Sensor	Sensor Description	Type	Connection	No. of Pins	Supply	Used for	Joint
Incremental optical encoder	US Digital HUBDISK-2-2000-625-IE; module EM1-2-2000-I	D I/O	Ch A, Ch B, Ch I, GND, PS	5	5 V	measuring biological joint angle	Ankle, Knee, Hip
Absolute magnetic encoder	AS5048A	SPI	GND, PS, SS, MISO, MOSI, CLK	6	5 V	measuring lever arm angle	Ankle, Knee, Hip
Hall sensors*	Integrated with motor	D I/O	GND, PS, NC, H1, H2, H3	6 (5)**	4.5-24 V [EC-i 40]; 3-24 V [EC 16]	?	Ankle, Knee, Hip
Incremental motor encoder	Encoder MR Type M, 512 CPT, 2 channels, w/ Line Driver ***	D I/O	NC, PS, GND, NC, Ch A, Ch A', Ch B, Ch B', Ch I, Ch I'	10	5 V	measuring motor position	Knee

* All 3 motors (EC-i 40 70W, EC-i 40 50W and EC 16 30W) come with Hall sensors. Both EC-i motors have the same Hall sensor connection - Cable AWG 26 and connector MOLEX (see attachment on EC-i motors). EC 16 motor, on the other hand, has 8-pin connector MKF 13268-6-0-808, where 3 pins are used for motor and 5 pins for Hall sensor (see attachment on EC 16 motor).
** 5 pins is in the case of EC 16 motor, where one 8-pin cable is used for both motor and Hall sensor
*** Encoder datasheet in the attachment [catalogue number:201937]

Motor (Maxon)	Part number chosen
Motor EC 16 30 W	405813 [36V]
Motor EC-i 40 50 W	449464 [24V]
Motor EC-i 40 70 W	449470 [36V]

Knee parallel mechanism
Knee
Ankle and hip

ABSOLUTE MAGNETIC ENCODER COLOR CODE

1. VDD
2. MOSI
3. SS
4. MISO
5. GND
6. SCK