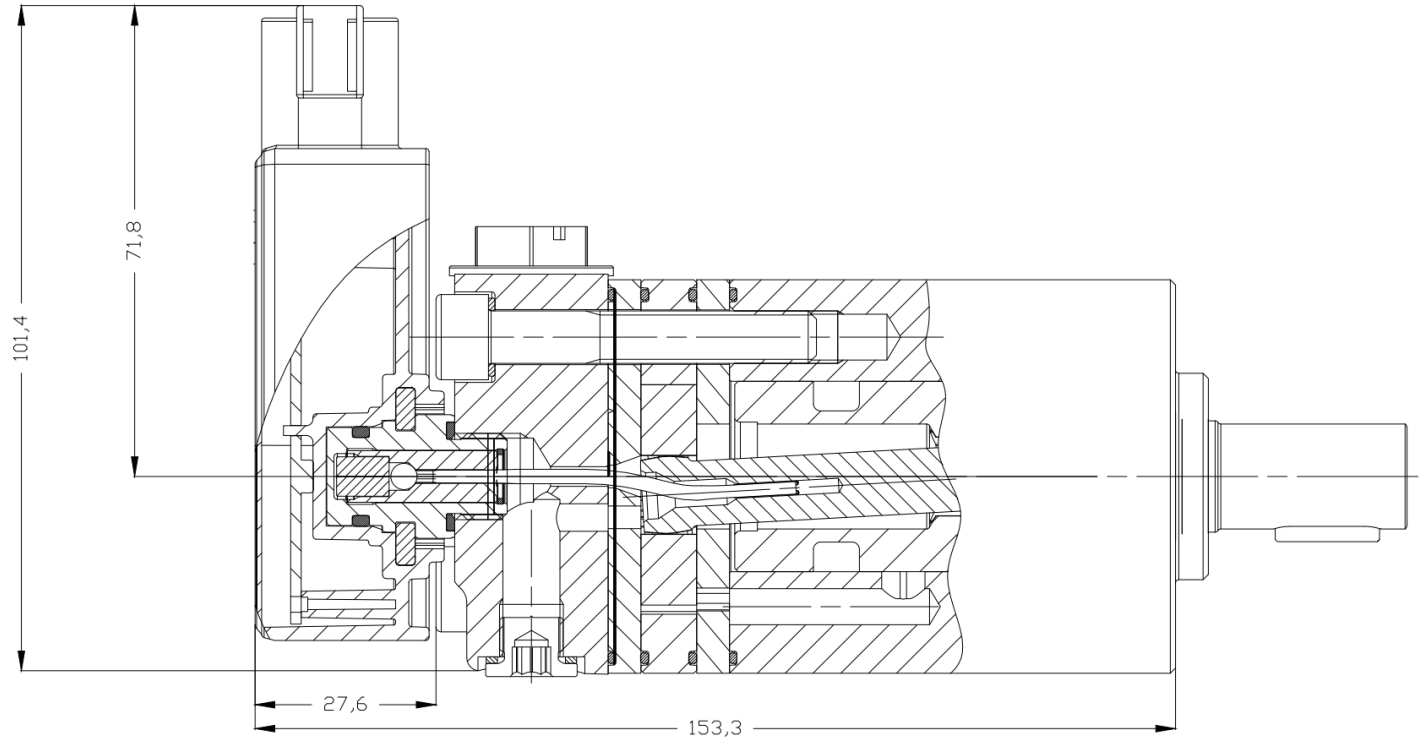


Figure 9 OMM EMD with Speed Sensor

OMP/OMR EMD

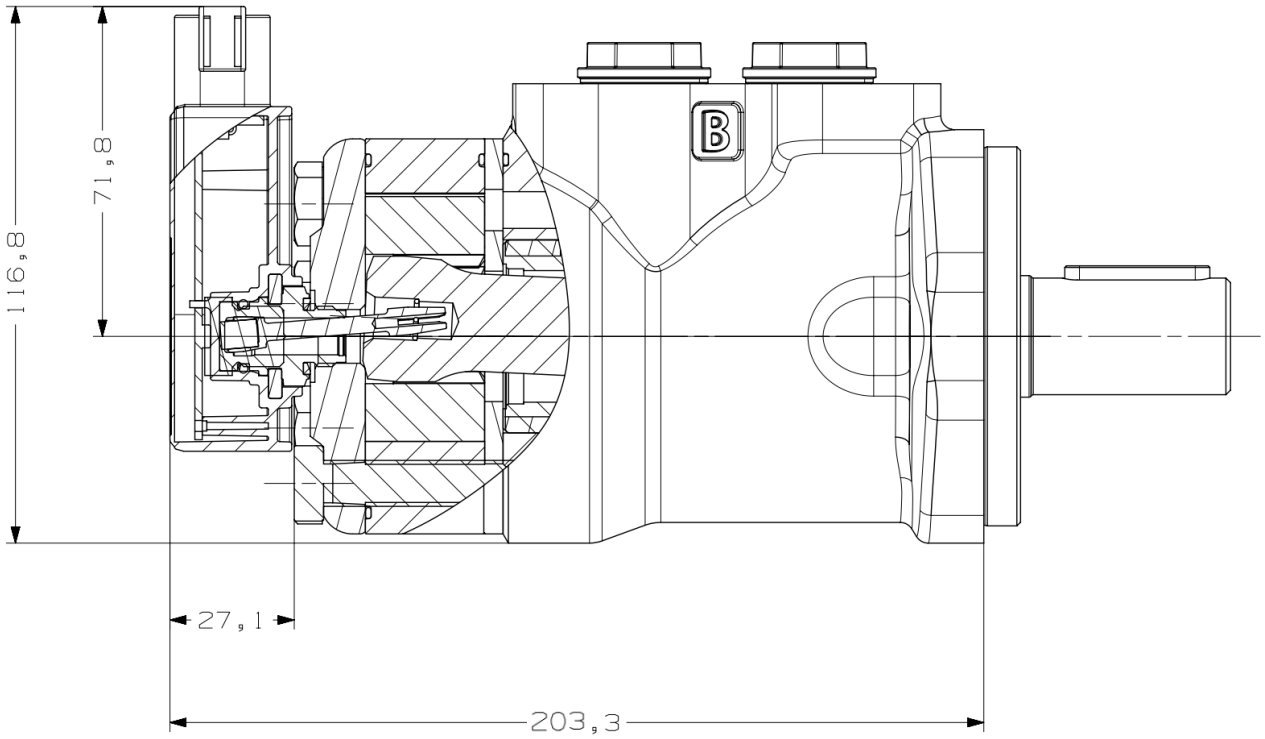


Figure 10 OMP/OMR EMD Speed Sensor

***Note**:*
Motor length depends on displacement. Dimensions on drawings are for max. gearset size.

OMS EMD

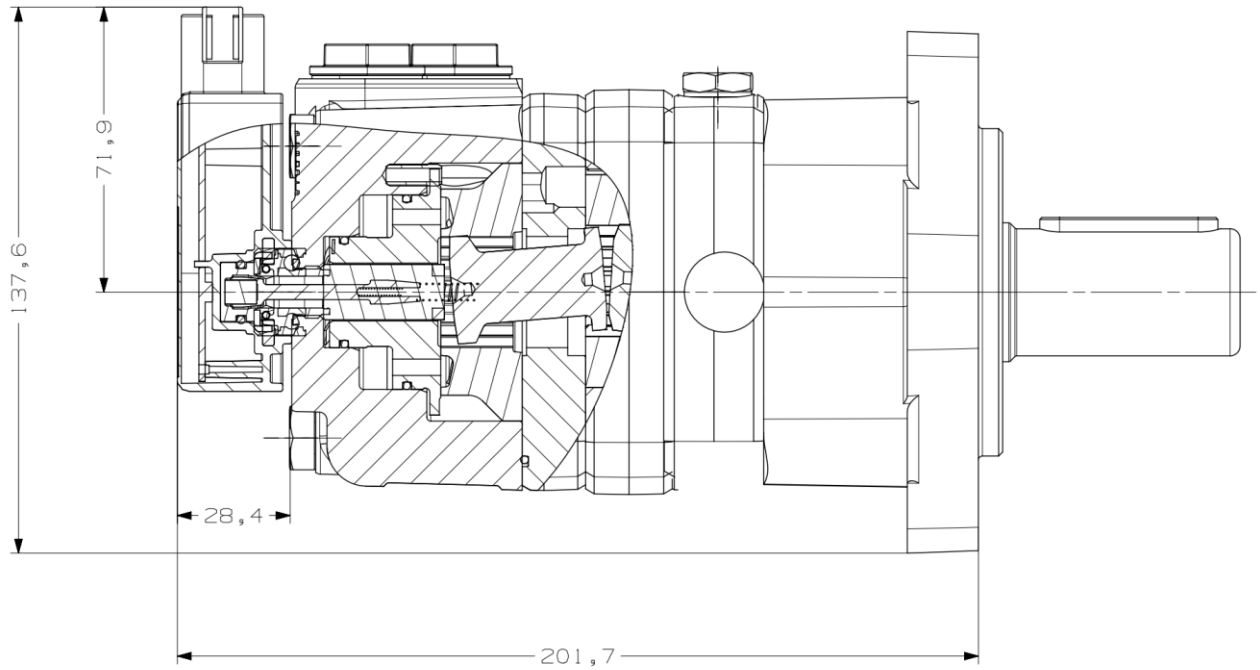


Figure 11 OMS EMD speed sensor

***Note**:*
Motor length depends on displacement. Dimensions on drawings are for max. gearset size.

Chapter 3
Filter parameter

Topics:

- *Moving Average Pulse period time Number*
- *Positioning*

Moving Average Pulse period time Number

In order to reduce noise when the frequency is calculated in pulse mode or the angular velocity is calculated in CAN mode, a moving average filter can be activated by setting a filter parameter (MA-filter) when configuring the sensor.

Valid range for the **M**oving **A**verage **P**ulse period time **N**umber (MAPN): 1, 2, 4, 8, 16, 32 & 64.

The (MAPN) can also be dynamic. Valid range is the same 1,2,4…64, the calculation is dependent on the detected speed and 2 types of filter-calculation, Dynamic 1 (default) & Dynamic 2 can be used.

How Dynamic 1 and Dynamic 2 select the MAPN see the table below.

RPM	MAPN	
	Dynamic 1	Dynamic 2
2.0 – 3.4	1	1
3.5 - 5.1	1	2
5.2 - 10	2	4
10 - 20	4	8
20 - 80	8	16
81 - 163	16	32
164 - 2500	32	64

Table 6 MAPN

Configuration of filter, see Configuration of EMD-Speed Sensor to other settings.

Positioning

It's possible to use the EMD sensor as feed-back / "encoder" in positioning applications.

Note:
In such applications, use pulse mode 180 PPR or Quadrature mode, as you in all other settings will get an adding error.

Typical Backlash in the Orbit Motors

The typical backlash in the Orbit motors is shown in the table below:

Motor	Backlash Output shaft → Sensor shaft		
	OMP	OMR	OMS
Minimum	1.2°	1.2°	9.1°
Maximum	2.2°	2.2°	14.0°

Table 7 Typical backlash in the Orbit Motors

Note:
It is not recommended to use OMM orbital motors in positioning applications where the EMD is used.

Chapter 4
Mounting of EMD Speed Sensor

Topics:

- *Installation guide*

Installation guide

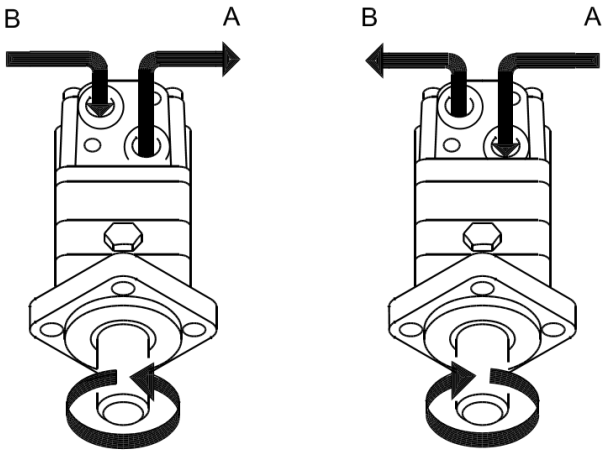
LSHT-motors with EMD-speed sensor

Turn the sensor to the desired position and mount the sensor on the plug.

To lock the sensor, push the clip into the sensor as shown.

It is possible to mount the sensor in 36 positions.

Direction of shaft rotation



CCW CW

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Figures

Tables

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