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DATA SHEET- UPPER LIMB EXOSKELETON

AIM:

To get the data sheet for the ILM-70x18 motor, HFUS-2SH-20, Gear drive and choose a suitable encoder for the upper limb Exoskeleton for bending and lifting application.

1. Motor: ILM 70x18

Details & Data sheet:

- Frameless motors for highest design flexibility
- Available with integrated safety brakes and encoders
- Hollow-shaft capability
- Extra-low voltage 12 V - 48 V
- **Company Name: TQ-RoboDrive, Germany, [1].**

DATA:

| | Motor: ILM 70x18 |
|---|-------------------------|
| Max Power [W] | 270 |
| Rated voltage U_r * [V] | 48 |
| Rated torque T_r * [Nm] | 1.24 |
| Peak torque T_{max} at 20% deviation from linearity [Nm] | 4.05 |
| Max rotation speed n_{max}^{**} at U_r [rpm] | 7,340 |
| Diameter D [mm] | 69 |
| Length L [mm] | 30.5 |
| Weight m [g] | 330 |
| Number of pole pairs | 10 |
| Rotor inertia J [kgcm²] | 0.321 |
| Nominal operational temperature of the stator | -40°C to 125°C |
| * At nominal current. Thermal behavior is strongly dependent on installation situation. | |
| ** Theoretical no-load rotation speeds at U_r . Variations can arise from operation with different inverters. | |
| *** Max rotation speed due to mechanical structure. | |

Web Address: https://www.tq-group.com/filedownloads/files/products/roboDrive/data-sheets/en/DRVA_DB_Servo-Kits_ILM_EN_Rev408_Web.pdf

2. Encoder: RD70-AKSIM

Details & Data sheet:

- Absolute magnetic multiturn encoder with hollow-shaft design.
- RD70-AKSIM encoders provide accurate absolute position data with high resolution for the precise, efficient control of TQ-RoboDrive servo motors. The encoders feature highly robust magnetic ASIC sensors, providing significantly better resistance to dust, dirt and other disruptive elements. Multiturn cycle information is stored electronically but is not updated during motion when there is no power supply to the sensor.
 - ▶ Hollow-shaft capability
 - ▶ Flat off-axis system for space-constrained applications
 - ▶ Singleturn resolution up to 262,144 incs/rev (18 bit)
 - ▶ Multiturn resolution 65,536 revs (16 bit)
 - ▶ Absolute accuracy $\pm 0.1^\circ$, repeatability 0.002° , no hysteresis
 - ▶ High speed operation up to 10,000 rpm
 - ▶ Differential BiSS-C interface (update rate 28 kHz)
 - ▶ Sampling rate 18 kHz
 - ▶ Dimensions adapted to corresponding TQ-RoboDrive servo kits
- **Company Name: TQ-RoboDrive, Germany.**

DATA:

| | Encoder: RD70-AKSIM |
|--|----------------------------|
| Singleturn resolution [incs/rev] | 262,144 (18 bit) |
| Multiturn resolution [revs] | 65,536 (16 bit) |
| Accuracy [deg] | ± 0.1 |
| Repeatability [deg] | 0.0014 |
| Sampling rate fs [kHz] | 18 |
| Maximum rotation speed nmax [rpm] | 7,000 |
| Maximum acceleration amax [rad/s²] | 60,000 |
| Sensor PCB diameter D [mm] | 74 |
| Sensor length L [mm] | 9.2 |
| Weight m [g] | 19.8 |
| Inertia J [kgcm²] | 0.070 |
| Operational temperature range | -40°C to +105°C |
| Supply voltage Udd [V] | 5 |
| Supply current Idd [mA] | 150 |

| | |
|--------------------------|--------------------|
| Communication interface* | BiSS-C differentia |
|--------------------------|--------------------|

Web Address: https://www.tq-group.com/filedownloads/files/products/robodrive/data-sheets/en/DRVA_DB_Sensors_RD50-70-85-AKSIM_EN_Rev404_Web.pdf

3. Gear: HFUS-25H-20

- **Company Name:** Harmonic Drive AG.

DATA:

| Gear: HFUS-25H-20 | | |
|---------------------|--------------------------|--------|
| Outer diameter (mm) | Max torque diameter (Nm) | Ratio |
| 90 | 92 | 50-160 |

| | CPU-H, -M, -S SHG-65 | | | CPU-H SHG-65 | HFUC-2UH | | | CSG-2UH | | | HFUS-2UH/250/25H | | | HFUS-2UH |
|------|----------------------|--------------------|--------|---------------------|---------------|--------------------|--------|---------------|--------------------|--------|------------------|--------------------|--------|---------------------|
| Size | Outer dia(mm) | Max torque dia(Nm) | Ratio | Hollow dia(m) shaft | Outer dia(mm) | Max torque dia(Nm) | ratio | Outer dia(mm) | Max torque dia(Nm) | Ratio | Outer dia(mm) | Max torque dia(Nm) | Ratio | Hollow dia(m) shaft |
| 14 | 78 | 28 | 50-100 | 14 | 73 | 28 | 30-100 | 73 | 36 | 50-100 | 70 | 28 | 50-100 | 14 |
| 17 | 88 | 54 | 50-120 | 19 | 79 | 54 | 30-120 | 79 | 70 | 50-120 | 80 | 54 | 50-120 | 19 |
| 20 | 98 | 92 | 50-160 | 21 | 93 | 92 | 30-160 | 93 | 120 | 50-160 | 90 | 92 | 50-160 | 21 |

Web Address: <https://systemcontrolstspl.com/harmonic-drive/>

Reference:

[1] Data sheet for ILM70x18

[2] Data sheet for RD70-AKSIM
