Pumpenantrieb
Pumpdrive
Entraînement de Pompe
Accionamiento de la bomba
Motore della pompa

PD 5001, PD 5006, PD 5025,
PD 5101, PD 5106, PD 5130,
PD 5201, PD 5206, PD 5230,

mit **Pumpenköpfen,**
with **Pump Heads,**
avec **Têtes de Pompes,**
con **teste pompa**

Betriebsanleitung

Instruction Manual

Mode d'Emploi

Manual de instrucciones

Istruzioni per l'uso

Thank you for purchasing a Heidolph Instruments product. This item has been designed, made and inspected in compliance with DIN EN ISO 61010 for long-term and flawless operation.

SUMMARY

Important information

Advice about power cord / mains supply

Caution: mandatory action

Caution: fire- and explosion hazard

Advice about maintenance / repair

STANDARD ITEMS AND OPTIONS

	item	quantity	P/N 230V / 50/60Hz	P/N 115V / 50/60Hz
	PD 5001 pump drive	1	523-50010-00	523-50010-01
or	**PD 5001 pump drive** includes multi-channel adapter	1	523-50013-00	523-50013-01
or	**PD 5006 pump drive**	1	523-50060-00	523-50060-01
or	**PD 5101 pump drive**	1	523-51010-00	523-51010-01
or	**PD 5101 pump drive** includes multi-channel adapter	1	523-51013-00	523-51013-01
or	**PD 5106 pump drive**	1	523-51060-00	523-51060-01
or	**PD 5201 pump drive**	1	523-52010-00	523-52010-01
or	**PD 5201 pump drive** includes multi-channel adapter	1	523-52013-00	523-52013-01
or	**PD 5206 pump drive**	1	523-52060-00	523-52060-01
or	**PD 5025 pump drive**	1	523-50250-00	523-50250-01
or	**PD 5130 pump drive**	1	523-51300-00	523-51300-01
or	**PD 5230 pump drive**	1	523-52300-00	523-52300-01
or	**PD 5001 with SP quick 1,6**	1	523-50019-00	523-50019-01
or	**PD 5006 with SP quick 1,6**	1	523-50069-00	523-50069-01
or	**PD 5006 with SP standard 2,5**	1	523-50068-00	523-50068-01
or	**PD 5101 with SP quick 1,6**	1	523-51019-00	523-51019-01
or	**PD 5106 with SP quick 1,6**	1	523-51069-00	523-51069-01
or	**PD 5106 with SP standard 2,5**	1	523-51068-00	523-51068-01
or	**PD 5201 with SP quick 1,6**	1	523-52019-00	523-52019-01
or	**PD 5206 with SP quick 1,6**	1	523-52069-00	523-52069-01
or	**PD 5206 with SP standard 2,5**	1	523-52068-00	523-52068-01
	PD 5201 with C4 und **4 x Cassette small**	1	523-52017-00	523-52017-01
	Instruction manual	1	01-005-002-75	01-005-002-75
	power cord (for PD 5001, PD 5006, PD 5025 only)	1	14-007-003-81	14-007-003-89

Accessories

	item	P/N
	peristaltic pump head SP quick (SWS 1.6 mm)	527-11100-00
	peristaltic pump head SP quick (SWS 2.5 mm)	527-11300-00
	peristaltic pump head SP quick d (SWS 1.6 mm)	527-11120-00
	peristaltic pump head SP quick d (SWS 2.5 mm)	527-11320-00
	peristaltic pump head SP standard (SWS 1.6 mm)	523-43010-00
	peristaltic pump head SP standard (SWS 2.5 mm)	523-43030-00
	peristaltic pump head SP vario	523-45110-00
	C 4 multi-channel pump head	524-80420-00
	C 8 multi-channel pump head	524-40810-00
	C 12 multi-channel pump head	524-81220-00
	cassette, small (SWS 0.9 mm)	524-90022-00
	cassette, medium (SWS 1.6 mm)	524-90021-00
	cassette, large (SWS 1.6 mm)	524-90010-00
	ZP 1 geared pump head	523-81000-00
	ZP 2 geared pump head	523-82000-00
	ZP 3 geared pump head	523-83000-00
	pedal switch	526-14100-00
	adapter for multi-channel pump heads	526-16000-00
	hose coupling 0.2-1.4 mm	526-22000-00
	hose coupling 2.8 mm	526-26000-00
	hoses as required, refer to Chapters 14 and 15	

GENERAL

Unpack your item carefully.
Inspect for damage and report such damage or missing parts to your supplier right away.

Read your Instruction Manual carefully. Take time to save time while working with your product. Make sure that every user has read and understood the Instruction Manual.

Please store the Instruction Manual in a place easily accessible to every user.

IF ALL ELSE FAILS, READ THESE INSTRUCTIONS !

A so-called EURO-plug (DIN 49441 CEE 7/VII 10/ 16 A 250 V) is standard on all of the products.
For the Continental US they feature a US-standard plug (NEMA Pub.No.WDI.1961 ASA C 73.1 . 1961 page 8 15A 125V).

For using the item in a country with deviating outlet / plug systems, we recommend to use approved adapters or to have an electrician replace the standard plug with one mating your local system.

As shipped, the item features a protective ground wire. When replacing the original plug, make sure to reconnect this protective ground wire in the new plug !

SAFETY INFORMATION

Please comply with all safety and accident prevention regulations as in force for laboratory work !

Comply with all safety instructions in force for pumps !

Use extra care while working with flammable substances; refer to safety data sheets. Store safety data sheets in a place easily accessible to all operators.

Use eye protection and adequate clothing.

Use extra care while working with flammable substances. Refer to safety data sheets.

Pump drives do not feature explosion protection!

Caution ! Hoses are wear parts. Inspect hoses in regular intervals and replace on condition.

E

Before connecting your item with the local power supply, make sure the item has been designed for your local voltage; refer to data plate on item.

Turn power switch to OFF when item is out of use, or before disconnecting from mains.

Repair work is limited to skilled personnel authorized by Heidolph.

Your item needs a solid stand.

Before turning pump drives ON, make sure your hands are clear of the squeeze rollers; contusion hazard !

A. SET-UP

1. General (fig. 21)

- The pump drive is located on a smooth horizontal plane.
- When using more pump drives at the same time (2 ea. max.), they may be stacked to save space.

fig. 21

2. Install peristaltic pump heads on pump drives:

2.1. SP quick (figs. 22,23)

- Press SP quick pump head (3) against PD.... pump drive front panel so that thread (4) and coupling (5) are in line with threaded bolt and coupling on pump head.
- Protruding parts of the coupling crown need to slip into cut-outs provided in pump drive coupling stud. To this end tilt pump head around rotor center or move rotor with forefinger, hose bed being open (refer to Chapter 3.3).

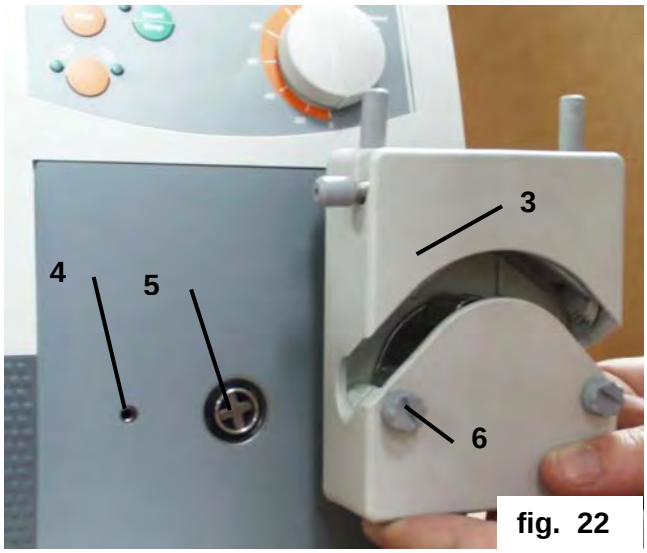


fig. 22

- When coupling is seated properly, secure pump head (3) with 2 ea. knurled-head bolts (6) by hand; if required, tighten with screwdriver or coin.

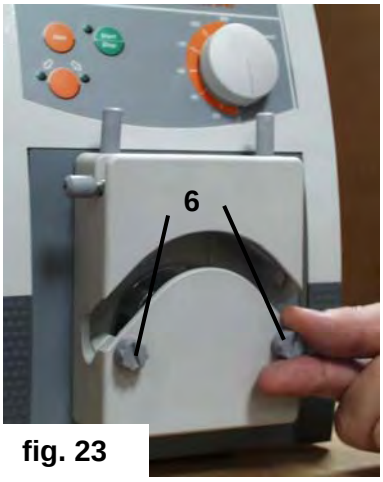


fig. 23

2.2. SP quick d (2 ea. SP quick pump heads arranged in series) (figs. 24,23,22)

⚠ Limited to PD 5001, PD 5101 and PD 5201 pump drives.

- SP quick pump head with one more SP quick pump head allows to run 2 ea. feeder channels the same time.
- Unscrew 2 ea. knurled head bolts (6 fig. 23) from SP quick pump head (3) with about 10 revolutions CCW. Replace with long knurled head bolts (7).
- Beware short knurled head bolts (6 fig. 23) for future use.
- Fit SP quick d pump head (8), with spacer (42) over threaded end of long knurled head bolts (7), seat long knurled head bolts and secure by turning clockwise; press two ea. pump heads (3 & 8) together. SP quick (3) properly needs to be caught by the SP quick d (8) counterpiece. As required, rotate rotor by hand (to this end open hose bed, refer to Chapter 3.3) Secure pump pack on pump drive as described in Chapter 2.1.

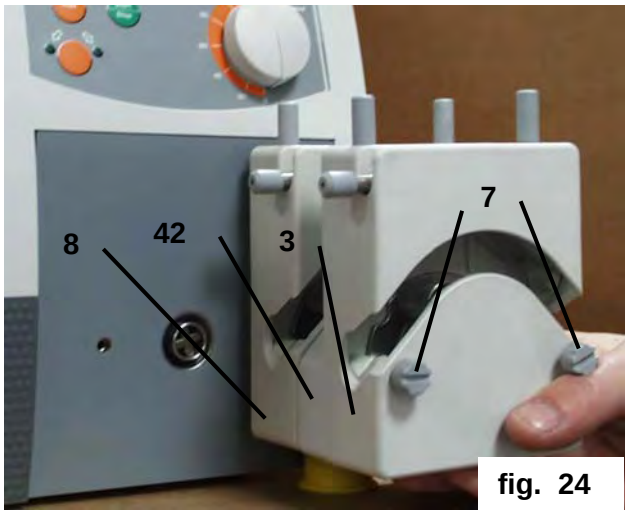


fig. 24

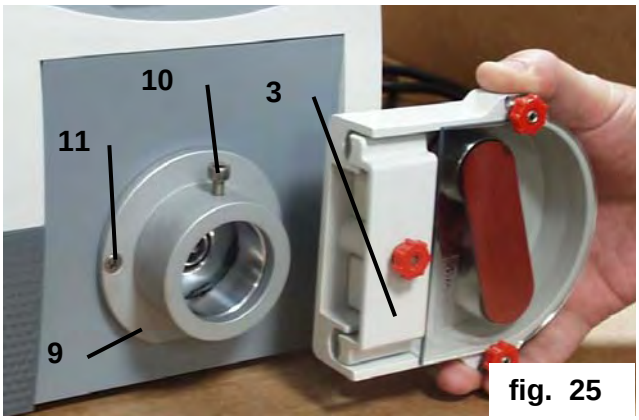


fig. 25

2.3. SP Standard, SP vario, (fig 25)

- Installation of SP Standard and SP vario pump heads needs flange (9) from your hardware kit.
- Uninstall flange (9) from pump head (3) by loosening setscrew (10).
- Secure flange on front panel with countersunk screws (11). Use Phillips screwdriver.
- Introduce SP Standard or SP vario pump head into flange (coupling pointing forward).

- Make sure that coupling fits counterpiece (as required, rotate rotor a little bit; remove cover to get access (also refer to Chapter 3.5)). Check horizontal location of pump head (3); hose outlet pointing to the left; secure in place with setscrew (10).

3. Install hose - peristaltic pumps

3.1. General

To avoid damage to the hose, make sure you are going to install the right wall thickness. If not, pump may fail to feed. To determine the right wall thickness, make reference to table below:

wall thickness (mm)	1.6	2.5
SP quick	527-11100-00	527-11300-00
SP quick d	527-11120-00	527-11320-00
SP Standard	523-43010-00	523-43030-00
SP vario	523-45110-00	523-45110-00

3.2. How to choose the hose material

For more information about hoses, their properties and chemical stability make reference to Chapter C.

3.3. SP quick (fig. 26)

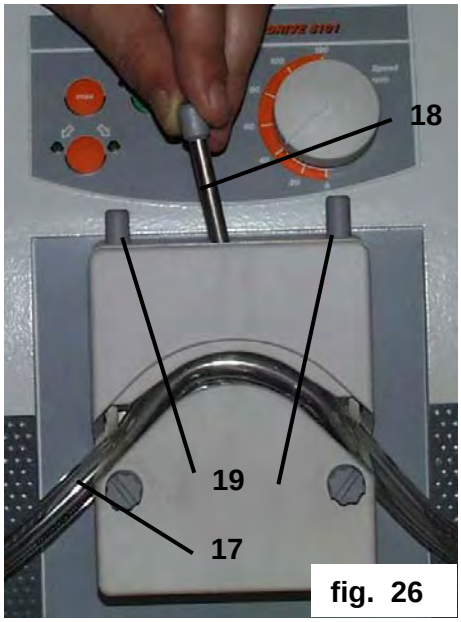


fig. 26

- The SP quick features snap-on mechanism to speed up installation of hoses.
- Fold lever (18) to the left to open hose bed.
- Rotate two clampscrews (19) CCW till stop.
- Seat hose (17) in sickle-shaped cut-out in pump head.
- Fold lever (18) to the right to close hose bed.
- Do a short trial run to check proper clamping of hose.
- Make shure that hose does not migrate during rotation.
- If necessary clamping can be increased by turning clampscrews (19) clockwise when hose bed is open. Close hose bed and check adjustment with trial run.
- Repeat above setting and testing work as required.

Carefully losen item; remember that clamping power has not been adjusted before and excessive clamping power may squeeze-off the hose.

Check for hose clamps properly seated. Hose (17) should not creep while pumping; check hose clamping in a brief test run.

3.4. SP quick d (fig. 27)

⚠ Use is limited to PD 5001, PD 5101 and PD 5201 pump drives.

- If two pump heads are set-up in series, the hose will be installed in the forward pump head (3), as described in Chapter 3.3 SP quick. The hose itself will be seated in the rear pump head's hose bed (8) through a wide gap between both pump heads. Continue as described for SP quick in Chapter 3.3.

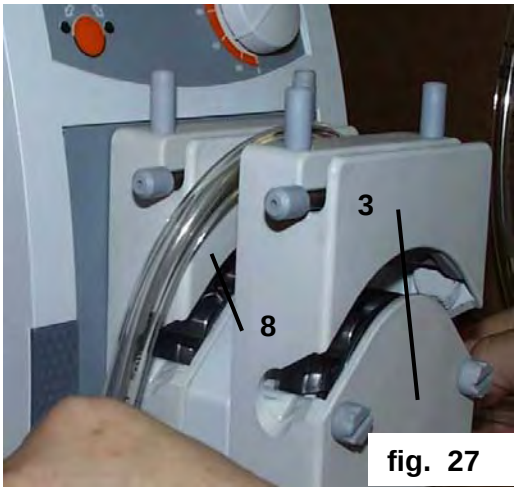


fig. 27

3.5. SP Standard (fig. 28)

- Loosen knurled nuts (22 & 23) to remove clamping lever (20) and cover (21). Seat hose (17) in hose bed (180 degrees loop), rotate rotor (24) by hand until hose (17) is pulled into the gap between the rollers (25) and hose bed (26).
- Check hose being squeezed properly by rotating the rotor (24) through several revolutions.
- Install clamp lever (20) and cover (21); hold both hose ends tight while tightening knurled nut (23).
- Holding hose ends tight over the rollers (25) will make sure both rollers (25) are centered over the hose (17) which is an essential requirement for proper feeding action and standstill sealing.
- Do a short test run (function test).

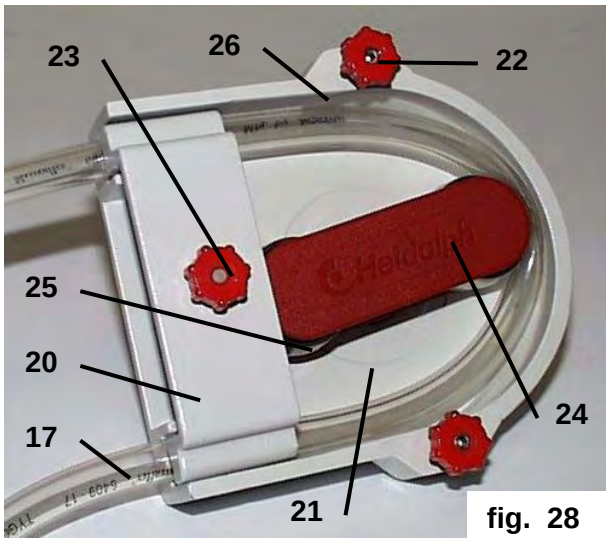


fig. 28

3.6. SP vario (fig. 29)

- The SP vario pump head accepts hoses of different wall thicknesses. Adjustment uses knurled knob (27).
- Set clockwise rotation with selector (31), refer to figs. 47,49 and 51).
- Uninstall clamp lever (20), cover (21) by loosening knurled nuts (22 & 23).
- Set clearance to max. hose thickness with knurled knob (27); rotate in "+" direction.
- Introduce a 180 degrees hose (17) loop in hose bed, rotate rotor (24) by hand until hose (17) is pulled into the gap between rollers (25) and hose bed (26).
- Run rotor (24) through several revolutions until hose is squeezed over its entire width.
- Energize pump on condition.

Select "clockwise" rotation before energizing pump !

CAUTION ! Contusion hazard

- Hose thickness is adjusted with knurled knob (27). Turn to "+" increase clearance (thick wall hose) or "-" to decrease clearance (thin wall hose).
- Best setting is reached, when hose is squeezed over about 80 % of its wall thickness. At this point, the fluid filled hose is squeezed by the rollers as to allow feeding; the same time no fluid may drain from the hose at standstill.
- Install cover (21) and clamp lever (20); hold both hose ends tight while tightening knurled nut (23).
- For easy adjustment of different sizes of hose wall thicknesses use enclosed auxillary tool for radial hole on knurled screw (27). After adjustment tighten screw (44) to secure knurled screw.

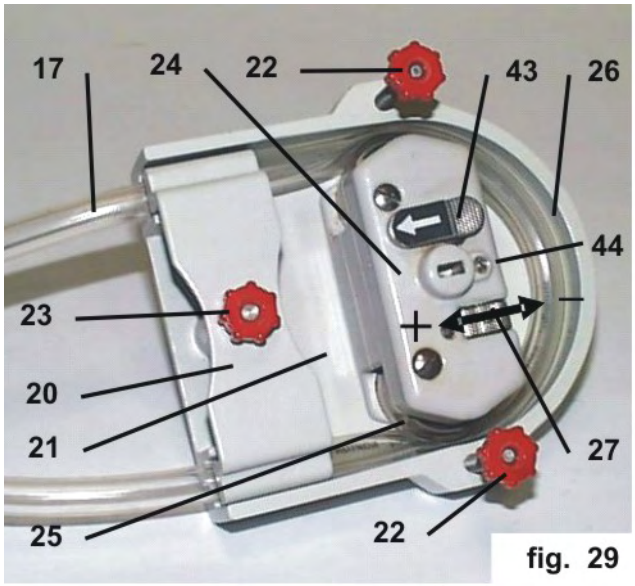


fig. 29

- Pulling hose ends over the rollers (25) will make sure both rollers (25) are centered over the hose (17) which is an essential requirement for proper feeding action and standstill sealing.
- Do a short test run to verify setting. Repeat setting and test run on condition.
- Before energizing the pump, close cover (21); Contusion HAZARD !
- Depress lever (43) to uninstall rotor by pulling; refer to arrow mark for this action.

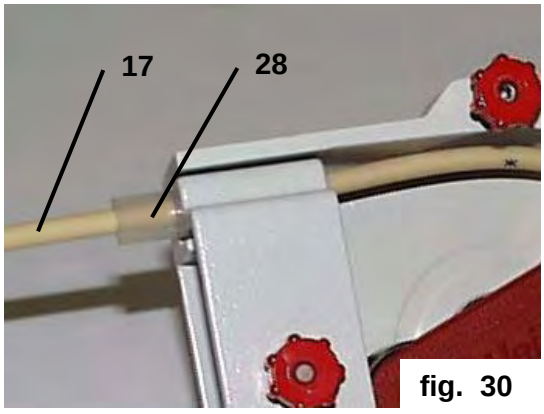


fig. 30

3.7. Use of small ID hoses (size 0.8 and 1.7 mm) (fig. 30).

- Short lengths of 0.8 and 1,7 hoses are supplied with the SP vario and SP Standard pump heads; the are used to improve clamping action.
- To this end slip these short hoses (28) over your pump hose (17) and install hose (17) with short hoses (28) in pump head so that these short hoses are located under the clamp. To go ahead from this point, refer to "install hose" Chapter.

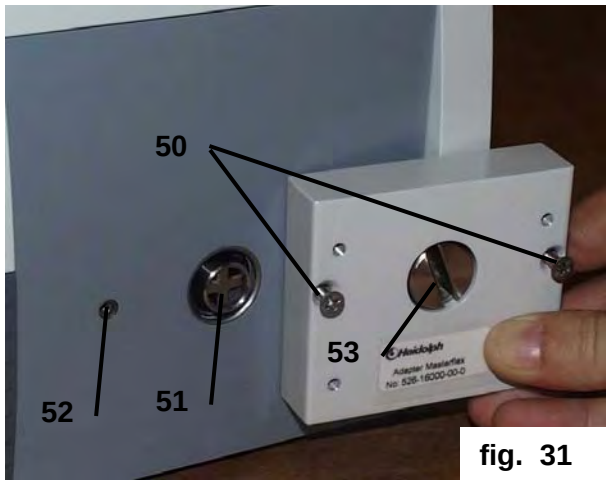


fig. 31

4. Install multi-channel pump head on pump drive

4.1. Install multi-channel adapter on pump drive (fig. 31)

Normally, the multi-channel adapter comes installed on the pump drive. If a multi-channel

adapter had been procured as an option for an existing pump drive, install item as stipulated below:

- Plug screws (50) from hardware kit in holes provided.
- Align multi-channel adapter coupling with counterpiece (51) on pump drive.
- Fit multi-channel adapter in coupling, align screws (50) with threaded holes (52) and pull both screws (50) tight with a screwdriver.

4.2. Install multi-channel pump head on pump drive (fig. 32)

Tooling required: long-reach screwdriver (from hardware kit).

- To install pump head on pump drive, align follower pin (54) with slot in multi-channel adapter (53, fig. 31).
- Secure pump head on pump drive with 4 ea. screws (55, from hardware kit); use special screwdriver from hardware kit.

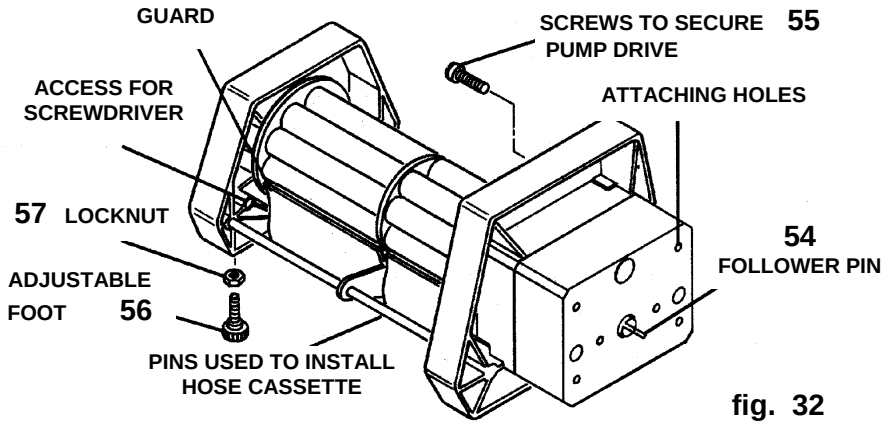


fig. 32

- We recommend to support the pump head for this action; use adjustable foot (56) for leveling. Pull lock-nut (57) tight against the pump head's underside.

- CAUTION: the multi-channel pump head's drive C 8 follower pin features a plastic sleeve (58) over the follower pin (54). Check for proper seat of parts. The plastic sleeve (58) is used for cushion between both parts of the coupling, limiting noise emission to a minimum. This sleeve (58) needs to be inspected after every 500 hours of operation and replaced on condition. Sleeve P/N: 23-09-01-01-88-0

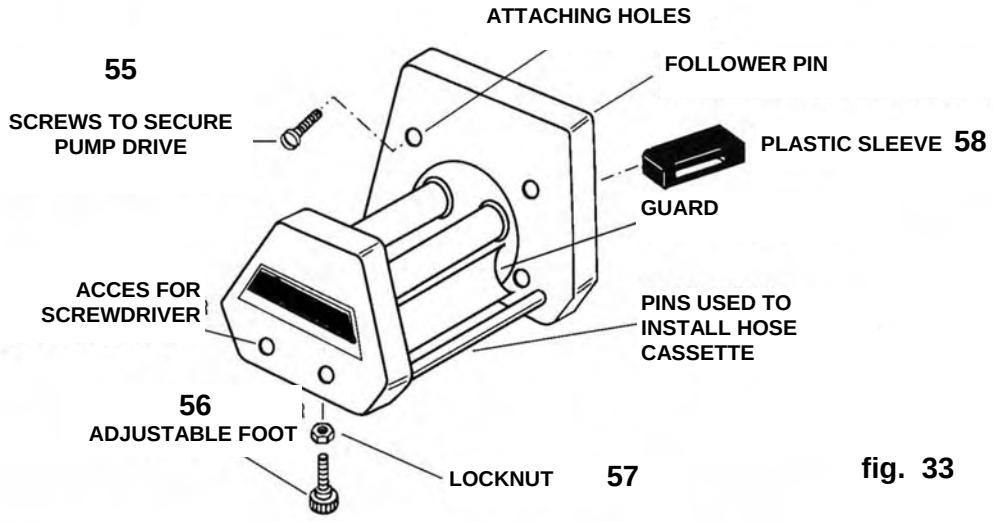


fig. 33

CAUTION: absence of SLEEVE (58) will harm the pump head.

5. Install hose and cassette

CAUTION: use only those combinations of multi-channel pump heads, cassettes, and hoses specified in reference table (Chapter 15). Deviation will increase wear or cause malfunction.

5.1. Cassette "small"

⚠ The cassette models "small" have been designed exclusively for C4 and C12 multi-channel pump heads.

⚠ The cassette model "small" accepts 3 only stopper hoses ! Use of hose in absence of a stopper will cause malfunction and voids your warranty !

⚠ Disconnect pump drive before installing or uninstalling cassettes, to avoid contusion hazard.

- The hose cassette system installs and uninstalls at ease (snap-on); no extra tooling required for this work. Since hose cassettes may work in both directions, no particular orientation of the cassette is required. Despite this fact, we recommend to arrange cassettes alternatingly, for ease of access to the setting knobs of every single cassette in a stack.
- Turn contact pressure setting knob (59) (fig. 34) to max. clearance (counter-clockwise); You do not need to do this work if you haven't touched the factory setting before, or contact pressure had been set for actual pumping work before.
- Load approved 3-stopper-hose in cassette (refer to fig. 35). Slip stopper on both ends of the cassette to the hose holder (refer to fig. 36).

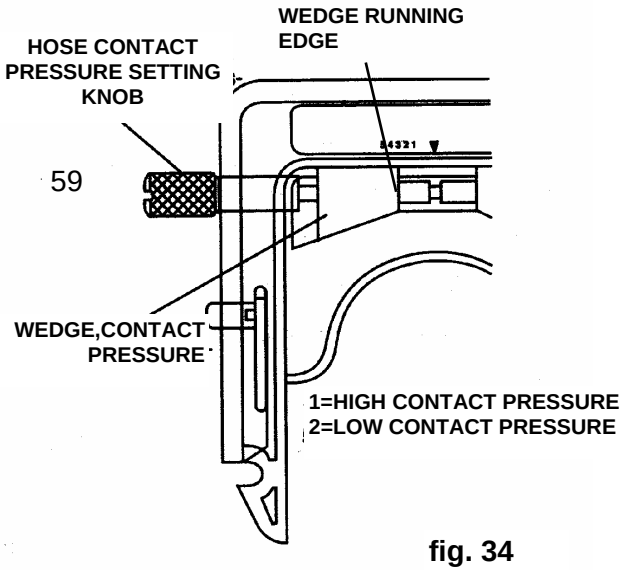


fig. 34

- Hook hose cassette over one of the carrier rods, while holding hose between cassette feet and pressing its against the hose holder (refer to figs. 36 & 37).

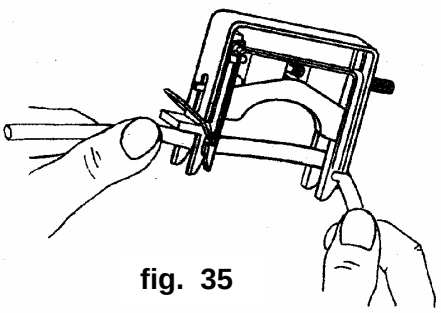


fig. 35

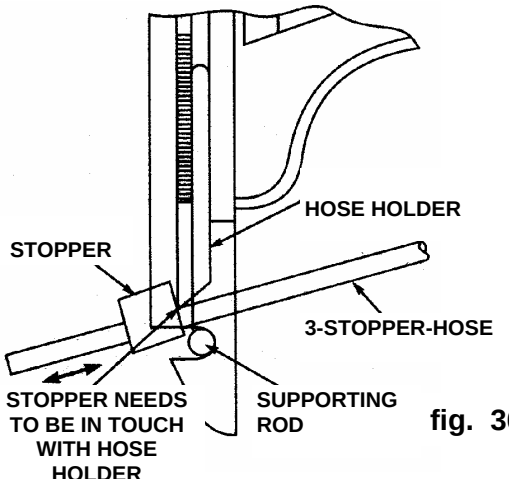


fig. 36

- Fold hose over rotor, depress latch (refer to pig. 37) until pawl snaps in (refer to fig. 38).

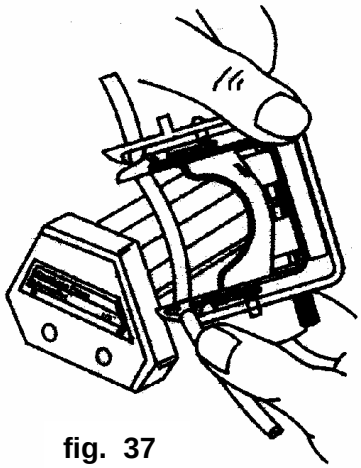


fig. 37

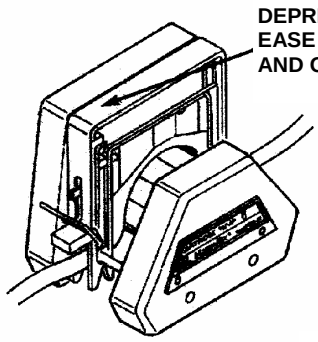


fig. 38

Note: as required, depress hose cassette at place marked in fig. 38, to ease snap action.

- Adjust hose contact pressure. Turn knob (59) until inside edge of wedge is centered between #1 and #2 marks on the data plate graduation (refer to fig. 34).

5.1.1. How to optimize contact pressure setting

For certain applications, contact pressure needs re-adjustment . For example, varying feed rate of a particular hose, minimizing feed rate fluctuations caused by changes in system pressure, or to simply extension.

5.1.1.1. For maximum of hose life

With the pump running, decrease hose contact pressure adjusted before. To this end turn regulating knob (59, fig. 34) counterclockwise to displace wedges to a higher scale reading (towards 5). Go ahead turning knob (59, fig. 34) until feed rate or pressure are too low. From this point go ahead turning knob clockwise until feed rate and pressure are ok.

5.1.2. Pump operation with partial use of a multi-channel pump head (fig. 39)

Pump may be run with all or part of the multi-channel pump head's ports connected. Both metal rods of the pump feature an elastic packing (60) on both ends that secures cassettes on the pump. Secure multi-channel pump heads with part of the ports loaded with cassettes by slipping packings (60) over the rods towards the front end of the outboard cassette (refer to e.g. position A). On

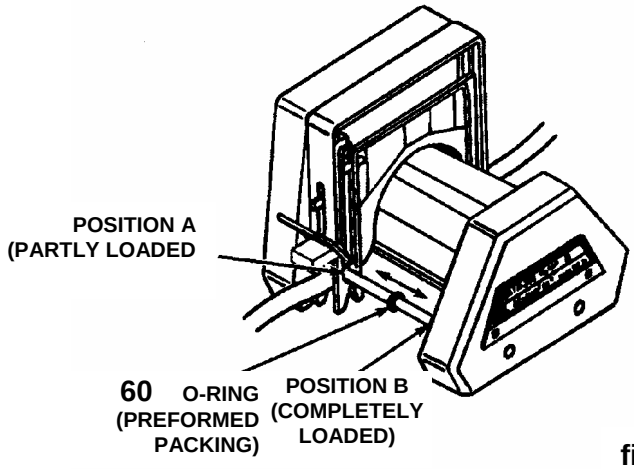


fig. 39

pumps completely loaded with cassettes, make sure to slip the packings (60) against the front end of the pump as far as possible (refer to position B).

5.1.3. Unload hose cassette:

- Turn drive to OFF.
- Depress cassette's locking pawl (refer to fig. 38) and unhook from rod.
- Tilt cassette up and unhook from rod. Unload cassette by lifting.

5.1.4. Stopper hose extension:

Optional PTFE hose couplings are available for extension. Just plug together with hoses from the reel.

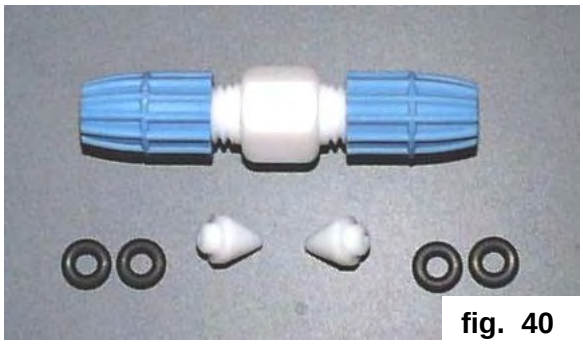


fig. 40

5.1.4.1. Size 0.2; 0.5; 0.9 and 1.4 hoses

Use packings from your hardware kit. Plug hose through coupling nut (refer to fig. 41); install packings and pull coupling nut hand-tight.

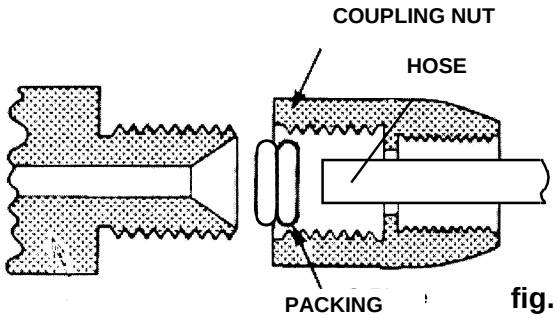


fig. 41

5.1.4.2. Size 2.8 hose

Use cone from your hardware kit. Refer to fig. 42 and plug hose through coupling nut, after having trimmed (pointed) hose end. After installation cut pointed end apart. Install cone as shown, pull coupling nut hand-tight.

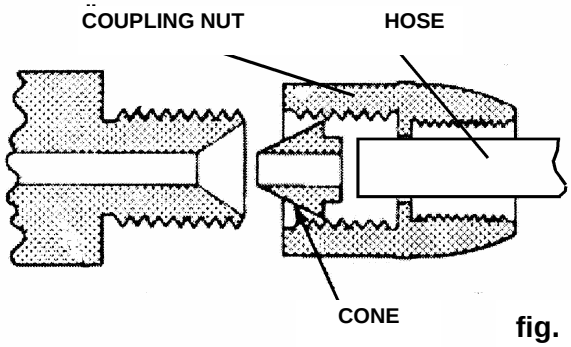


fig. 42

5.2. Cassette medium;

Medium-model cassettes exclusively have been designed for C8 multi-channel pump heads.

Installation procedure is the same as described for the small-model cassette (refer to Chapter 5.1 ff); these cassettes however do not feature stoppers, they use hoses from the reel only (refer to Chapter 15, reference table).

When cassette is interlocked with multi-channel pump head exert some pull force on both ends of the hose to prevent hose from looping.

To adjust roller contact pressure, turn setting knob until inboard wedge reads between 3 and 4 on the scale; refer to Chapter 5.1.1 to optimize roller contact pressure.

5.3. Cassette large

Large-model cassettes exclusively have been designed for C8 multi-channel pump heads.

Installation procedure is the same as described for the small-model cassette (refer to Chapter 5.1 ff); these cassettes however do not feature stoppers, they use hoses from the reel only (refer to Chapter 15, reference table).

The large-model cassette features adjustable hose retainers on in- and outlet ends. These retainers adjust hose clamping action for different sizes of hoses. To adjust setting knob (61) make reference to fig. 43 and the reference table below:

size of hose	set to
1,7	14
3,1	16
4,8	25
6,3	17

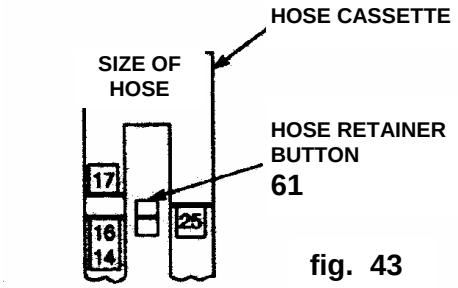


fig. 43

When cassette is interlocked with multi-channel pump head exert some pull force on both ends of the hose to prevent hose from looping.

To adjust roller contact pressure, turn setting knob until inboard wedge reads between 3 and 4 on the scale; refer to Chapter 5.1.1 to optimize roller contact pressure.

6. Install geared pumps (fig. 44)

- Turn setscrew (12) on flange (13) counter-clockwise until geared pump (14) can be introduced.
- Install geared pump (14) in flange (13). At this point make sure hose nipples (15) are horizontal and by-pass adjusting screw (16) is on the left.
- Pull setscrew (12) tight by turning clockwise.

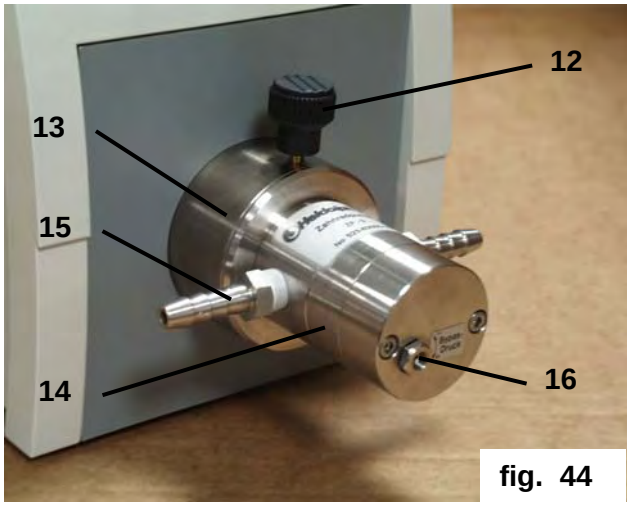


fig. 44

6.1. Connect hoses (fig. 45)

- Slip hose (17) (refer to reference table for ID) over nipple (15) and secure with industrial quality hose clamp (very important, when working at high pressure levels); inlet end is left, outlet end is right, pump running clockwise.

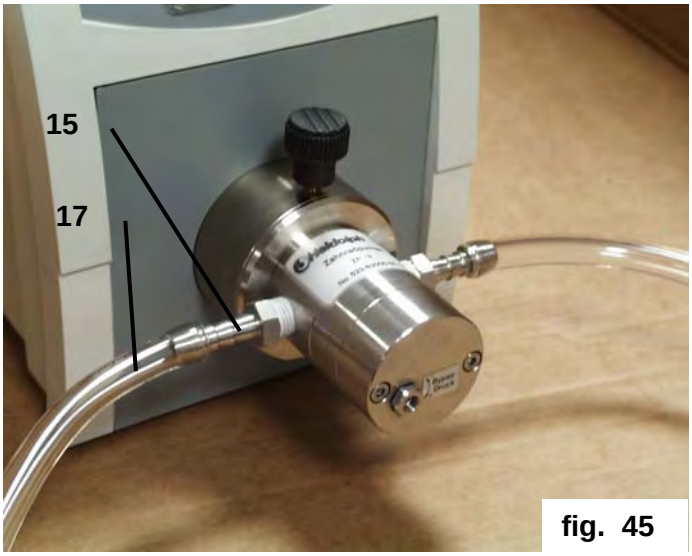


fig. 45

⚠ When using geared pumps, run pump drive clockwise only, not to override by-pass feature (refer to Chapter 6).

⚠ Geared pumps should not run dry.

⚠ Caution ! On standstill, geared pumps are not reflux-safe. Use industrial-quality non-return valve as required.

geared pump head	hose ID
ZP1/ZP2	5-6mm
ZP3	8-9mm

6.2. Adjust by-pass (fig. 46)

- Max. feed pressure of a geared pump is adjusted with the by-pass valve (6). We recommend to limit operating pressure to avoid possible damage to components in your feed system by overpressure.
- Loosen locknut with SW 11 box-end spanner, adjust valve, and secure with locknut.
- To rise pressure, use 3 mm hex pin and turn hex. socket in front panel of geared pump clockwise; to lower pressure, turn counter-clockwise.

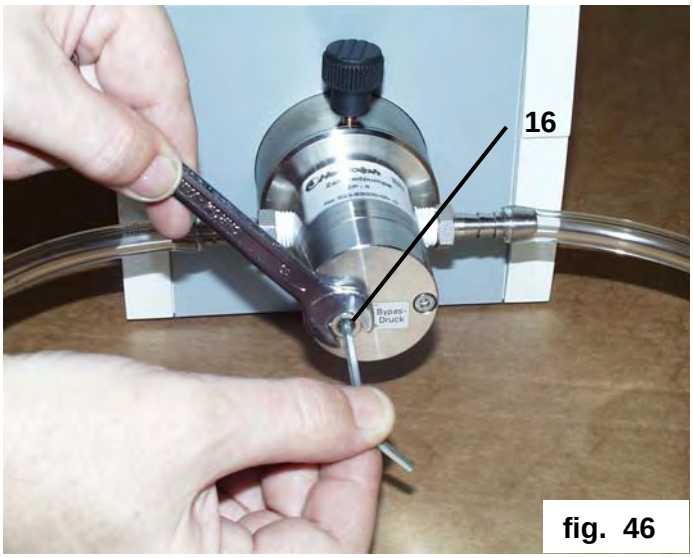


fig. 46

⚠ PD 5130 and PD 5230 pump drives fulfill IP 55 requirements with geared pump head installed only.

B. OPERATION

7. General

Before running the item, read all of the safety and general information !

Before connecting your item with your local power supply, make sure item has been designed and wired for your voltage and frequency. Use your national standard plugs. For more information refer to Chapter "General Information".

- Connect with mains.

8. PD 5001, PD 5006, PD 5025 (fig. 47)

- Power switch (29) on control panel starts pump rotation.
- Select speed with selector knob (30).
- Feed rate is proportional with pump speed. Go by rpm scale on the item. For more information about exact speed refer to reference tables in Chapters 17 and 18.
- Select sense of rotation with switch (31); (go by arrow marks).

fig. 47

By-pass feature of geared pumps is active when rotating clockwise only !

9. PD 5101; PD 5106; PD 5130 (figs 48,49)

- PD 5101, PD 5106 and PD 5130 pump drives are splash proof (IP 55).

Service work is limited to expert personnel authorized to do so by Heidolph.

Keep interface connector (37) closed all the time by either an interface plug or a blind plug, not to void splash protection.

To comply with IP 55 requirements, PD 5130 pump drive needs to be fitted with a geared pump head.

- Item's master switch (29) is located on the rear panel. LED (40) for sense of rotation in ON.
- Set speed with speed selector (30) on the control panel.
- Feed rate is proportional with pump speed. Go by rpm scale on the item. For more information about exact speed refer to "Specifications" section.

fig. 48

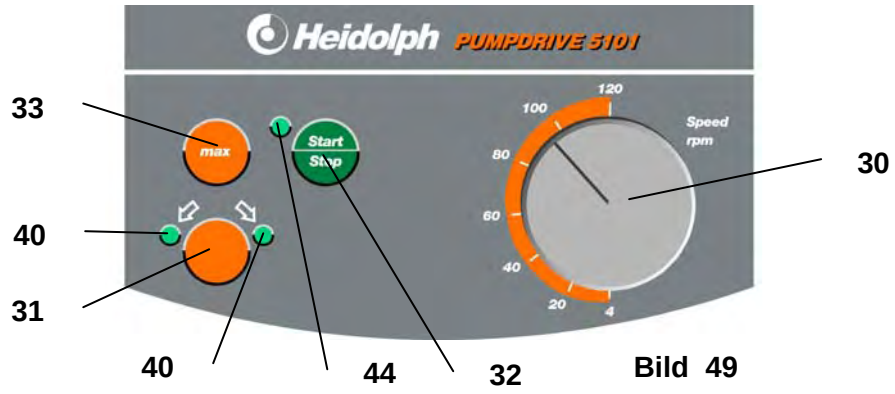


Bild 49

30: Rotation speed
31: Direction of rotation
32: Start/Stop
33: Maximal conveyance

- Select sense of rotation with switch (31); (go by arrow marks). Sense of rotation may be changed on standstill only.

⚠ Caution! Hit Stop key (32) before changing sense of rotation, select new sense of rotation and restart.

- Sense of rotation selected is confirmed by LEDs (40).

⚠ Geared pumps' by-pass feature is limited to clockwise rotation !

- Start pump with „Start Stop" key (32). Pump status is confirmed by an LED (44).
- To stop pump rotation, hit „Start Stop" key (32) once more.
- When hitting „max." key (33), pump will run at max. speed as long as this key is held depressed; this feature eases filling or draining hoses without any change to basic settings.

9.1. Interface (fig. 48)

- This built-in analog interface allows external pump control.

Control voltage 0 - 10 volts equals a rotational speed of 0 to max.

control voltage	**PD 5101**	**PD 5106**	**PD 5130**
0 - 0,9 V	0 [1/min]	0 [1/min]	0 [1/min]
1 V	5 [1/min]	24 [1/min]	112 [1/min]
10 V	120 [1/min]	600 [1/min]	3000 [1/min]

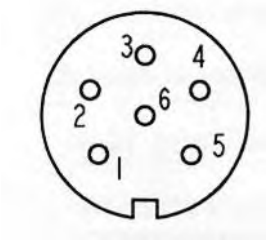
Or control current 4 - 20 mAmps for rotational speed of 0 to max.

control current	PD 5101	PD 5106	PD 5130
0 - 4.9 mA	0 [1/min]	0 [1/min]	0 [1/min]
5 mA	5 [1/min]	24 [1/min]	120 [1/min]
20 mA	120 [1/min]	600 [1/min]	3000 [1/min]

- 5 V TTL signal inverts sense of rotation (at standstill only !)
- A 5 volts TTL signal turns item ON, next signal to follow turns item OFF. This function is available all the time (in internal mode either).
- For triggering sense of rotation and ON / OFF function, a 5 volts pin is available in the interface connector, which allows potential-free switching.
- The analog interface is recognized at a level of 0.2 volts or a 4 m Amps current;

Interface socket wiring (37):

- Interface socket is located on the pump drive's rear panel; pin wiring:



PIN 1 = +5 V
PIN 2 = Start /Stop
PIN 3 = 0-I0V
PIN 4 = sense of rotation
PIN 5 = 0 V(GND)
PIN 6 = 4-20 mA

view on terminal end

- Use IP 67 plug connectors only (6-pin 99-5121-15-06) Heidolph P/N 14-010-006-81 not to void splash protection.
- Make sure, plug connectors are installed properly.

10. PD 5201, PD 5206, PD 5230 (figs. 50,51)

- PD 5201, PD 5206 and PD 5230 pump drives are splash-proof (IP 55).

⚠ Service work is limited to expert personnel authorized to do so by Heidolph.

⚠ Interface sockets (37 & 39) need to be closed with an interface plug or blind plug all the time, not to void splash protection.

⚠ To comply with IP 55 requirements, PD 5230 pump drive needs to be fitted with a geared pump head.

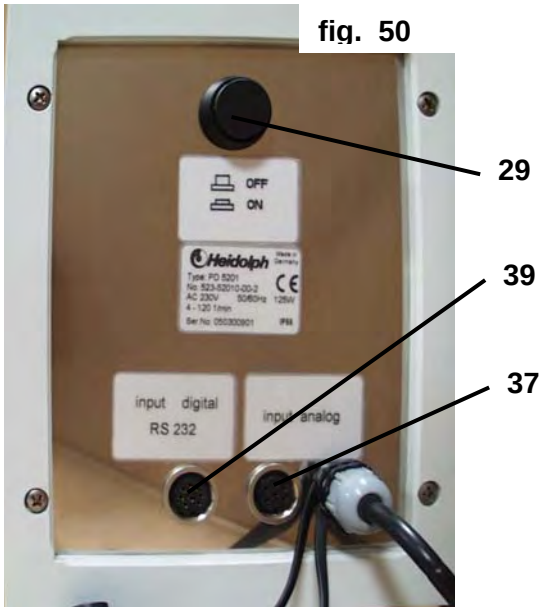


fig. 50

10.1. Standard functions

- Turn item ON with power switch (29) located on the item's rear panel.
- Item runs through a processor self-test routine. The following parameters are displayed, one after the other:
  - all display (41) bars and all Select LEDs are ON.
  - pump head selected is displayed (e.g. „Pu 1).
  - gearbox transmission ratio is displayed, e.g. „5.066
  - hose ID selected is displayed, e.g. „3,1"
  - possible backstroke is displayed. e.g. „r on".
- Item is ready to go at this point.
- Use sense of rotation key (31) to select sense of

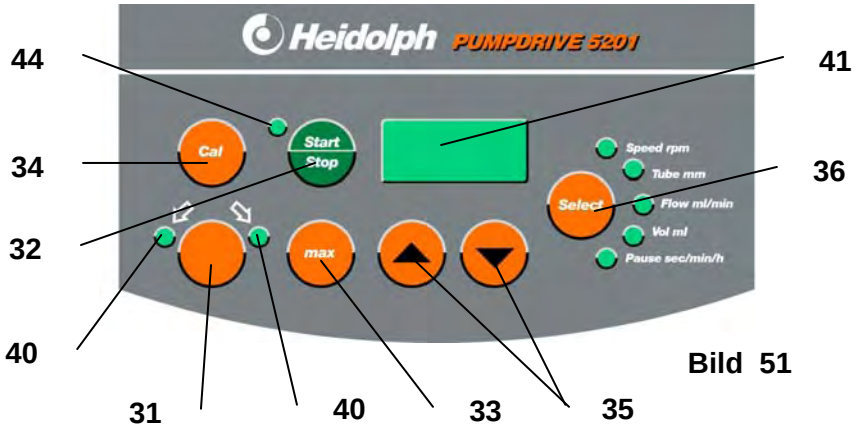


Bild 51

31: Direction of rotation
32: Start/Stop
33: Maximum conveyance
34: Calibration
35: Change value
36: Selection key

- rotation (go by arrow marks). Sense of rotation may be changed on standstill only.

CAUTION: hit STOP key (32), select sense of rotation, START item

- Sense of rotation is confirmed by an LED (40).

Geared pumps' by-pass feature is limited to clockwise rotation !

- Start pump with „Start / Stop" key (32). Pump running is confirmed by an LED (44).
- Hit „Start Stop" key (32) once more to stop pump.
- When hitting the „max." key (33), pump will run at full speed as long as key (33) is held depressed. This feature speeds up filling and draining of hoses without doing any changes to the basic setting. "Full" as plain text appears in the display (41), when "max." key is depressed.
- Actual speed is displayed (41) in rpm (1/min), as long as the "speed rpm" LED is lighted.
- To alter speed setting (+ & -), use arrow keys (35).
- Feed rate is proportional with speed. Speed is displayed in rpm (1/min). For speed setting make reference to the feed rate graphs (Specifications).

10.2. Charging / Discharging of hose

As long as key “max” (33) is pressed pump runs with maximum speed. This function is useful to speed up the charging and dischargiung of the hose without changing the settings. When key “max” ist pressed display shows “Full”.

10.3. Extra functions

The PD 5201 PD 5206 / PD 5230Z pump drives feature the following options:

- display of feed rate in ml/minute
- metering by volume
- interval metering
- calibrate feed rate or volume

To allow using the above options, you need to know about the pump model used; in case of peristaltic pumps, you need to know size of hose. In as shipped condition, the SP quick peristaltic (PU1) / ZP 1 (PU5) geared pump is preset. When using a different pump head, you need to program the item accordingly.

10.3.1. How to program particular pump heads (figs. 50,51)

If you have purchased a PD5201 or PD5206 in a product package, the drive has already been adjusted to the respective pump head at the factory!

- Turn power switch (29) OFF. Hit „Cal" key (34) and turn power switch (29) ON. Pump head actually programmed is displayed.
- Select different pump head with arrow keys (35), e.g. „Pu 2".
- Confirm choice with „Select“ key (36).
- For coding of pump heads refer to reference table below.

code	pump head	PD 5206	PD 5201	PD 5230
Pu 0	multi-channel pump head C 8		**X**	
Pu 1	SP quick / SP quick d	**X**	**X**	
Pu 2	SP Standard / SP vario	**X**	**X**	
Pu 3	SP mini (obsolete)	**X**	**X**	
Pu 4	Masterflex	**X**	**X**	
Pu 5	ZP 1			**X**
Pu 6	ZP 2			**X**
Pu 7	ZP 3			**X**
Pu 8	multi-channel pump head C 12		**X**	
Pu 9	multi-channel pump head C 4		**X**	

10.3.2. Select display mode

Select key (36) allows to choose from several display modes:

- **speed rpm** (speed in 1/min)
- **tube mm** (hose ID in mm)
- **flow ml/min** (feed rate in ml/min)
- **vol ml** (metered volume in ml)
- **pause sec/min/h** (pause in seconds, minutes, or hours) (interval metering)

10.3.3. Display feed rate in ml/min

- In order to display feed rate in ml/min, the item needs to "know" about de hose diameter used.
- Feed rate is proportional with hose ID and pump speed.
- Enter hose ID: hit select-key (36) several times until „Tube mm" LED lights.
- Enter hose ID with arrow keys (35) (e.g. 0.8; 1.7; 3.1; 4.8; 6.3 or 7.9).

If the LED **Vol ml** blinks when you adjust the internal diameter of the hose, the metering volume is being adapted to the minimum allowable volume. (See Chap. 10.3.5)

- Hit select key (36) until LED „Flow ml/min" LED lights.'

- Feed rate in ml/min is displayed (41).
- To alter feed rate, use arrow keys (35) after having selected the "flow ml/min" mode with the select key.
- At this point, the processor is going to determine rotational speed.
- Since every hose has its own tolerance, it will be required to calibrate the pump drive for a particular hose, if high accuracy is mandatory.
- For geared pumps, the „tube mm" menu is skipped, and „----" displayed instead.

Caution: with reference to the very small quantities involved, feed rate is displayed in µl / min, when " **Cassette small** and hose size **0.2 0.5 or 0.9** are selected.

10.3.4. Calibrate feed rate

- Enter hose data and feed rate wanted, as described under 10.2.3.
- Hit „Cal" key (34). Display (41) flashes.
- Hit „Start Stop" key (32).
- The pump is going to run for 1 minute exactly. Collect fluid and determine quantity.
- Enter value so determined with arrow keys (35).
- Hold "Cal" key (34) depressed for not less than 3 seconds to save value. Data in memory are revised. "Cal" is displayed (41) for about 2 seconds to confirm action.
- Select actual feed rate wanted with arrow keys (35).

Caution: with reference to the very small quantities involved, feed rate is displayed in µl / min, when " **Cassette small** and hose size **0.2 0.5 or 0.9** are selected.

10.3.5. Metering by volume

There is a minimum allowable metering volume that depends upon the set speed and the hose diameter. Lower values can only be achieved with smaller hoses. (see page 178)

The PD5206 drive can only meter with a maximum of 300 l/min for reasons of precision! During the metering process, the drive is automatically limited to 300 l/min. The LED **Speed rpm** and the display blink before the metering process as an indication.

- The pump drive features metering of a certain volume of fluid. Once set, this quantity may be fed no matter how often by just hitting the Start/Stop key (32) or by triggering the interface (37/39). Max volume is 9999 ml
- To select a certain volume, you first need to enter hose ID.
- Feed rate is proportional to the number of rotations and hose ID.
- Enter hose ID: hit select-key (36) until „tube mm" LED lights.
- Enter actual hose ID with arrow keys (35) (e.g. 0.8; 1.7; 3.1; 4.8; 6.3 or 7.9).

If the LED **Vol ml** blinks when you adjust the internal diameter of the hose, the metering volume is being adapted to the minimum allowable volume!

- Hold select-key (36) depressed until „Vol ml" LED lights.

Caution: with reference to the very small quantities involved, feed rate is displayed in µl / min, when " **Cassette small** and hose size **0.2 0.5 or 0.9** are selected.

- Volume is displayed (41) in ml.
- Desired volume can be selected with arrow keys (35).
- At this point the processor is going to determine the number of revolutions required.
- Since every hose has its own tolerance, it will be required to calibrate the pump drive for a particular hose, if high accuracy is mandatory.

10.3.6. Calibrate metered volume

- Determine and set speed by your actual requirements

The PD5206 drive can only meter with a maximum of 300 l/min for reasons of precision! During the metering process, the drive is automatically limited to 300 l/min. The LED **Speed rpm** and the display blink before the metering process as an indication.

- Enter hose data and volume to be metered, as described under 10.3.5.
- Hit „Start Stop" key (32).
- Pump is going to feed fluid at the speed and volume entered before.
- Determine exact quantity of fluid collected.
- Hit „Cal" key (34). Display (41) flashes.

Caution: with reference to the very small quantities involved, feed rate is displayed in µl / min, when " **Cassette small** and hose size **0.2 0.5 or 0.9** are selected.

- Enter value so determined with arrow keys (35).
- Hit "Cal" key (34) and hold depressed for not less than 3 seconds to enter. Data in memory are revised. "Cal" is displayed (41) for about 2 seconds to confirm action.
- Enter volume wanted with arrow keys (35).

Programmed flow rate and hence volume metered, are a function of pump head and hose selected. If, during calibration, the user finds a deviation in excess of 30 %, a setting error is very probable. In this case discontinue calibration (hit "select" key once), and go ahead checking the following parameters:

- did you select the right pump head (Chapter 10.3.1)?
- did you choose the right hose (Chapter 10.3.3)?
- is the hose properly installed in the pump head (Chapter 3) ? Is the clamping action ok ? (Chapter 3)

If wrong parameters have been entered for calibration of metered volume, metering action cannot be started with the "Start" key. The select LED will turn to „Flow ml/min", and 4 dashes (----) are displayed.
Correct wrong parameters as described below:

- go into feed rate graph (Chapters 17 & 18) and determine a speed figure (1/min) plus a logical feed rate (ml/min).
- go to "speed" menu (1/min) with select key and choose a speed with arrow keys.
- go to "flow" menu (ml/min) with select key and choose a feed rate from the graph, as described under Chapter 10.3.4.
- at this point, a reasonable feed rate is saved.

10.3.7. Interval metering

- Interval metering is a sub-routine of metering by volume mode; repetition is not launched by hitting a key, or by a triggering pulse, but automatically after a pause selected before.
- Set volume as described under 10.3.5, metering by volume.
- Hold Select-key (36) depressed until „Pause sec/min/h" LED lights.
- Enter pause with arrow keys (35); choose pause between 0.1 seconds and 750 hours.

  seconds range: display 0.1 to 599.9 (no extra signal displayed)

  minutes range: display 10 to 599, „' " displayed(600sec= 10min)

  hours range: display 10 to 750 „h" displayed (600min=10Std.)
- Hold select key (36) depressed until „Vol ml" LED and LED „Pause sec/min/h" LED light the same time.
- Interval metering is controlled with the „Start Stop" key (32) or via the interface.
- After having hit the „Start Stop" key (32) the metered volume is displayed (41), rising from zero to the current value, or a pause interval rising from zero the value s et before. The respective LED is going to flash.

-

10.3.8. Adjust backstroke for metering by volume mode (figs. 50,51)

To avoid dripping in the "metering by volume" mode, a short backstroke of the pump may be programmed.

- Turn power switch (29) OFF. Hit „Cal" key (34), and, while holding depressed, turn power switch (29) ON.
- Pump head, e.g. "Pu 1" is displayed (41).
- Hit arrow keys (35) until „r on" or „r of" is displayed (41).
- „r on" turns backstroke ON, „r off" turns backstroke OFF.
- Confirm mode with select key (36).

10.4. Interfaces (fig. 50)

10.4.1. Analog interface

- An analog interface connector (37) is installed in the item's rear panel.
- External pump control uses this analog interface.

Control voltage of 0 - 10 volts equals rotational speed between 0 and max.

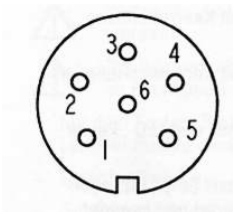
control voltage	**PD 5201**	**PD 5206**	**PD 5230**
0 - 0.9 V	0 [1/min]	0 [1/min]	0 [1/min]
1 V	5 [1/min]	24 [1/min]	120 [1/min]
10 V	120 [1/min]	606 [1/min]	3,070 [1/min]

Control current 4 - 20 mA equals rotational speed between 0 and max.

control current	**PD 5201**	**PD 5206**	**PD 5230**
0 - 4.9 mA	0 [1/min]	0 [1/min]	0 [1/min]
5 mA	5 [1/min]	24 [1/min]	120 [1/min]
20 mA	120 [1/min]	606 [1/min]	3,070 [1/min]

- TTL-level 0 V = CW rotation, TTL-level 5 V = CCW rotation.
- A 5 volts TTL signal turns item ON, next signal to follow turns item OFF. This function is available all the time (in internal mode either).
- For triggering sense of rotation and ON / OFF function, a 5 volts pin is available in the interface connector, which allows potential-free switching.
- The analog interface is recognized at a level of 0.2 volts or a 4 m Amps current; This mode is confirmed by "EA" in the display. As long as the pump drive is controlled via the analog interface, Start / Stop-key will be the only active key on the item.

- Wiring of the interface connector (37):



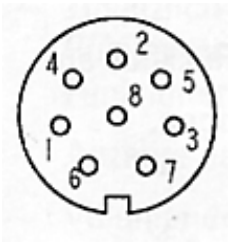
PIN 1 = +5 volts
PIN 2 = start/stop
PIN 3 = 0-10 V
PIN 4 = sense of rotation
PIN 5 = 0 V (GND)
PIN 6 = 4-20 mA

View on terminal end

- Use IP 67 plug connectors only (Binder 6-pin 99-5121-15-06), Heidolph P/N 14-010-006-81(, not to void splash water protection.
- Installation of plug connectors is limited to skilled personnel.

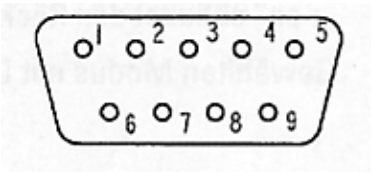
10.4.2. RS 232 interface

- The RS 232 interface allows pump control from a PC via parallel interface.
- The RS 232 interface connector is installed in the rear panel of the pump drive. Wiring:



PIN 1 = PIN 1
PIN 2 = PIN 6
PIN 3 = PIN 2
PIN 4 = PIN 7
PIN 5 = PIN 3
PIN 6 = PIN 8
PIN 7 = PIN 4
PIN 8 = PIN 5

9-pin.SUB-D



View on terminal (soldered) end)

- Use IP 67 plug connectors only (Binder 8-pin 99-5171-15-08), Heidolph P/N 14-010-006-82, not to void splash water protection.
- Installation of plug connectors is limited to skilled personnel.

Interface parameters: 9600 Baud, no parity, 8 bit, 1 stop bit.

- As long as the RS 232 interface is active, all of the pump's control elements and displays will remain active.

Commands:

query	range	reply	remark	action
LEDx1?	x1=0..7	LED=0000	LED is „OFF"	LED-status
		LED=0001	LED is „ON"	
DSP?		DSP=xxxx	xxxx=display	act. displays

command	range	action
TAx2!	x2=0..7 0=no key, 1=Cal, 2=start, 3=sense of rotation, 4=max, 5=up, 6=down, 7=select	key
SPx3=xxxx!	x3=0, xxxx=0001..5999(sec) x3=2, xxxx=0010..0599(min) x4=3, xxxx=0010..0750(hour)	pause
SDM=xxxx!	xxxx=000,1..9999	volume, metered
SDZ=xxxx!	xxxx=0000..9999 (depends on transmission used)	rotational speed
SMM=xxxx!	xxxx=000,1..9999(not during calibration) wait a minute for reply.	ml/min
SSD=xxxx!	xxxx=0000..0014	hose #

general	reply	remark	action
	OK	command successful	self explaining
	ERROR	command failed	none
	PO	metering complete	none

10.5. Recommended sizes of hose

- To achieve high metering accuracy, in particular in the metering by volume mode, we recommend the smallest hose diameter available; higher metering accuracy of small dia. hoses is a function of the higher number of revolutions of the pump drive.

C. RECOMMENDATIONS ABOUT HOSES

11. Hose properties

Designation	Tygon® Standard	Tygon® Food	Tygon® Hydrocarbons
Advantages	Low-price tube for laboratory applications, transparent. Ideal for inorganic media. Only slightly pervious to gas. Recommendable for viscous media. Good dielectric properties. Odourless, nontoxic.	Specially for food. Smooth inner walls, abrasion-proof. Neutral to smell and taste. Easy to clean and dry. Good dielectric properties.	Specially for hydrocarbons. Natural oil products and distillates. Ideal for petrol, kerosene, heating oil, cutting solutions, glycol-based coolants.
Limitations	Plasticizers may become disassociated. Limited life span.	Limited life span.	Unsuitable for concentrated acids and lyes. Plasticizers may become disassociated.
Use with: **Acids** **Lyes** **Solvents** **Pressure** **Vacuum** **Viscous media** **Sterile media**	 good good unsuitable good good excellent under certain conditions	 good good unsuitable good good excellent good	 good good under certain conditions good good excellent under certain conditions
Temperature range	-50 to +70 °C	-40 to +70 °C	-40 to +70 °C
Physical properties	Thermoplastic soft PVC Transparent	Thermoplastic soft PVC Transparent	Thermoplastic soft PVC Yellow translucent
Complies with standards		FDA21 CFR 177.2600 BASPP and NSF (Standard 51) USDA Standard	
Permeability*) CO_2 H_2 O_2 N_2	1,7-7,4 97 0,7-12 0,2-3,0	1,7-7,4 97 0,7-12 0,2-3,0	1,7-7,4 97 0,7-12 0,2-3,0
Cleaning/sterilization	Can be sterilized with ethylene oxide or by autoclaving. Wrap the tube in a non-linting cloth or in paper and autoclave for 30 minutes at 121°C and 1 bar (takes on a milky colour). Dry in air at max. 66°C for 2 to 2 1/2 hours until the tube is clear again.	Can be sterilized with ethylene oxide or by autoclaving. Wrap the tube in a non-linting cloth or in paper and autoclave for 30 minutes at 121°C and 1 bar (takes on a milky colour). Dry in air at max. 66°C for 2 to 2 1/2 hours until the tube is clear again.	Sterilization not recommended.

Designation	PharMed®	Silikon	Viton®
Advantages	Ideal for non-toxic and non-haemolytic cell cultures and tissues. Impervious to normal light and UV radiation. The tube can be welded, bonded and formed. Very long life. Low gas permeability.	Excellent bio-compatibility. Practically no disassociation of plasticizers and additives. Neutral to smell and taste. Not susceptible to mildew. Ideal for low temperatures. Waterproof; resistant to ozone, radiation and sunlight. Does not warp. Silicon peroxide; hot vulcanized.	Highly resistant to chemicals. Excellent resistance to corrosive media, solvents and oils at high temperatures. Only slightly pervious to gas.
Limitations	Additives may become disassociated.	Unsuitable for concentrated acids, solvents, oils, acids or diluted caustic soda. Relatively highly pervious to gas.	Limited life span.
Use with: **Acids** **Lyes** **Solvents** **Pressure** **Vacuum** **Viscous media** **Sterile media**	good good unsuitable good excellent good excellent	under certain conditions under certain conditions unsuitable satisfactory good satisfactory excellent	excellent excellent varies, tests recommended good good good satisfactory
Temperature range	-60 to +130 °C	-50 to +230 °C	-30 to +200 °C
Physical properties	Thermoplastic elastomeron a polypropylene basis with plasticizers. Excellent tensile strength. Opaque, beige.	Polydimethylsiloxane with siliceous earth and silicon additives. Translucent, white. Excellent resistance to contact pressure.	Fluorocarbon rubber, thermally formed. Viton B (67 fluorinated). Opaque, black.
Complies with standards	USP, Class VI FDA21 CFR 177.2600 NSF (standard 51)	USP, Class VI FDA21 CFR 177.2600	
Permeability*) CO_2 H_2 O_2 N_2	450 - 75 29	20132 6579 7961 2763	76-79 - 13-15 4,3
Cleaning/sterilization	Can be autoclaved without ageing symptoms.	Can be cleaned with hot water and suds. Use only soap without oil additives; use no synthetic detergents. Rinse with distilled water. Can be sterilized by autoclaving in a moist atmosphere or with gamma rays. Cannot be sterilized with ethylene oxide.	Can be sterilized at 249°C in 16 hours in a circulating air heating cabinet.

12. Chemical stability of hoses

• Tube: .
  P = PharMed®
  S = Silikon
  T = Tygon® standard und Tygon® food
  K = Tygon® hydrocarbon
  V = Viton®

• Resistance
  A = very good
  B = good
  C = satisfactory
  D = unsuitable
  - = not testet

• Please note:
  - All information provided is not guaranteed
  - Recommend testing of tubing prior to application use

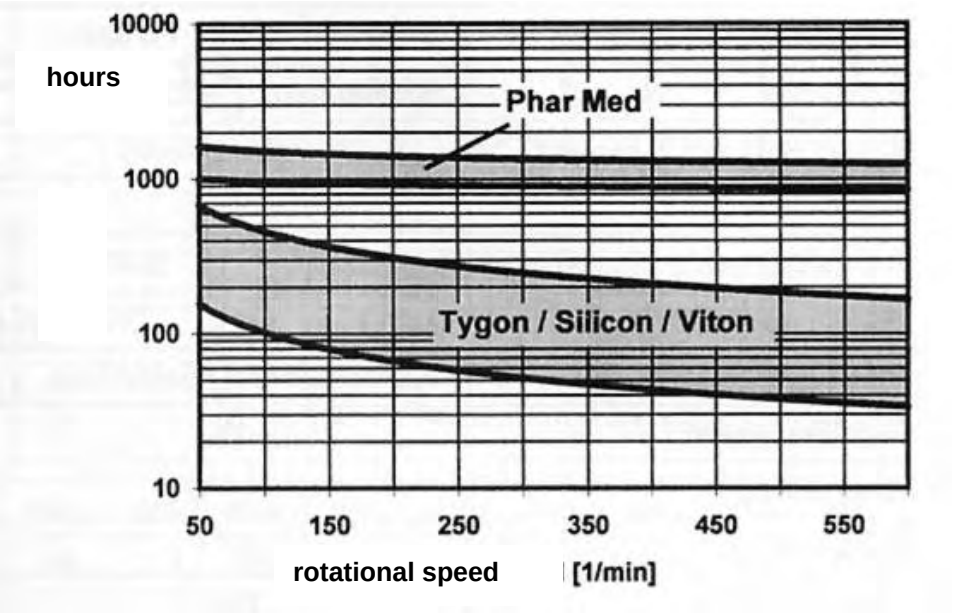
	Chemical	P	S	T	K	V
A	Acetaldehyde	D	C	D	D	D
	Acetic acid, 10% in W.	A	A	A	A	-
	Acetic acid, 100%	B	D	D	D	-
	Acetic anhydride	A	A	D	D	D
	Acetone	D	C	D	D	D
	Acetonitrille	D	D	D	D	D
	Acetyl bromide	C	D	D	D	-
	Acetyl chloride	C	D	D	D	A
	Aliphatic hydrocarbons	D	D	D	B	-
	Aluminium chloride, 53% in W.	A	A	A	A	A
	Aluminium sulfate, 50% in W.	A	A	A	A	A
	Alums	A	A	A	A	-
	Ammonia, gas and liquid	A	D	B	B	D
	Ammonium acetate, 45% in W.	A	A	A	A	-
	Ammonium carbonate, 20%in W.	A	A	A	A	-
	Ammonium chloride	A	C	A	A	A
	Ammonium hydroxide, 30 in W.	A	D	A	C	A
	Ammonium nitrate	A	C	A	A	-
	Ammonium phosphate	A	A	A	A	-
	Ammonium sulfate	A	A	A	A	A
	Amyl acetate	C	D	D	D	D
	Amyl alcohol	D	D	D	A	A
	Amyl chloride	C	D	D	D	-
	Aniline	C	D	D	D	-
	Aniline hydrochloride	C	D	D	D	D
	Aqua regia 80% HCl, 20% HNO_3	D	D	D	D	-
	Aromatic hydrocarbons	D	D	D	D	-
	Arsenic salts	A	A	A	A	-
B	Barium salts	A	A	A	A	-
	Benzaldehyde	D	C	D	D	D
	Benzene	D	D	D	D	-
	Benzenesulfonic acid	D	D	D	D	A
	Boric acid, 4% in W.	A	A	A	A	A
	Bromine	D	D	D	D	A
	Butane	A	A	A	A	A
	Butanol (butyl alcohol)	D	D	D	A	A
	Butyl acetate	B	D	D	D	D
	Butyric acid	B	D	D	C	-
C	Calcium oxide	A	A	A	A	-
	Carbon bisulfide	D	D	D	D	-
	Carbon tetrachloride	D	D	D	D	A
	Chlorine, wet	D	D	B	B	B
	Chloracetic acid, 20 in W.	B	A	A	D	D
	Chlorobenzene	D	D	D	D	A
	Chrobromomethane	B	D	D	D	A
	Choroform	D	D	D	D	A
	Chromic acid, 20% in W.	A	D	B	C	A
	Chromic acid, 50% in W.	C	D	C	D	-
	Copper salts	A	A	A	A	-
	Cyclohexane	D	D	D	C	A
	Cyclohexanone	D	D	D	D	D
	Cyorosulfonic acid	D	D	D	D	D
D	Diesel	D	D	-	B	-
	Dimethyl formamide	B	A	D	D	D
E	Ethanol (ethyl alcohol)	A	B	D	B	A
	Ether	C	D	D	C	-
	Ethyl acetate	B	D	D	D	D
	Ethyl bromide	D	D	D	D	-
	Ethyl chloride	C	D	D	D	A
	Ethylamine	D	C	D	D	-
	Ethylene chlorhydrin	A	B	D	B	A
	Ethylene dichloride	C	D	D	D	B
	Ethylene glycol	A	A	A	A	A
	Ethylene oxide	A	A	A	A	D
F	Ferric chloride 40% in W.	A	A	A	A	B
	Ferric sulfate 5% in W.	A	A	A	A	A

	Chemical	P	S	T	K	V
	Ferrous chloride 43% in W.	A	A	A	A	-
	Ferrous sulfate 5% in W.	A	A	A	A	-
	Fluoboric acid, 10% in W.	D	D	A	A	-
	Fluoroborate salts	A	-	A	A	-
	Fluosilicicacid	C	B	D	B	-
	Formaldehyde, 37% in W.	D	C	D	D	D
	Formic acid, 25% in W.	A	A	A	C	D
	Freon 11	A	A	A	A	-
	Fruit juice	A	A	A	A	A
G	Gasoline, high-aromatic	D	D	D	B	A
	Gasoline, non-aromatic	D	D	D	B	A
	Glycerin	A	A	A	A	A
H	Hydrobromic acid, 20-50%	A	A	A	A	C
	Hydrochloric acid, 10% in W.	A	A	A	A	A
	Hydrochloric acid, 37% in W.	B	B	A	A	-
	Hydrocyanic acid	A	A	A	A	A
	Hydrofluoric acid, 10% in W.	D	D	A	A	B
	Hydrofluoric acid, 50%	D	D	B	D	A
	Hydrogen peroxide, 10% in W.	A	A	A	A	A
	Hydrogen peroxide, 90% in W.	B	C	D	D	-
	Hydroiodic acid	B	B	A	A	-
	Hypochlorousacid,25% in W.	A	A	A	A	A
I	Iodine solutions	A	C	A	A	-
K	Ketones	D	D	D	D	-
L	Lactic acid, 10% in W.	A	A	A	A	-
	Lactic acid, 85% in W.	B	D	D	D	-
	Lead acetate, 35% in W.	A	A	A	A	-
M	Maqanese salts	A	A	A	A	-
	Magnesium chloride, 35% in W.	A	A	A	A	A
	Magnesium sulfate, 25% in W.	A	A	A	A	-
	Mercury salts	A	A	A	A	-
	Methane	A	-	A	A	A
	Methanol	A	B	D	B	D
	Methyl Ethyl Ketone	D	D	D	D	D
	Monoethanolamine	C	D	D	D	D
N	Naphtha	D	D	D	D	A
	Nickel salts	A	A	A	A	-
	Nitric acid, 10% in W.	A	C	A	D	A
	Nitric acid, 35% in W.	A	D	A	D	A
	Nitric acid, 68-71% in W.	D	D	D	D	-
	Nitrobenzene	D	D	D	D	-
	Nitrous acid, 10% in W.	A	B	A	C	-
0	Oil, animal	C	A	D	A	-
	Oils, mineral	D	D	C	A	A

	Chemical	P	S	T	K	V
	Oleic acid	C	B	D	B	B
P	Perchloric acid. 67% in W.	A	D	C	D	A
	Perchlorethylene	C	D	D	D	A
	Phenol, 91% in W.	A	B	D	C	-
	Phosphonic acid, 25% in W.	A	D	A	A	A
	Phthalic acid, 9% in Alc.	A	B	D	C	-
	Potassium carbonate, 55% in W.	A	A	A	A	-
	Potassium cyanide, 33% in W.	A	A	A	A	-
	Potassium hydroxide,<10% in W	A	A	A	D	B
	Potassium iodide, 56% in W.	A	A	A	A	-
	Propanol (propyi alcohol)	C	A	D	D	B
	Pyridine	C	D	D	D	D
S	Silicone oils	C	D	B	A	A
	Silver nitrate, 55% in W.	A	A	A	A	A
	Soap solutions	B	A	A	A	A
	Sodium bicarbonate, 7% in W.	A	A	A	A	A
	Sodium bisulfate	A	-	A	A	-
	Sodium borate	A	A	A	A	A
	Sodium carbonate	A	A	A	A	B
	Sodium ferrocyanide	A	-	A	A	-
	Sodium hydrosulfite	A	-	A	A	-
	Sodium hydroxide, 10-15% in W.	A	A	A	D	B
	Sodium hydroxide, 30-40% in W.	A	C	A	D	B
	Sodium nitrate, 3.5% in W.	A	A	A	A	-
	Sodium sulfate, 3.6% in W.	A	A	A	A	A
	Sodium sulfide, 13% in W.	A	A	A	A	-
	Stearic acid, 5% in Alc.	C	D	D	B	-
	Sulfuric acid, 10% in W.	A	A	A	B	A
	Sulfuric acid, 30% in W.	A	B	A	B	A
	Sulfuric acid, 95-98% in W.	D	D	D	D	A
	Sulfurous acid	A	A	A	A	A
T	Tannic acid, 75% in W.	B	A	B	D	-
	Tartaric acid, 56% in W.	A	A	A	A	A
	Tin salts	A	A	A	A	-
	Toluene (toluol)	D	D	D	D	A
	Trichloroacetic acid, 90 in W.	B	A	A	D	C
	Trichlorethylene	C	D	D	D	A
	Trisodium phosphate	A	A	A	A	A
	Turpentine	D	D	D	B	A
U	Urea, 20% in W.	A	A	A	A	-
	Uric acid	A	A	A	C	-
X	Xylene	D	D	D	D	B
Z	Zinc chloride, 80% in W.	A	A	A	A	A

13. Service life of hoses

Peristaltic pumphoses are wear parts. Service life of hoses is a function of material, rotational speed, and properties of the substance to be fed, e.g. temperature, viscosity, chemical composition, and pressure. For more information about expected service life of hoses (not binding), refer to graphs overleaf.



14. Feed rates - list of hoses for peristaltic pumps

Tubing sizes		**0,8**		**1,7**		**3,1**		**4,8**		**6,3**	
Inner diameter	[mm]	0,8		1,7		3,1		4,8		6,3	
Outer diameter	[mm]	4		4,9		6,3		8		9,5	
Wall thicknes (wt)	**[mm]**	**1,6**		**1,6**		**1,6**		**1,6**		**1,6**	
Max. pressure	[bar]	0,7 / 1,7		0,7 / 1,7		0,7 / 1,7		0,5 / 1,5		0,5 / 1,5	
Suction	[mWs]	8,8		8,8		8,8		8,8		6,7	
Flow rates in combination with pump head / pump drive:											
SP quick / SP quick d		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
PD 5106 / 5206	[ml/min]	1,6	40	6,8	169	25,7	643	56	1400	88,7	2217
PD 5006	[ml/min]	3,3	40	14,1	169	53,6	643	116,7	1400	184,8	2217
PD 5101 / 5201	[ml/min]	0,3	8,0	1,4	34	5,2	129	11,2	280	17,7	443
PD 5001	[ml/min]	0,7	8,0	2,8	34	10,7	129	23,3	280	37,0	443
SP standard / SP vario											
PD 5106 / 5206	[ml/min]	2,4	60,2	10,4	260	41,2	1029	86,3	2157	146	3644
PD 5006	[ml/min]	5,0	60,2	21,7	260	85,8	1029	179,8	2157	304	3644
PD 5101 / 5201	[ml/min]	0,5	12,0	2,1	52,0	8,2	206	17,3	431	29,2	729
PD 5001	[ml/min]	1,0	12,0	4,3	52,0	17,2	206	36,0	431	60,7	729
Pump head order numbers:											
SP quick		527-11100-00		527-11100-00		527-11100-00		527-11100-00		527-11100-00	
SP quick d		527-11120-00		527-11120-00		527-11120-00		527-11120-00		527-11120-00	
SP standard		523-43010-00		523-43010-00		523-43010-00		523-43010-00		523-43010-00	
SP vario		523-45110-00		523-45110-00		523-45110-00		523-45110-00		523-45110-00	
Tubing order numbers:											
Silikon		525-33000-00		525-34000-00		525-36000-00		525-30027-00		525-30028-00	
Viton		525-53000-00		525-54000-00		525-56000-00		525-50027-00		525-50028-00	
PharMed		525-23000-00		525-24000-00		525-26000-00		525-20027-00		525-20028-00	
Tygon (standard)		525-63000-00		525-64000-00		525-66000-00		525-60027-00		525-60028-00	
Tygon (hydrocarbon)		525-73000-00		525-74000-00		525-76000-00		525-70027-00		525-70028-00	
Tygon (food)		525-83000-00		525-84000-00		525-86000-00		525-80027-00		525-80028-00	

Tubing sizes		**4,8**		**6,3**		**7,9**	
Inner diameter	[mm]	4,8		6,3		7,9	
Outer diameter	[mm]	9,8		11,3		12,9	
Wall thicknes (wt)	**[mm]**	**2,5**		**2,5**		**2,5**	
Max. pressure	[bar]	0,8 / 1,8		0,8 / 1,8		0,8 / 1,8	
Suction	[mWs]	8,8		8,8		8,8	
Flow rates in combination with pump head / pump drive:							
SP quick / SP quick d		min.	max.	min.	max.	min.	max.
PD 5106 / 5206	[ml/min]	56	1400	88,7	2217	132	3300
PD 5006	[ml/min]	116,7	1400	184,8	2217	275	3300
PD 5101 / 5201	[ml/min]	11,2	280	17,7	443	26,4	660
PD 5001	[ml/min]	23,3	280	37,0	443	55	660
SP standard / SP vario							
PD 5106 / 5206	[ml/min]	86,3	2157	146	3644		
PD 5006	[ml/min]	179,8	2157	303,7	3644		
PD 5101 / 5201	[ml/min]	17,3	431	29,2	729		
PD 5001	[ml/min]	36,0	431	60,7	729		
Pump head order numbers:							
SP quick		527-11300-00		527-11300-00		527-11300-00	
SP quick d		527-11320-00		527-11320-00		527-11320-00	
SP standard		523-43030-00		523-43030-00		523-43030-00	
SP vario		523-45110-00		523-45110-00		523-45110-00	
Tubing order numbers:							
Silikon		525-35000-00		525-39000-00		525-32000-00	
Viton		525-55000-00		525-59000-00		525-52000-00	
Pharmed		525-25000-00		525-29000-00		525-22000-00	
Tygon (standard)		525-65000-00		525-69000-00		525-62000-00	
Tygon (hydrocarbon)		525-75000-00		525-79000-00		525-72000-00	
Tygon (food)		525-85000-00		525-89000-00		525-82000-00	

Pump drive / options order numbers:			
Pump drive PD 5006	523-50060-00	Adaptor for multi-channel pump haeds	526-16000-00
Pump drive PD 5001	523-50010-00	Foot-switch	526-14100-00
Pump drive PD 5106	523-51060-00		
Pump drive PD 5101	523-51010-00		
Pump drive PD 5206	523-52060-00		
Pump drive PD 5201	523-52010-00		

15. Feed rates - list of hoses for multi-channel pumps

Tubing sizes		**0,2**	**0,5**	**0,9**	**1,4**	**2,8**
Inner diameter	[mm]	0,25	0,51	0,89	1,42	2,79
Outer diameter	[mm]	2,05	2,31	2,69	3,22	4,59
Wall thicknes (wt)	[mm]	**0,9**	**0,9**	**0,9**	**0,9**	**0,9**
Max. pressure	[bar]	0,5/1,5	0,5/1,5	0,5/1,5	0,5/1,5	0,5/1,5
Suction	[mWS]	7	7	7	7	7

Flow rates in combination with pump haed / pump drive:												
PD 5101 / PD 5201		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max. number
Cassette small / Pump head C12	[ml/min]	0,005	0,12	0,02	0,50	0,05	1,24	0,11	2,80	0,33	8,20	12
Cassette small / Pump head C4	[ml/min]	0,024	0,60	0,11	2,50	0,25	6,24	0,56	13,9	1,63	40,8	4
PD 5001												
Cassette small / Pump head C12	[ml/min]	0,01	0,12	0,04	0,50	0,10	1,24	0,23	2,80	0,68	8,20	12
Cassette small / Pump head C4	[ml/min]	0,05	0,60	0,21	2,50	0,52	6,24	1,16	13,9	3,40	40,8	4

Tubing order numbers:						
Silikon	3-Stopper			525-30014-00	525-30015-00	525-30016-00
	Meterware			525-30024-00	525-30025-00	525-30026-00
Viton	3-Stopper			525-50014-00	525-50015-00	525-50016-00
	Meterware			525-50024-00	525-50025-00	525-50026-00
PharMed	3-Stopper	525-20012-00	525-20013-00	525-20014-00	525-20015-00	525-20016-00
	Meterware	525-20022-00	525-20023-00	525-20024-00	525-20025-00	525-20026-00
Tygon (standard)	3-Stopper	525-60012-00	525-60013-00	525-60014-00	525-60015-00	525-60016-00
	Meterware	525-60022-00	525-60023-00	525-60024-00	525-60025-00	525-60026-00

Fittings for extension tubes (PTFE)						
Fittings for extension tubes (PTFE)		526-22000-00				526-26000-00

Tubing sizes		**0,8**	**1,7**	**3,1**	**4,8**	**6,3**
Inner diameter	[mm]	0,8	1,7	3,1	4,8	6,4
Outer diameter	[mm]	4	4,9	6,3	8	9,6
Wall thicknes (wt)	[mm]	**1,6**	**1,6**	**1,6**	**1,6**	**1,6**
Max. pressure	[bar]	0,7 / 1,7	0,7 / 1,7	0,7 / 1,7	0,7 / 1,7	0,5 / 1,5
Suction	[mWS]	8,8	8,8	8,8	8,8	6,7

Flow rates in combination with pump haed / pump drive:												
PD 5101 / PD 5201		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max. number
Cassette medium / Pump head C8	[ml/min]	0,29	7,20	1,0	25,2							8
Cassette large / Pump head C8	[ml/min]			1,0	25,2	3,8	96,0	8,2	204	13,5	336	4
PD 5001												
Cassette medium / Pump head C8	[ml/min]	0,60	7,20	2,10	25,2							8
Cassette large / Pump head C8	[ml/min]			2,10	25,2	8,00	96,0	17,0	204	28,0	336	4

Tubing order numbers:						
Silikon	Meterware	525-33000-00	525-34000-00	525-36000-00	525-30027-00	525-30028-00
Viton	Meterware	525-53000-00	525-54000-00	525-56000-00	525-50027-00	525-50028-00
PharMed	Meterware	525-23000-00	525-24000-00	525-26000-00	525-20027-00	525-20028-00
Tygon (Standard)	Meterware	525-63000-00	525-64000-00	525-66000-00	525-60027-00	525-60028-00
Tygon (Hydrocarbons)	Meterware	525-73000-00	525-74000-00	525-76000-00	525-70027-00	525-70028-00
Tygon (Food)	Meterware	525-83000-00	525-84000-00	525-86000-00	525-80027-00	525-80028-00

Cassette / Pump head / Pump drive order numbers:						
Pump drive PD 5001 (incl. Adaptor)	523-50013-00	Multi-channel pump head C12	524-81220-00	Cassette small	524-90022-00
Pump drive PD 5101 (incl. Adaptor)	523-51013-00	Multi-channel pump head C4	524-80420-00	Cassette medium	524-90021-00
Pump drive PD 5201 (incl. Adaptor)	523-52013-00	Multi-channel pump head C8	524-40810-00	Cassette large	524-90010-00

CLEANING AND SERVICING

For **cleaning** wipe housing surfaces with a damp cloth (add some sort of mild liquid soap).

NOTE: To avoid damage to the surface finish, avoid using chlorine bleach, chlorine-based detergents, abrasive substances, ammonia, rags or cleaning pads containing metallic particles.

Pump drives and pump heads are maintenance-free. Repair work is limited to technicians so authorized by Heidolph. Please call your local Heidolph dealer or field representative.

Hoses for peristaltic pumps are wear parts. We recommend to replace hoses in regular intervals to avoid the mess with broken hoses. Service life of hoses used in conventional peristaltic pumps is between about 50 and 500 hours in use (depends on hose material and mission profile).

UNINSTALL, FORWARD & STORE

Uninstall

1. Turn the item OFF and disconnect mains plug.
2. Clear area around the item to get enough room for uninstall work.
3. Uninstall optional equipment.

Forward & Store

1. We recommend to store the item and its components in its original box, or a similar container that offers adequate protection against damage in transit. Tape the box securely.
2. Store the item in a dry place.

Caution
Do not jolt or shake the item during transport.

DISPOSAL

For disposal, please comply with your local or national regulations.
Split by metal, plastic, etc.
Packing material to be treated as described above (material split).

TROUBLESHOOTING

Work on electric and electronic components is limited to qualified personnel.

pump won't feed, motor running
a) SP quick: hose bed open
b) hose with deviating wall thickness installed (refer to Chapter 3.1)
c) hose with deviating wall thickness tolerance installed; use genuine Heidolph hose only.
d) SP vario: wall thickness of hose not set (refer to Chapter 3.6)
e) pump head (SP Standard, SP mini or SP vario) not properly seated on drive, coupling not in gear

Hose creeping in peristaltic pump
a) re-adjust hose clamp (refer to Chapter 3.3.)
b) use short hoses for 0.8 mm and 1.7 mm hoses for clamping (refer to Chapter 3.7).

Pump drive won't run
a) wall outlet dead
b) check power cord and pump drive wiring
c) fuse blown (replace fuse in rear panel of PD 5001/5006/5025 (use 1.25 Amps delay-type fuse)
d) power switch broken
e) control circuit or drive motor broken

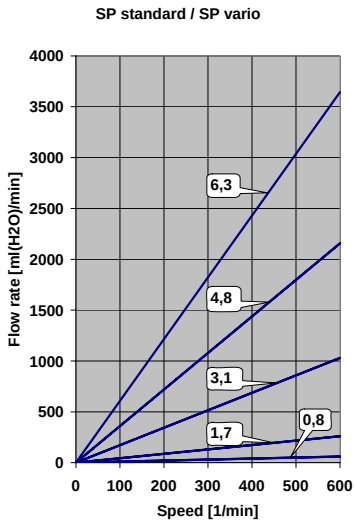
SPECIFICATIONS

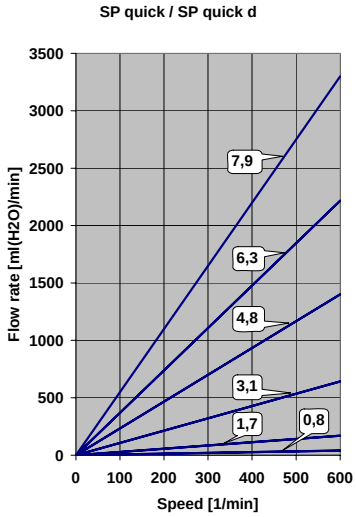
16. Peristaltic pump drives

model	PD 5001	PD 5006	PD 5101	PD 5106	PD 5201	PD 5206
P/N	523-50010-00	523-50060-00	523-51010-00	523-51060-00	523-52010-00	523-52060-00
electronic motor control	capacitor motor		Electronically commutated direct current (DC) motor			
feed rates	refer to Chapters 17 & 18					
speed range (1/min.)	10-120	50-600	5-120	24-600	5-120	24-600
speed control	rotary know, scaled				4-digit digital display	
speed governor	analog with answer-back		digital, with answer-back			
accuracy of control	±2%		± 0,5%			
sense of rotation	CW, CCW selector					
motor power (W)	71		100			
dissipated power (W)	150		140			
interface, analog			speed: (0-10 V or 4-20 mA), sense of rotation & Start/Stop (TTL)			
interface, digital					RS232	
feed rate display					4-digit digital display	
metering by volume (ml)					0.1-9999	
interval metering (ml)					0.1-9999; pause 0,. sec-750 h	
motor protector	ÜHS*)	ÜHS*)	Electronic current limitation and overheat protection (ÜHS*))		Electronic current limitation and overheat protection (ÜHS*))	
weight, pump head not included (kg)	6.8	6.2	8.2	7.6	8.3	7.7
protective class	IP30		IP55			
ambient conditions	0-40 °C at 80 % rel. humidity, no dewing					
size (w x d x h) (mm)	166x256x225					

*) ÜHS = overheat protection

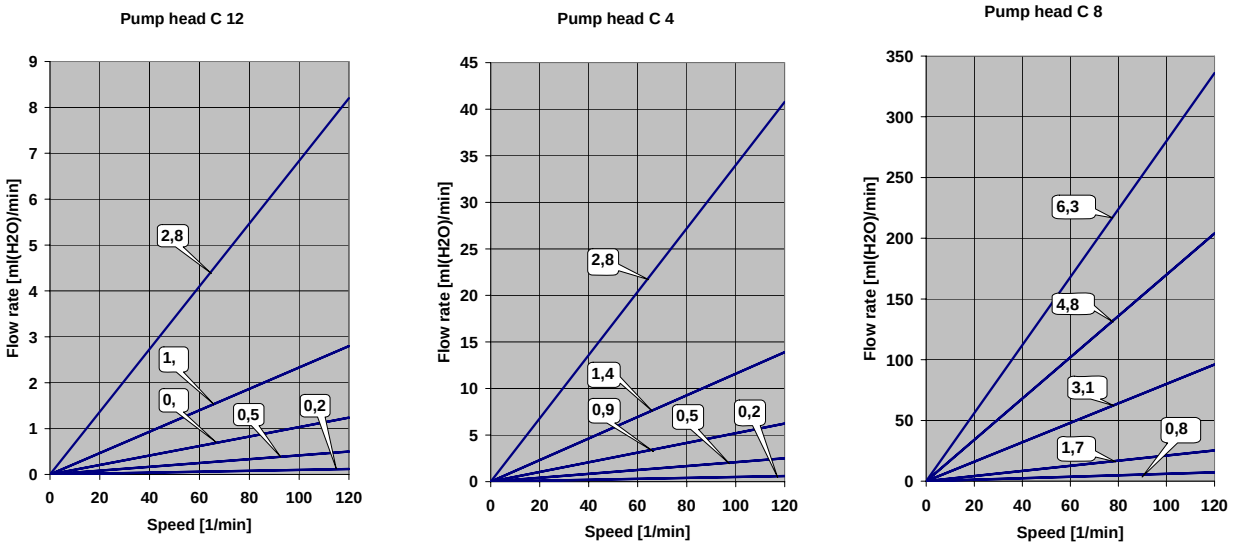
17. Feed rate graphs for peristaltic pumps





E

18. Feed rate graphs for multi-channel pumps



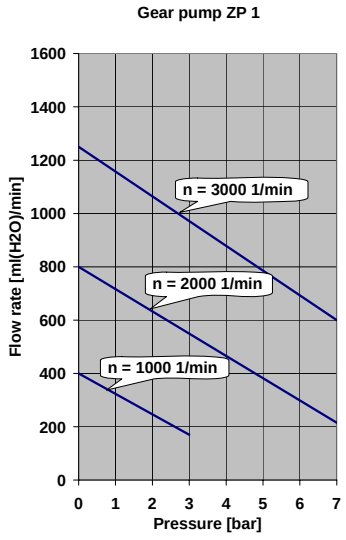
19. Geared pumps

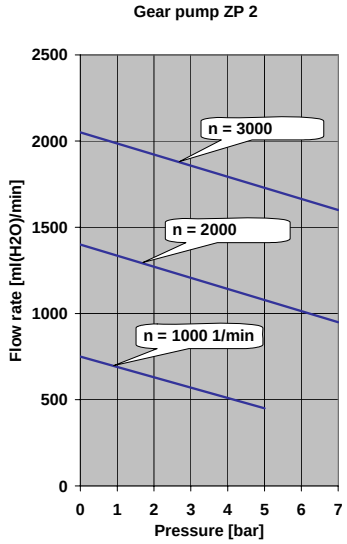
model	**PD 5025**	**PD 5130**	**PD 5230**
P/N	523-50250-00	523-51300-00	523-52300-00
electronic motor control	capacitor motor	Electronically commutated direct current (DC) motor	
feed rates	refer to table		
speed range (min^{-1})	210-2500	120-3000	
speed control	rotary knob, scaled		4-digit digital display
speed governor	analog, with answer-back	digital, with answer-back	
accuracy of control	±2%	± 0,5%	
sense of rotation	CW / CCW selector		
motor power (W)	71	100	
dissipated power (W)	150	140	
interface, analog		for speed (0-10 V or 4-20 mA), sense of rotation & Start/Stop (TTL)	for speed (0-10 V or 4-20 mA), sense of rotation & Start/Stop (TTL)
interface, digital			RS232
feed rate display			4-digit digital display
metering by volume (ml)			0,1-9999
interval metering (ml)			0,1-9999; pause 0.1 sec-750 h
motor protector	ÜHS**)	Electronic current limitation and overheat protection (ÜHS**))	Electronic current limitation and overheat protection (ÜHS**))
weight, pump head not included (kg)	6,5	7,9	8
protective class	IP 30		I P 55*)
ambient conditions	0-40 °C at 80 % rel. humidity, no dewing		
size (w x d x h) (mm)	166x256x225		

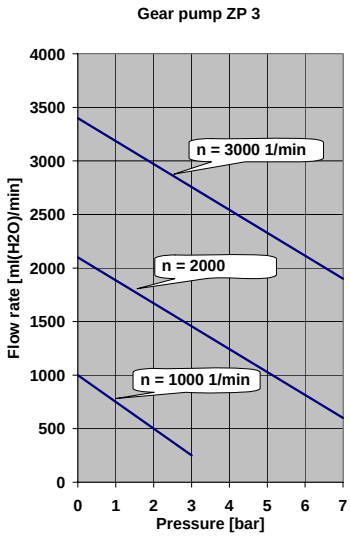
***)** with geared pump installed only
**) ÜHS = overheat protection

pump heads		ZP1		ZP2		ZP3	
pump head P/N		523-81000-00		523-82000-00		523-83000-00	
max. pressure at n max.	(bar)	7		7		7	
max. pressure at n min	(bar)	1		1		1	
max. sucking height (water)	(mWS)	8		8		8	
max. viscosity	(cSt)	2000		2000		2000	
feed rates		min	max	min	max	min	max
PD 5025	(ml/min)	86	945	150	1600	325	2625
PD 5130	(ml/min)	40	1130	73	1850	156	3154
PD 5230	(ml/min)	40	1130	73	1850	156	3154

20. Feed rate graphs for geared pumps







WARRANTY, LIABILITY & COPYRIGHT

Warranty
Heidolph Instruments warrents that the present product shall be free from defects in material (except wear parts) and workmanship for 3 years from the date shipped off the manufacturer's warehouse.
Damage in transit is excluded from this warranty.

To file for such warranty service, contact Heidolph Instruments (phone ++49-9122-9920-68) or your local Heidolph Instruments Dealer. If defects in material or workmanship are found, your item will be repaired or replaced at no charge.
Misuse, abuse, neglect or improper installation are not covered by this warranty.
Alterations to the present warranty need Heidolph Instruments' consent in writing.

Exclusion Clause
Heidolph Instruments cannot be held liable for damage from improper use or misuse. Remedy for consequential damage is excluded.

Copyright
Copyright in pictures and wording of the present Instruction Manual is held by Heidolph Instruments.

FAQ / REPAIR WORK

If any **aspect** of installation, operation or maintenance remains unanswered in the present Manual, please contact the following address:

For repair services please call Heidolph Instruments (phone: +49 - 9122 - 9920-68) or your local, authorized Heidolph Instruments Dealer.

Note
You will receive approval for sending your defective item to the following address:

Heidolph Instruments GmbH & Co. KG
Lab Equipment Sales
Walpersdorfer Str. 12
D-91126 Schwabach / Germany
phone: ++49–9122-9920-68
Fax: ++49–9122-9920-65
E-Mail: Sales@Heidolph.de

Note
If you are based in the United States of America, please contact Heidolph US:

Heidolph Instruments, LLC
Lab Equipment Sales
2615 River Rd.
Cinnaminson, NJ 08077
Phone: 856-829-6160
Fax: 856-829-7639
E-Mail: heidolph@snip.net

Safety Information
When shipping items for repair that may have been contaminated by hazardous substances, please:

- advise exact *substance*
- take proper *protective* meason to ensure the safety of our receiving and service personnel
- *mark* the pack IAW Hazardous Materials Act

CE-DECLARATION OF CONFORMITY

We herewith declare that the present product complies with the following standards and harmonized documents:

EMC-guideline:

EN 61326: 1997 + A1:1998 + A2:2001
EN 61000-3-2:2000
EN 61000-3-3:1995
EN 61326: 1997 + A1:1998 + A2:2001
EN 61000-4-2:1995
EN 61000-4-3:1996
EN 61000-4-4:1995
EN 61000-4-5:1995
EN 61000-4-6:1996

Low-voltage guideline (73/23/EWG)

EN 61010

APPENDIX

Allowed dispensing volumes according to pump head and tube diameter
tube in [mm], volume in [ml], (PU8 and PU9 [µl])

PD 5201

pump head	PU 0		PU 1		PU 2		PU 3		PU 4		PU 8		PU 9	
	Tube	Volume	Tube	Volume	Tube	Volume	Tube	Volume	Tube	Volume	Tube	Volume	Tube	Volume
	0,8	/	0,8	/	0,8	0,2	0,8	/	0,8	/	0,2	1,1	0,2	5,5
	1,7	0,3	1	0,2	1	0,3	1	/	1,7	0,3	0,5	4,6	0,5	22,8
	3,1	0,9	1,7	0,4	1,7	0,5	1,7	0,2	3,1	0,9	0,9	11,3	0,9	57,2
	4,8	1,9	2	0,5	2	0,7	2	0,3	4,8	1,9	1,4	/	1,4	0,2
	6,3	3,1	3	1,1	3	1,7	3	0,6	6,3	3,1	2,8	/	2,8	0,4
			3,1	1,2	3,1	1,9	3,1	0,7	7,9	4,2				
			4	1,9	4	2,9	4	1,1						
			4,8	2,6	4,8	3,9								
			5	2,7	5	4,2								
			6	3,9	6	6,0								
			6,3	4,1	6,3	6,6								
			7	4,9	7	7,3								
			7,9	6,0	7,9	8,6								
			8	6,4	8	8,7								
			9	8,1	9	11,0								

PD 5206

pump head	PU 1		PU 2		PU 3		PU 4	
	Tube	Volume	Tube	Volume	Tube	Volume	Tube	Volume
	0,8	0,4	0,8	0,6	0,8	0,3	0,8	0,4
	1	0,6	1	1,4	1	0,4	1,7	1,2
	1,7	1,6	1,7	2,4	1,7	1,0	3,1	4,4
	2	2,2	2	3,5	2	1,4	4,8	9,2
	3	5,2	3	8,5	3	3,0	6,3	15,7
	3,1	5,9	3,1	9,5	3,1	3,1	7,9	21,1
	4	9,3	4	14,5	4	5,5		
	4,8	12,9	4,8	19,9				
	5	13,6	5	21,2				
	6	19,5	6	30,4				
	6,3	20,5	6,3	33,4				
	7	24,7	7	37,1				
	7,9	30,4	7,9	43,5				
	8	32,3	8	44,5				
	9	40,9	9	55,6				

01-005-002-75-2 23/01/2006