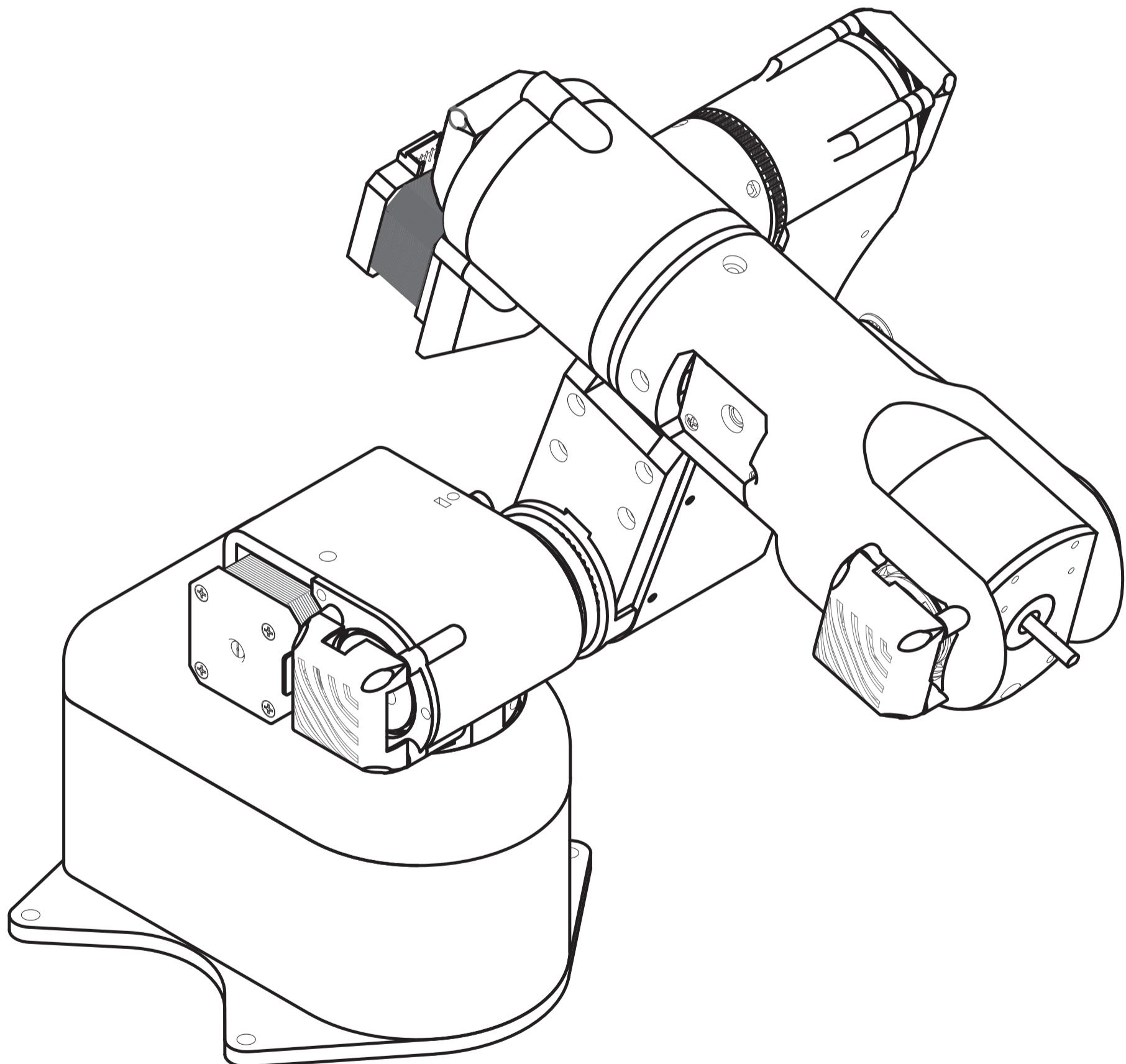


HELENE V4

Construction Manual



Assembly Steps

Assembly III

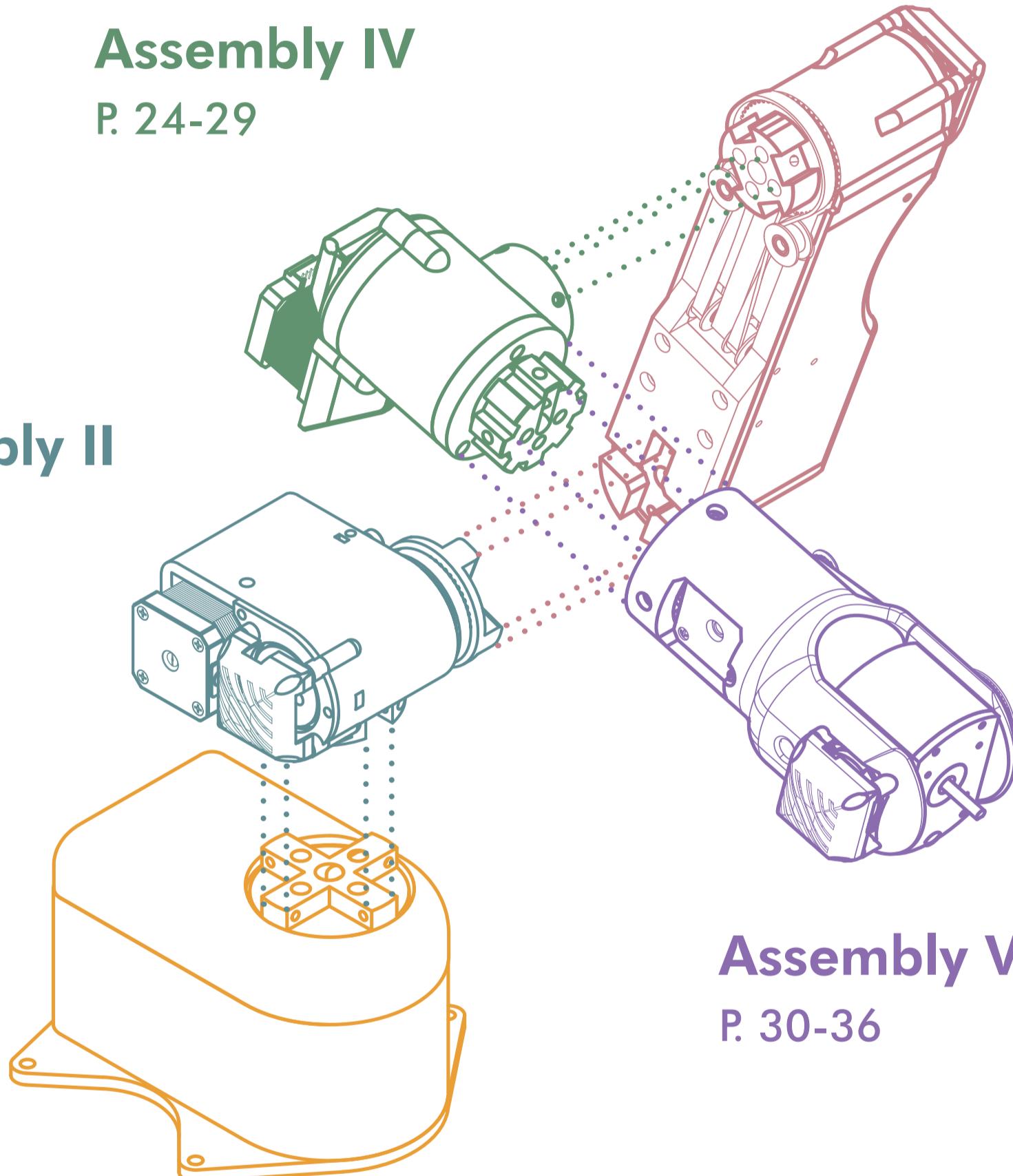
P. 18-23

Assembly IV

P. 24-29

Assembly II

P. 11-17



Assembly V

P. 30-36

Assembly I

P. 4-10

Component Listing

Standardized Parts

Threaded Inserts - CNC kitchen

M3 - M3 Threaded Insert

M3k - M3 Threaded Insert short

M4 - M4 Threaded Insert

M4k - M4 Threaded Insert short

M5 - M5 Threaded Insert

N15 - AS5048A Magnet Encoder

N16 - GT2 Pulley without teeth

N17 - Power Supply NAC3MPA

N18 - USB-Socket 2.0-Micro-B

N19 - NdFeB N45 Disc Magnet

N20 - Circuit Board

Nuts

SM1 - M3 Hexagonal Nut

SM2 - M3 Square Nut

SM3 - M4 Hexagonal Nut

Screws

S1 - M2,5x8 with Drill Bit

S2 - M3x5 with Drill Bit

S3 - M3x6

S4 - M3x8

S5 - M3x10

S6 - M3x12

S7 - M3x16

S8 - M3x20

S9 - M3x45

S10 - M4 Grub Screw

S11 - M4x6

S12 - M4x10

S13 - M4x16

S14 - M4x20

S15 - M4x30

S16 - M5x16

Additional Standardized Parts

N1 - Motor Nema 23

N2 - Motor Nema 17HS15

N3 - Motor Nema 17HS4401S

N4 - Belt Drive 232mm GT2 6mm width

N5 - Belt Drive 207mm 3M 6mm width

N6 - Belt Drive 420mm 3M 6mm width

N7 - Belt Drive 267mm 3M 6mm width

N8 - Belt Drive 280mm GT2 6mm width

N9 - Ball Bearing 6009 2RS

N10 - Miniature Ball Bearing 623 ZZ/2Z

N11 - Miniature Ball Bearing 608 2RS

N12 - Ball Bearing 6806/61806 2RS

N13 - GT3 Timing Pulley 9mm 20 teeth

N14 - GT2 Timing Pulley 5mm 20 teeth

3D Printed Parts

Assembly I

B1 - Base_Main
B2 - Base_Shaft
B3 - Base_Bearing_Cover
B4 - Base_Pulley_large
B5 - Base_Pulley_small
B6 - Base_Pulley_small2
B7 - Base_Foundation
B8 - Base_Beltdrive_Cover

Assembly II

B9 - Joint 2_Main
B10 - Joint 2_Pulley_Threading_Insert
B11 - Joint 2_Shaft
B12 - Joint 2_Bearing_fixed
B13 - Joint 2_Shaft_End
B14 - Joint 2_Bearing_Cover

Assembly III

B15 - Joint 3_Main_lower
B16 - Joint 3_Main_upper
B17 - Joint 3_Shaft
B18 - Joint 3_Pulley
B19 - Joint 3_Pulley_small
B20 - Joint 3_Shaft_End
B21 - Joint 3_Motor_Unit
B22 - Joint 3_Cover

Assembly IV

B23 - Joint 4_Main
B24 - Joint 4_Shaft
B25 - Joint 4_Motor_Unit
B26 - Joint 4_Pulley
B27 - Joint 4_Bearing_Cover
B28 - Joint 4_5_Transition

Assembly V

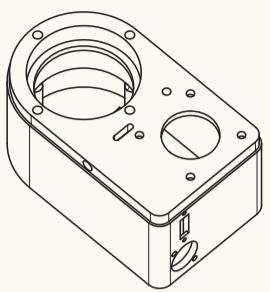
B29 - Joint 5_Main
B30 - Joint 5_Shaft
B31 - Joint 5_Pulley
B32 - Joint 5_Cable_Lead
B33 - Joint 6_Main
B34 - Joint 6_Cover

Additional Printed Parts

B35 - Cover_Electronics
B36 - Bearing_Distance

Assembly I

1



1x B1



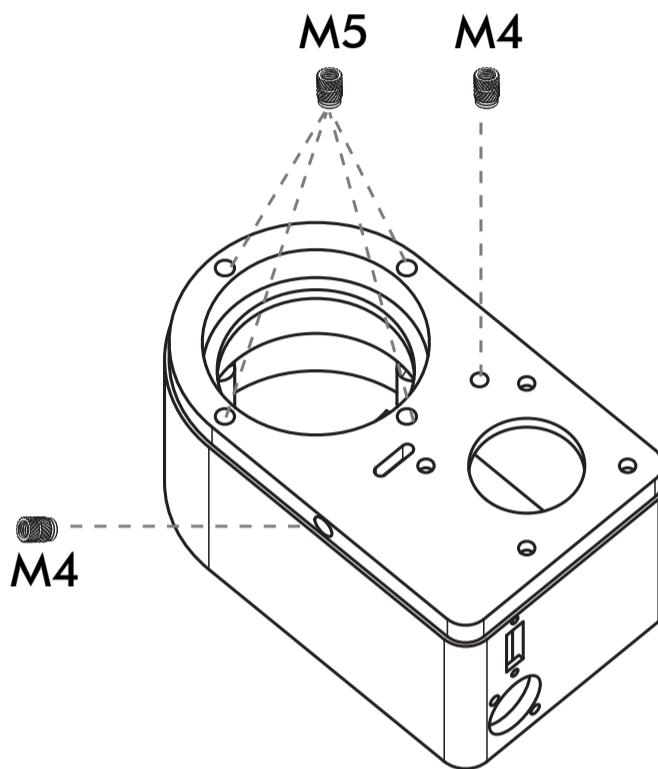
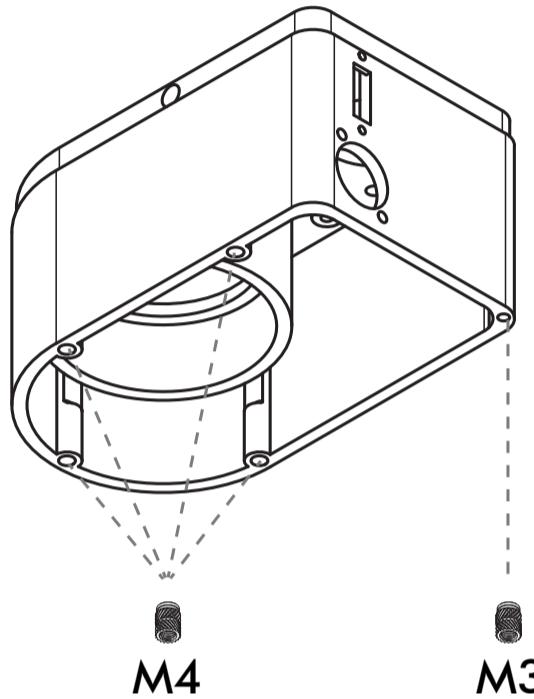
6x M4



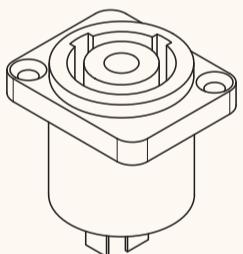
1x M3



4x M5



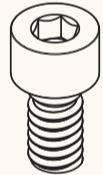
2



1x N17



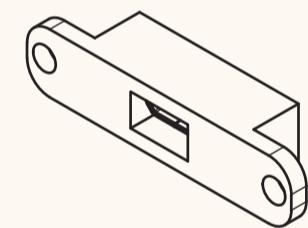
2x SM1



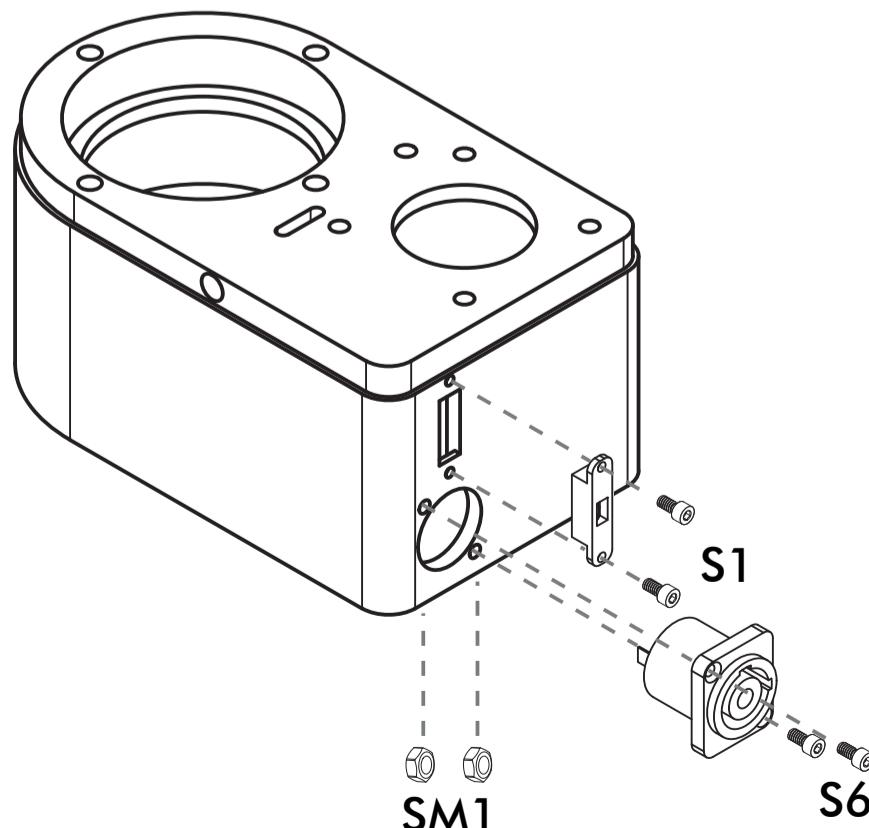
2x S6

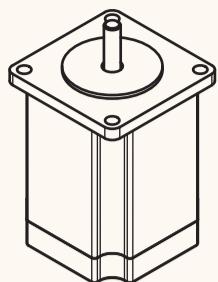


2x S1

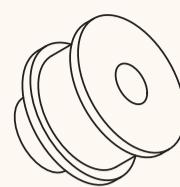


1x N18



3

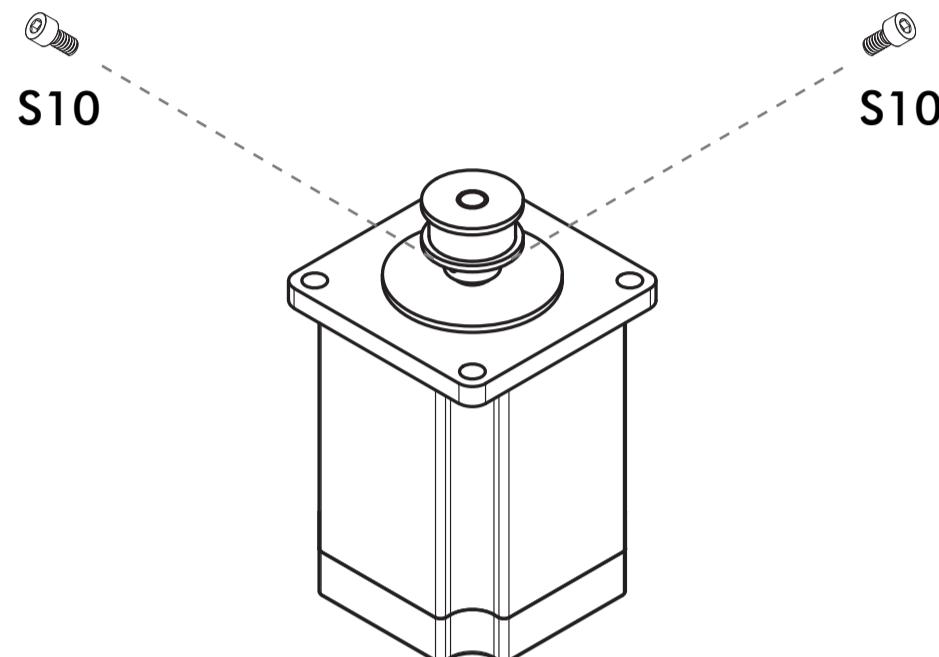
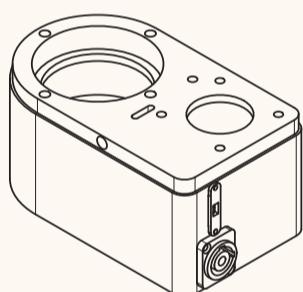
1x N1



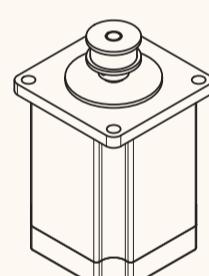
1x N13



2x S10

**4**

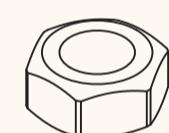
Step 2



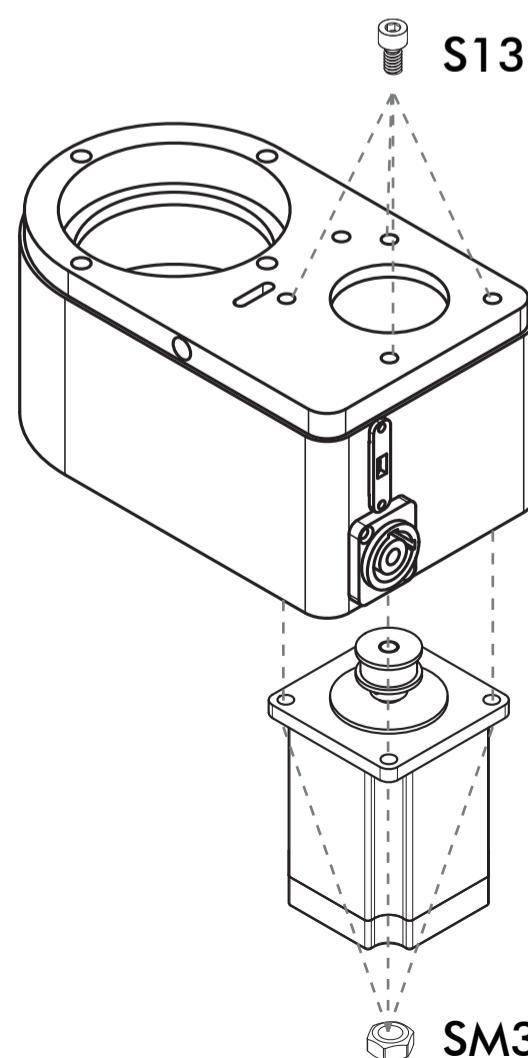
Step 3



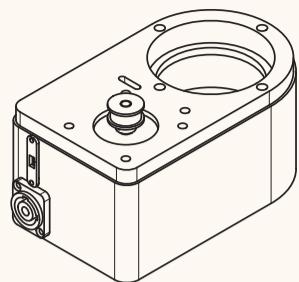
4x S13



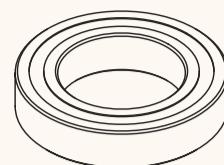
4x SM3

**Note**

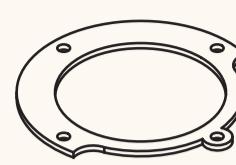
You must not completely fasten the screws yet.

5

Step 4



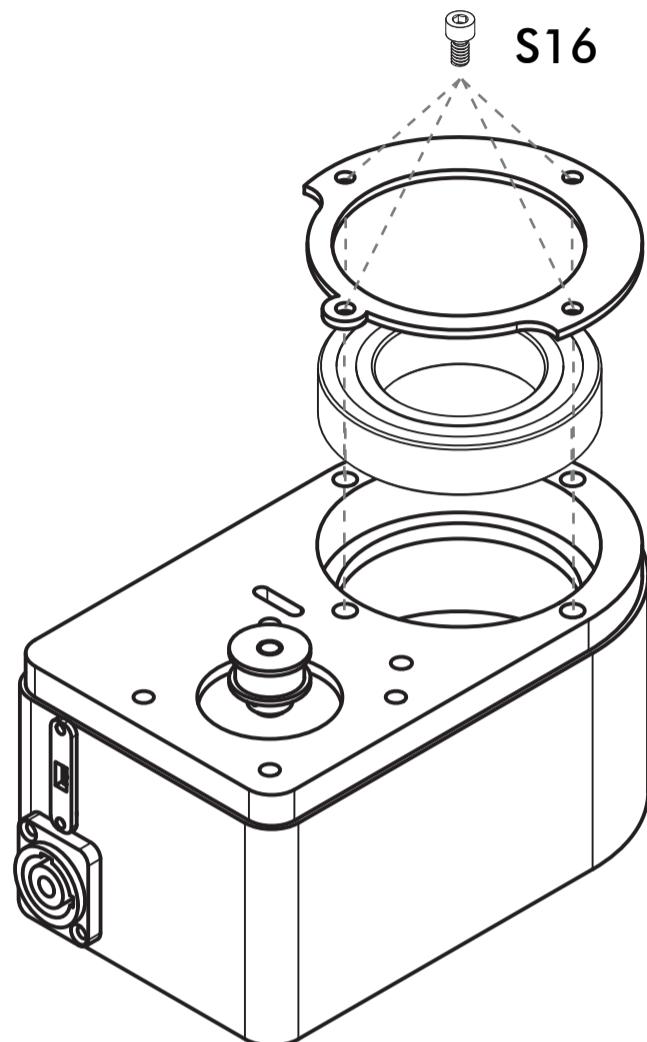
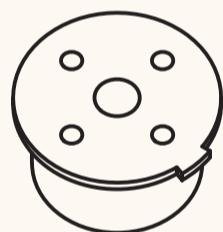
1x N9



1x B3



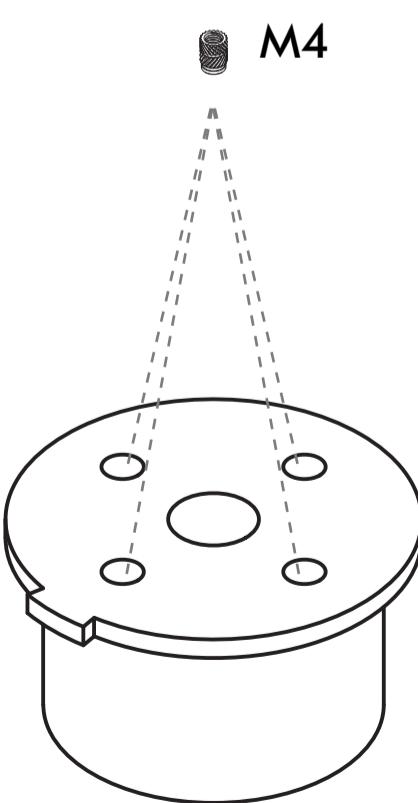
4x S16

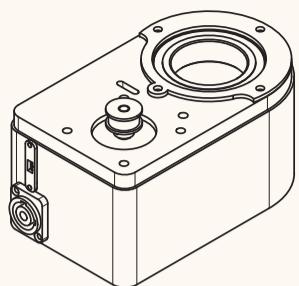
**6**

1x B2

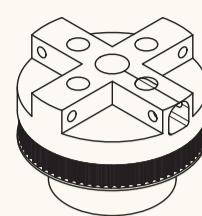


4x M4

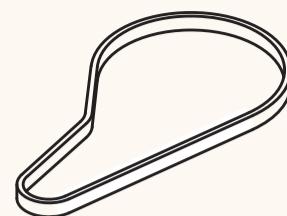


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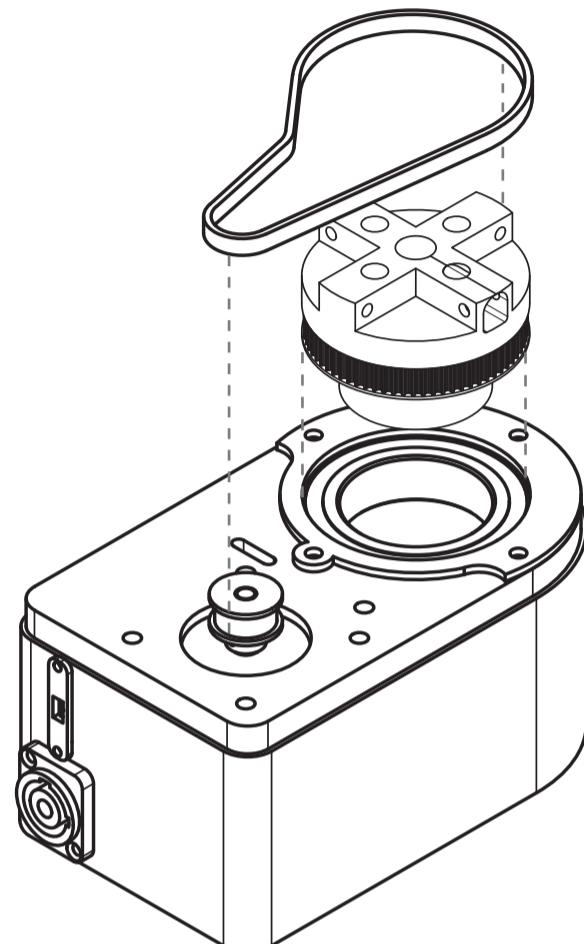
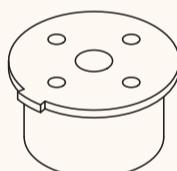
Step 5



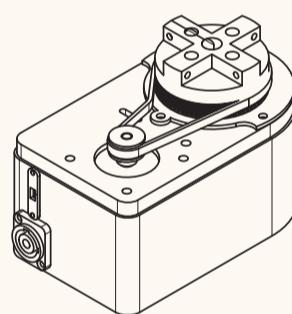
1x B4



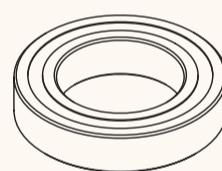
1x N4

**8**

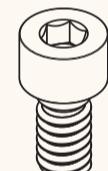
Step 6



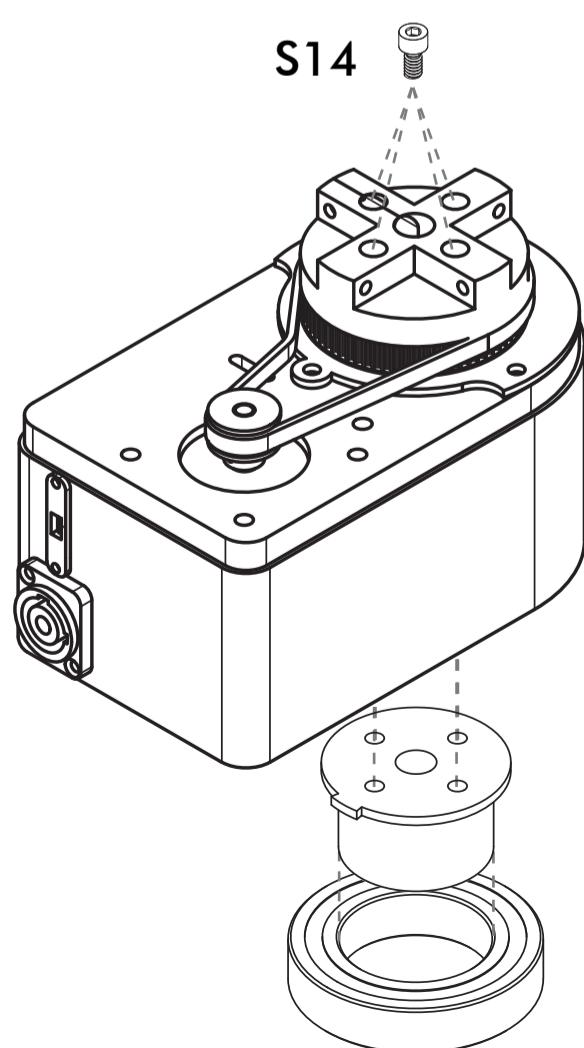
Step 7

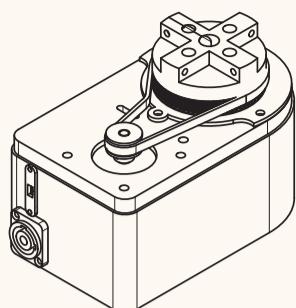


1x N9

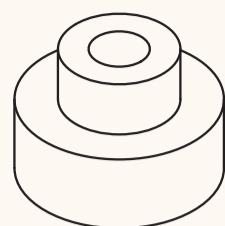


4x S14

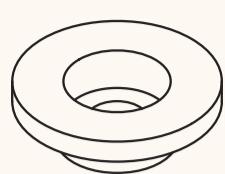


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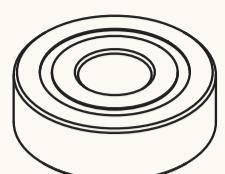
Step 8



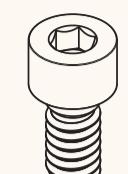
1x B5



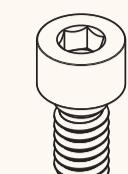
1x B6



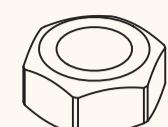
1x N11



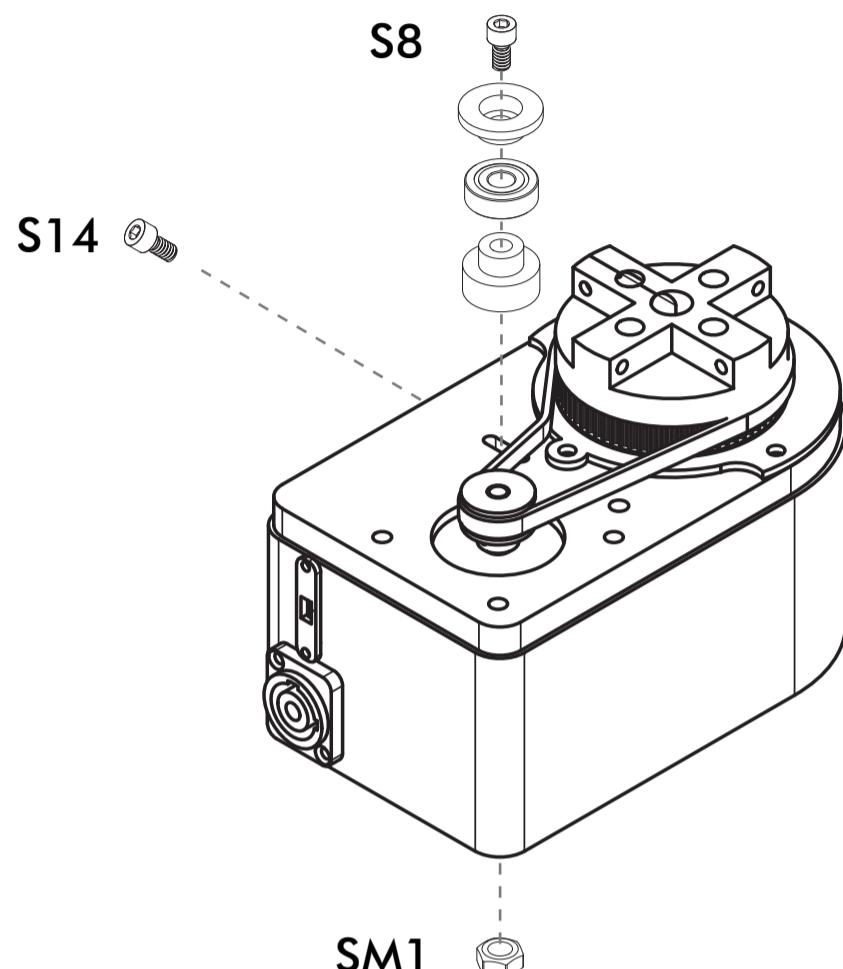
1x S14



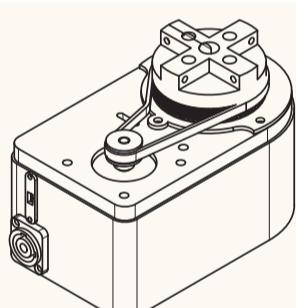
1x S8



1x SM1

**Note**

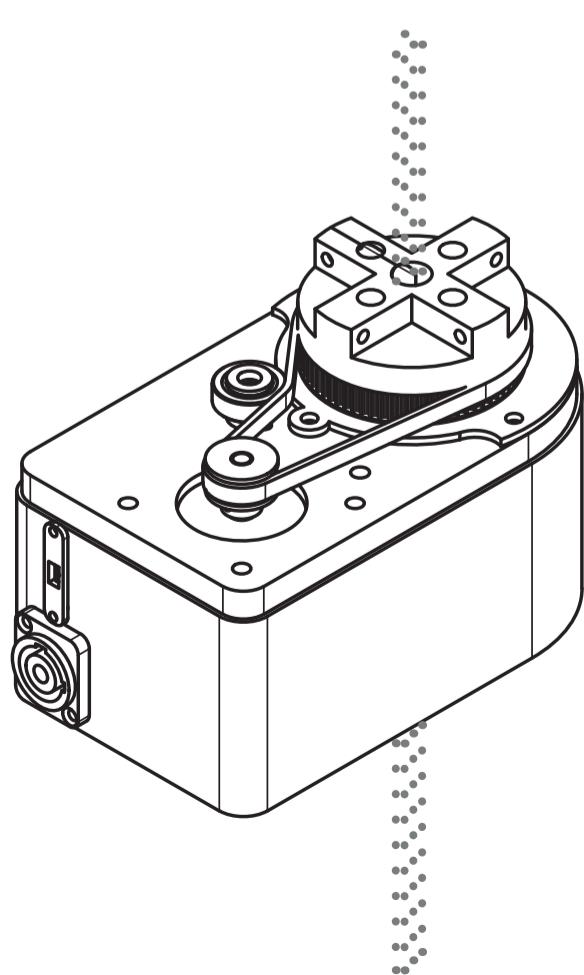
Completely fasten the screws of the motor unit (see step 4).

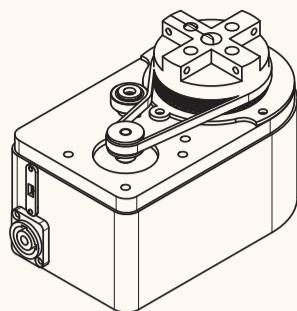
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Step 9

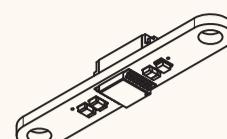
Note

All cables have to be fed through B2 and B4 as shown in the figure with sufficient length on both ends.



11

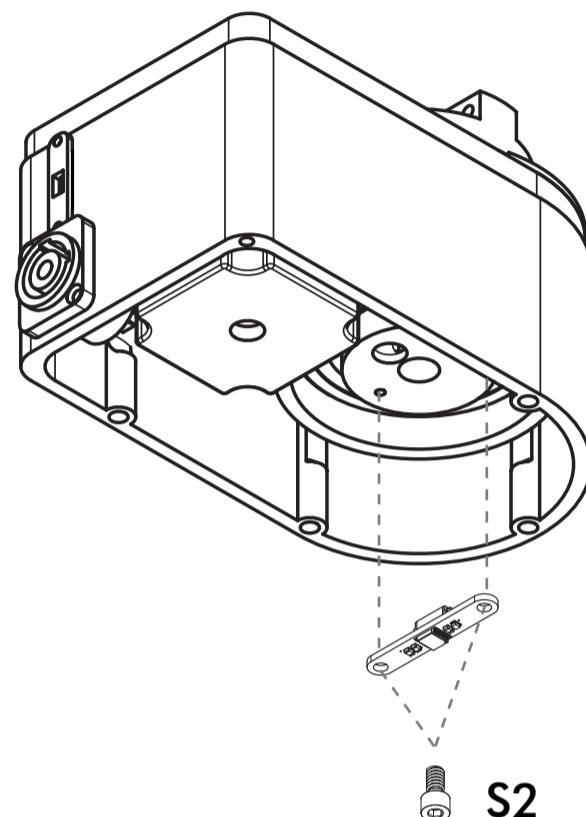
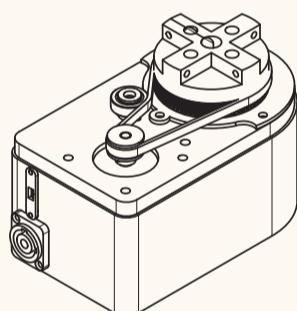
Step 10



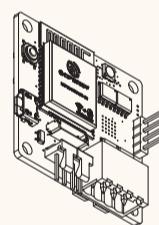
1x N15



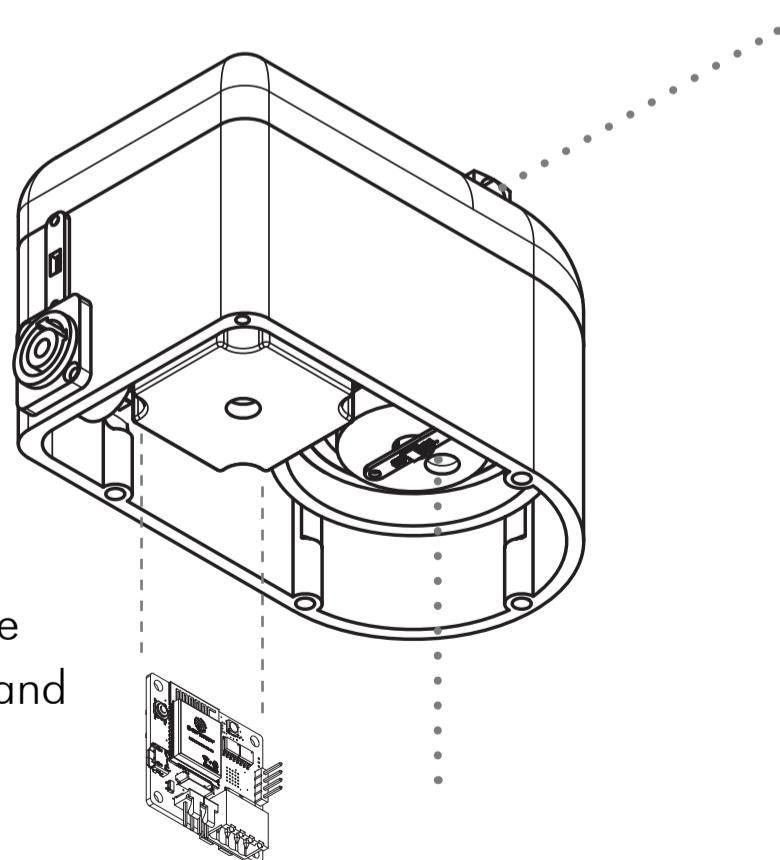
2x S2

**12**

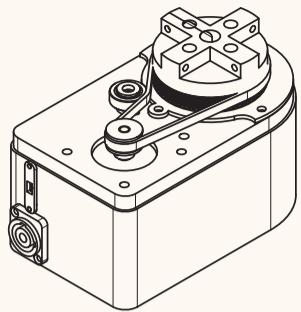
Step 11



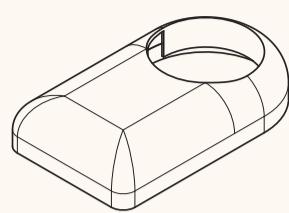
1x N20

**Note**

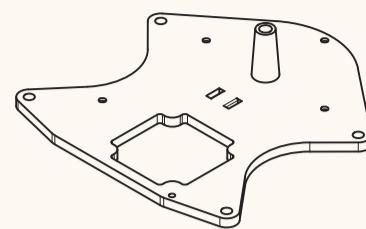
Attach the respective plugs to the cables on the down facing end and attach them to the circuit board according to the instructional video. Insert the circuit board afterwards inside of building step 11.

13

Step 12



1x B8



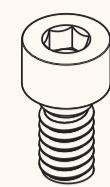
1x B7



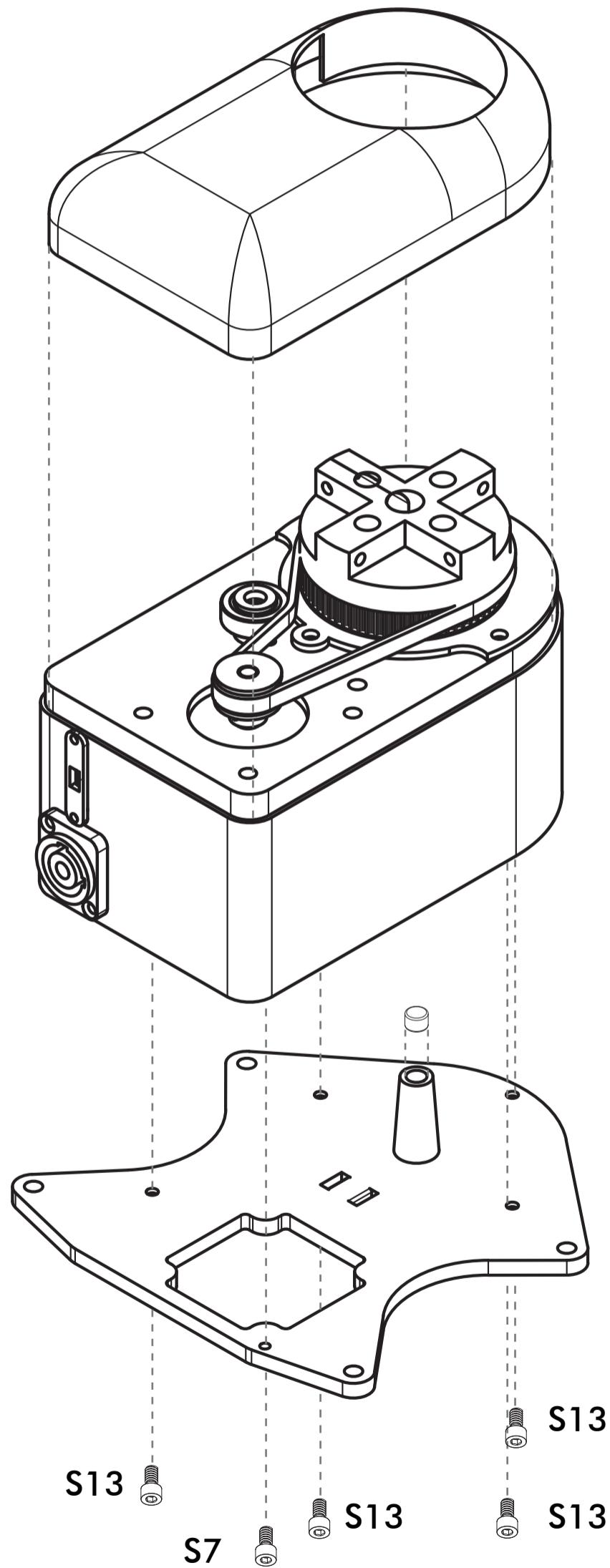
1x N19



1x S7

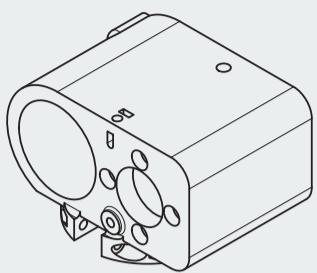


4x S13



Assembly II

1



1x B9



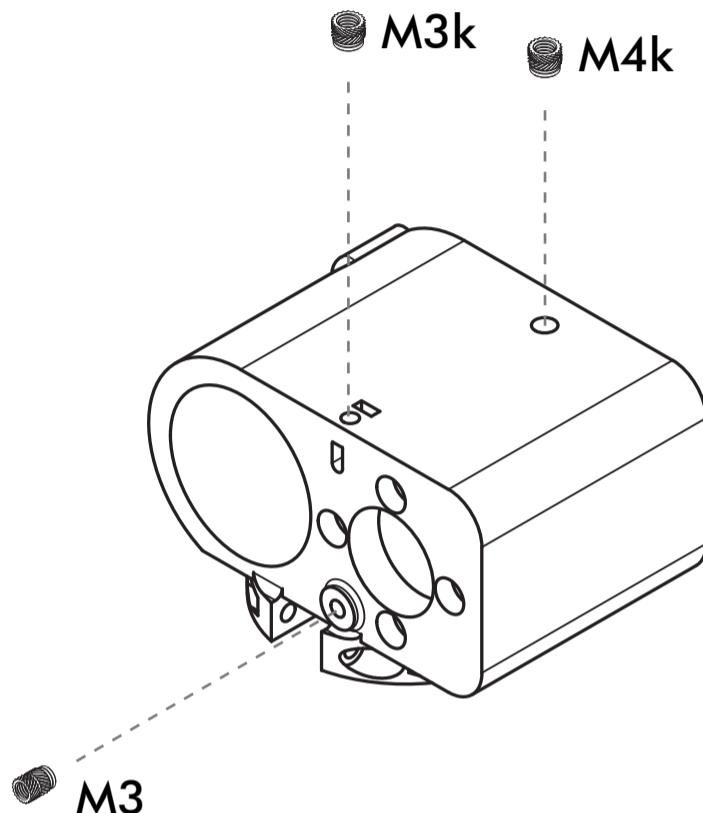
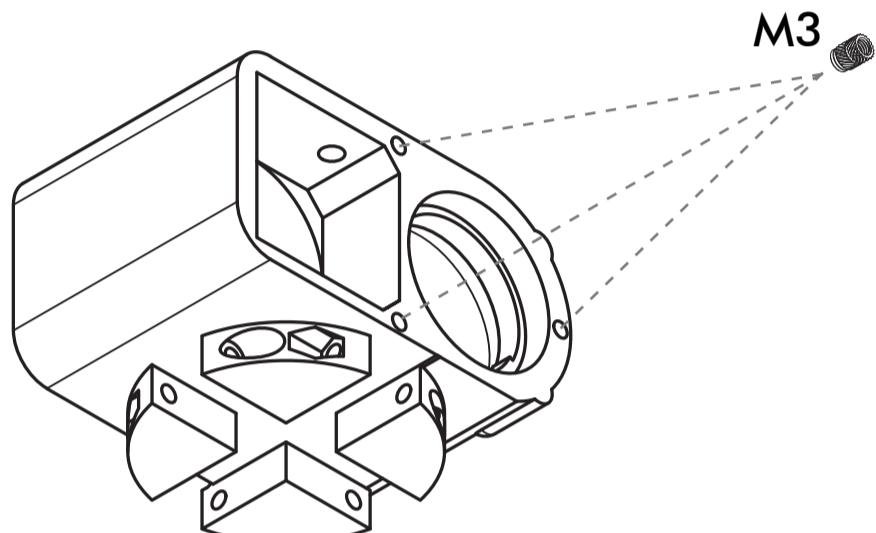
1x M3k



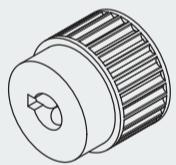
1x M4k



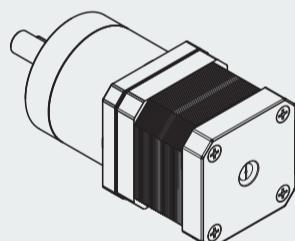
4x M3



2



1x B10



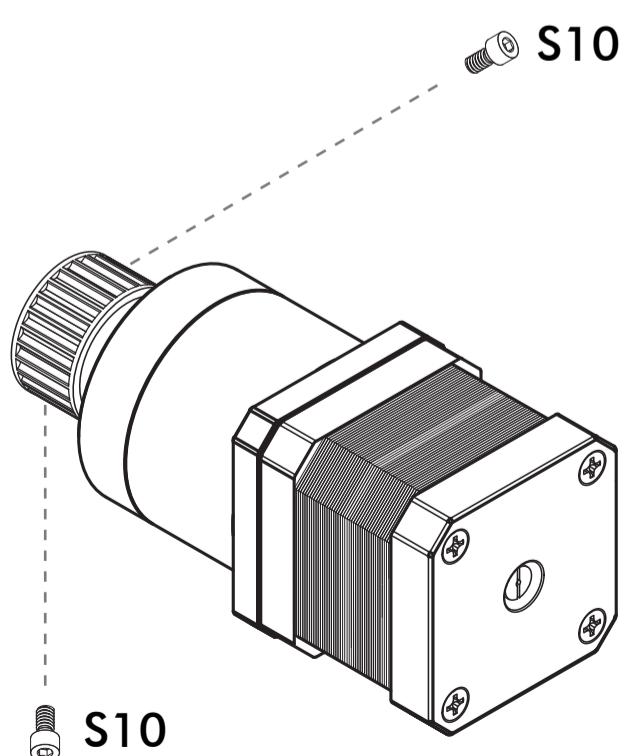
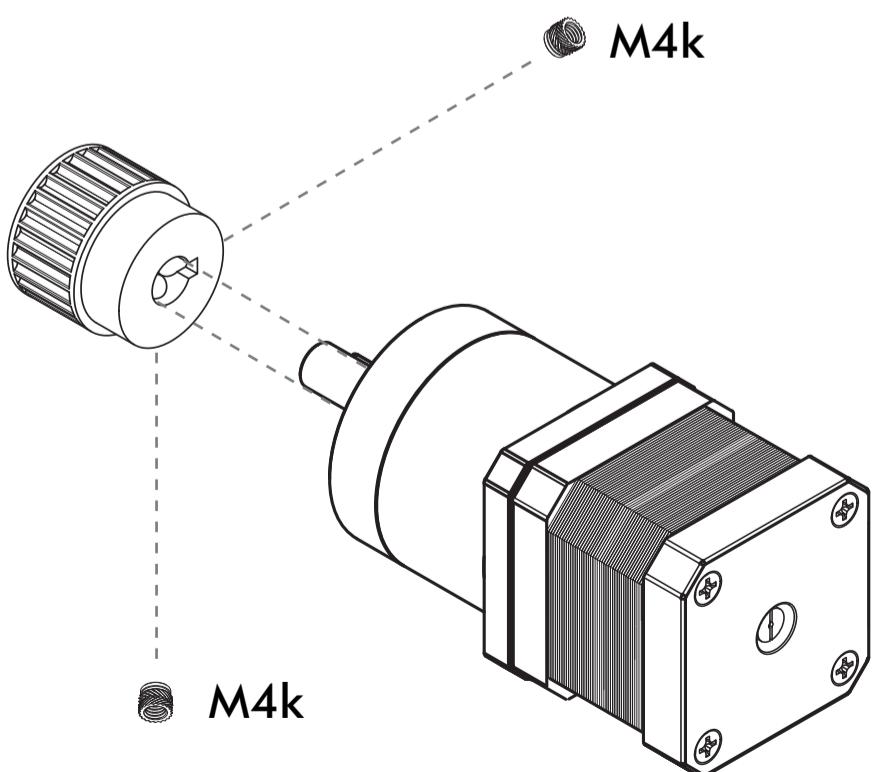
1x N2



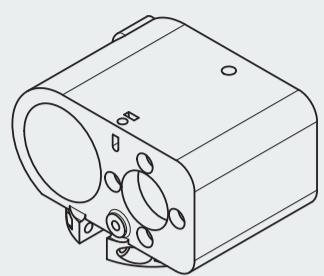
2x M4k



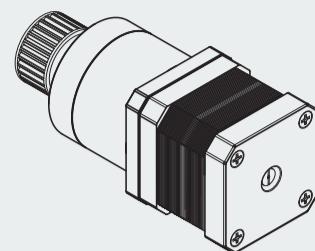
2x S10



3



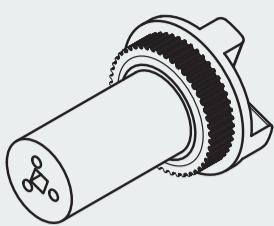
Step 1



Step 2



5



1x B11



1x B12



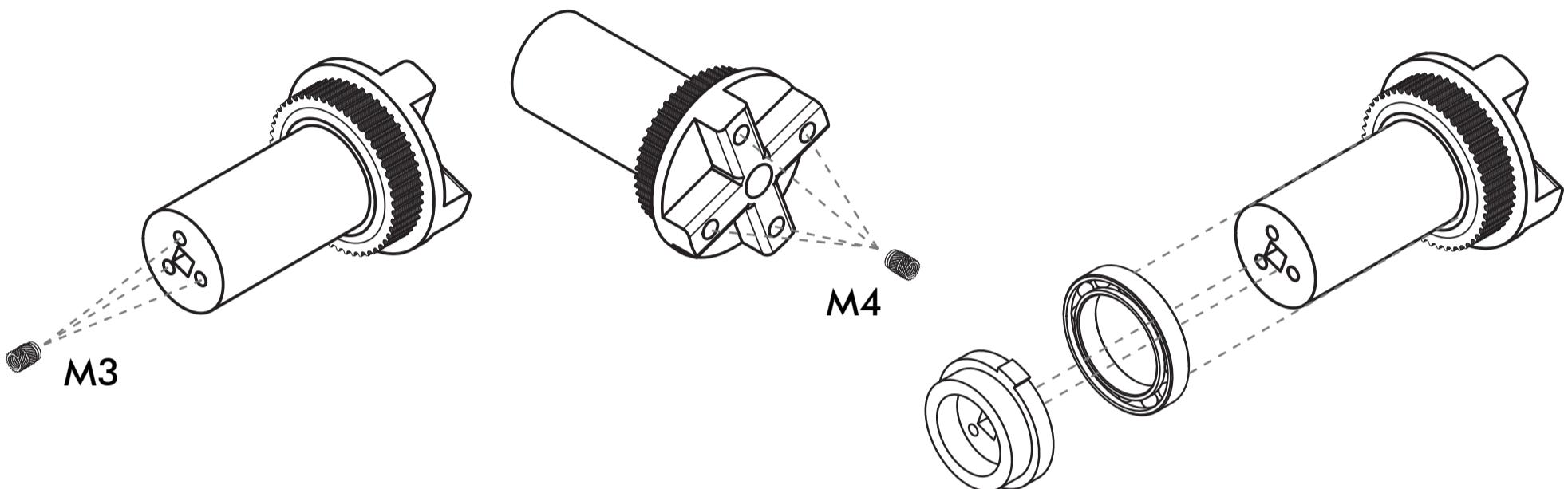
1x N12



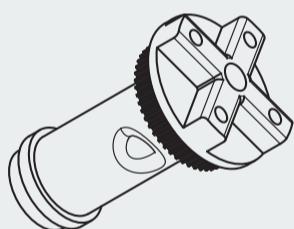
4x M4



3x M3



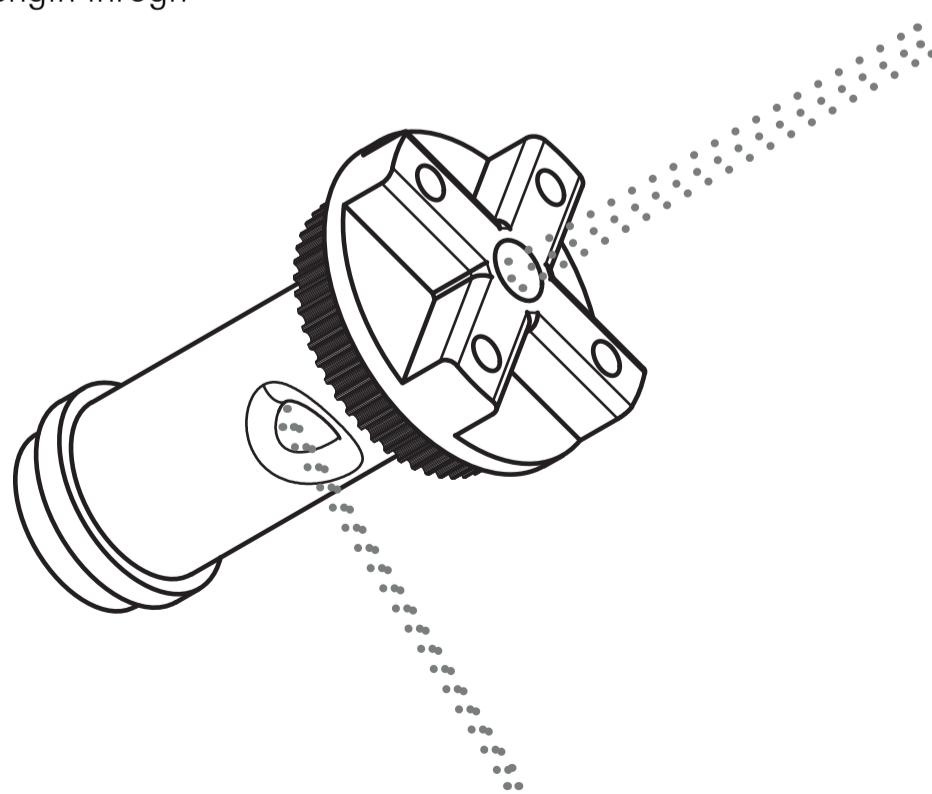
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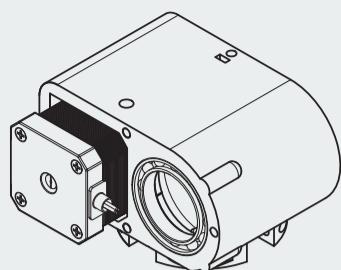
Step 5

Note

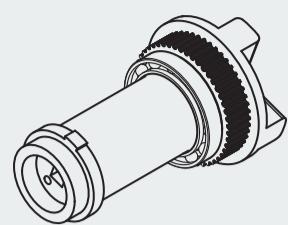
Feed the cables with sufficient length through
B11 as shown.



7



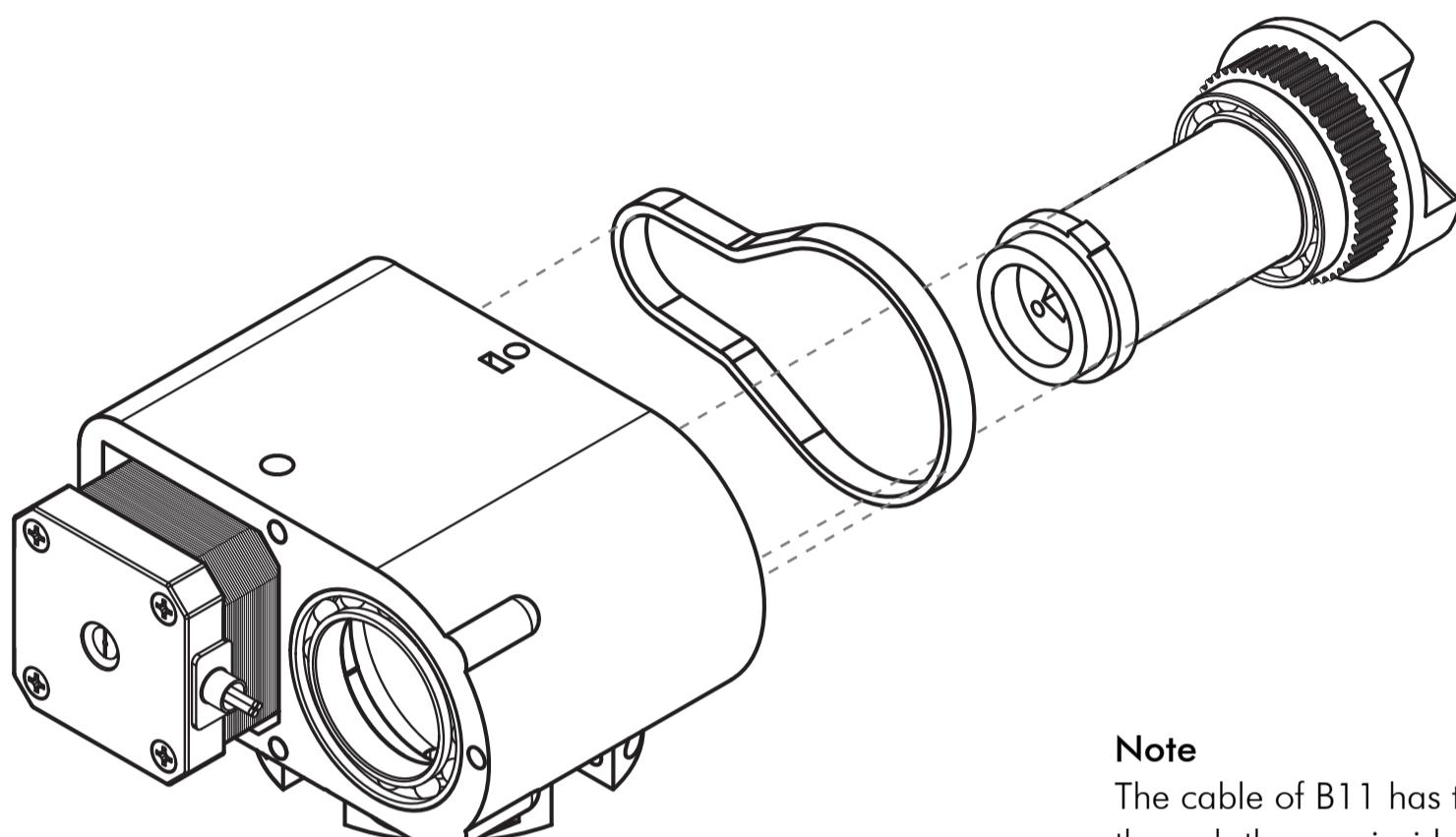
Step 4



Step 6

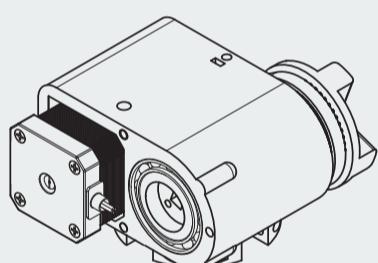


1x N5

**Note**

The cable of B11 has to be fed through the gap inside of B9.

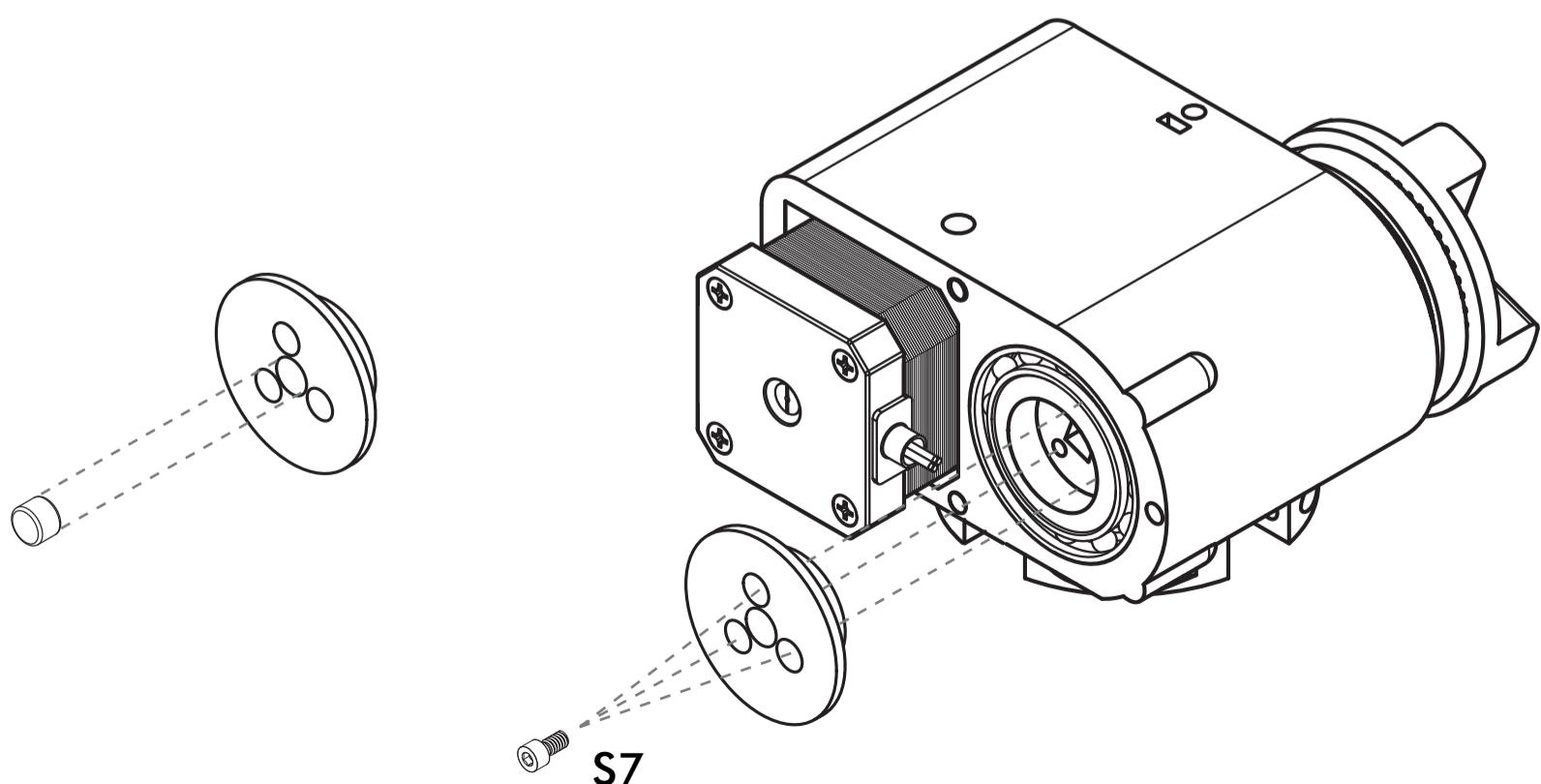
8



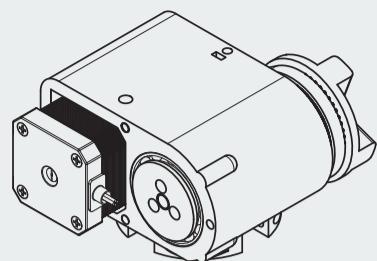
Step 7



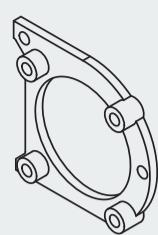
3x S7



9



Step 8



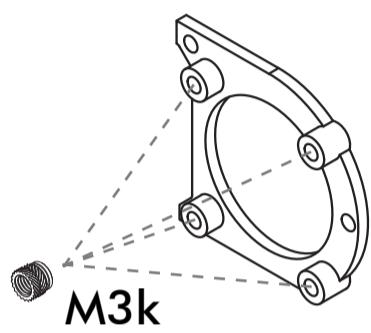
1x B14



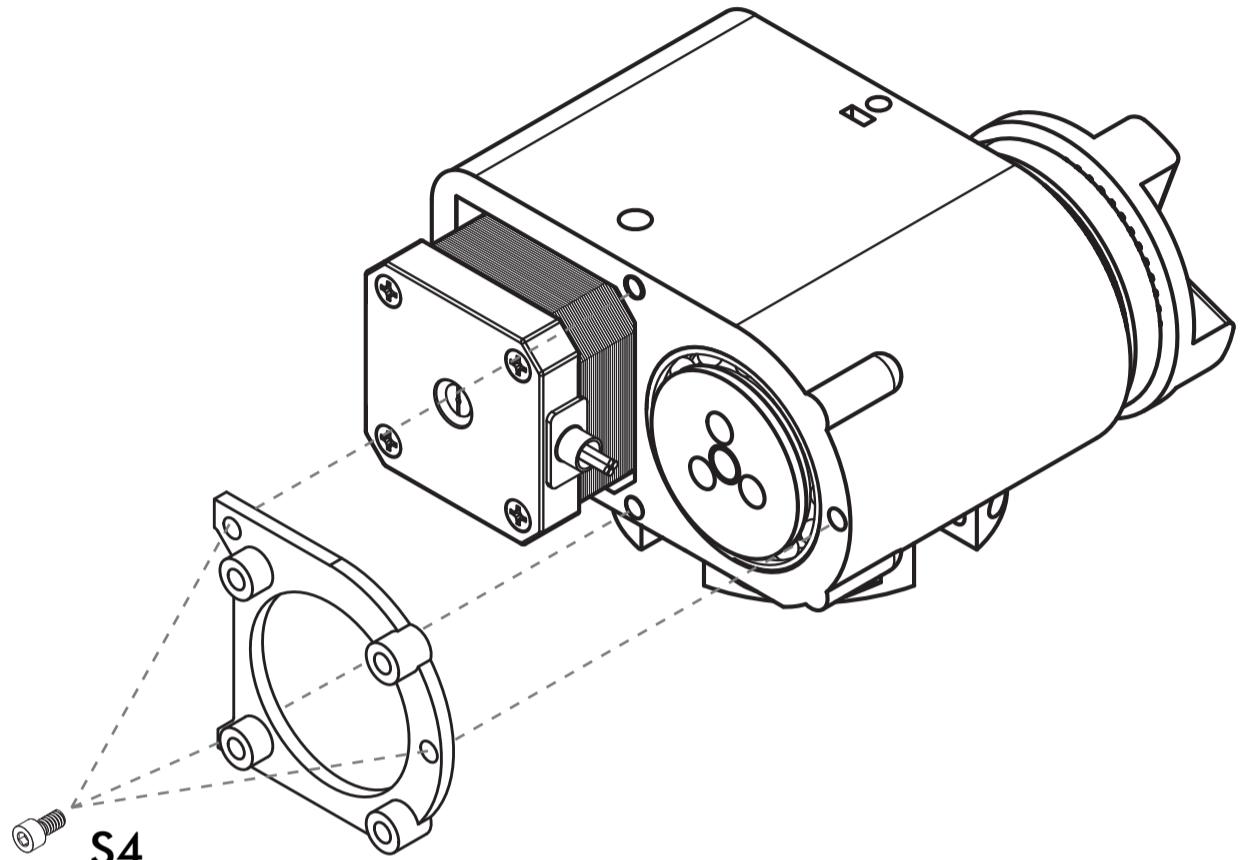
4x M3k



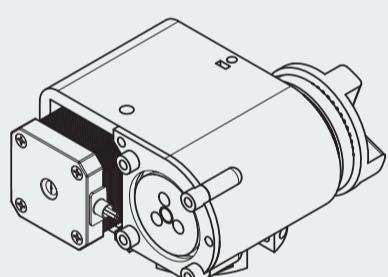
3x S4



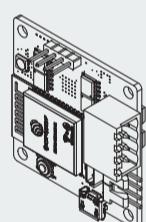
M3k



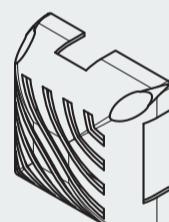
10



Step 9



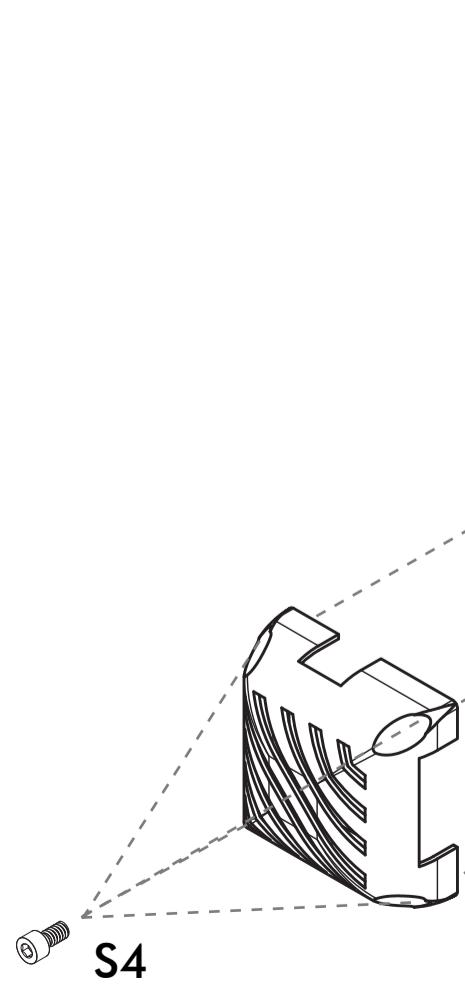
1x N20



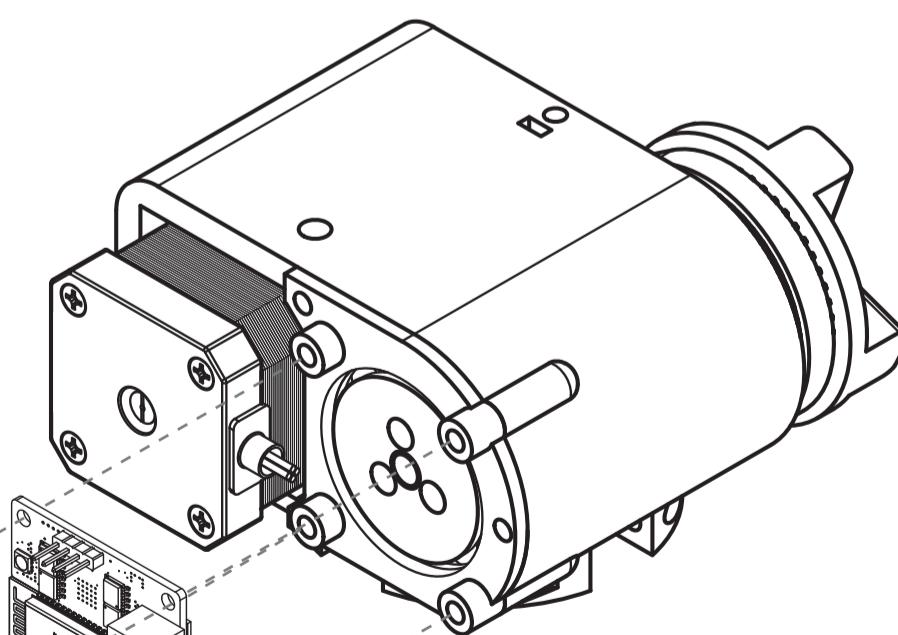
1x B35



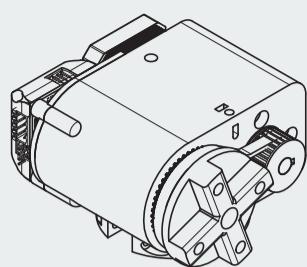
4x S4



S4



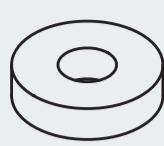
11



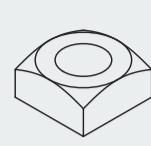
Step 10



4x N10



1x B36



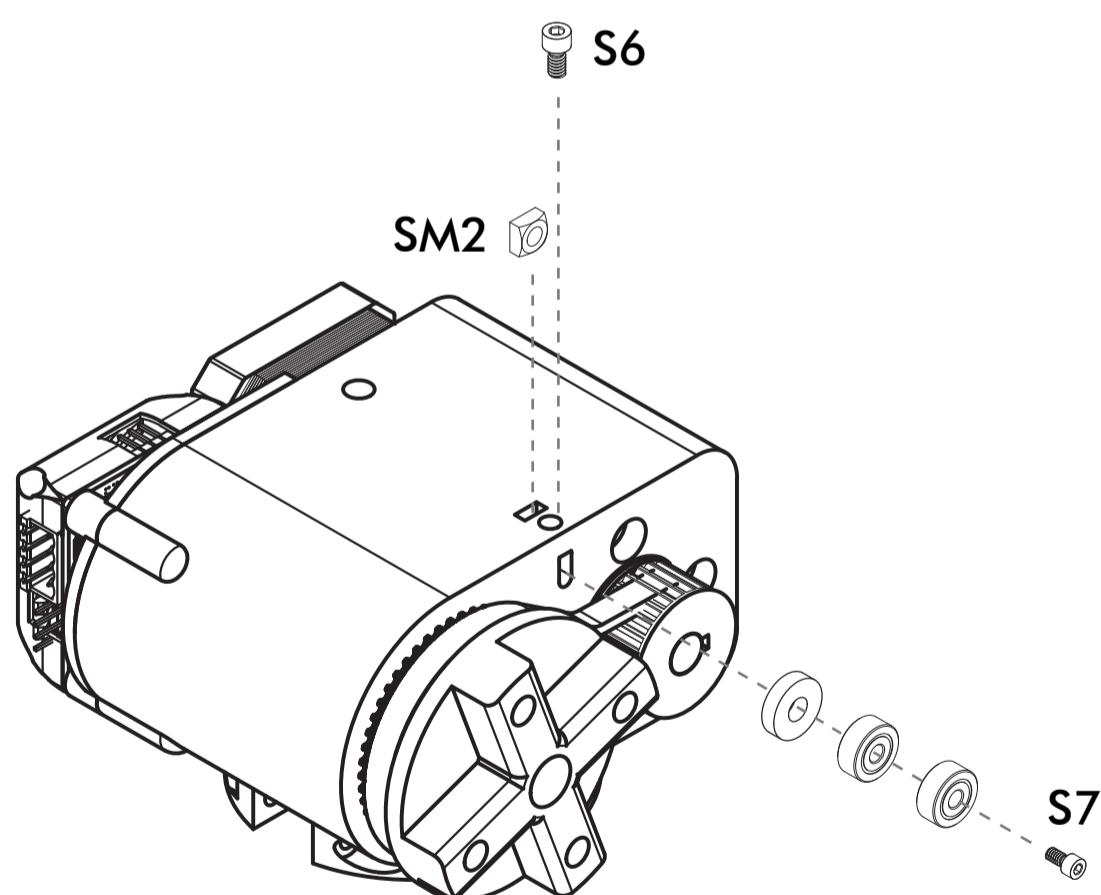
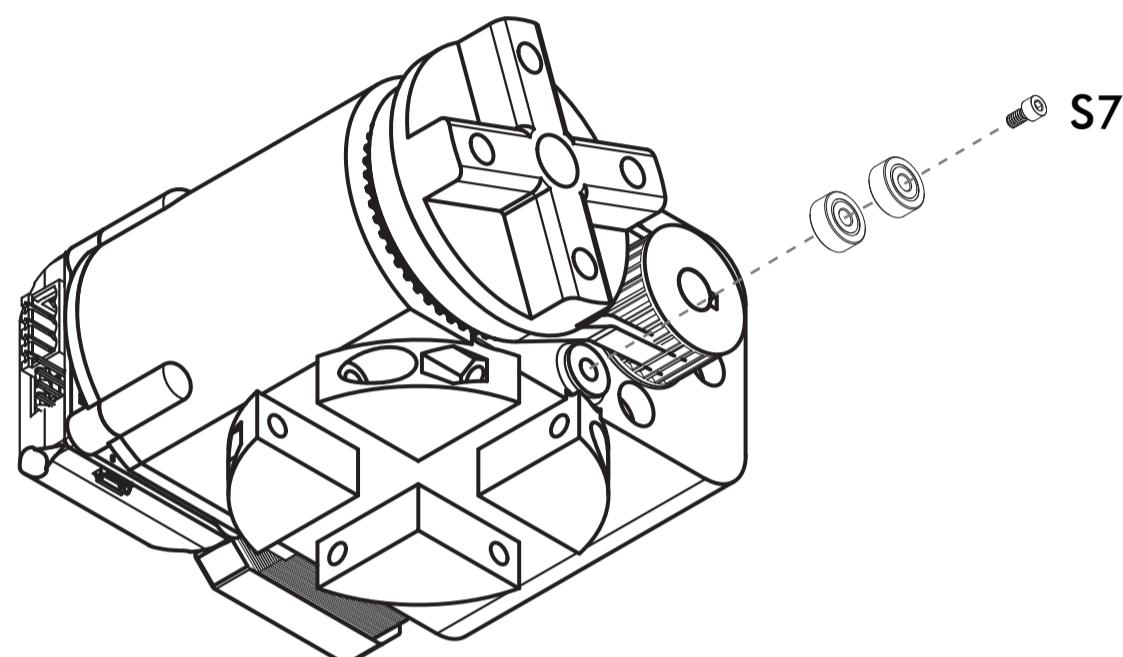
1x SM2



2x S7

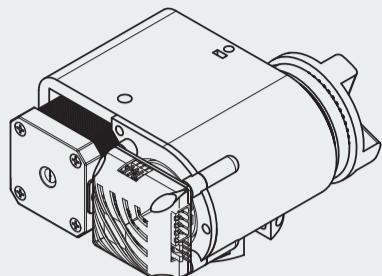


1x S6

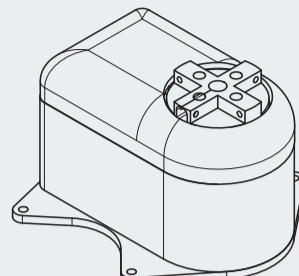
**Note**

The S7 screws have to be attached in advance of S6. Completely fasten S7 (figure below) after fastening S6.

12



Assembly I



Assembly II



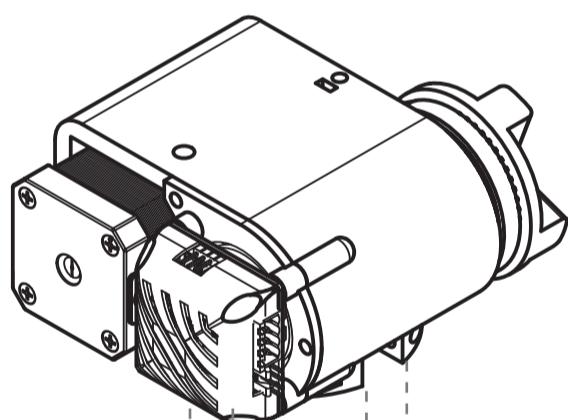
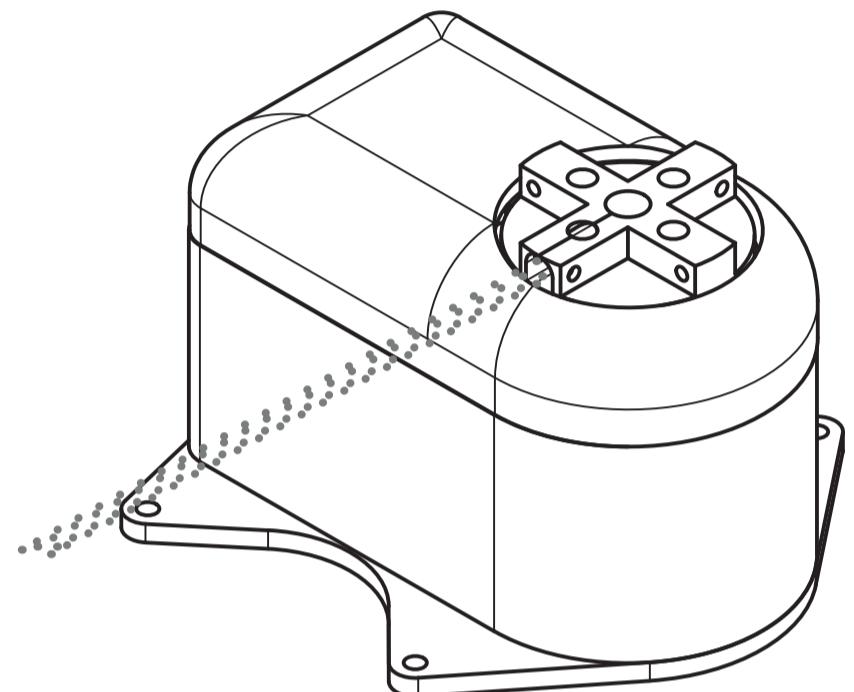
4x S15



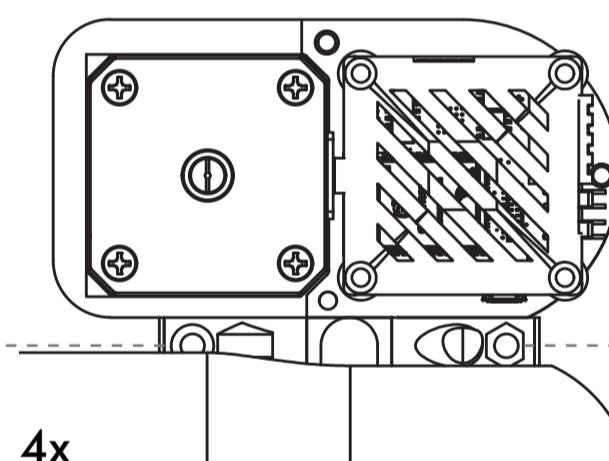
4x SM3

Note

Mind the orientation between Assembly I and Assembly II regarding the cable feed through.

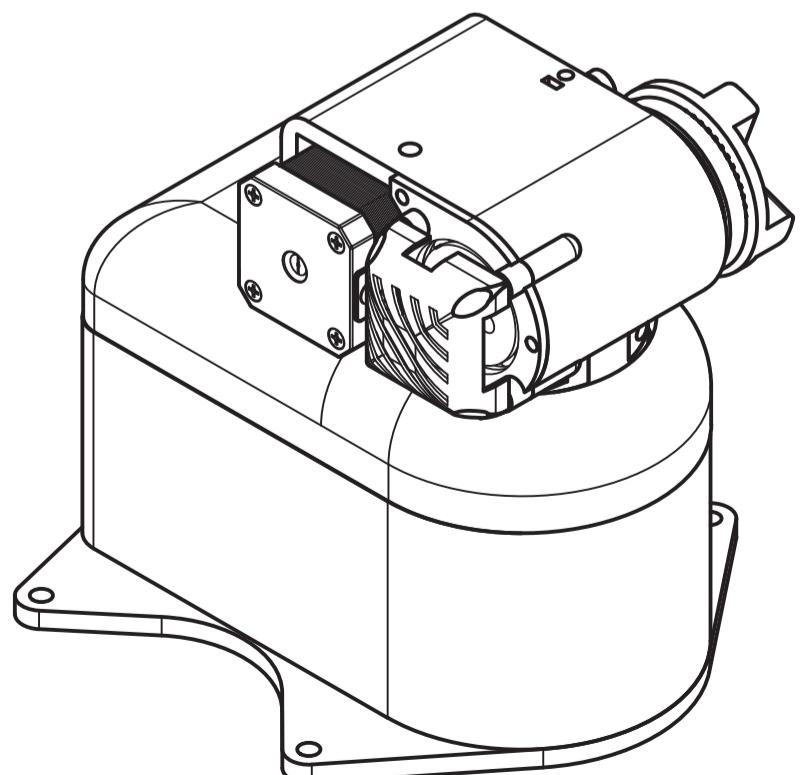
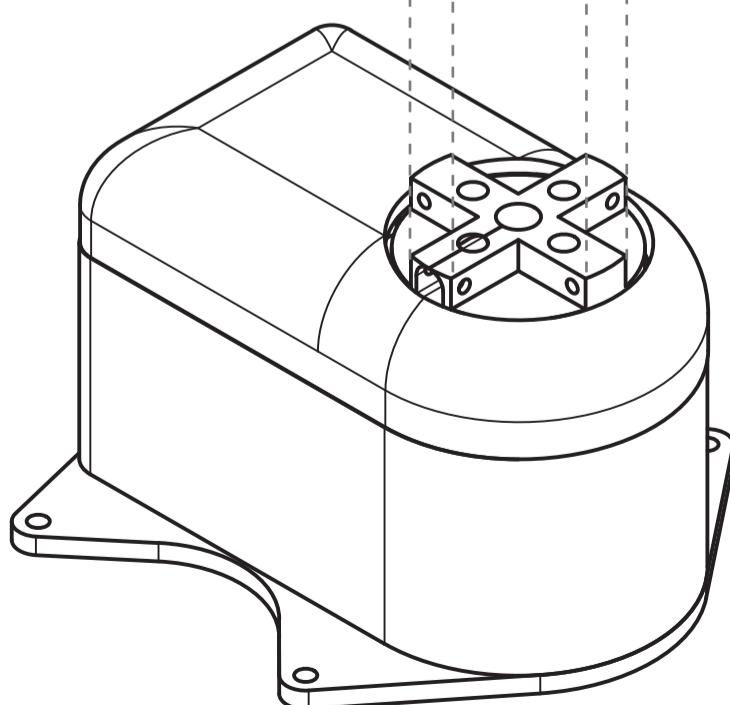


SM3



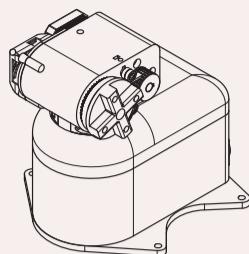
S15

4x

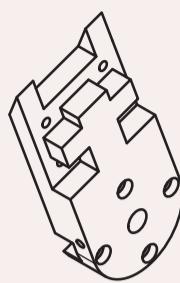


Assembly III

1



Assembly I+II



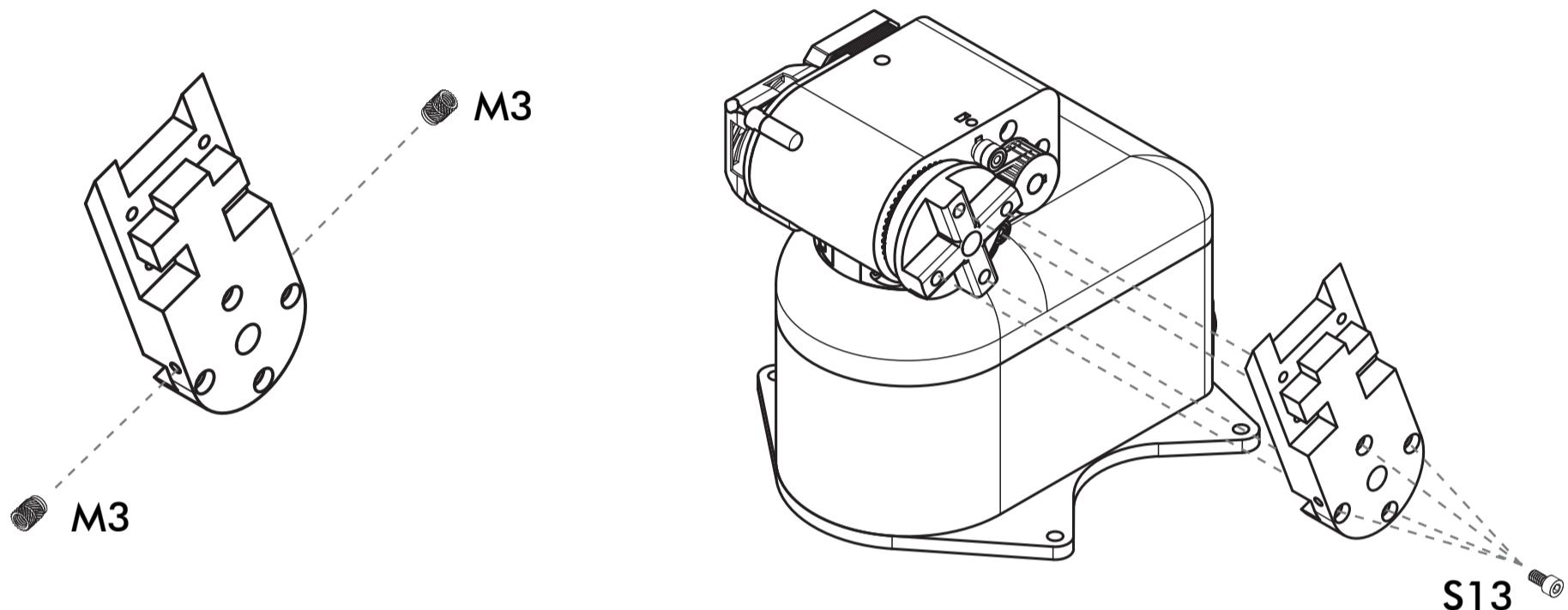
1x B15



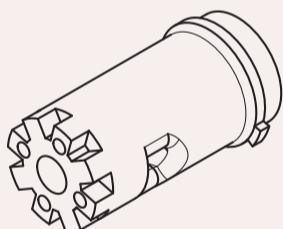
2x M3



4x S13



2



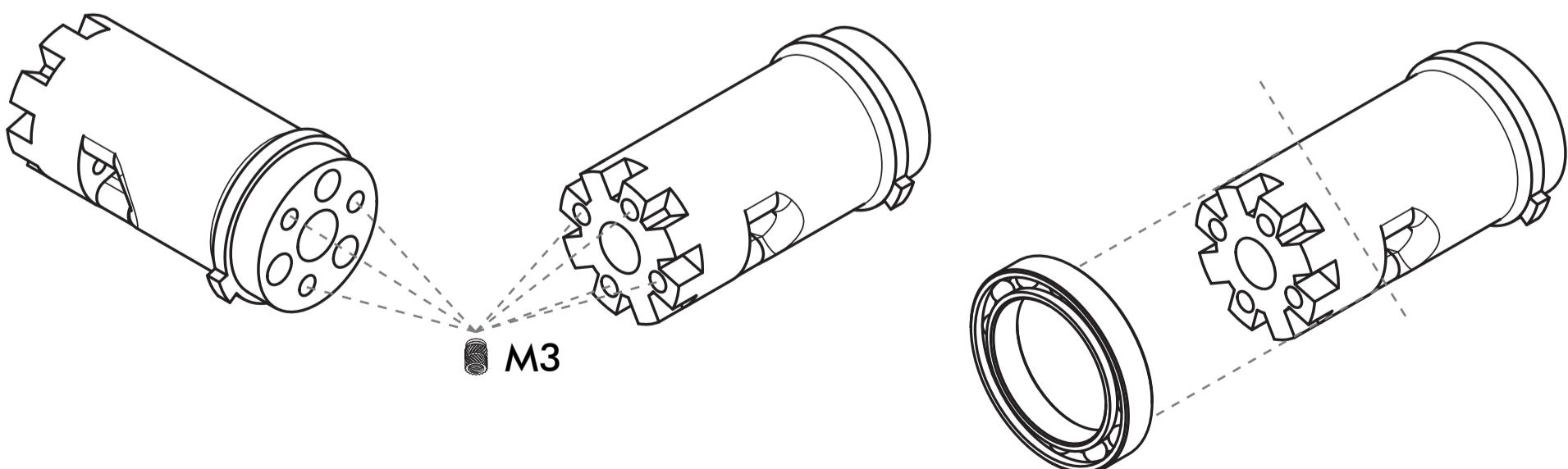
1x B17

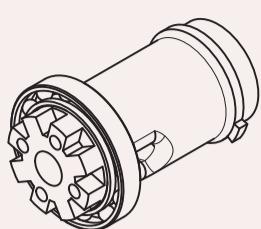


7x M3

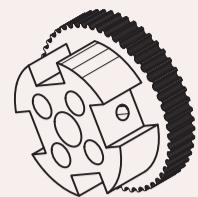


1x N12



3

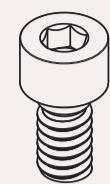
Step 2



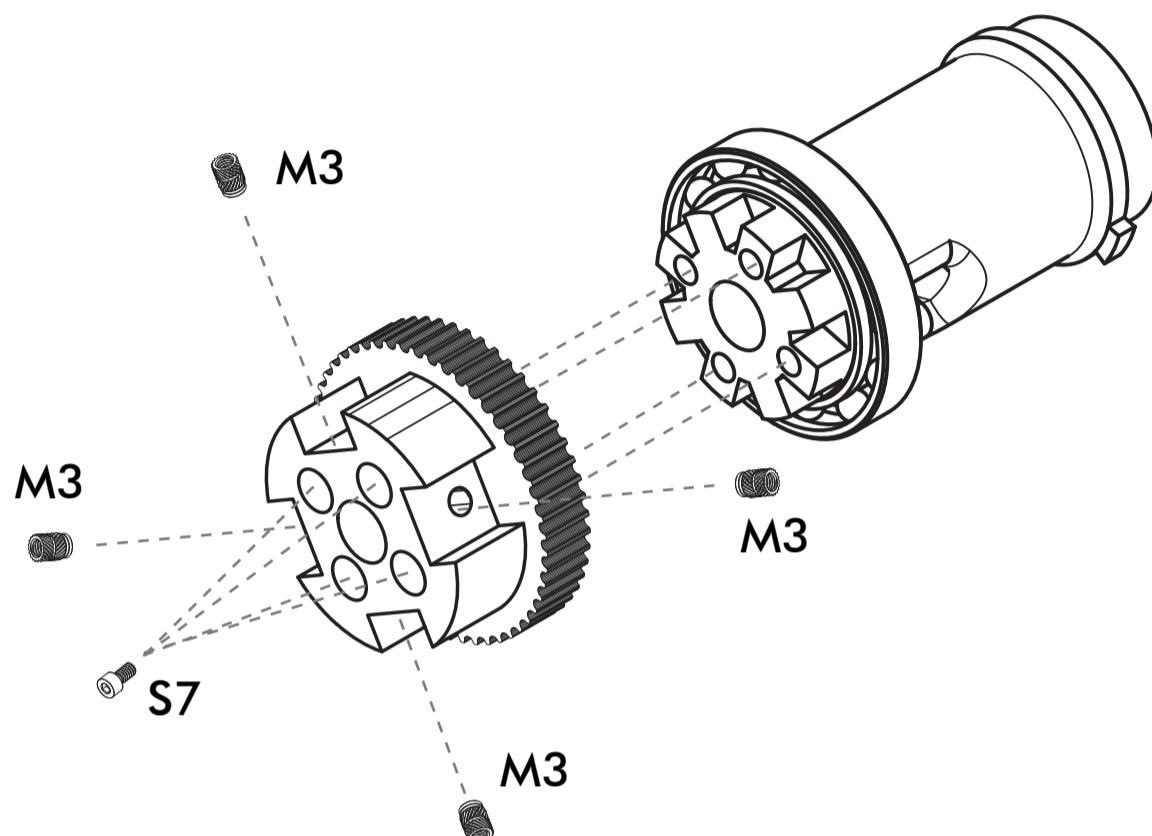
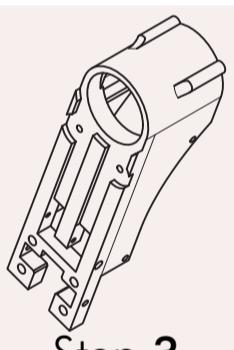
1x B18



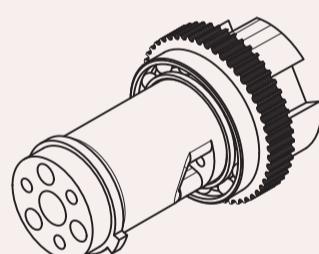
4x M3



4x S7

**4**

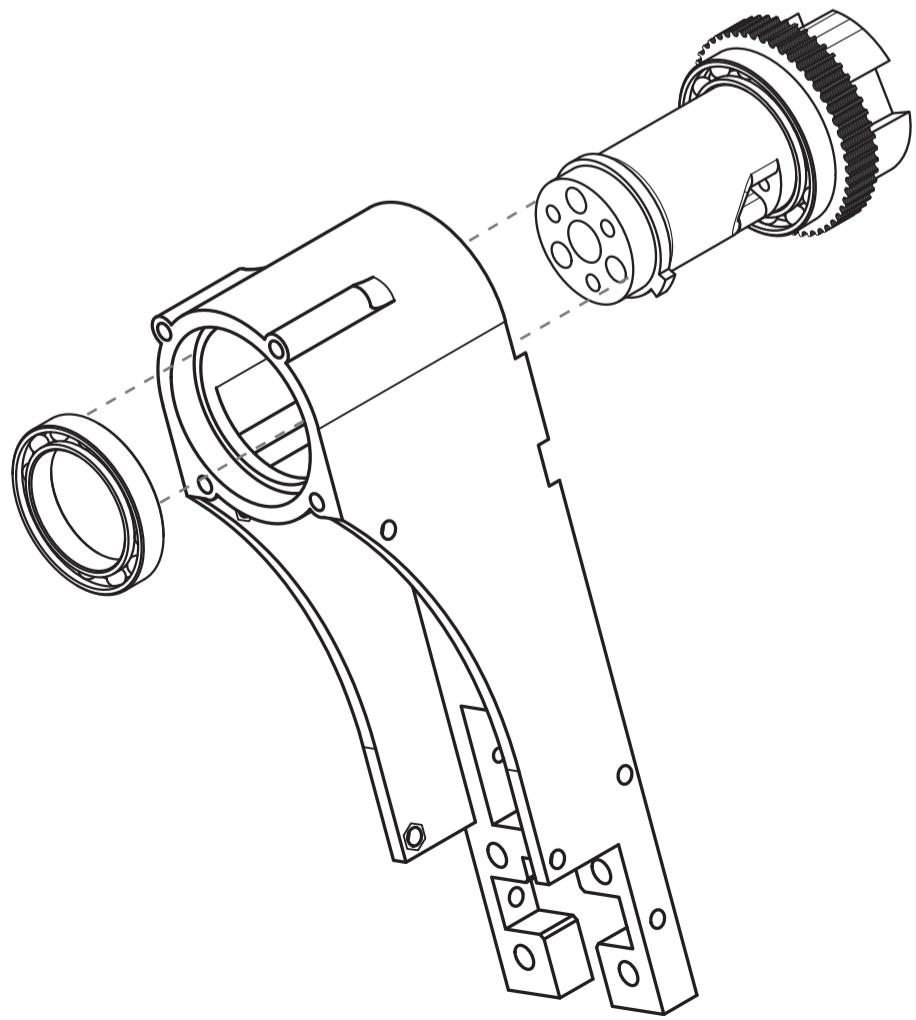
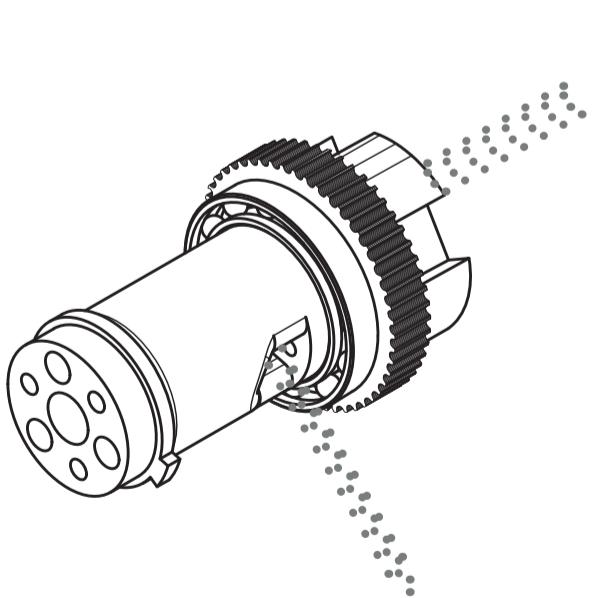
Step 3



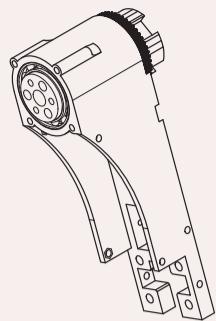
1x B16



1x N12

**Note**

Before inserting building step 3 feed the cables with sufficient length through the holes of B17 and B18 as shown.

5

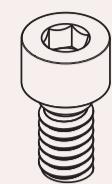
Step 4



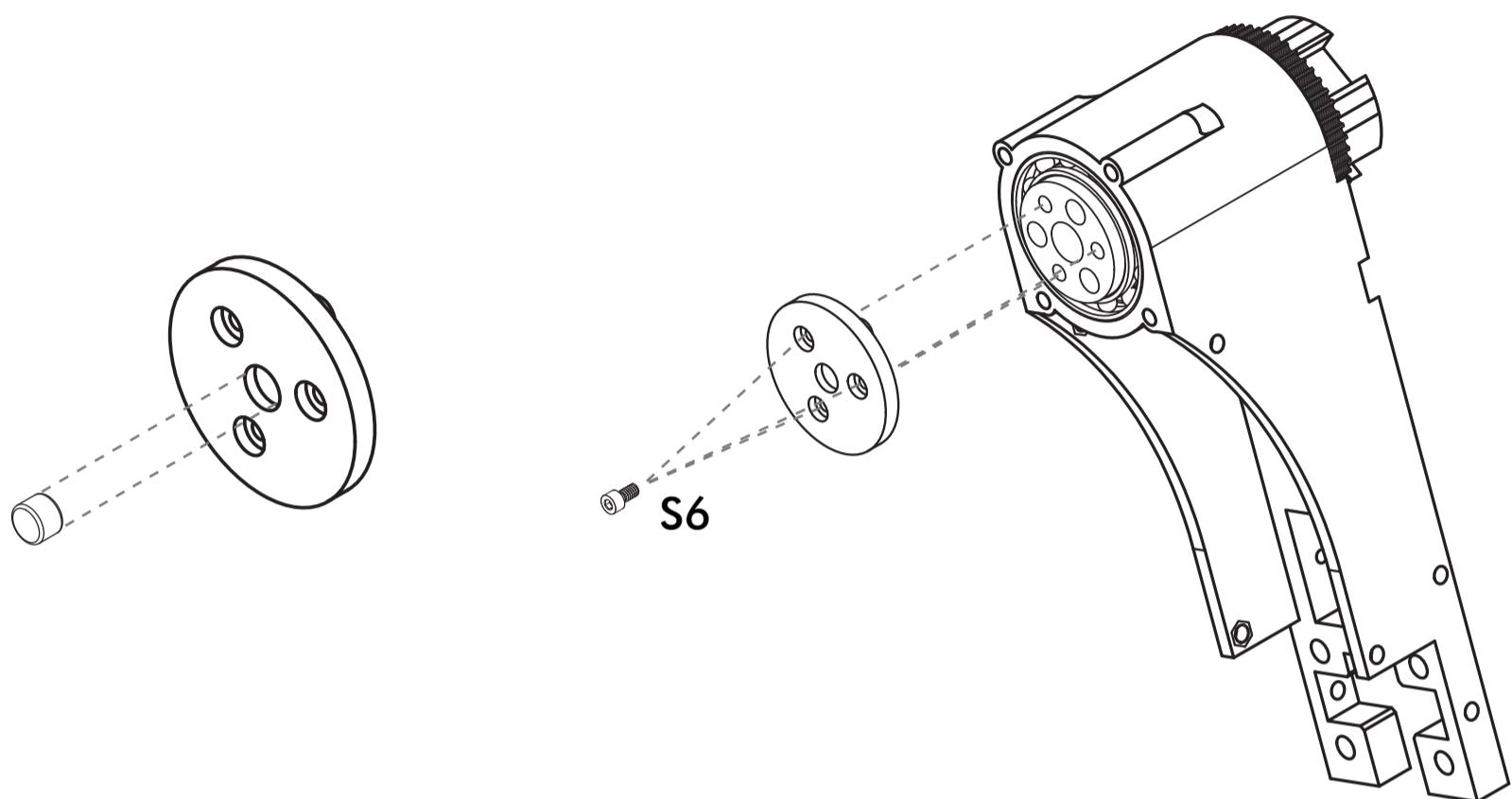
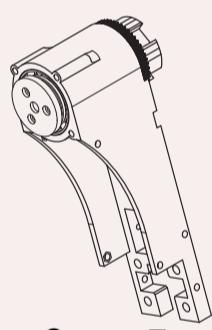
1x B20



1x N19



3x S6

**6**

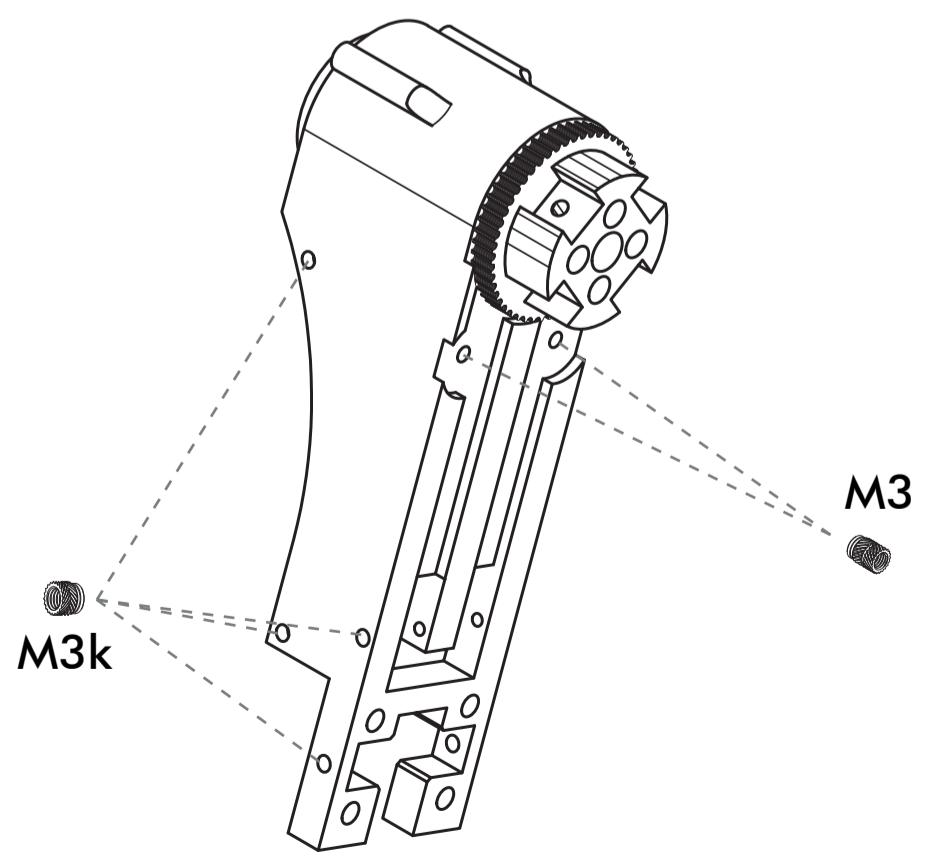
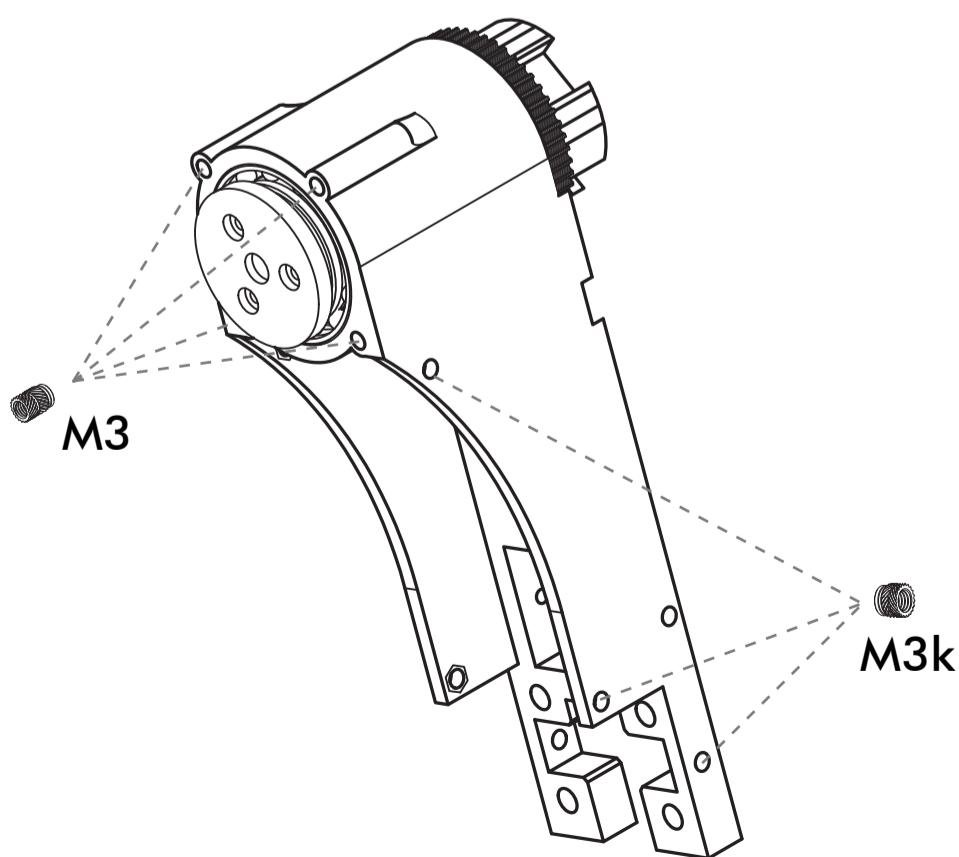
Step 5

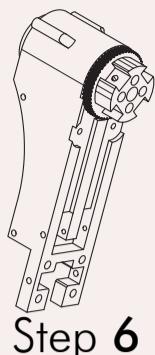


6x M3



7x M3k



7

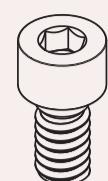
Step 6



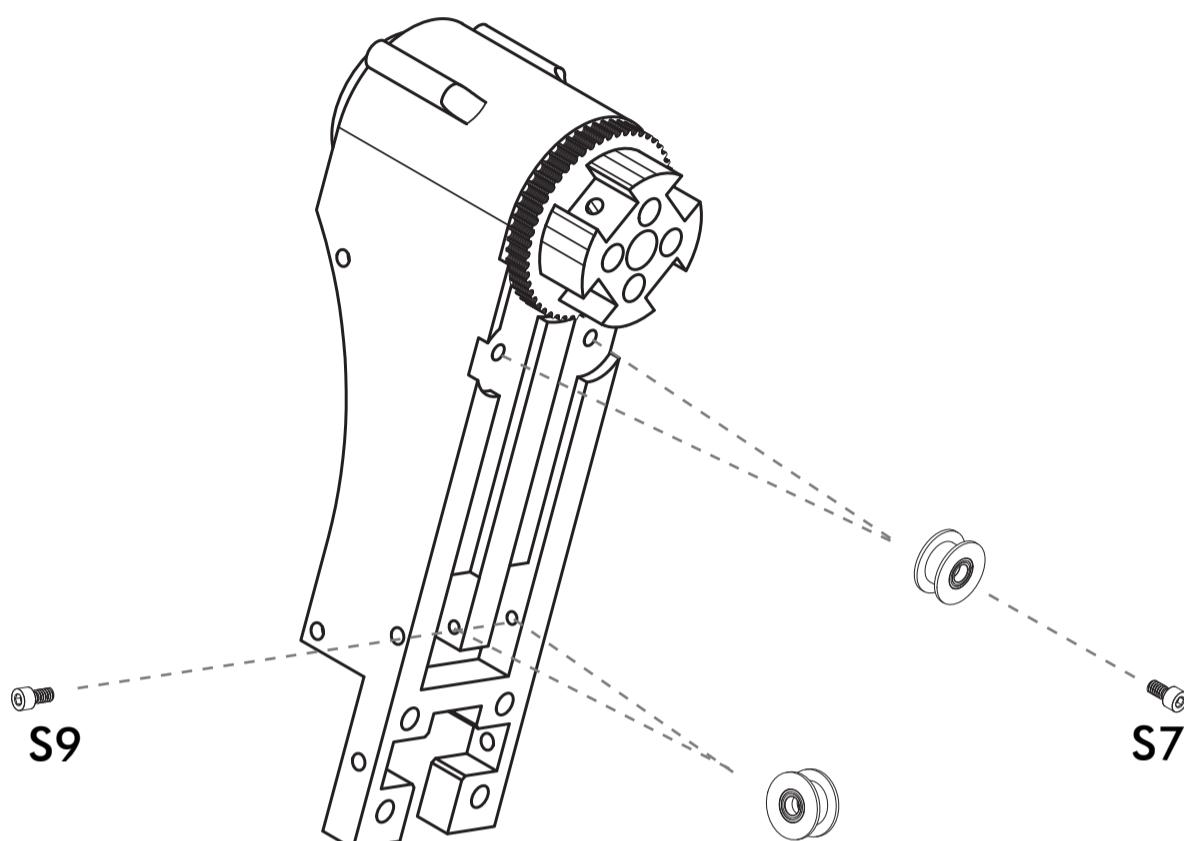
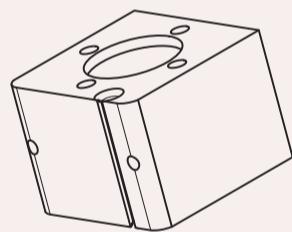
4x N16



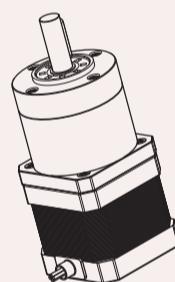
1x S9



2x S7

**8**

1x B21



1x N2



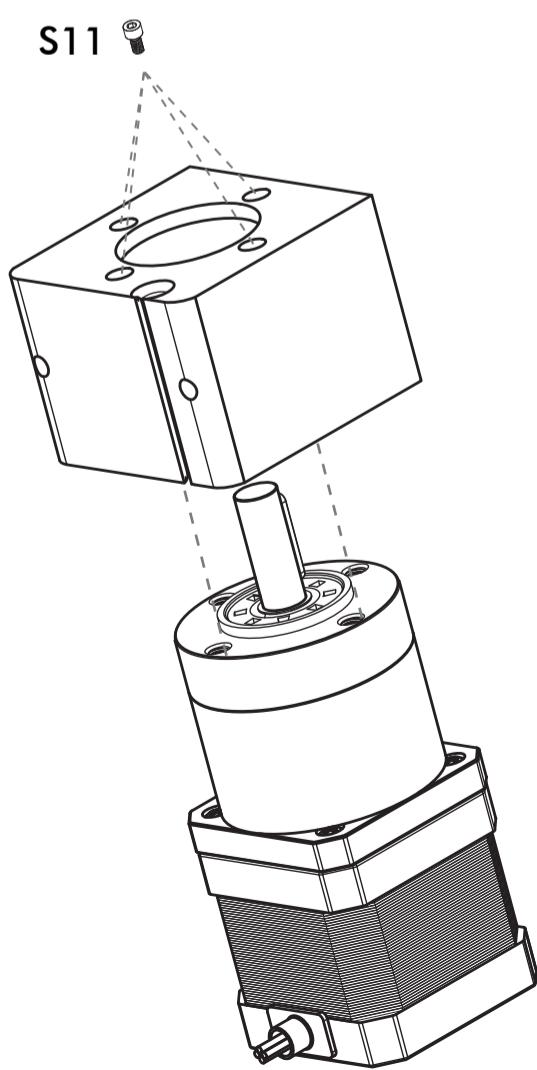
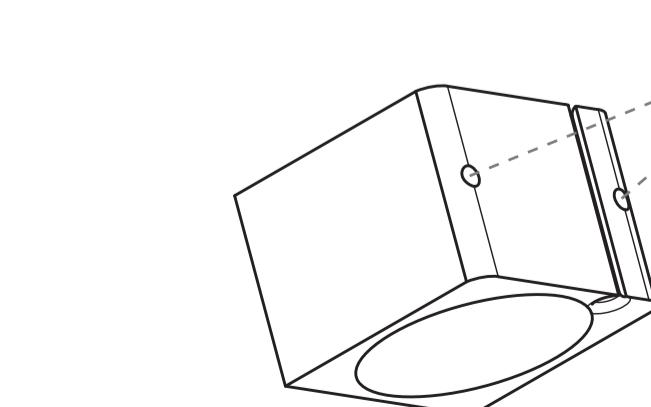
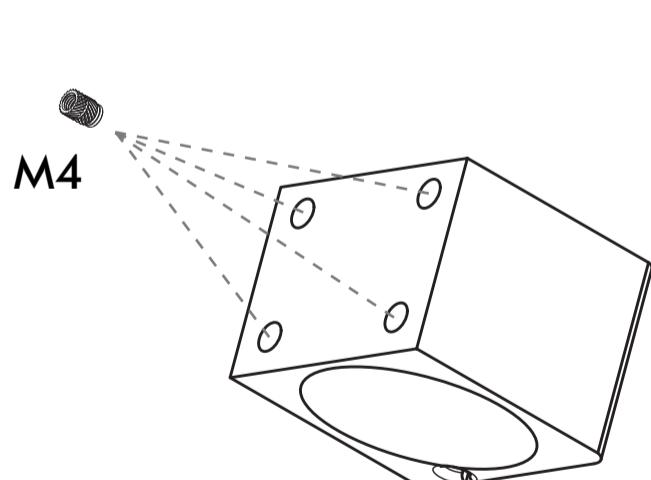
4x M4

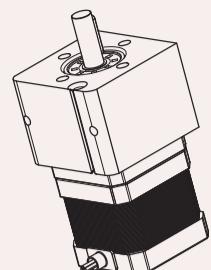


2x M3

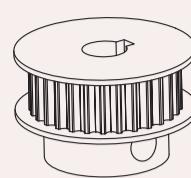


4x S11



9

Step 8



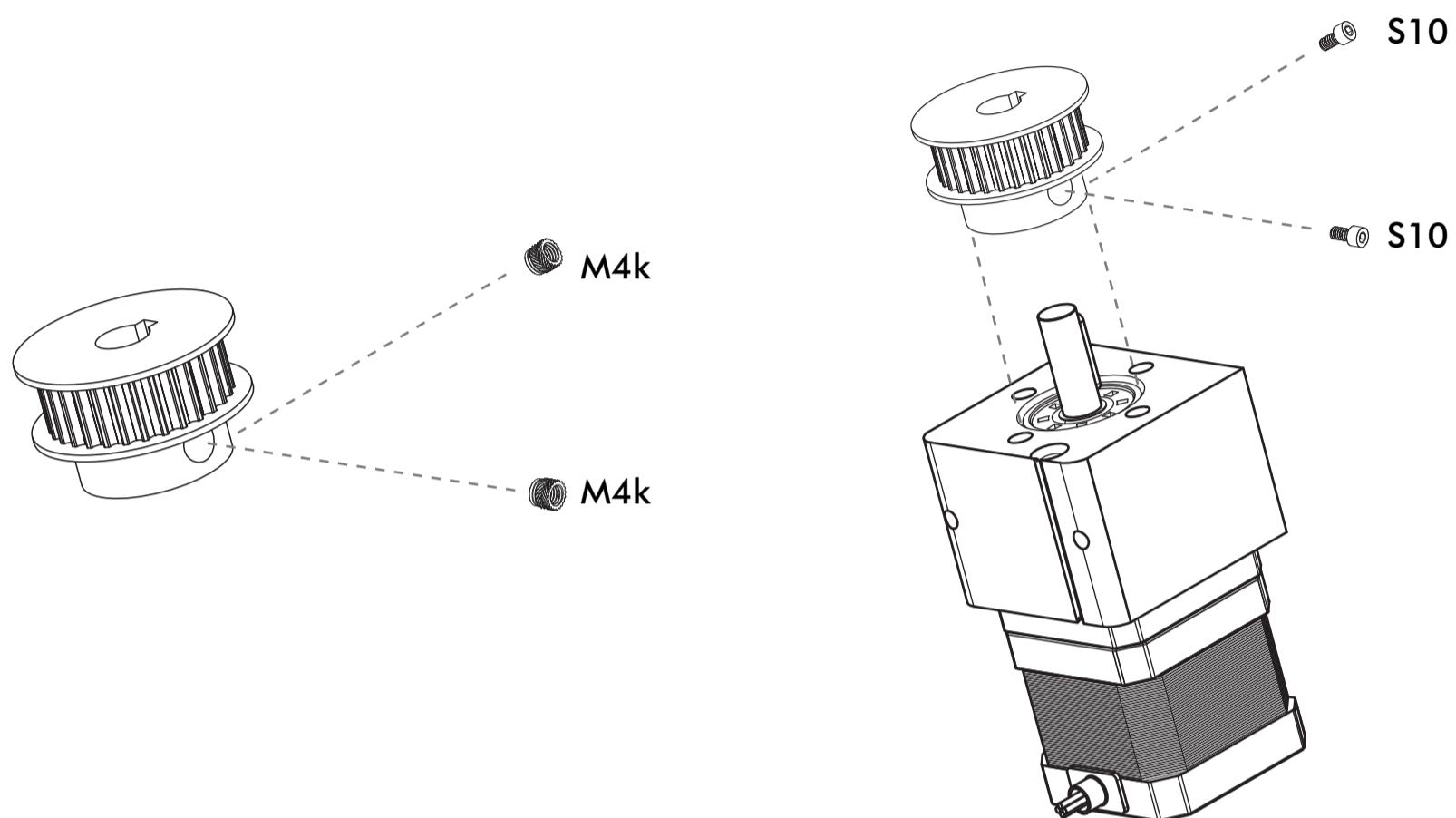
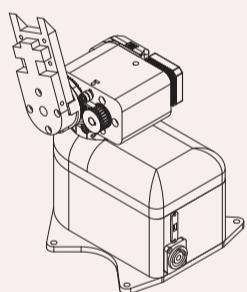
1x B19



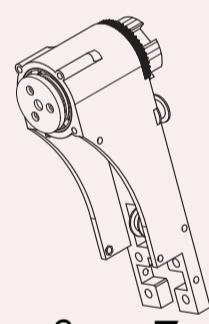
2x M4k



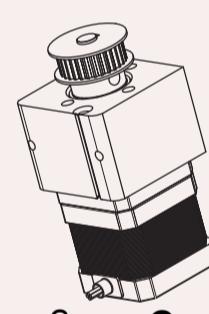
2x S10

**10**

Step 1



Step 7



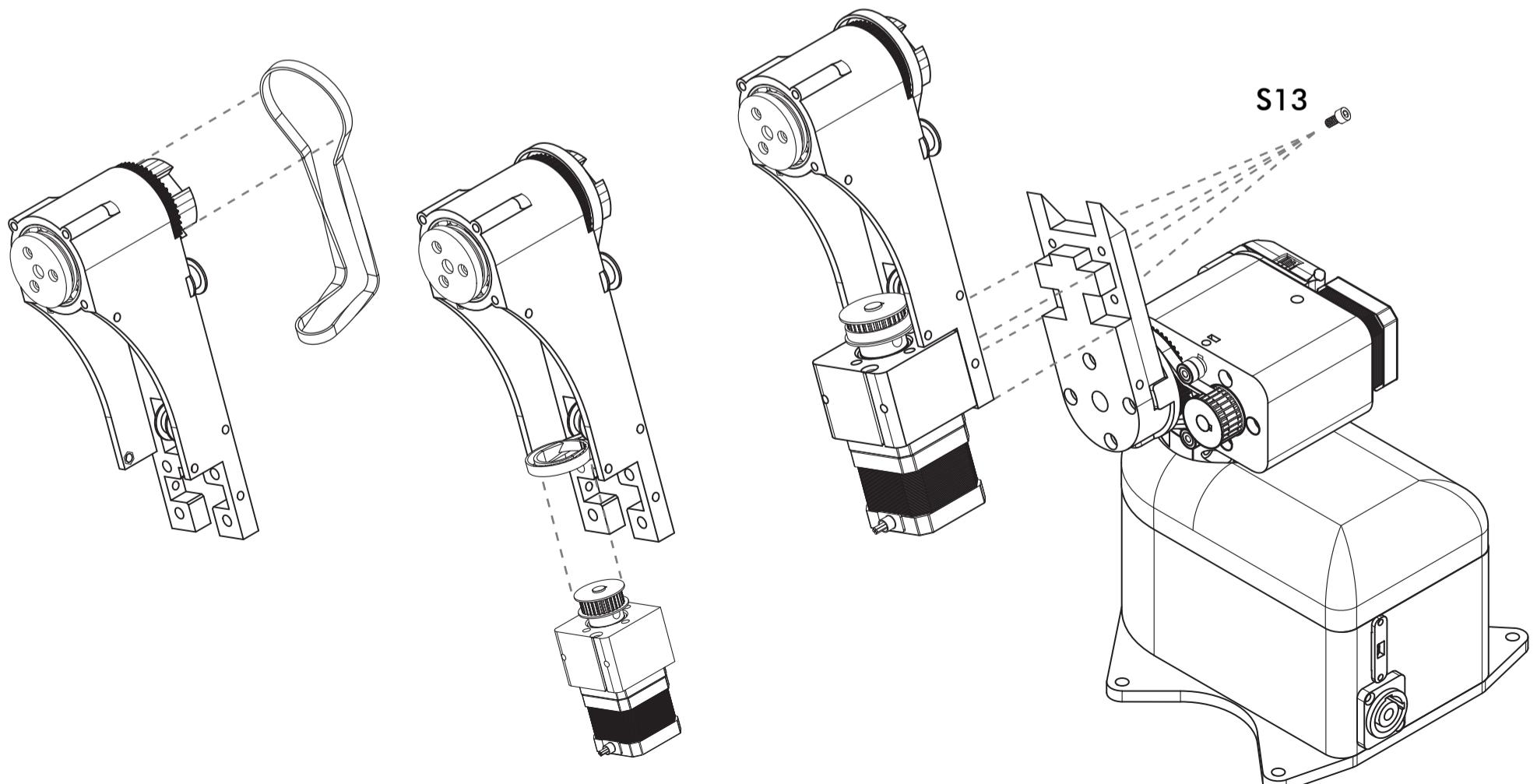
Step 9



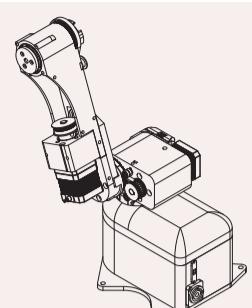
1x N6



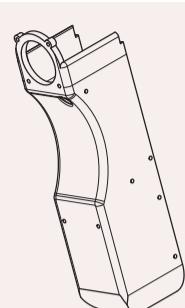
4x S13



11



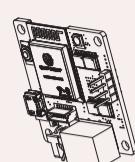
Step 10



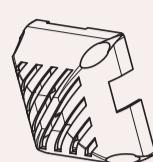
1x B22



4x B36



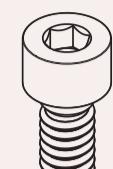
1x N20



1x B35



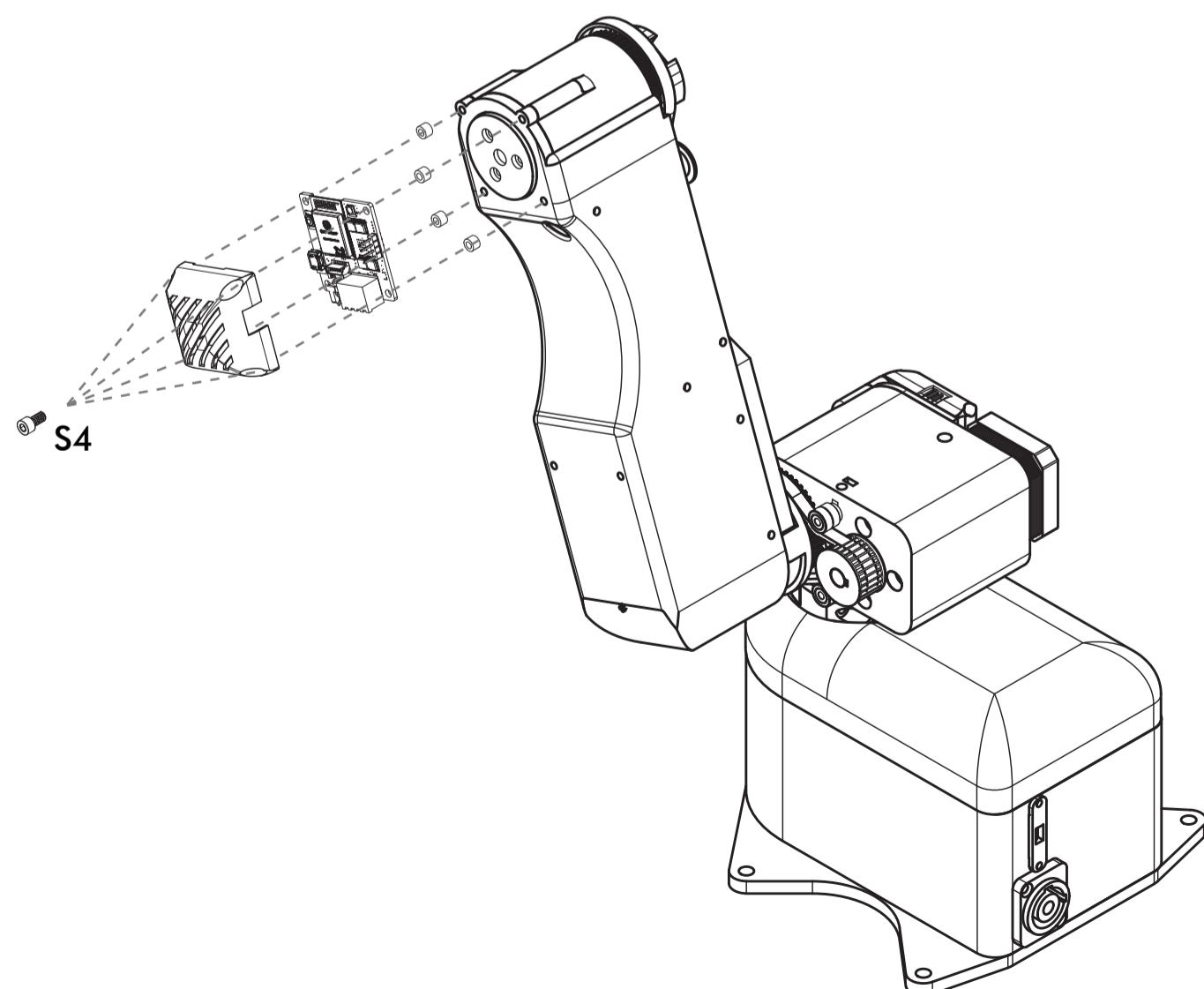
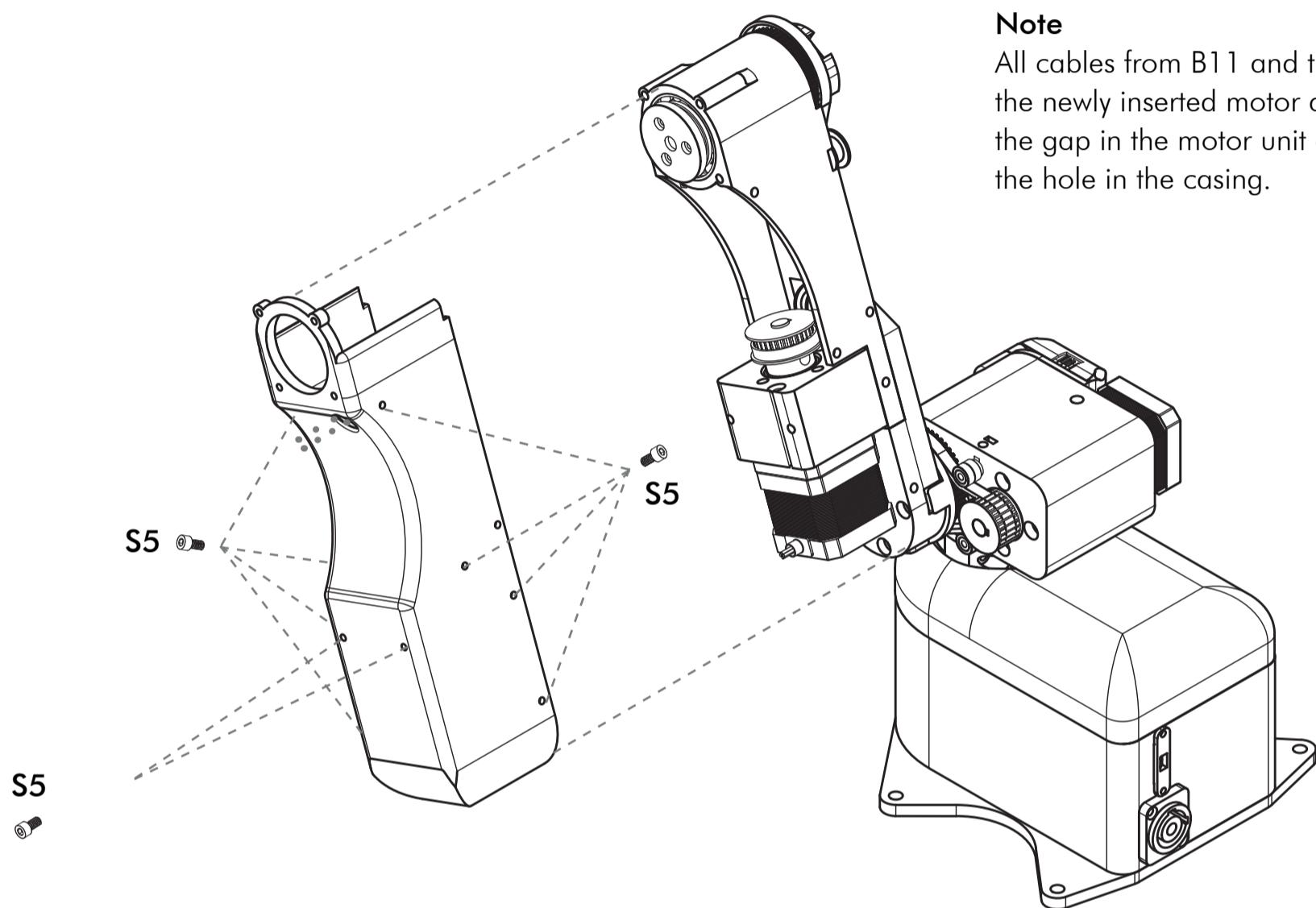
4x S4



10x S5

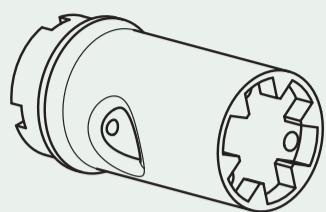
Note

All cables from B11 and the cables of the newly inserted motor are fed through the gap in the motor unit and through the hole in the casing.

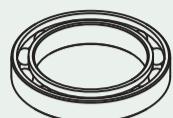


Assembly IV

1



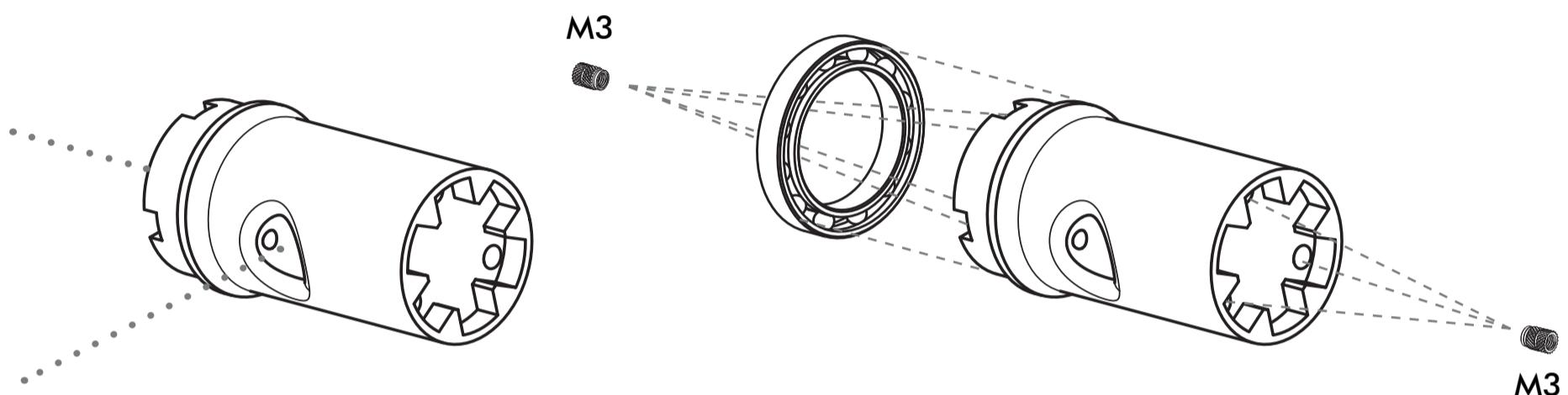
1x B24



1x N12



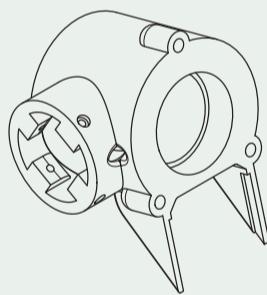
7x M3



Note

The cables are fed through the hole in B24 with sufficient length (see Assembly V step 8).

2



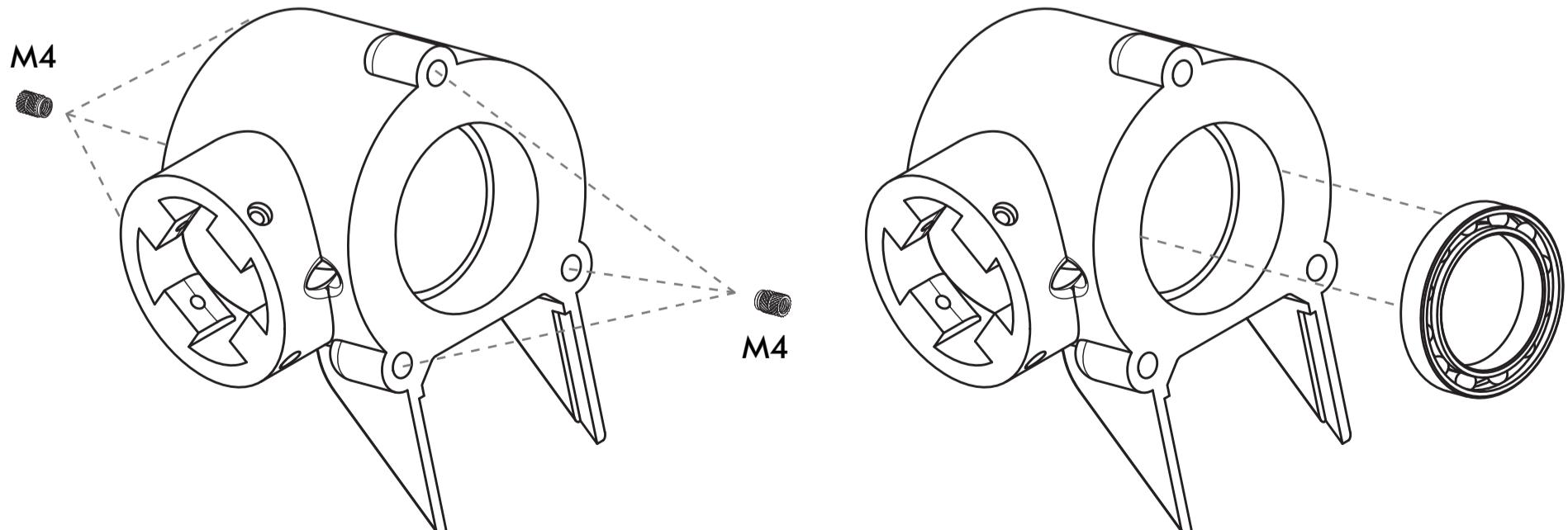
1x B23

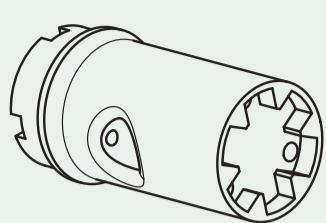


1x N12

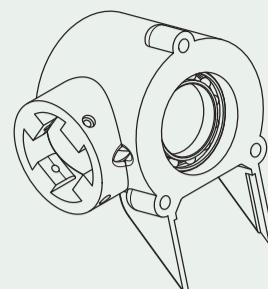


6x M4

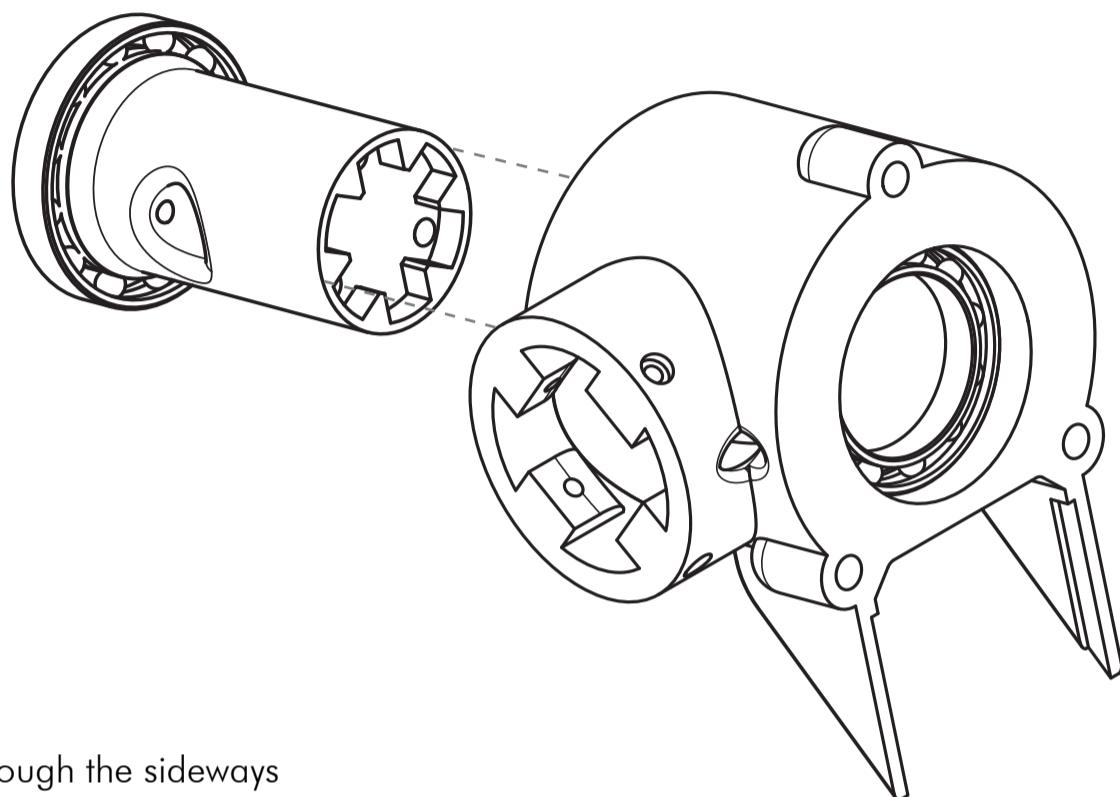


3

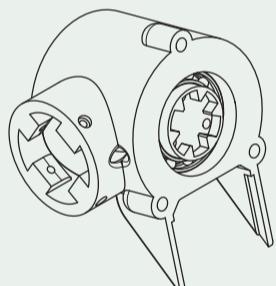
Step 1



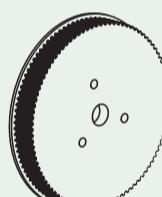
Step 2

**Note**

Feed the cables of B24 through the sideways hole in B23 before inserting.

4

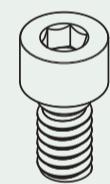
Step 3



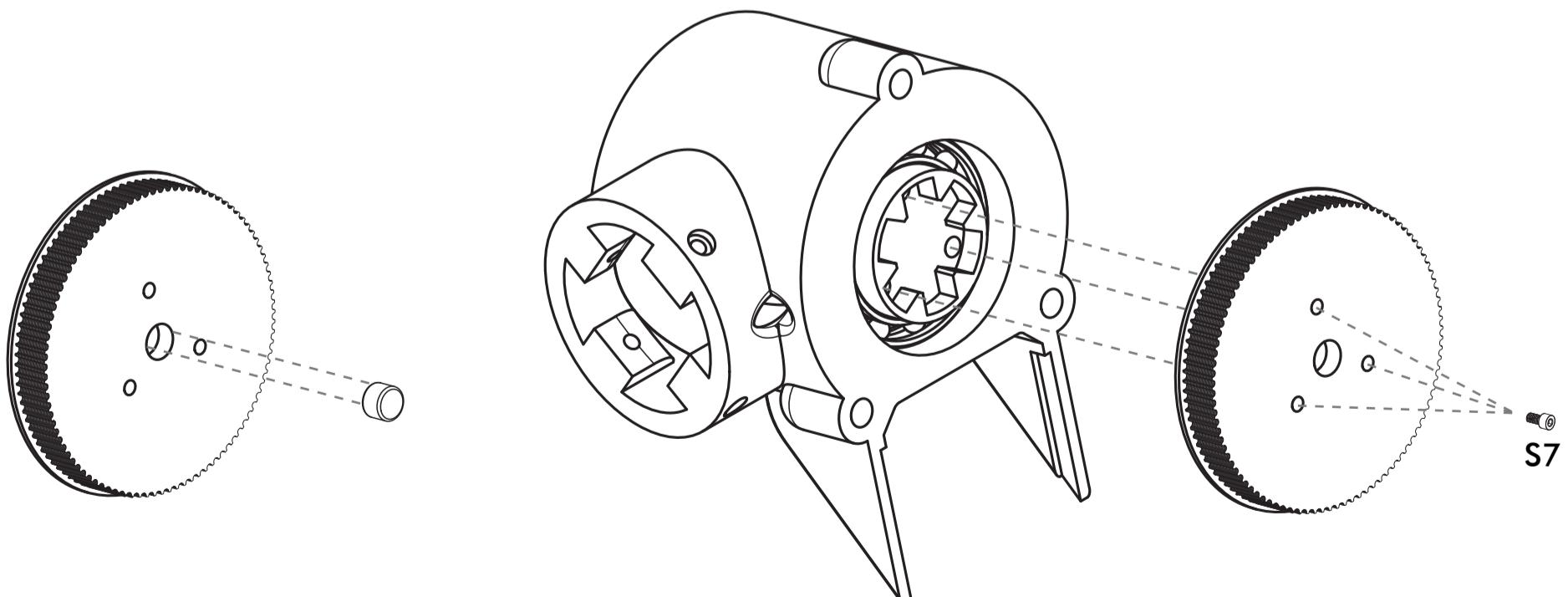
1x B26



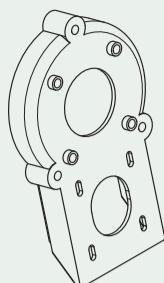
1x N19



3x S7



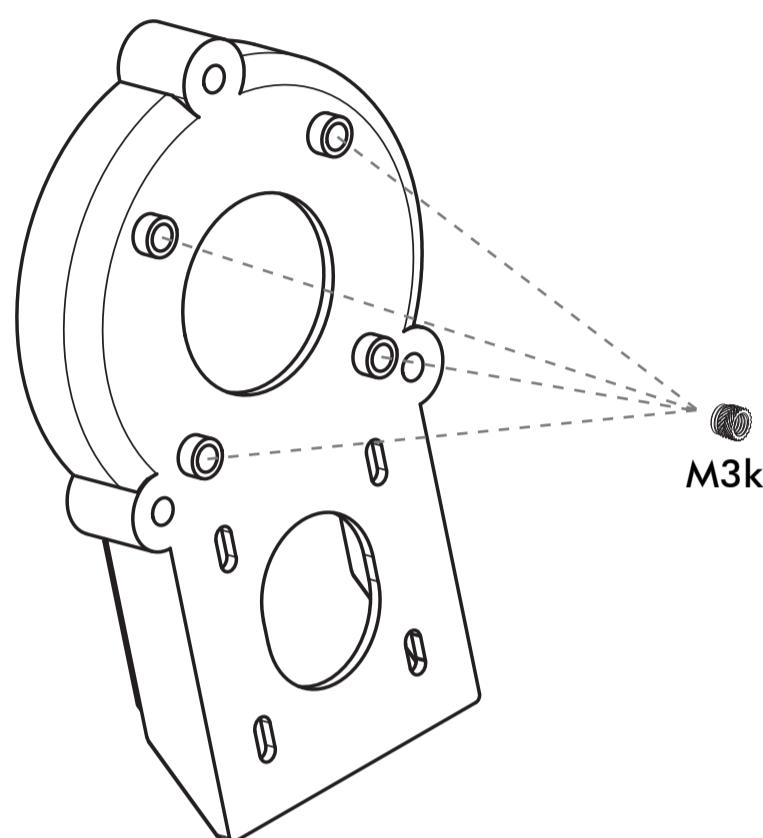
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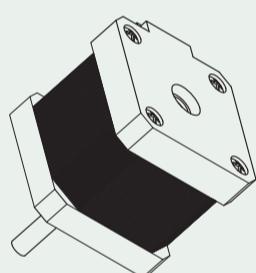
1x B25



4x M3k



6



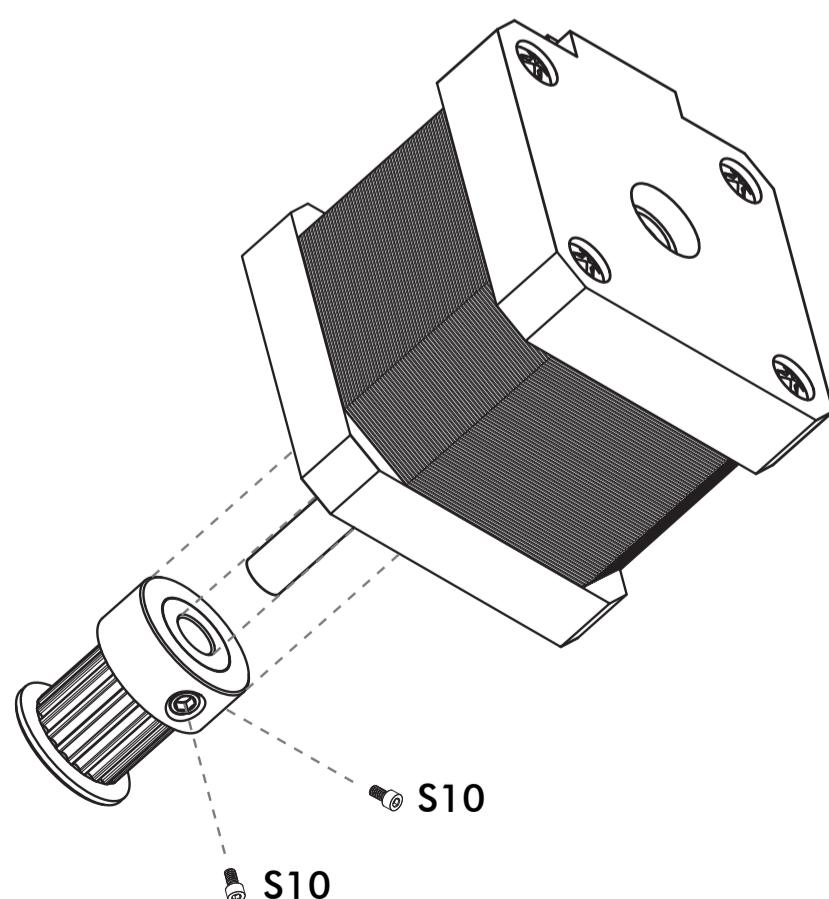
1x N3



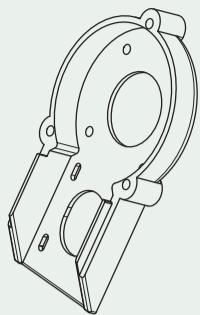
1x N14



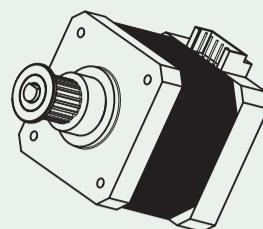
2x S10



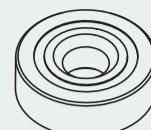
7



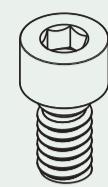
Step 5



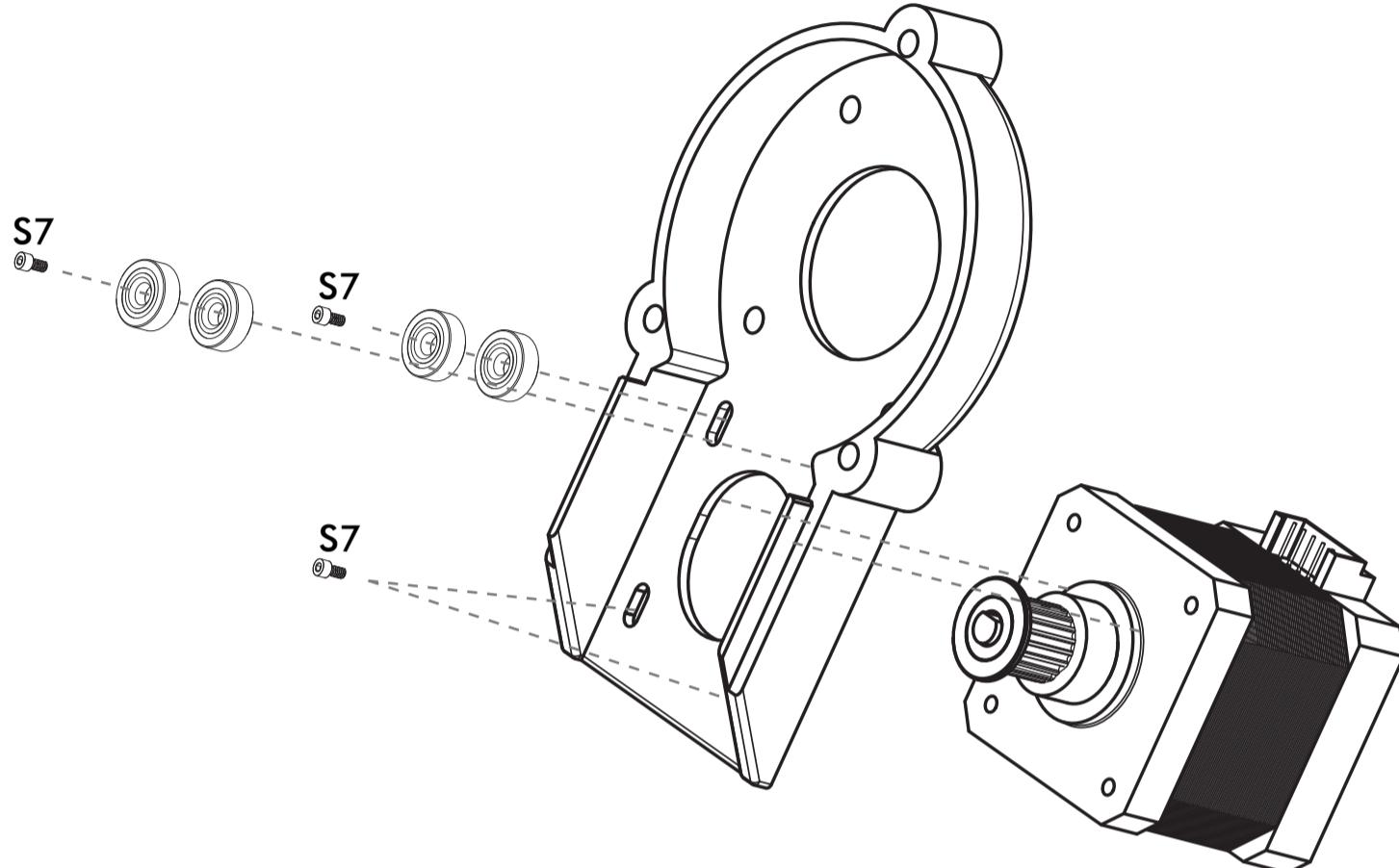
Step 6



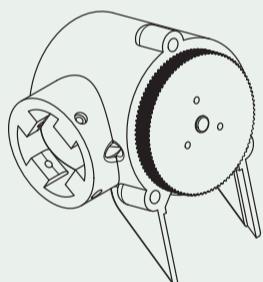
4x N10



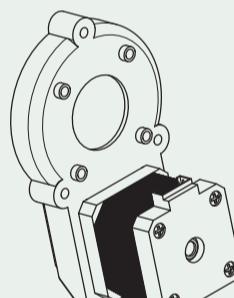
4x S7



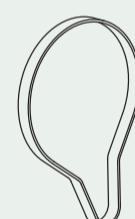
8



Step 4



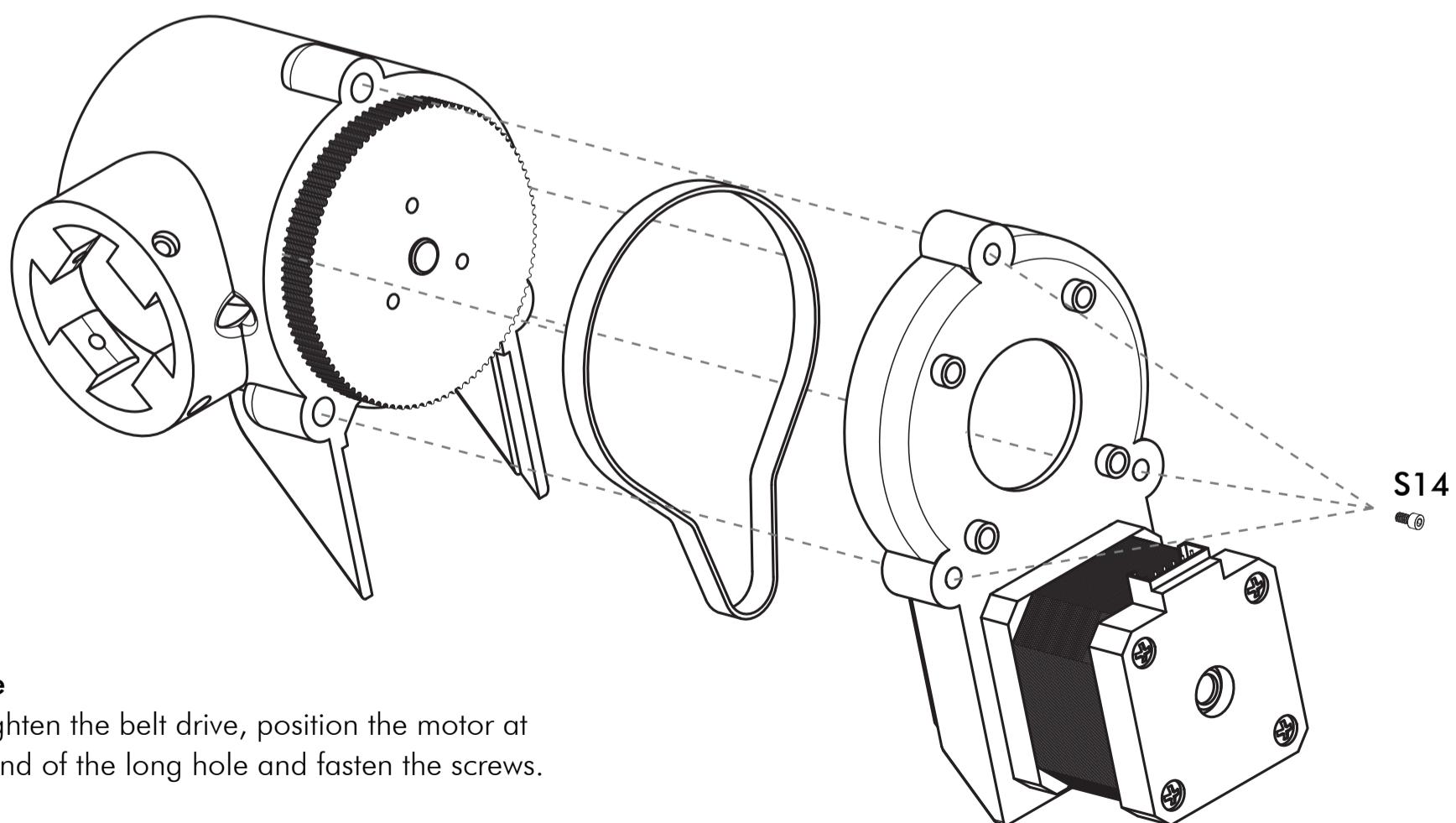
Step 7

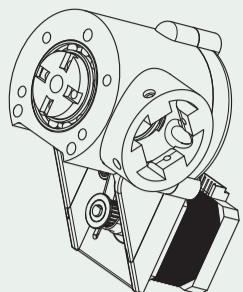


1x N7

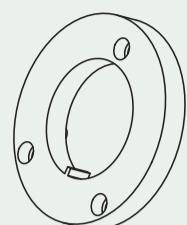


3x S14



9

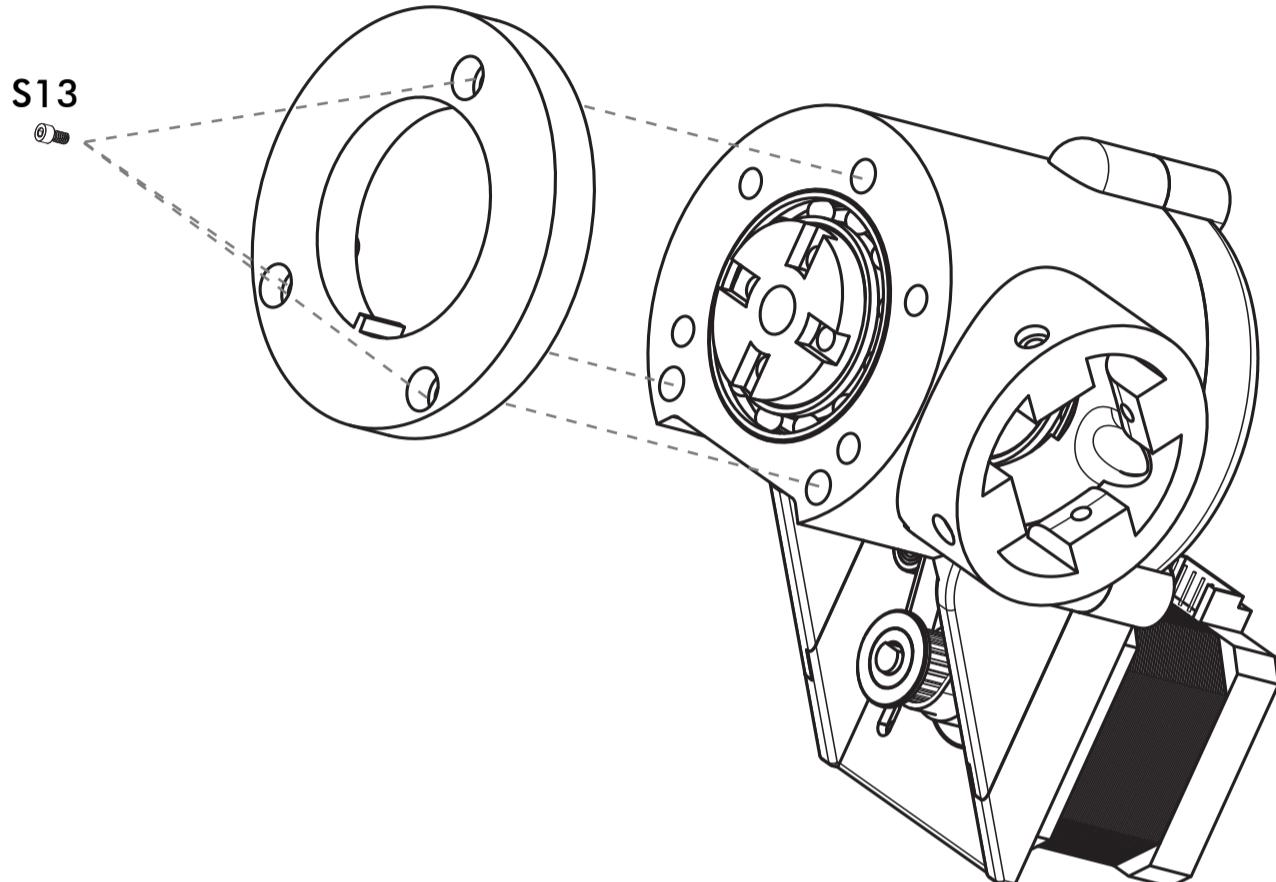
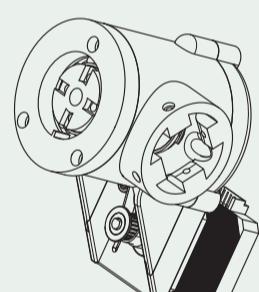
Step 8



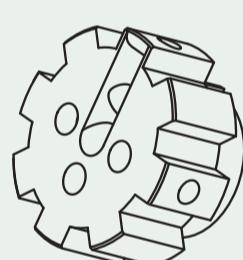
1x B27



3x S13

**10**

Step 9



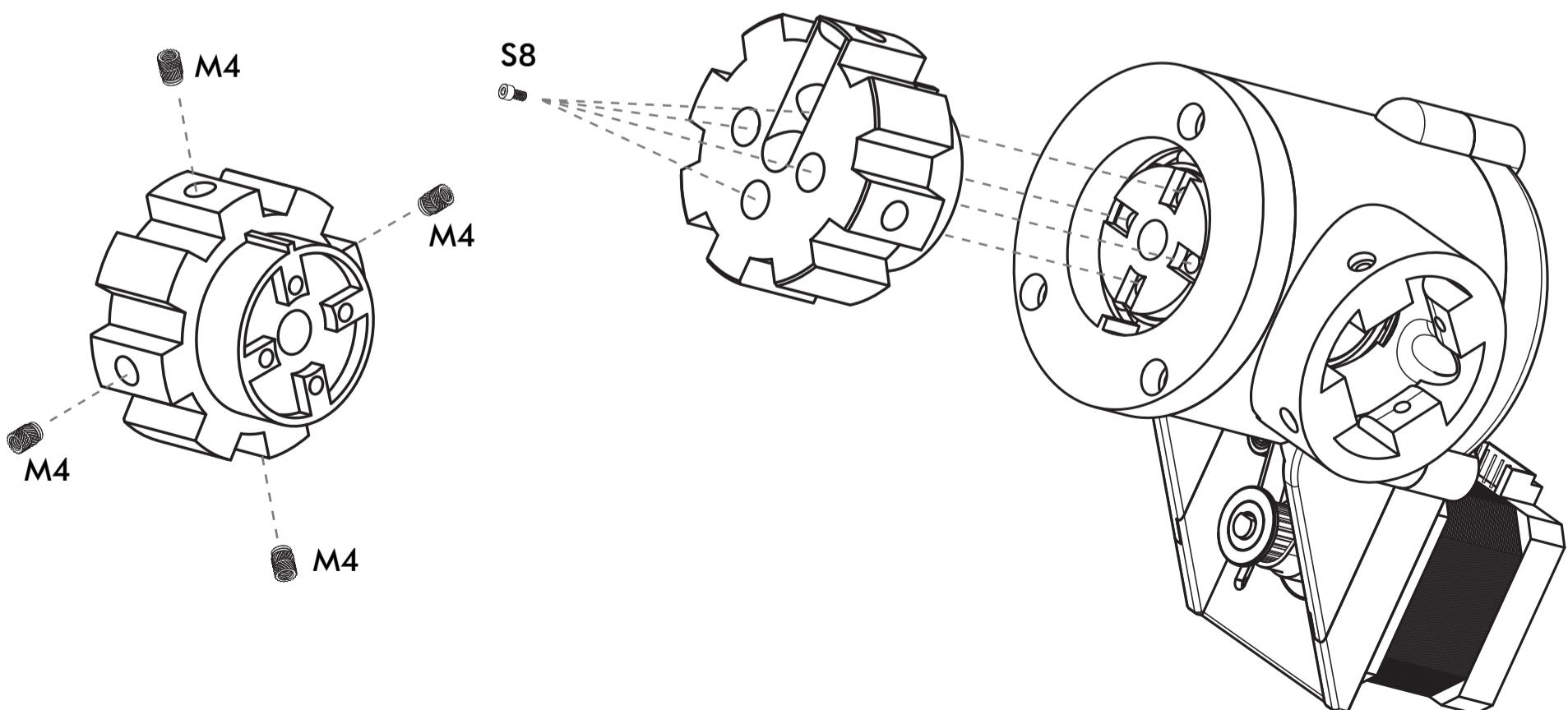
1x B28

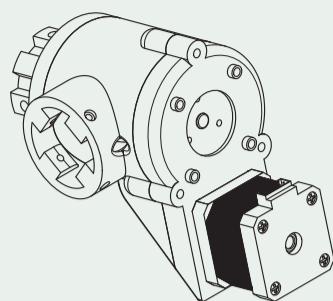


4x M4

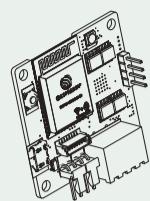


4x S8

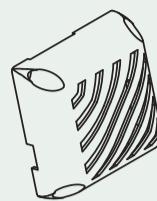


11

Step 10



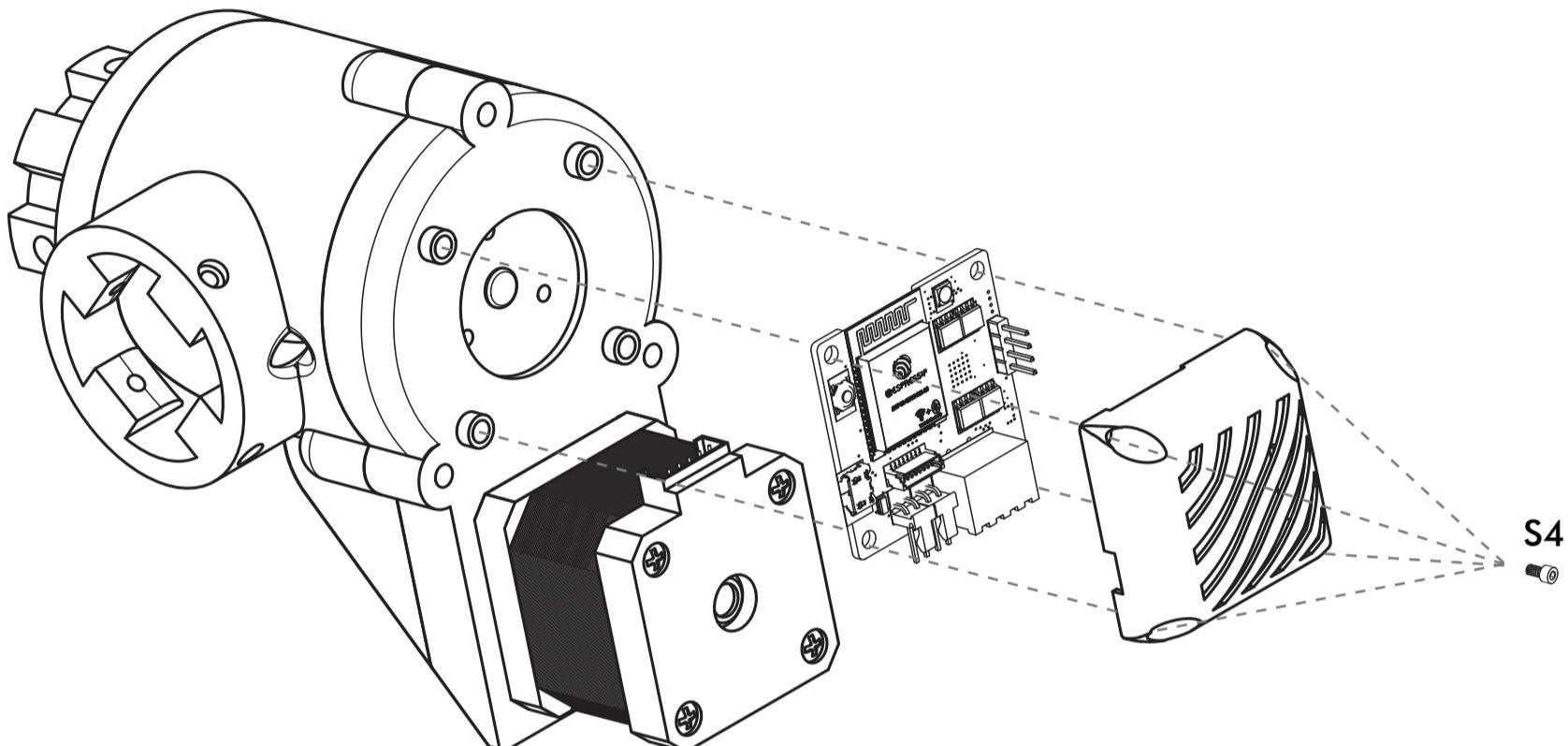
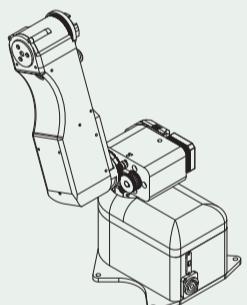
1x N20



1x B35



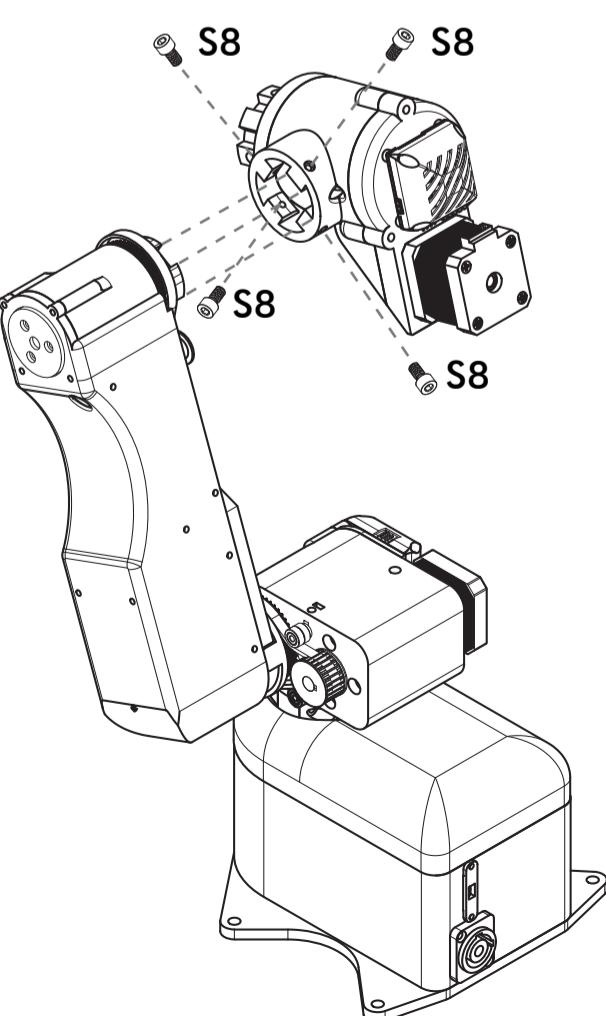
4x S4

**12**

Assembly I-III



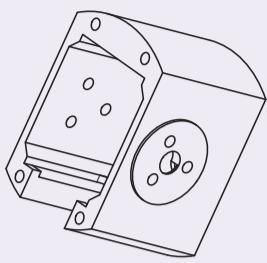
4x S8

**Note**

Before assembly, feed the cables from Assembly I-III through the hole in B23.

Assembly V

1



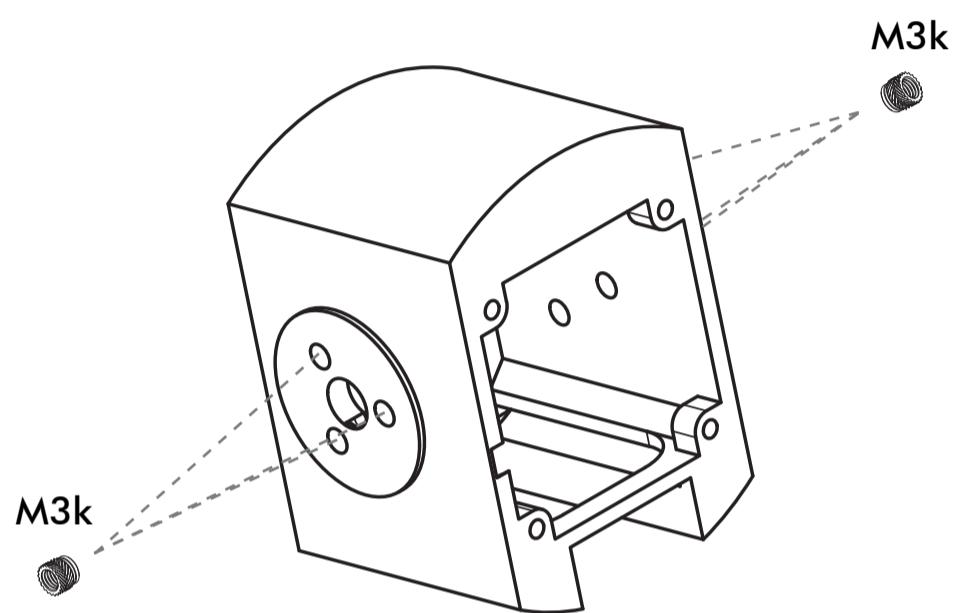
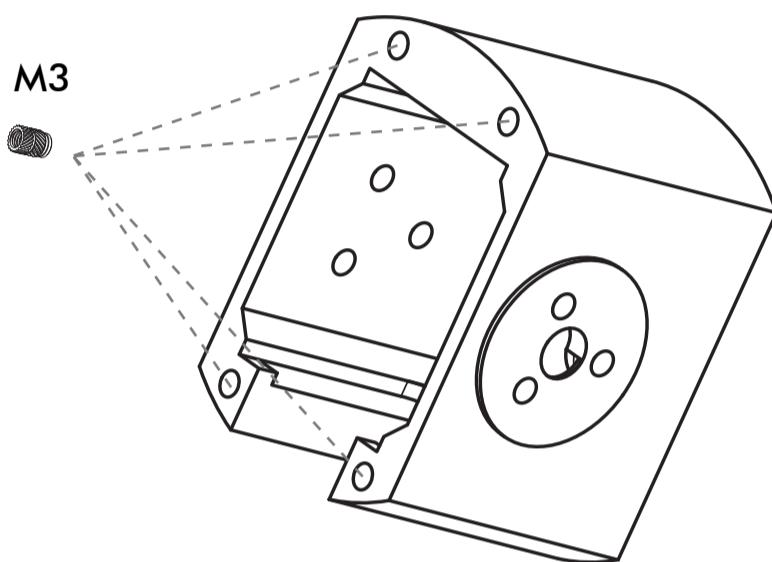
1x B33



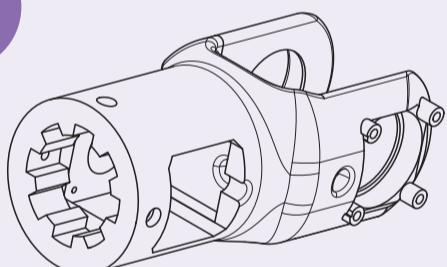
6x M3k



4x M3



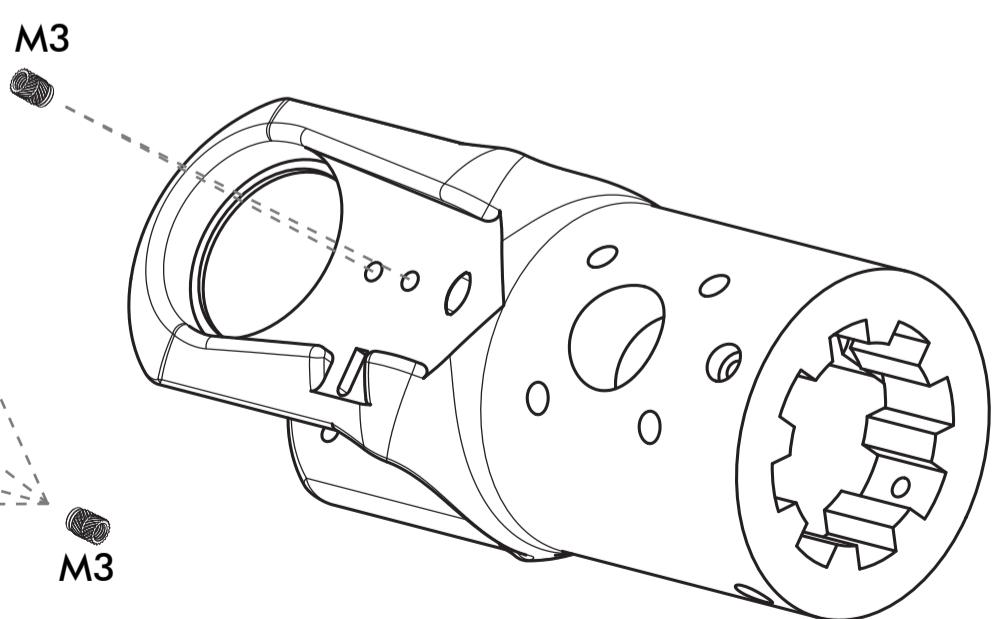
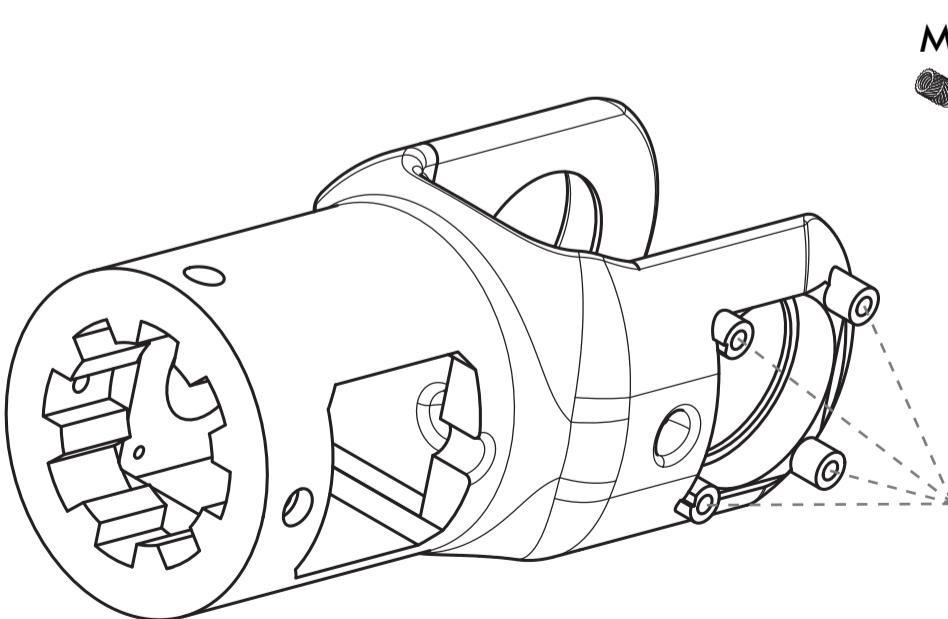
2



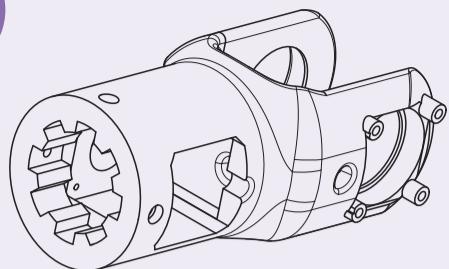
1x B29



6x M3



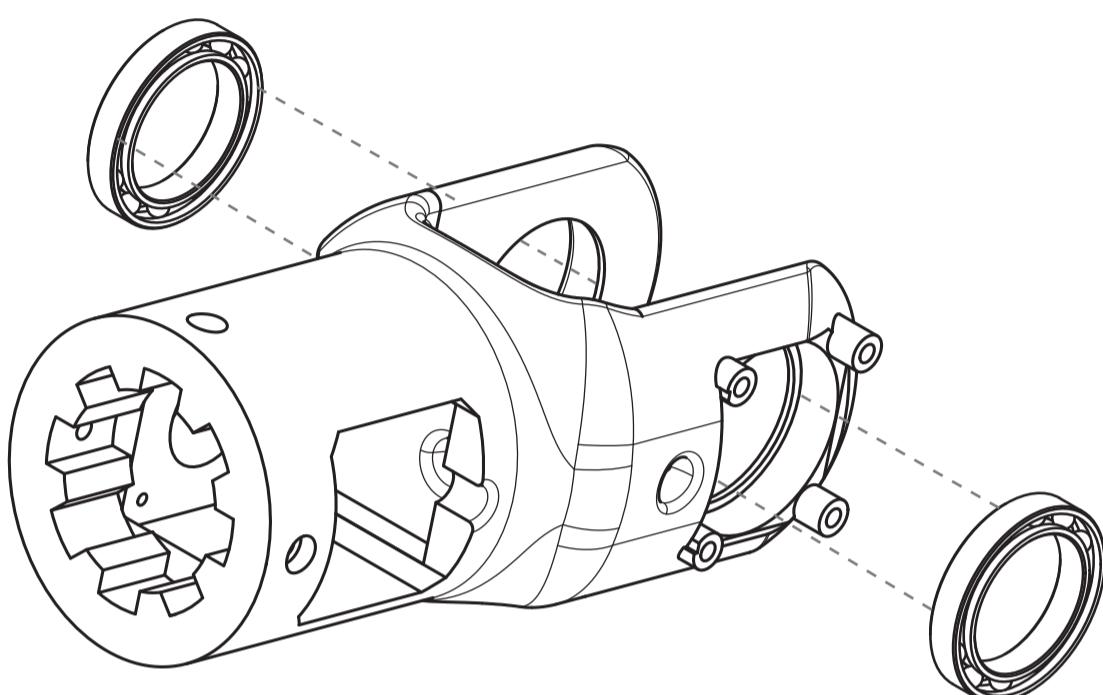
3



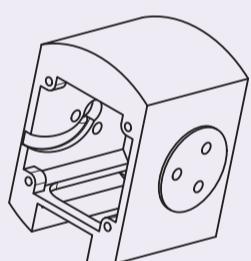
Step 2



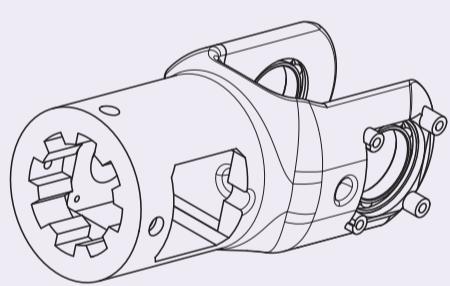
2x N12



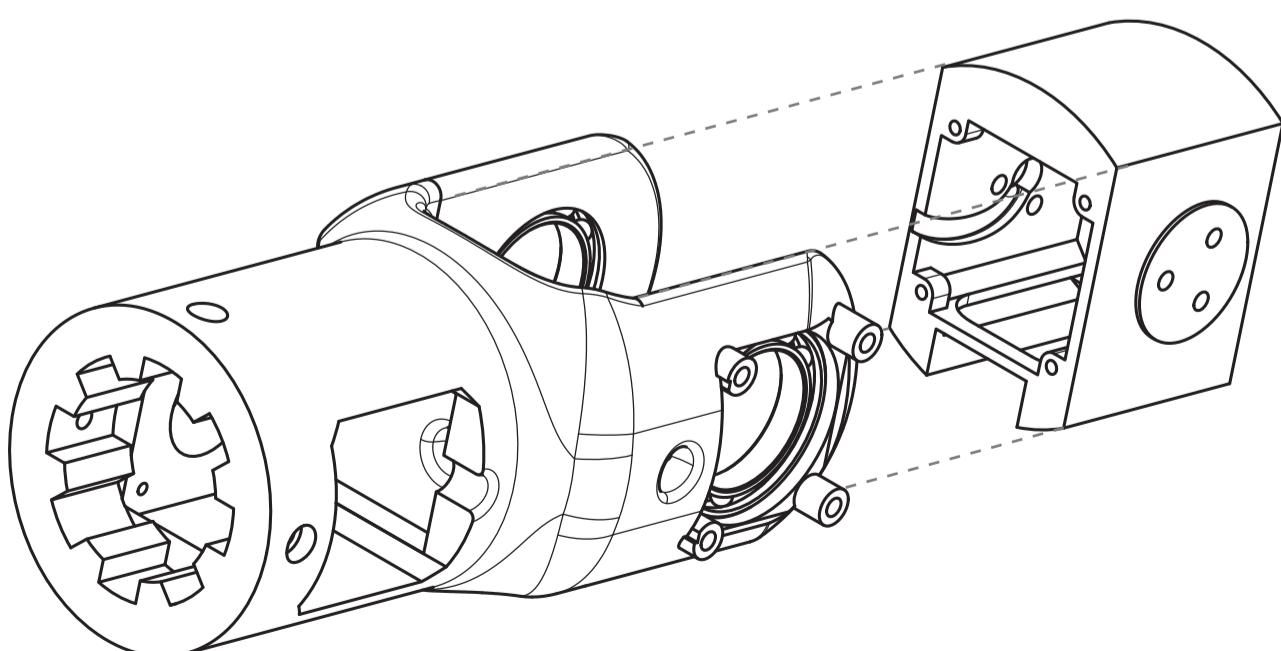
4

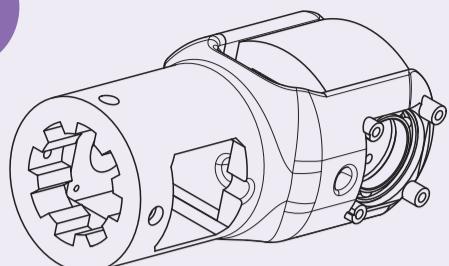


Step 1



Step 3

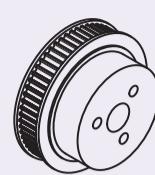


5

Step 4



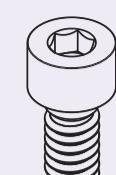
1x B30



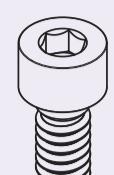
1x B31



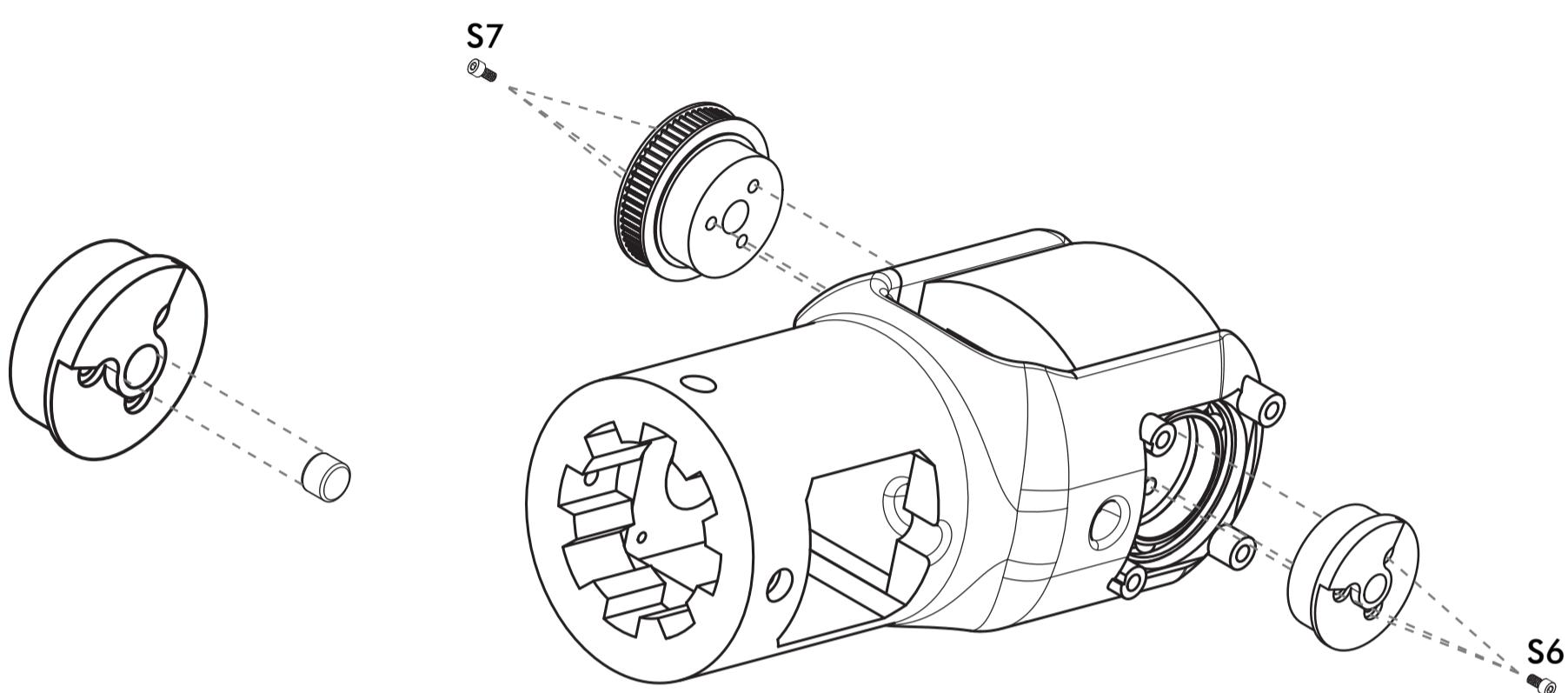
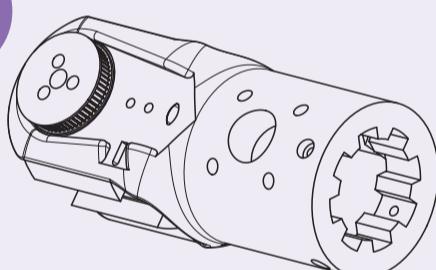
1x N19



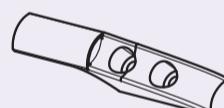
3x S6



3x S7

**6**

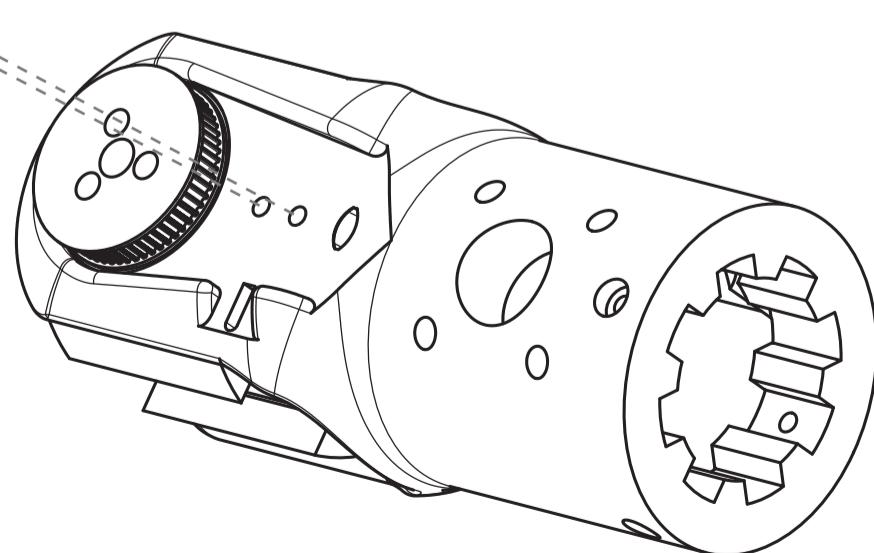
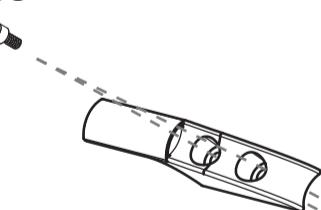
Step 5



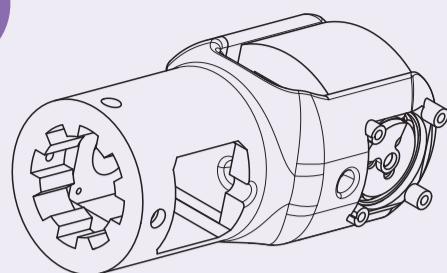
1x B32



2x S5

S5

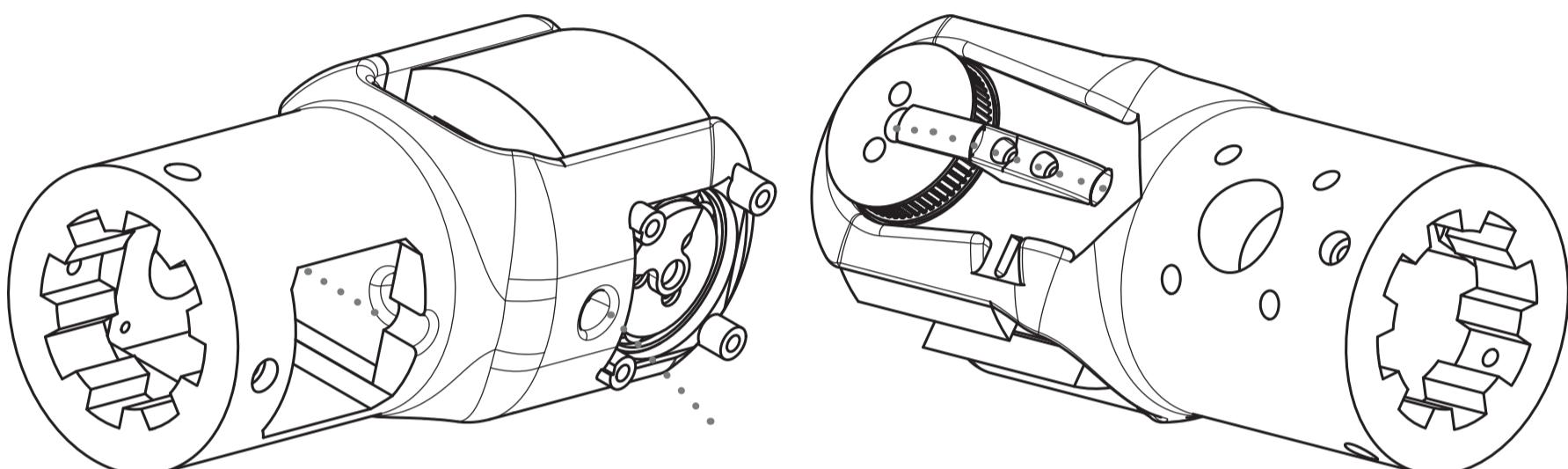
7



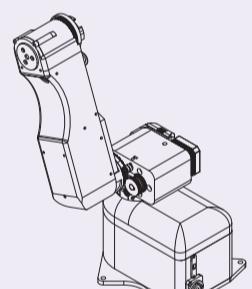
Step 6

Note

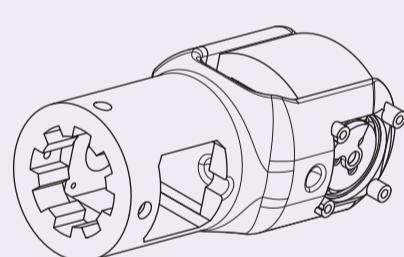
Feed the cables with sufficient length along the path shown below in between B29 and B33 through the hole in B31 to the inside.



8



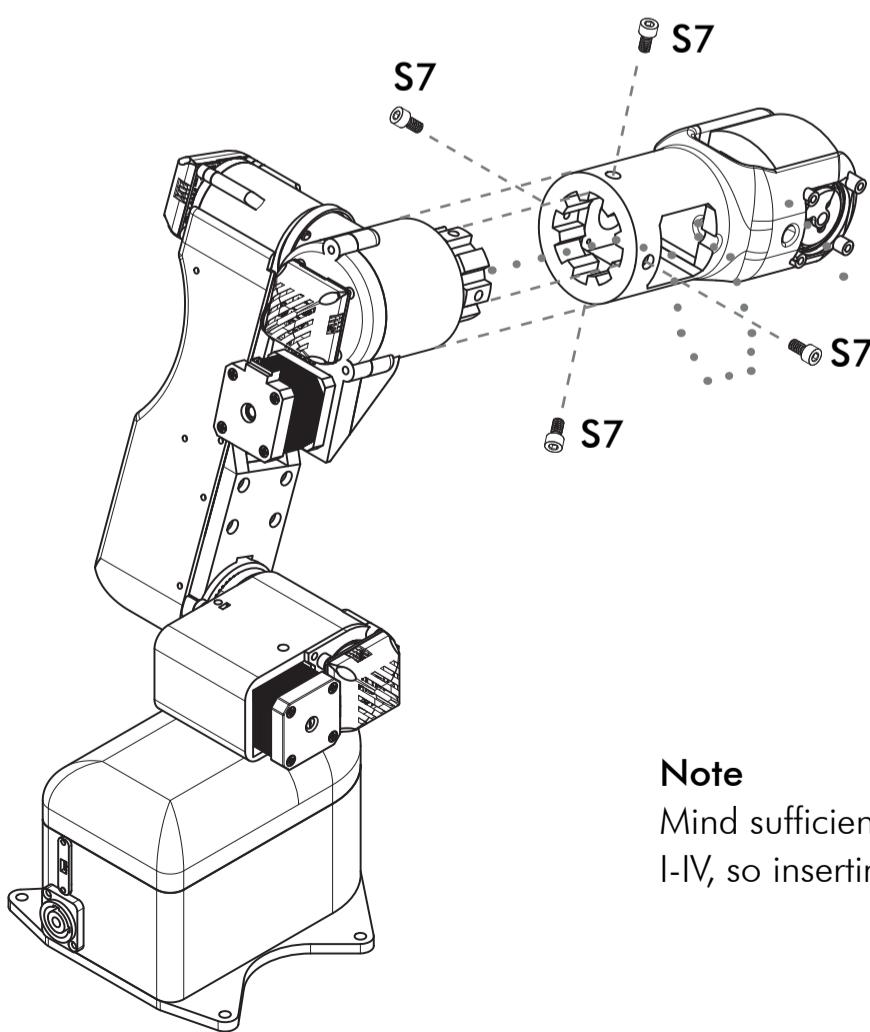
Assembly I-IV



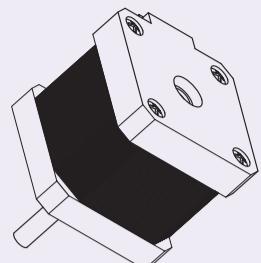
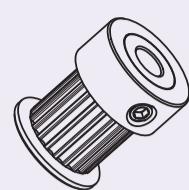
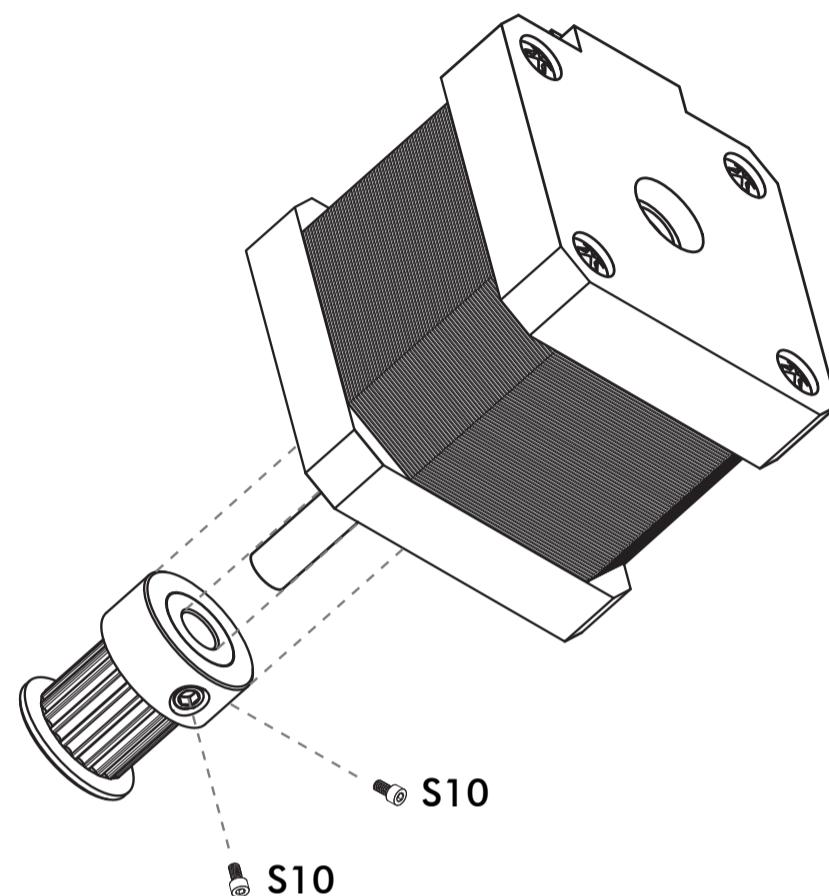
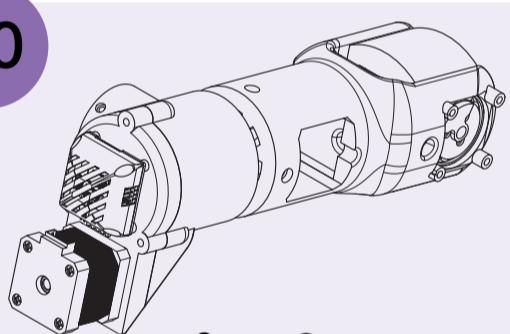
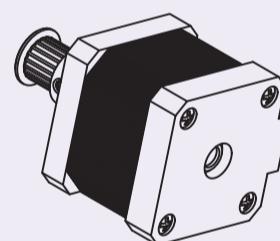
Step 7



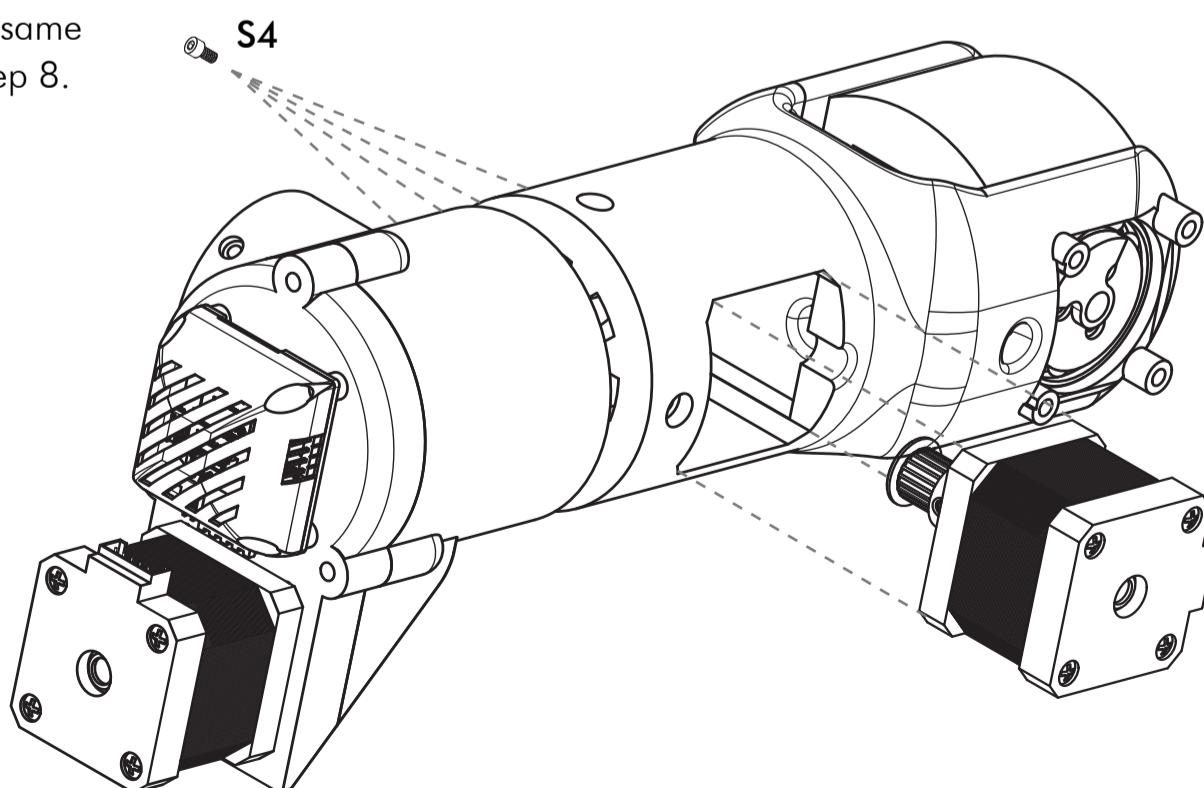
4x S7

**Note**

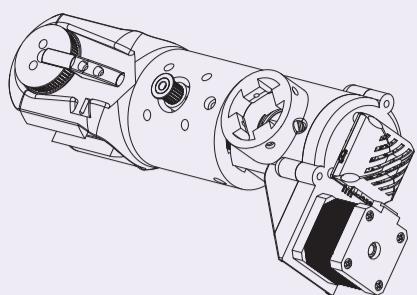
Mind sufficient length of the cables of Assembly I-IV, so inserting the motor (step 10) is possible.

91x **N3**1x **N14**2x **S10****10**Step **8**Step **9**4x **S4****Note**

The cable of the motor
are fed through the same
hole in B29 as in step 8.



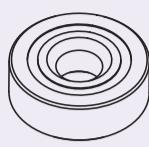
11



Step 10



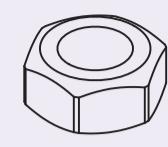
1x N8



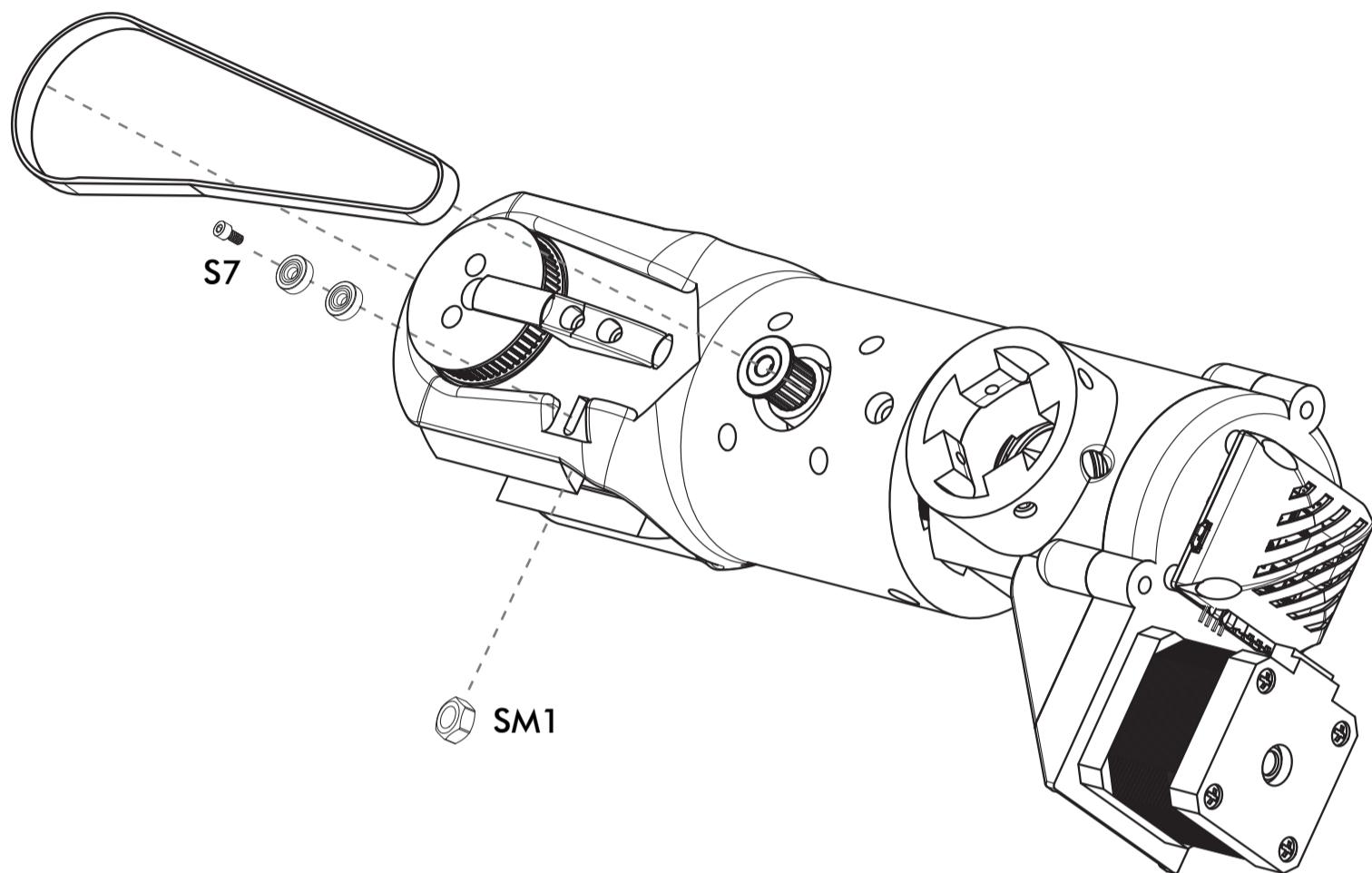
2x N10



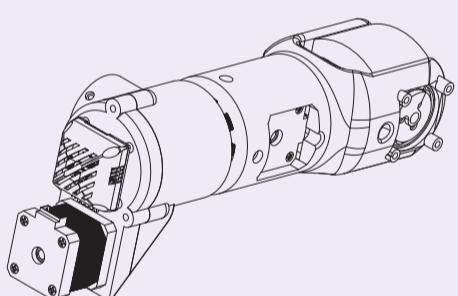
1x S7



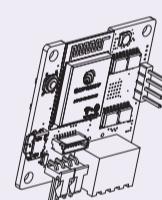
1x SM1



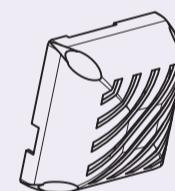
12



Step 11



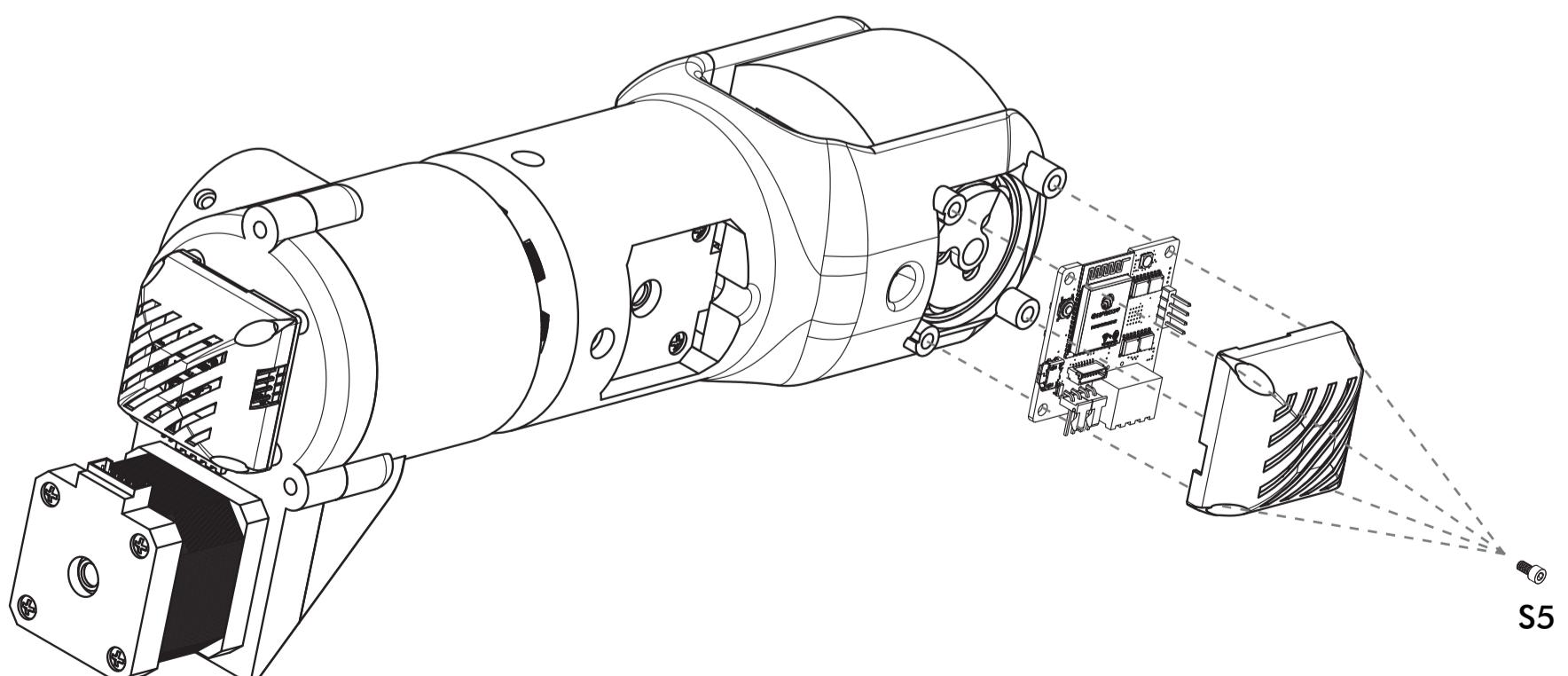
1x N20

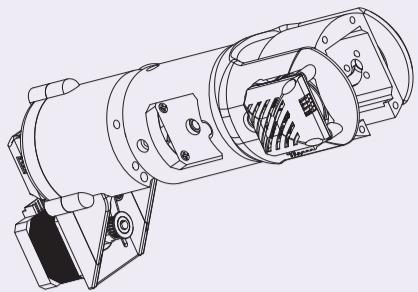


1x B35

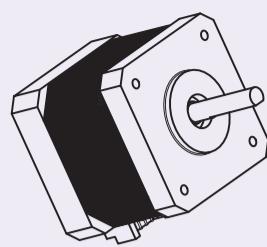


4x S5

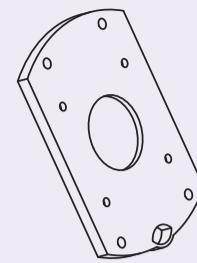


13

Step 12



1x N3



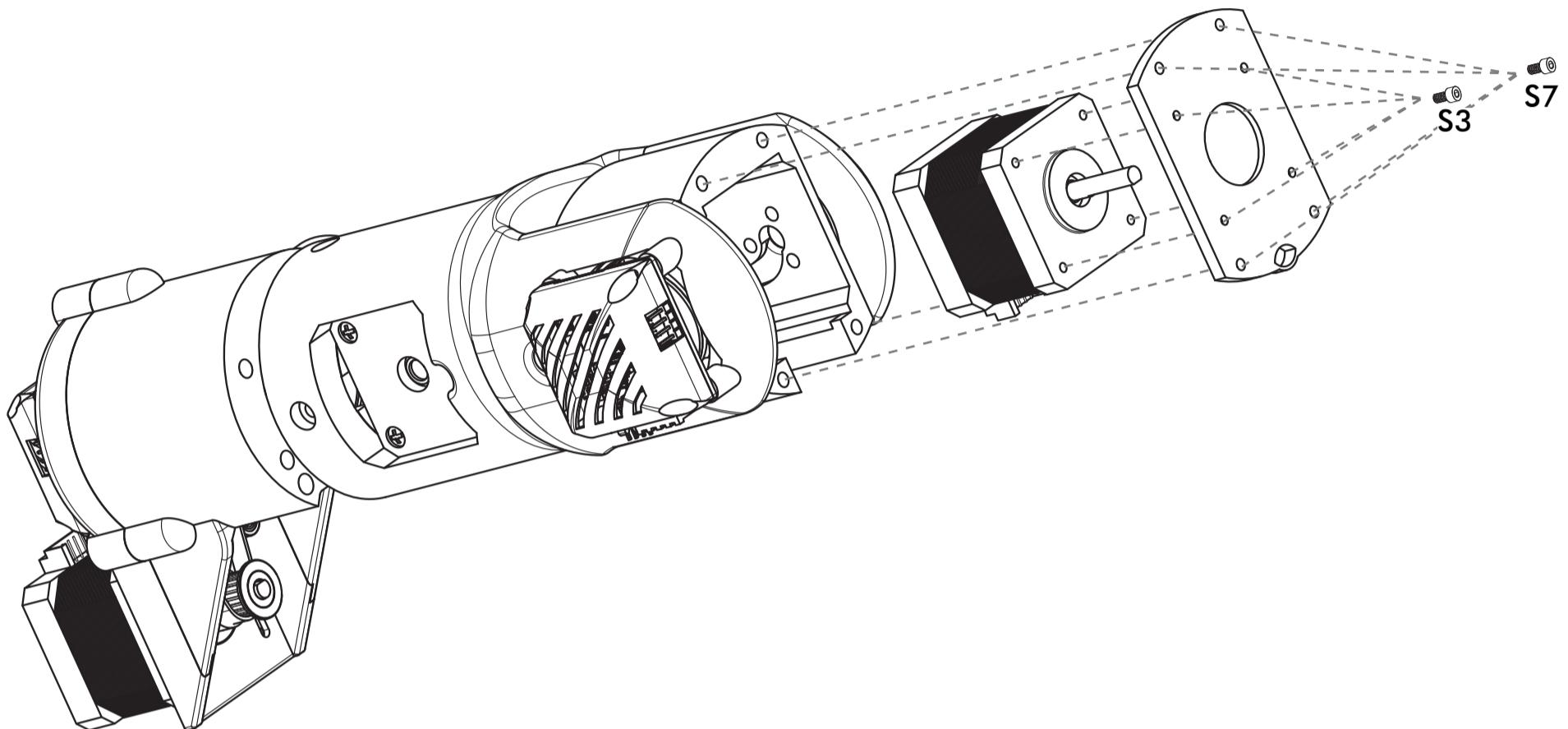
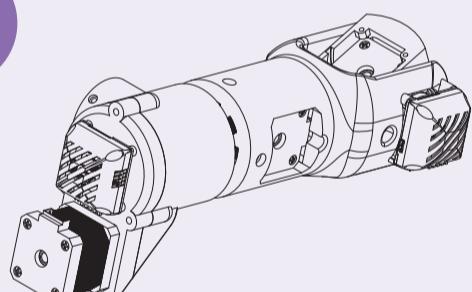
1x B34



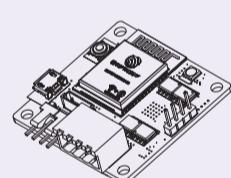
4x S7



4x S3

**14**

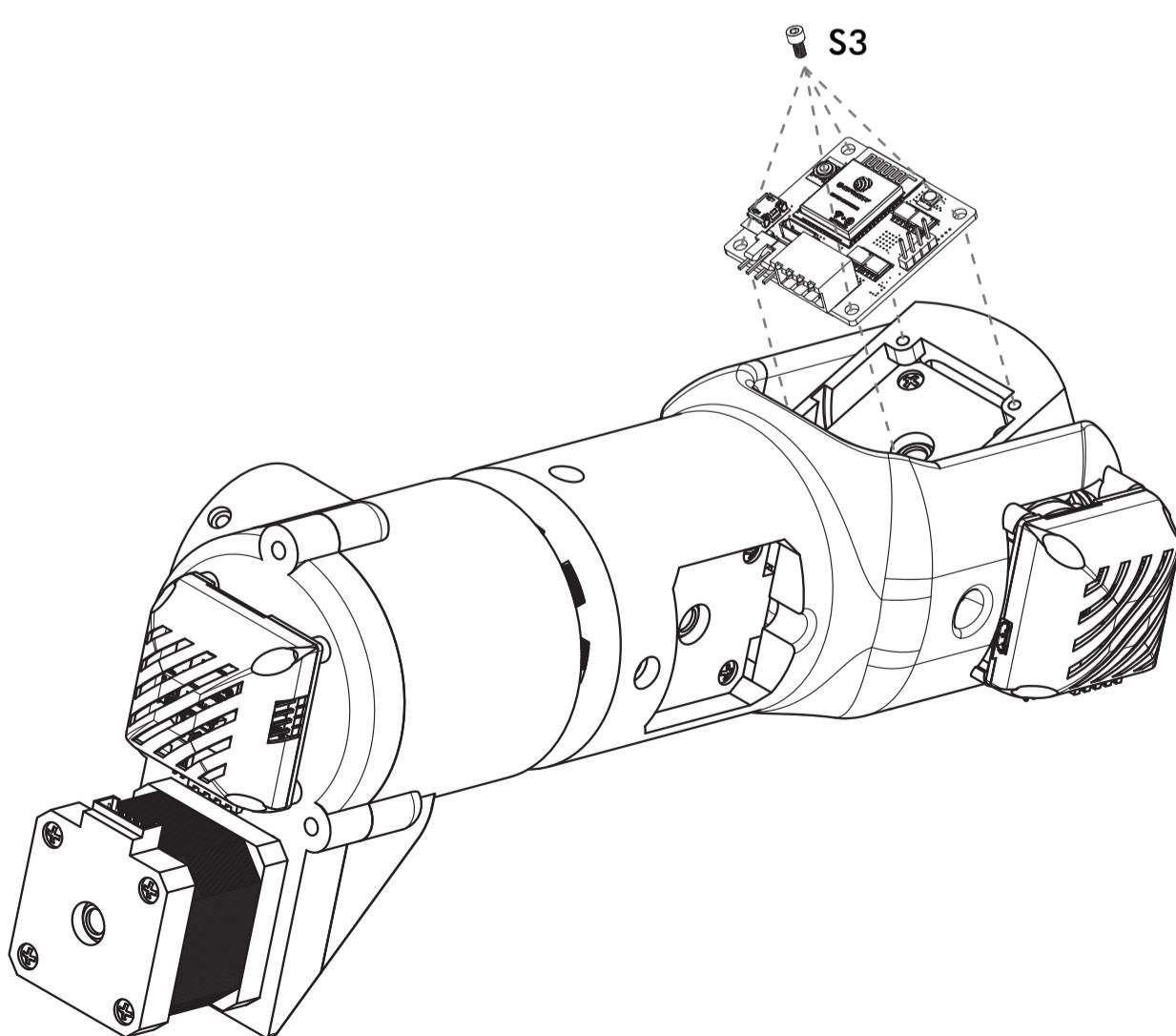
Step 13



1x N20



4x S3



Ready.

