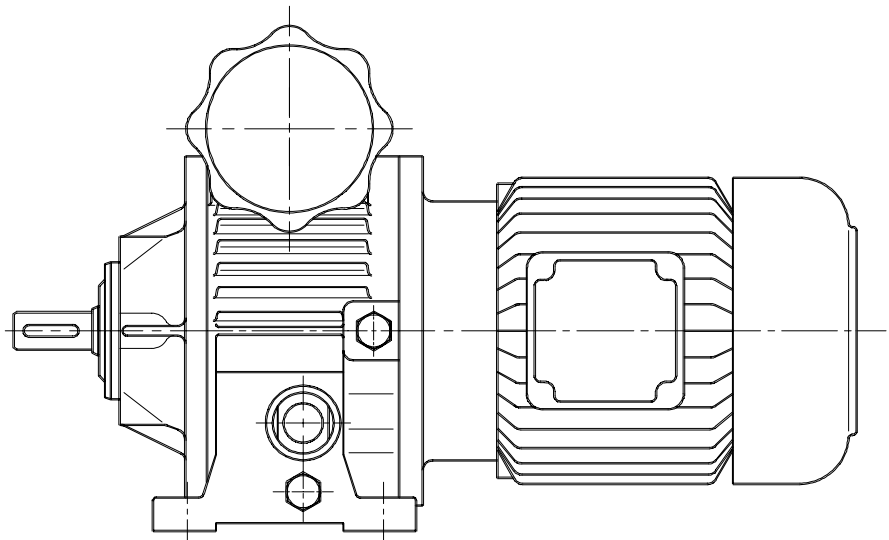


178395 GB

Lenze

Antriebstechnik

*Mounting and
operating instructions*



Disco
Variable speed drives
type 11.700 size 04 - 07

MB11.5025

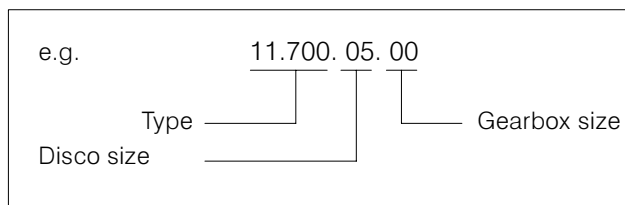
1. edition 12/92

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1.0 Technical description

The Disco variable speed drive is a planetary drive, where all functioning parts run in an oil bath. The planets and the planet carrier rotate around the driving inner sun. From the input shaft, the speed and the torque are transmitted to the inner sun. The double conical discs (planets) are driven by the inner sun and roll along the outer rings which are fixed at the housing. Therefore, the planets do not only rotate about their own axis, but also move around the inner sun, where they drive the planet carrier, which is connected to the output shaft. The speed is adjusted by moving one of the outer rings laterally in the housing via a cam profile, thus changing the air gap between the rings when rotating the adjustment spindle. The planets move on different radii, which is controlled by the size of the air gap between the outer rings, thereby adjusting the output speeds infinitely within a 6:1 range. By combining single- or multi-stage helical, worm, or spur gear planetary systems, the output speed range can be adapted to suit individual requirements.

2.0 Type code



3.0 Assembly

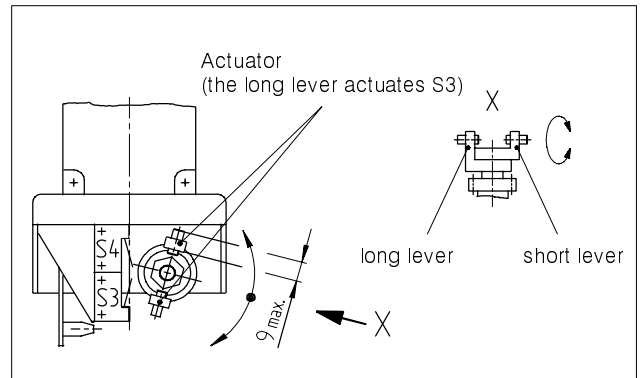
Disco planetary variable speed drives must be assembled stress free on a flat surface. They are built onto and up from their output cover. Care must be taken during assembly not to pressure or distort this cover. Otherwise strains may occur in the housing, which will have negative effects on the alignment of shafts and therefore on the bearing and gear teeth. The output shaft of the Disco planetary speed drive must be carefully aligned to the driving machine shaft. Minor misalignments can be compensated by fitting a flexible coupling. Couplings, gearwheels, sprockets, etc. may only be mounted on the shaft ends by means of a screw as hammering may damage the bearings. Fill Disco drives with oil prior to start-up (see item 4.0).

3.1 Electrical supply

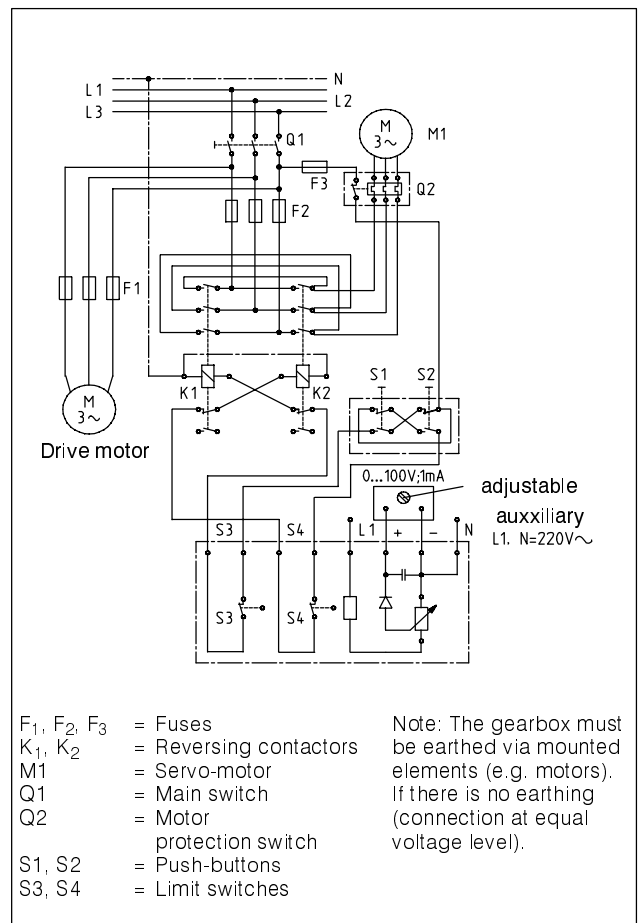
A potentiometer which is connected to the adjustment spindle via a worm pinion, transmits the position values of the spindle as partial voltage to a moving coil instrument (100V=; 1000W/V). Normally, the scale is not calibrated, but can be calibrated to output speeds. Special calibration on request. Power supply 220 V.

Caution:

Observe polarity when connecting the servo motor.



Circuit diagram of servo adjuster with potentiometer display.



a) Servo motor position I (Standard design)

The servo motor is located on the left hand side when viewed from the motor end (spindle housing on top). When switching to the fast mode (counterclockwise rotation of the actuators in the limit switch casing) the limit switch S₄ (see figure) is actuated using an insulated screwdriver. When the polarity is correct, the servo motor and the actuator stop. If not, the direction of rotation must be changed by changing the polarity.

b) Servo motor position II

The servo motor is located at the right hand side when viewed from the motor end (spindle housing on top). When switching to the fast mode (clockwise rotation of the actuators in the limit switch casing), the limit switch S₃ is actuated using an insulated

screwdriver. When the polarity is correct, the servo motor and the actuator stop. If not, the direction of rotation must be changed by changing the polarity.

Caution:
Live wires!

Caution:
The servo motor can be switched on to the slow mode, when the drive is at standstill, but switching to the fast mode with the drive at standstill is not permissible.

4.0 Maintenance

Disco drives are normally supplied without oil and must therefore be filled prior to start-up. We recommend oil types with a viscosity of approx. 32 mm²/sec + 10% at 405 C (see Disco lubrication instructions).

Lubrication instructions for connected gearboxes can be ordered separately. The following quantities (in liters) are approximate values.

Disco planetary variable speed drive

Disco size	Mounting positions				
	horizontal			vertical	
	spindle housing			output shaft	
	top	side	bottom	bottom	top
04	0,5	0,5	1,0	1,0	1,0
05	0,7	1,0	2,0	2,0	1,5
06/07	1,5	2,0	3,0	3,5	2,5

Disco differential drive

Disco size	Mounting positions				
	horizontal			vertical	
	spindle housing			output shaft	
	top	side	bottom	bottom	top
04	0,6	0,6	1,5	1,5	1,5
05	0,8	1,5	2,5	2,5	2,5
06/07	2,0	2,5	3,5	4,5	5,0

We recommend to check the oil level regularly!

5.0 Repair

5.1 Dismantling

Adjust the drive to a medium speed. Drain oil. Instructions such as "left"/"right" refer to the spare parts drawings.

5.1.1 Housing and flange cover

1. Remove flange-mounted electric motor (2.08), if any, from the drive.
2. Remove allen screws (4.45) and take out of spindle housing (4.01). Remove ball head stud (4.06).
3. Mark position of cover (3.01) or flange (3.02) relative to the housing (1.01).
4. Remove screws (0.30) and position drive vertically (input side up).
5. Pull off complete housing (1.01).

6. Mark position of cam ring (3.14) and movable outer ring (3.16) relative to the cover or flange (3.01 or 3.02) or, for differential drives, relative to the housing (3.04).

5.1.2 Inner sun

1. Remove stationary outer ring (1.02) and inner sun assembly (6.01 to 6.06).
2. Secure planets to prevent displacement! Press cup springs (6.05) over spring retaining plate (6.04) using a special tool, or a parallel vice.
3. Remove circlip (6.06) and release cup springs (6.05).

5.1.3 Output shaft (for drives without gearboxes)

1. Remove movable outer ring (3.16), ball cage (3.15), cam ring (3.14) and compression springs (3.27).
2. Remove screws (3.53) and press planet carrier (3.09) off the output shaft (3.05) using two levers.
3. Remove shaft seal (3.36) and scrap, remove circlips (3.39) and press output shaft out of the cover (3.01) to the right.

5.1.4 Flange (for drives with gearbox)

5.1.4.1 Worm gearbox

1. Remove circlip (3.53) pull off planet carrier (3.09) from the hub (3.08).
2. Remove setscrew (3.73) and pull off hub (3.08) from the input shaft of the worm gearbox.

5.1.4.2 Helical gearbox and helical worm gearbox

1. Punch out pin (3.61) and remove pinion (3.18) (not for pinion shaft 3.06)
2. Remove circlip (3.44) and press shaft (3.06 or 3.07) out of the flange to the right.

5.1.4.3 Spur gear planetary drive in the differential drive

1. Remove movable outer ring (3.16), ball cage (3.15), cam ring (3.14) and compression springs (3.27).
2. Remove screws (3.53) and pull planet carrier (3.09) off the hub (3.22).
3. Remove hex head bolts (0.34) and pull cover (3.01) completely out of the housing (3.04).
4. Remove shaft seal (3.36) and scrap, remove circlip (3.39) ausbauen.
5. Press complete output shaft out of the bearing to the right.
6. Pull cylindrical pins (3.70) out of the planet gear carrier (3.25) and remove pinion (3.24) with washers (3.69).
7. Unscrew allen screws (3.67) and take out planet gear carrier (3.25).
8. For design with connected motor, remove circlip (3.48) and press the short pinion shaft (3.23) with ball bearing (3.34) to the right out of the hub (3.22).
9. Press hub (3.22) out of the bearing.

5.1.5 Input shaft

1. Remove hex head bolt (0.28) and take out complete cover (2.01 to 2.23) from the housing (1.01).
2. Remove shaft seal (2.19) and press shaft (2.02) out of the cover to the left.

5.1.6 Hand wheel adjuster

1. Punch out pin (4.34) and pull off hand wheel (4.12).
2. Remove setscrew (4.39) and take out position indicator (4.14).
3. Remove normal torque plate (7.29) using two narrow screwdrivers.
4. Turn spindle (7.03) out of the guide-piece (7.04) and pull off the housing (7.01). Remove shim (7.31).

5.1.7 Servo adjuster

1. Before disassembly always disconnect from power supply!
2. Loosen setscrew (4.41) and pull off small geared motor (4.10).
3. Punch out pin (4.33) and pull off bush (4.08).
4. Loosen screws (5.13) from the housing (5.01, 5.02) and open housing.
5. Loosen allen screws (4.47) and remove housing (5.02).
6. Punch out pin (4.35) and pull off intermediate part (4.09).
7. Remove shaft seal (4.23) and scrap, and remove circlip (4.28) with shims (4.30 and 4.31).
8. Pull spindle (4.03) out of the housing (4.01), so that the ball bearing (4.20) is free.
9. Rotate spindle out of the guide piece (4.04).
10. Press bush (4.21) and shaft seal (4.24) out of the spindle housing (4.01).

5.1.8 Bevel gear adjuster

1. Loosen setscrew (4.40) and pull off housing (4.02).
2. Punch out pin (4.34) and pull off hand wheel (4.12).
3. Pull off circlip (4.32) and press end cap (4.27) out of the housing (4.02).
4. Pull shaft (4.05) out of the bushes (4.22).
5. Punch out pins (4.37, 4.38) and pull off bevel gears wheels (4.16, 4.15).

For further disassembly see section 5.1.7, items 7-10!

5.2 Assembly

Disco planetary speed drives are put together as modules and then assembled.

5.2.1 Housing or flange cover (for drives without gearboxes)

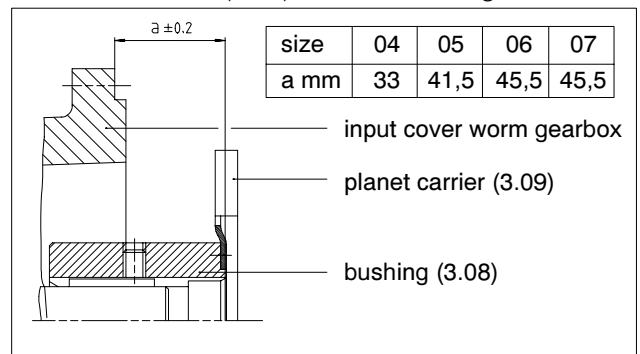
1. Press shaft (3.05) with ball bearing (3.29) in flange or cover (3.01) and secure using circlip (3.39).
2. Insert shaft seal (3.36) and key (3.76).
3. Fix planet carrier (3.09) with pin and screws (3.53) on shaft (3.05).

4. Insert compression springs (3.27) and cam ring (3.14). Observe the mark on the cam ring relative to the housing.
5. Assemble ball cage (3.15) and movable outer ring (3.16). Observe the mark on the housing or flange relative to the cam ring and the movable outer ring.

5.2.2 Flange (for variable speed drives with gearbox)

5.2.2.1 Worm gearbox

1. Push hub (3.08) on input shaft of the worm gearbox, until dimension "a" is reached and fix using setscrew (3.73).
2. Fix planet carrier (3.09) using pins (3.52) and screws (3.53) on hub (3.08). Before inserting, cover screws (3.53) with anaerobic glue.



For further assembly see section 5.2.1, item 4

5.2.2.2 Helical gearbox and helical worm gearbox

1. Insert circlip (3.43) in flange (3.02).
2. Press shaft (3.07) with ball bearing (3.31) in flange (3.02).
3. Assemble shaft seals (3.37), circlip (3.42), ball bearing (3.30) and circlip (3.44).
4. Press pinion (3.18) on shaft (3.07), hammer in pin (not for pinion shaft 3.06).

For further assembly see section 5.2.1, item 3.

5.2.2.3 Spur gear planetary drive in the differential drive

1. Press hub (3.22) in ball bearing (3.33).
2. Fix planet carrier (3.25) using allen screws (3.67).
3. Insert pinion (3.24) with washers (3.69) in planet gear carrier (3.25) and press in pins (3.70).
4. Press pre-assembled shaft (3.05) in cover (3.01). Assemble circlip (3.39) and insert shaft seal (3.36).
5. Fix the ring gear carrier (3.20) on shaft (3.05) by covering the countersunk screw (3.55) with anaerobic glue prior to insertion.
6. Fix cover (3.01), seal (0.26) and housing (3.04) using bolts (0.34).
7. Fix planet carrier (3.09) with pins (3.52) and screws (3.53) on hub (3.22). (Before, cover screws with anaerobic glue).
8. For design with connected motor, press the short pinion shaft (3.23) with ball bearing (3.34) in hub and insert circlip (3.48).

For further assembly see section 5.2.1, items 4+5.

5.2.3 Inner sun

1. Left inner sun must be easily displaceable on the input shaft or motor shaft. Lay left inner sun (6.01) with the hub at the top on the assembly device.
2. Push right inner sun (6.02) with chamfer (approx. 1mm) at the bottom on the hub.
3. Push planets (6.03) with long journal at the bottom to the middle of the seating surface between the inner sun assembly and secure against displacement.
4. Push cup springs (6.05) on the hub in the correct sequence, lay spring retaining plate (6.04) with recess at the top and circlip (6.06) on cup springs (6.05).
5. Press together cup springs (6.05) over spring retaining plate (6.04) using an assembly device, assemble circlip (6.06).

Caution:

Check if the circlip fully rests in the keyway and is located in the recess of the spring retaining plate. After this, release the cup springs!

5.2.4 Input shaft

1. Press shaft (2.02) with ball bearing (2.15) and circlips (2.20) in cover (2.01) and assemble circlip (2.19). Assemble shaft seal (2.18).
2. Bolt complete cover (2.01 to 2.23) and seal (0.25) using hex head bolts (0.28) and spring lock washers (0.29) to housing (1.01).

5.2.5 Hand wheel adjuster

1. Push spindle (7.03) with greased O-rings (7.23) into the housing (7.01).
2. Turn guide-piece (7.04) on the spindle (7.03).
3. Set shim (7.31) on spindle (7.03). Push spindle in flange sleeve (7.75) and press normal torque plate (7.29) on the spindle (7.03).
4. Assemble handwheel (4.12) using pin (4.34). Assemble position indicator (4.14), secure using setscrew (4.39).

5.2.6 Servo adjuster

1. Press bush (4.21) in spindle housing (4.01).
2. Push spindle (4.03) with ball bearing (4.20) in spindle housing (4.01).
3. Rotate guide-piece (4.04) on spindle and press spindle completely in.
4. Assemble circlip (4.28) and shaft seal (4.23).
5. Assemble shaft seal (4.24) and secure intermediate part (4.09) using pin (4.35).
6. Secure bush (4.08) using pin (4.33).
7. Do not yet assemble small geared motor (4.10) and limit switch housing (5.02 and 5.01)! (see section 5.3.2)

5.2.7 Bevel gear adjuster

1. Assembly as explained under section 5.2.6, item 1-5.

2. Secure bevel gears (4.16, 4.15) using pins (4.37, 4.38).
3. Push shaft (4.05) in bushes (4.22).
4. Assemble circlip (4.32).
5. Assemble handwheel (4.12) and hammer in pin (4.34).
6. Assemble housing (4.02) only after setting of the dead stops at the spindle housing (4.01) (see section 5.3.2).
7. Bevel gears have a soft running. The permissible axial tolerance in X-direction is maximum 0.2 mm.

5.2.8 Assembly of the modules

1. Lay seal (0.26) on cover (3.01) or flange (3.02) or housing (3.04).
2. Push stationary outer ring (1.02) in housing (1.01) and slightly misalign or support in the spindle housing recess by using a bolt.
3. Lay complete inner sun (6.01 to 6.06) on movable outer ring (3.16) thereby inserting the journals of the planets (6.03) in the planet bearings (3.10).
4. Lay housing (1.01) vertically on the pre-assembled flange (3.02), cover (3.01) or housing (3.04). Observe mark at the flange or housing.
5. Secure using hex head bolts (0.30).
6. Screw in ball head studs (4.06).

5.2.9 Motor assembly

1. Lay seal (0.25) on housing (1.01).
2. Cover motor shaft end with lubricant and vertically insert into the inner sun (6.01).
3. Secure motor (2.08) and housing (1.01) using hex head bolts (2.30).

5.2.10 Adjusters

1. Lay handwheel or servo adjuster with seal (4.25) on housing (1.01). Ball head stud (4.06) must slide in the guide piece (4.04).
2. Fix adjuster using allen screws (4.45) at the housing. See chapter 5.3.

5.3 Speed setting

1. Fill gearbox oil up to the middle of the oil sight glass, in individual cases up to the oil check plug, according to the mounting position.

5.3.1 Handwheel adjuster

Setting is also necessary when the drive has been disassembled!

1. Bolt handwheel adjuster in the desired position with a seal and turn towards the fast mode, until a resistance is perceptible.
2. Switch on motor and set minimum idle speed using tacho tachometer according to the table.
3. Fix setscrew (1.04) against guide piece (4.04) in housing (1.01). Slightly fix using counter nut (1.05).
4. Set maximum idle speed according to the table.

5. Fix setscrew (1.04) against guide piece (4.04) inhousing (1.01). Slightly fix using counter nut (1.05).
6. When the driving motor is at standstill, change the adjustment from maximum to minimum. Switch on drive motor. Check speeds and correct, if necessary. Tighten nuts (1.05), without turning setscrews (1.04).

No-load output speeds

Type 11.710	size	04	05	06	07
4-pole motors	$n_{\min}(\text{min}^{-1})$	185^{-5} 1) 205 ⁺⁵	185^{-5} 1) 205 ⁺⁵	195^{-5} 1) 215 ⁺⁵	195^{-5} 1) 215 ⁺⁵
	$n_{\max}(\text{min}^{-1})$	1025^{+10} 1) 995 ⁻¹⁰	1000^{+10} 1) 970 ⁻¹⁰	1045^{+10} 1) 1010 ⁻¹⁰	1045^{+10} 1) 1010 ⁻¹⁰
2-pole motors	$n_{\min}(\text{min}^{-1})$	370^{-10} 1) 400 ⁺¹⁰	370^{-10} 1) 400 ⁺¹⁰	--	--
	$n_{\max}(\text{min}^{-1})$	3035^{+15} 1) 1995 ⁻¹⁵	2015^{+15} 1) 1975 ⁻¹⁵	--	--

Type 11.740	size	04	05	06	07
4-pole motors	$n_{\min}(\text{min}^{-1})$	$0^{+2,5}$ 1) 25 ^{+2,5}	$0^{+2,5}$ 1) 25 ^{+2,5}	$0^{+2,5}$ 1) 25 ^{+2,5}	$0^{+2,5}$ 1) 25 ^{+2,5}
	$n_{\max}(\text{min}^{-1})$	940^{+10} 1) 905 ⁻¹⁰	940^{+10} 1) 905 ⁻¹⁰	940^{+10} 1) 905 ⁻¹⁰	940^{+10} 1) 905 ⁻¹⁰
2-pole motors	$n_{\min}(\text{min}^{-1})$	0^{+5} 1) 30 ⁺⁵	0^{+5} 1) 30 ⁺⁵	--	--
	$n_{\max}(\text{min}^{-1})$	1880^{+10} 1) 1850 ⁻¹⁰	1880^{+10} 1) 1850 ⁻¹⁰	--	--

Dead stops as for hand wheel adjusters

1) Switching points for limits switches in case of servo adjusters.

5.3.2 Servo adjuster

5.3.2.1 Servo motor position I (Standard design)

1. Assemble spindle housing (4.01) and seal (4.25) in the corresponding position using screws (4.45) and spring lock washer (4.46) on housing (1.01). The guide piece (4.04) must slide on the ball head studs (4.06)!
2. Connect main motor (2.08) and switch on.
3. Adjust minimum idle speed n_{\min} (see table) by hand using a hand tacho. Screw in setscrew (1.04) against guide piece (4.04) in housing (1.01). Tighten nut (1.05).
4. Adjust maximum idle speed n_{\max} (see table) by hand using a hand tacho. Screw in setscrew (1.04) against guide piece (4.04) in housing (1.01). Tighten nut (1.05).
5. Set medium speed by hand!
6. Assemble small geared motor (4.10) on spindle housing (4.01). Before, cover the output shaft of the small geared motor with ant-corrosion agent, in order to avoid frictional corrosion. Cover setscrew (4.41) with screw locking glue and tighten.
7. Assemble limit switch housing (5.02) with allen screws (4.47) and shakeproof washers (4.48) at spindle housing (4.01). Observe gearing of worm shaft (4.17) and worm wheel (5.08).
8. Connect power supply for small geared motor. Check polarity of the servo motor according to

section 3.1 item a) or b) and change polarity, if necessary.

9. Set speed according to the lowest switching point for the limit switch (see table) for jogging. Find out the direction of rotation of the wiper in the potentiometer. The wiper moves towards the zero position of the multiturn potentiometer. The setscrew (5.14) in the actuator may have to be released using a long lever (5.03). If, after reaching the lowest switching point for limit switches, the wiper should not be at the beginning of the multiturn potentiometer, the potentiometer must be adjusted. For this, remove setscrew (5.15) in the worm gear (5.08). Turn actuator (5.03) until wiper is at the beginning of the multiturn potentiometer. Retighten setscrew (5.15) in the worm gear (5.08).
10. Turn setscrew (5.11) in the actuator with long lever (5.03) against the limit switch (S3) (see section 3.1), until you hear it switching. Tighten actuator (5.03) using setscrew (5.14).
11. Slightly increase idle speed and approach to the lower switching point, make fine setting using setscrew (5.11) if necessary. Check with hand tacho.
12. In the jogging mode, select the speed according to the upper switching point for limit switches (see table) using hand tacho. Loosen setscrew (5.14) in the actuator with short lever (5.03).
13. Turn setscrew (5.11) in the actuator with short lever (5.03) against limit switch (S4) (see section 3.1) until you hear it switching. Tighten actuator (5.03) using setscrew (5.14).
14. Slightly lower idle speed and approach to the upper switching point for limit switches, make fine setting using setscrew (5.11) if necessary. Check using hand tacho.
15. Again approach both switching points and correct, if necessary.
16. Close housing (5.02) with housing (5.01), seal (5.19) and screws (5.13).

Caution:

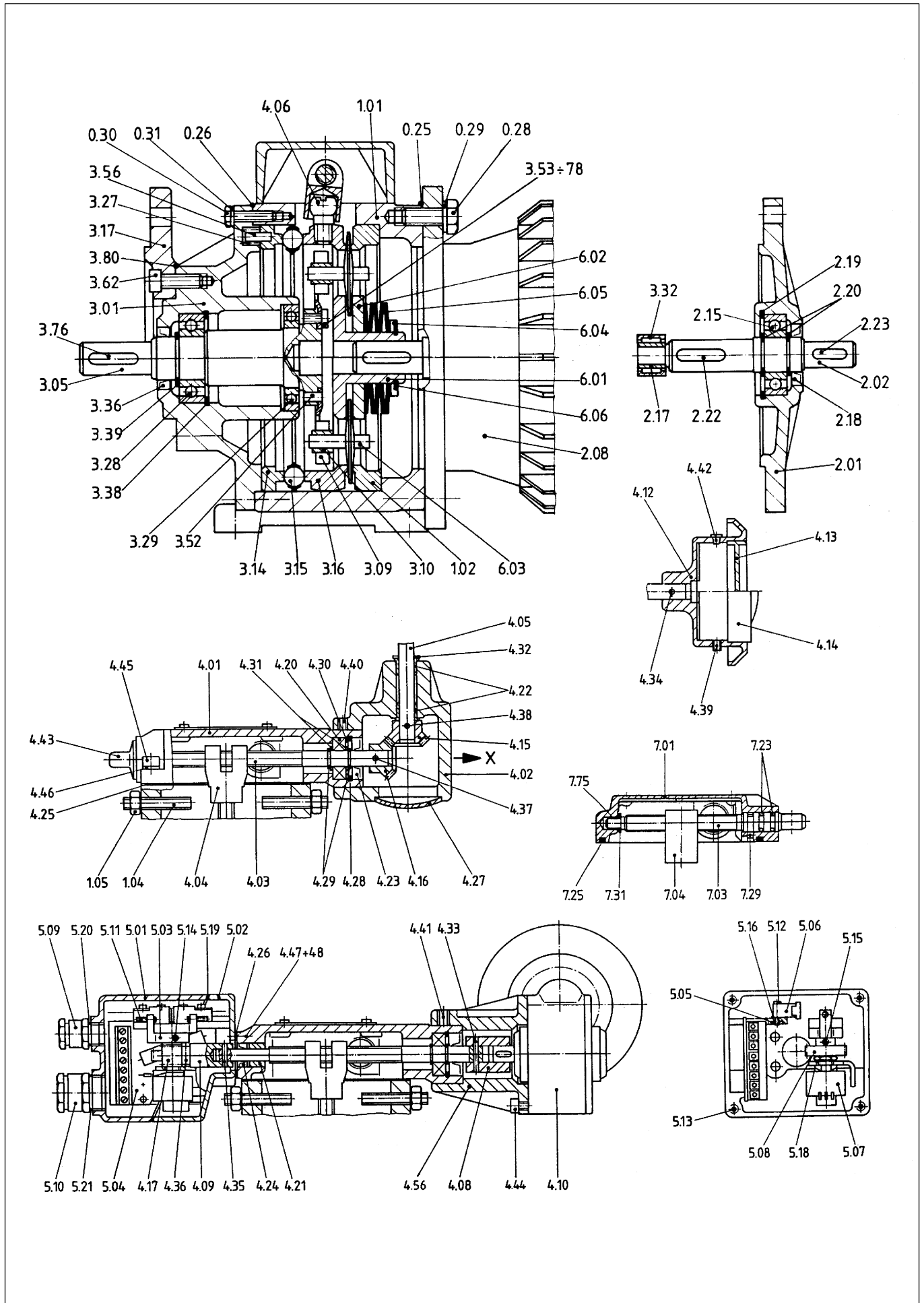
If Disco variable speed drives are subsequently modified from servo motor position I to servo motor position II, the two plug-in contacts on the back of the board (5.04) in the limit switch housing (5.02) must be interchanged. In this case, proceed according to section 5.3.2.2 "servo motor position II", which applies for Disco variable speed drives with servo motor position II as standard.

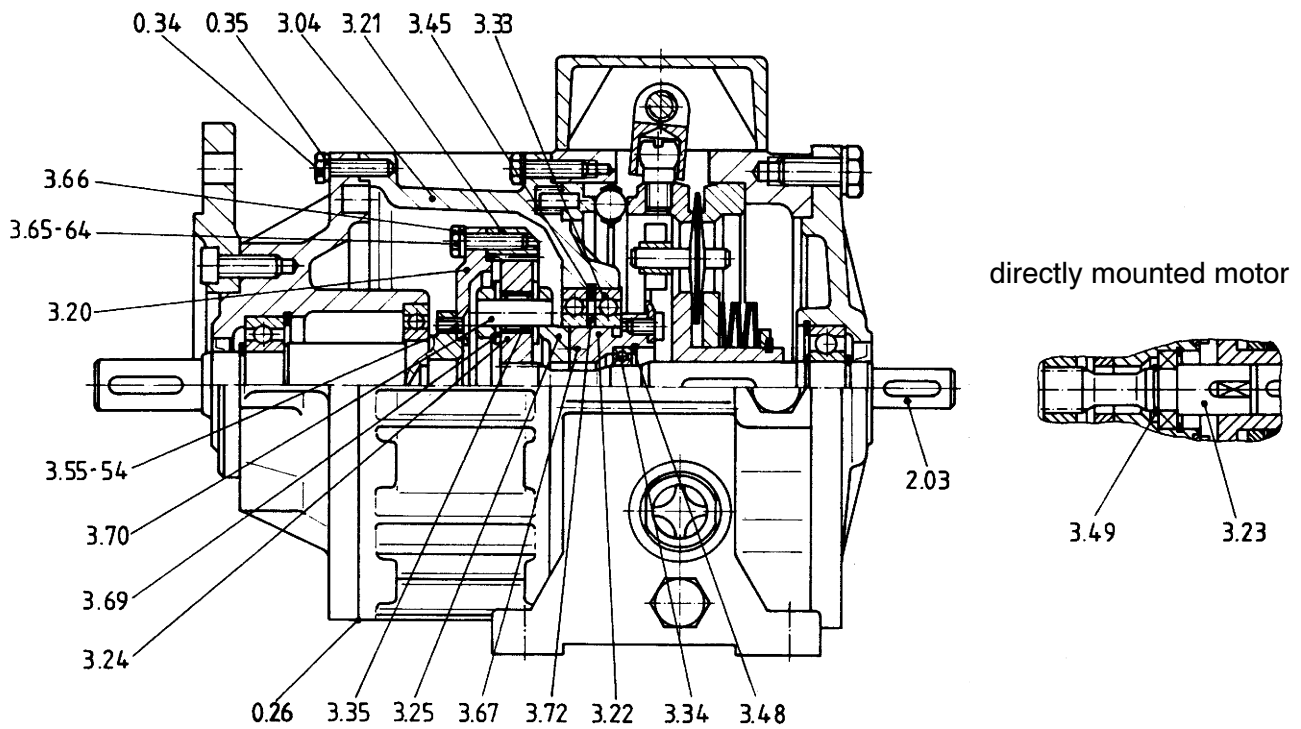
5.3.2.2 Servo motor position II

1. Assemble spindle housing (4.01) and seal (4.25) in the corresponding position using screws (4.45) and spring lock washer (4.46) on housing (1.01). The guide piece (4.04) must slide on the ball head studs (4.06)!
2. Connect main motor (2.08) and switch on.
3. Adjust minimum idle speed n_{\min} (see table) by hand using a hand tacho. Screw in setscrew (1.04) against guide piece (4.04) in housing (1.01). Tighten nut (1.05).

4. Adjust maximum idle speed n_{\max} (see table) by hand using a hand tacho. Screw in setscrew (1.04) against guide piece (4.04) in housing (1.01). Tighten nut (1.05).
5. Set medium speed by hand!
6. Assemble small geared motor (4.10) on spindle housing (4.01). Before, cover the output shaft of the small geared motor with anti-corrosion agent, in order to avoid frictional corrosion. Cover setscrew (4.41) with screw locking glue and tighten.
7. Assemble limit switch housing (5.02) with allen screws (4.47) and shakeproof washers (4.48) at spindle housing (4.01). Observe gearing of worm shaft (4.17) and worm wheel (5.08).
8. Connect power supply for small geared motor. Check polarity of the servo motor according to section 3.1 item a) or b) and change polarity, if necessary.
9. Set speed according to the lowest switching point for the limit switch (see table) for jogging. Find out the direction of rotation of the wiper in the potentiometer. The wiper moves towards the zero position of the multiturn potentiometer. The setscrew (5.14) in the actuator may have to be released using a long lever (5.03). If, after reaching the lowest switching point for limit switches, the wiper should not be at the beginning of the multiturn potentiometer, the potentiometer must be adjusted. For this,
 - remove setscrew (5.15) in the worm gear (5.08). Turn actuator (5.03) until wiper is at the beginning of the multiturn potentiometer. Retighten setscrew (5.15) in the worm gear (5.08).
10. Turn setscrew (5.11) in the actuator with short lever (5.03) against the limit switch (S4) (see section 3.1), until you hear it switching. Tighten actuator (5.03) using setscrew (5.14).
11. Slightly increase idle speed and approach to the lower switching point, make fine setting using setscrew (5.11) if necessary. Check with hand tacho.
12. In the jogging mode, select the speed according to the upper switching point for limit switches (see table) using hand tacho. Loosen setscrew (5.14) in the actuator with long lever (5.03).
13. Turn setscrew (5.11) in the actuator with long lever (5.03) against limit switch (S3) (see section 3.1) until you hear it switching. Tighten actuator (5.03) using setscrew (5.14).
14. Slightly lower idle speed and approach to the upper switching point for limit switches, make fine setting using setscrew (5.11) if necessary. Check using hand tacho.
15. Again approach both switching points and correct, if necessary.
16. Close housing (5.02) with housing (5.01), seal (5.19) and screws (5.13).

6.0 Spare parts list

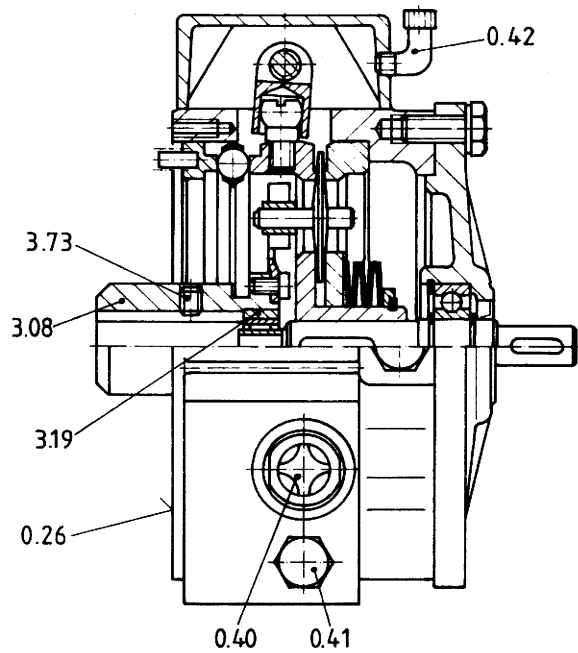
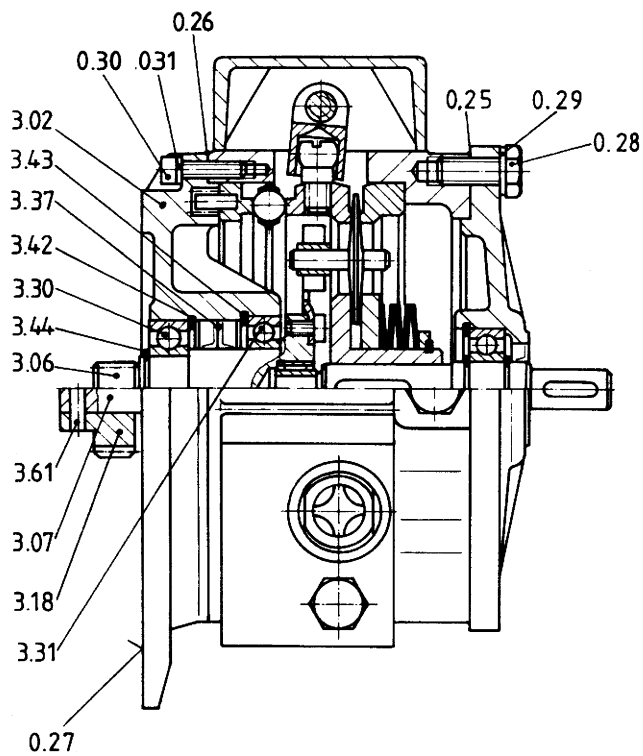




Suitable for mounting of

helical and helical worm gearboxes

worm gearboxes



Item	Description	Item	Description	Item	Description
0.25	Gasket	3.36	Shaft seal	4.37	Dowel pin
0.26	Gasket	3.37	Shaft seal	4.38	Dowel pin
0.27	Gasket	3.38	Circlip	4.39	Set screw
0.28	Hex. head screw	3.39	Circlip	4.40	Set screw
0.29	Spring washer	3.42	Circlip	4.41	Set screw
0.30	Hex. head screw	3.43	Circlip	4.42	Conical plug
0.31	Spring washer	3.44	Circlip	4.43	Protective cap
0.34	Screw	3.45	Circlip	4.44	Socket head cap screw
0.35	Spring washer	3.48	Circlip	4.45	Socket head cap screw
0.35	Seal ring 1)	3.49	Circlip	4.46	Spring washer
0.40	Oil sight glass	3.52	Dowel pin	4.47	Socket head cap screw
0.41	Screw plug	3.53	Socket head cap screw	4.48	Locking washer
0.42	Angled breather pipe	3.54	Dowel pin	4.56	Bell housing
1.01	Housing	3.55	Countersunk screw	5.00	Microswitch housing, compl.
1.02	Stationary outer ring	3.56	Dowel pin	5.01	Housing
1.04	Set screw	3.61	Dowel pin	5.02	Housing
1.05	Seal-Lock-hex. nut	3.62	Socket head cap screw	5.03	Actuator
2.01	Cover	3.64	Dowel pin	5.04	Complete board
2.02	Shaft	3.65	Hex. head screw	5.05	Metal sheet
2.03	Pinion shaft	3.66	Spring washer	5.06	Microswitch
2.08	Motor (3-phase)	3.67	Socket head cap screw	5.07	Pre-set potentiometer
2.15	Deep groove ball bearing	3.69	Washer	5.08	Wormwheel
2.17	Internal ring	3.70	Cylindrical pin	5.09	Gland connection
2.18	Shaft seal	3.72	Shim	5.10	Gland connection
2.19	Circlip	3.73	Set screw	5.11	Set screw
2.20	Circlip	3.76	Key	5.12	Socket head cap screw
2.22	Key	3.80	Gasket	5.13	Screw
2.23	Key	4.00	Spindle housing, compl.	5.14	Set screw
3.01	Cover	4.01	Spindle housing	5.15	Set screw
3.02	Flange	4.02	Housing	5.16	Leveling piece
3.04	Housing	4.03	Spindle	5.18	Locking washer
3.05	Shaft	4.04	Guide-piece	5.19	Gasket
3.06	Pinion shaft	4.05	Shaft	5.20	O-ring seal
3.07	Shaft	4.06	Speed control stud	5.21	O-ring seal
3.08	Hub	4.08	Bush	6.00	Complete inner sun
3.09	Planet carrier	4.09	Adapter	6.01	LH inner sun
3.10	Planet bearing	4.10	Small worm geared motor	6.02	RH inner sun
3.14	Cam ring	4.12	Handwheel	6.03	Planet
3.15	Ball cage	4.13	Direction indicator	6.04	Spring retaining cap
3.16	Movable outer ring	4.14	Position indicator	6.05	Cup spring
3.17	Flange	4.15	Bevel gear	6.06	Circlip
3.18	Pinion	4.16	Bevel gear	7.00	Spindle housing, compl.
3.19	Bush	4.17	Worm	7.01	Spindle housing
3.20	Outer ring gear carrier	4.20	Deep groove ball bearing	7.03	Spindle
3.21	Outer ring gear	4.21	Bush	7.04	Guide-piece
3.22	Hub	4.22	Collar bush	7.23	O-ring seal
3.23	Pinion shaft	4.23	Shaft seal	7.25	Gasket
3.24	Pinion	4.24	Shaft seal	7.29	Fixing metal sheet
3.25	Planet gear carrier	4.25	Gasket	7.31	Shim
3.27	Pressure spring	4.26	Gasket	7.75	Collar bush
3.28	Deep groove ball bearing	4.27	End cover		
3.29	Deep groove ball bearing	4.28	Circlip		
3.30	Deep groove ball bearing	4.29	Circlip		
3.31	Deep groove ball bearing	4.30	Shim		
3.32	Needle bush	4.31	Shim		
3.33	Deep groove ball bearing	4.32	Seeger ring		
3.34	Deep groove ball bearing	4.33	Dowel pin		
3.35	Needle bush	4.34	Dowel pin		
		4.35	Dowel pin		
		4.36	Dowel pin		

1)For the screws (0.34) inside of the oval flange of the differential drive with helical gearbox

When ordering spare parts please quote :

Type and no. as shown on type plate, position and description of the spare part as shown in the spare parts list and no. of the installation and operating instructions.

Pos. 7.00 (7.01...7.75): only complete replaceable.