

Digital Pump Drive for AP40 Centrifugal pump head

User's manual



Ordering number:

73-5157 PUMP DRIVE FOR CENTRIFUGAL PUMP HEAD AP40 (73-5173), 115 - 230 VAC



CAUTION: FOR RESEARCH USE ONLY. NOT FOR CLINICAL USE ON PATIENTS !



HUGO SACHS ELEKTRONIK
a division of **Harvard Bioscience, Inc.**

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1.0 Warranty



Research Use Only !!!

Manufacturer of the magnetic coupling and adaptation of the pump drive for the AP40 pump head:

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Hugo Sachs Elektronik (HSE) warrants the PUMP DRIVE FOR CENTRIFUGAL PUMP HEAD for a period of one year from the date of purchase. At its option, HSE will repair or replace the unit if it is found to be defective as to workmanship or materials. This warranty does not extend to any instrumentation which has been (a) subjected to misuse, neglect, accident or abuse, (b) repaired or altered by anyone other than HSE without HSE express and prior approval, (c) used in violation of instructions furnished by HSE. This warranty extends only to the original customer purchaser. IN NO EVENT SHALL HSE ELEKTRONIK BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states and regions do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE. Some states or regions do not allow this limitation on an implied warranty, so the above limitation may not apply to you. Without limiting the generality of the foregoing, HSE shall not be liable for any claims of any kind whatsoever, as to the equipment delivered or for non-delivery of equipment, and whether or not based on negligence. Warranty is void if the device is changed in any way from its original factory design or if repairs are attempted without written authorization by HSE. Warranty is void if parts or connections not manufactured by HSE are used with the equipment. If a defect arises within the warranty period, promptly contact Hugo Sachs Elektronik, Gruenstrasse 1, D-79232 March-Hugstetten Germany by phone at +49(0)7665/9200-0 or email sales@hugo-sachs.de. In the USA, call 800-272-2775 or 508-893-8999 or email: support@hbiosci.com). Goods will not be accepted for return unless an RMA (Returned Materials Authorization) number has been issued by our customer service department. The customer is responsible for shipping charges. Please allow a reasonable period of time for completion of repairs, replacement and return. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device. This warranty gives you specific rights, and you may also have other rights, which vary from state to state.

Warranty

pump head: according to pump head manufacturer's information
In case of any doubt please contact your supplier.

1.1 Out of Warranty Service

Proceed exactly as for Warranty Service on previous page. If our service department can assist you by phone or other correspondence, we will be glad to help at no charge. Repair service will be billed on the basis of labor and materials. A complete statement of items spent and materials used will be supplied. Shipment should be prepaid. Your bill will include return shipment freight charges. Disassembly by the user is prohibited. Service should only be carried out by experienced HSE technicians.

1.2 Repair Facilities and Parts

HSE stocks replacement and repair parts. When ordering, please describe parts as completely as possible, preferably using our part numbers. If practical, enclose a sample photo or drawing.

1.3 Safety Information

Please read the following safety precautions to ensure proper use of your amplifier. If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

1.4 Use Proper Input Plug

Use only the specified input plug for this product and make sure input plug is certified for country of use.

1.5 Make Proper Connections

Make sure to use the appropriate connection for your country. Attach the connector of the amplifier power supply always correctly to the input socket at the rear side of the amplifier and the power socket. Never increase the connection cable length longer than 3 meters.

1.6 Observe All Terminal Ratings

Review the operating manual to learn the ratings on all connections.

1.8 Avoid Exposed Circuitry

Do not touch any electronic circuitry inside of the product.

1.9 Do Not Operate with Suspected Failures

If damage is suspected on or to the product do not operate the product. Contact qualified service personnel to perform inspection.

1.10 Orient the Equipment Properly

Do not orient the equipment so that it is difficult to manage the connection and disconnection of devices.

1.11 Place Product in Proper Environment

Review the operating manual for guidelines for proper operating environments.

1.12 Observe all Warning Labels on Product



CAUTION Refer to manual. Read all labels on product to ensure proper usage.

1.13 Caution Notice



CAUTION: FOR RESEARCH USE ONLY. NOT FOR CLINICAL USE ON PATIENTS.

The unit itself does not generate waste but may be used with samples that are hazardous. Please use appropriate PPE and ensure disposal in accordance with local regulations and practices. This product should not be used in the presence of a flammable atmosphere such as an anesthetic mixture with air, oxygen, or nitrous oxide.

1.14 Compliance

These systems have been designed to meet the standards for electromagnetic compatibility (EMC) intended for laboratory equipment applications as well as the applicable safety requirements for electrical equipment for measurement, control, and laboratory use.

1.15 Copyright

This product and the corresponding documentation are protected by copyright. All rights reserved. This document must not be copied, photocopied, reproduced or translated, either as a whole or in parts, without prior written agreement by Hugo Sachs Elektronik - HARVARD APPARATUS GmbH, March-Hugstetten, Germany.

2.0 Introduction

These Operating Instructions describe the function and the use of the digital pump drive with coupling to a centrifugal AP40 pump head. This manual is just an addition to the pump drive manual which describes the functions and the handling of the AP40 pump head. The pump drive manual can be found on the USB-stick delivered with the pump drive.

This manual represents an essential part of the pump and must be kept close to the pump, accessible to all users. All the information in these Instructions has been assembled after careful examination but does not represent any warranty of product properties. Alterations in line with technical progress are reserved.

Carefully read the operating instructions as well as other materials in this manual.

This manual is not a warranty of product performance. If you need help or have questions, please contact us and we will assist you. We want you to be completely satisfied with this product.

2.1 Preliminary notes on the pump system

The complete pump system consists of the pump drive and a centrifugal pump head AP40 (Medtronic). The action of the pump heads ensures very gentle pumping of blood. The head forms a completely enclosed unit without any moving parts to the outside. Pump head and drive are linked by a magnetic coupling. The driving motor turns a magnet which transmits the rotation to another magnet located inside the pump head.

The pump heads have a limited life. The pump head mounting is therefore so arranged that the heads can be replaced without the use of tools. Read these Operating Instructions!

We recommend that you carefully read this Instruction Manual and adhere fully to the information contained in it. We accept no responsibility for any damage caused by inappropriate handling.



The pump heads never should run dry. Always fill the heads with fluid before starting the pump. Due to the centrifugal construction these heads are not self-filling when you start the pump.

More see 3.3. Filling the pump head bubble free

2.2 Range of application and safety precautions

The pumps are intended for liquid handling in laboratory and industry. We assume that all laboratory guidelines are observed as well as the recommendations given below:

- The electrical circuit between supply and pump must be grounded, use only grounded power cables
- The pump must only be operated within the given operating and ambient conditions
- Do not position the pump closer than 10 cm from a wall and ensure that the ventilation apertures are not obstructed
- The fuse holder must not be bridged (short-circuited)
- During operation the pump drive housing must not be opened or removed
- Any repairs must only be carried out by a qualified person fully aware of the potential hazards
- Any work carried out on and inside the unit by customers or third persons is undertaken on their own responsibility

The pump must not be used:

- for medical applications on humans
- in hazardous (Ex) areas and in the presence of flammable gases and vapors

Warning note

In the operation of pump it is not possible to exclude certain risks. The manufacturer does not accept any responsibility for any resulting damage.

WARNING: powerful magnetic fields!

Both the pump drive (magnet box) and the centrifugal pump head incorporate magnets which produce a powerful magnetic field. Any magnetically sensitive objects such as magnetic data storage media or watches should be kept away, in order to avoid damage! Users with pacemakers should be careful and not come too near to the magnetic coupling.

2.3 Residual risks

- The handling of chemicals is not within the responsibility of the manufacturer
- The pump head must only be changed while the pump is switched off
- Tubing has a certain permeability to gases depending on material and pressure conditions; it can also acquire static charges. We are warning of possible dangers if any tubing is run in hazardous areas.
- Where damage may be caused by leakage of liquid following a tubing burst, the necessary safety precautions must be taken before start-up
- Do not carry out any manipulation on the pump head before the pump has been switched off
- The pump head must be filled with the pumped liquid before start-up

IMPORTANT:



Pump heads must never be run dry! Danger of bearing damage!

2.4 List of items supplied

- digital pump drive with mounted magnetic coupling for AP40 head
- mains supply cable
- Operating Instructions

Accessory if ordered:

- AP40 pump head (73-5173)

Please check the packaging and the contents for transport damage. If you find any signs of a damage, please contact the supplier immediately. Any claims can only be entertained within 8 days from receipt of the goods.

Digital pump drive with magnetic coupling for AP40 heads



Fig. 1 Pump drive without AP40 head

3.0 Operating panel



Start/Stop button

Priming key, maximal speed button

Fig. 2 **Display** **Control keypad**

IMPORTANT NOTE: The drive must run counter clockwise only with the AP40 head !!!

Rear side of the unit

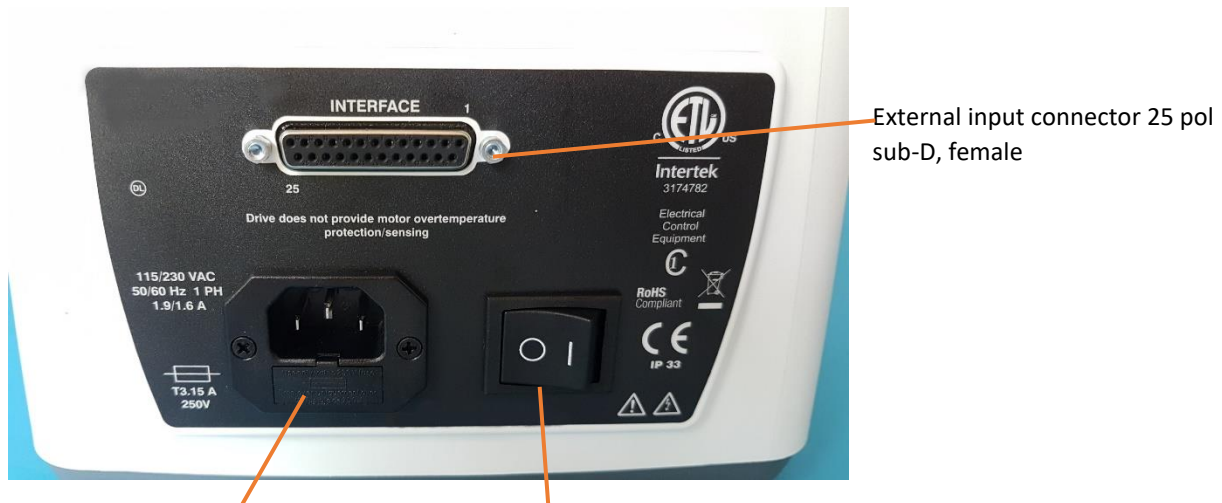


Fig. 3 Supply socket for mains cable Main Power Switch

Supply voltage

Supply voltage: 115 / 240 V AC 50/60 Hz

Fuse: 3.15A, 250V

Supply socket / mains supply cable

Use only the original cable supplied. The supply socket must be grounded (protective earth contact).

3.1 Starting up Overview (see also step by step setup on page 12, this may be easier)

Before starting up, setup the pump as described below in steps

Use only the CONTINUOUS MODEs "LOCAL" or the "REMOTE CONTROL" mode.

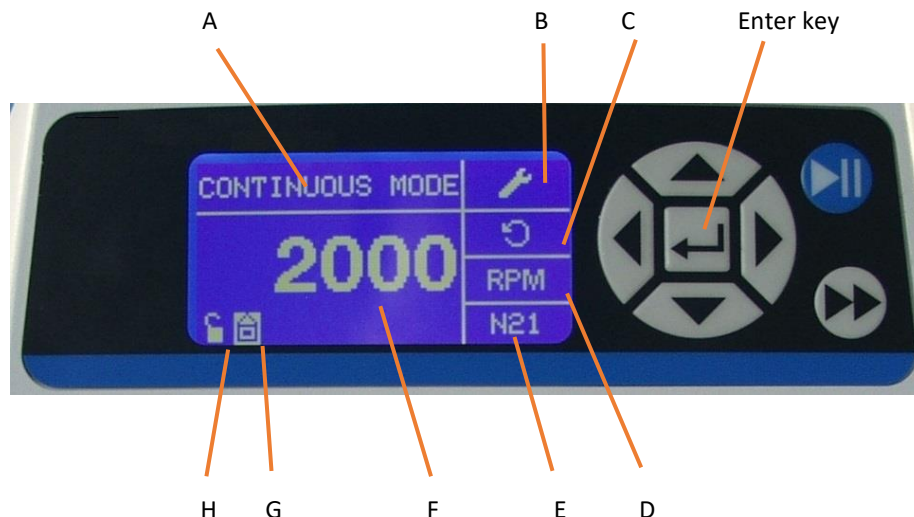


Fig. 4

Continuous Mode Screen

A

Mode Display: Shows the current operating mode in which the drive will operate.

Pressing ENTER key when highlighted will cycle through the different operation modes.

Use always only the CONTINUOUS MODE together with the centrifugal pump head.

The other modes TIME DISP. MODE, COPY DISP. MODE, VOL. DISP. MODE, will not work with the centrifugal pump head !!! **Please don't use them !**

If you press the key to the right you come to B

B

Setup : Pressing the ENTER key on this icon brings you to the Setup screen. The Setup screen contains the functions that can be accessed from the Continuous Mode operation screen. More see next chapter.

C. Flow Direction: Pressing the ENTER key on this icon toggles between clockwise and counterclockwise flow direction. **Use only counter clockwise with the AP40 centrifugal pump head !!!**

D. Flow Units: Pressing the ENTER key on this icon goes to the Flow Unit selection screen. **NOTE: Use only RPM with the centrifugal pump head.**

E. Pump Head Size: Has no function with the centrifugal pump head, use N21

F. RPM setting. In **LOCAL** Mode you can set the pump speed on the display. In **Remote** Mode the DC voltage on the input connector defines the pump speed

G. **Local/Remote**  or : Navigate the cursor to the Local/Remote icon, Press the ENTER key on this icon brings you to the Remote Control setup screen. This icon indicates whether your drive is in local or remote control mode. **If the solid rectangle appears in the center of the figure the drive is set to be operated locally. If the solid rectangle does not appear in the center of the figure the drive is set to be operated by remote control.**

If you are in REMOTE MODE and attach a voltage to the input you see the RPM number displayed.
To start the pump press the blue Start/STOP key.

H. **Key Pad Lock** : Key Pad Lock : Pressing the ENTER key on this icon goes to the Keypad Lockout screen. Locking the keypad will prevent someone from changing the settings on the drive. When locked this icon changes to 

NAVIGATION: From the Main Menu or SETUP Menu press ENTER, you will come to the REMOTE CONTROL menu.



Fig. 5

LOCAL: When this is selected the drive is controlled by the front panel keypad, Start/Stop **Input**, Directional Input or Prime Input.

No need to set **CURRENT INPUT** and **CURRENT OUTPUT**, we normally control the pump with an external 10V Voltage. (Voltage input)

VOLTAGE INPUT: When this is selected, the drive is in remote control. This allows the user to input a voltage signal to control the pump speed. The user has an option to adjust the minimum, maximum and middle setpoints for voltage and speed. By default the minimum (MIN) voltage is set to 00.0 V DC and the speed is set to 00.0. The maximum (MAX) is set to 10.0 V DC and the speed can be set to 3000 RPM. The middle (MID) is auto calculated for a voltage and speed that is centered between the MIN and the MAX. The MID can be adjusted if other profiles are needed (not recommended). The scaling can be inverted, if necessary. **Don't use that function together with the centrifugal pump head !**

To confirm VOLTAGE INPUT MODE is selected, select EXIT after returning to the Remote Control Menu, then select CONTINUOUS PUMP MODE. To deselect Remote Voltage Input Mode select Local and ENTER. More see in the Example in the next chapter.

NOTE: When Voltage Input is selected the drive will not start until the REMOTE CONTROL MODE is exited and CONTINUOUS PUMP MODE is selected.

VOLTAGE OUTPUT: This allows the user to adjust the voltage output for a given RPM. The user has an option to adjust the minimum, maximum and middle set points for voltage and RPM. By default the minimum (MIN) flow is set to 00.00 and the voltage is set to 00.0V DC. The maximum (MAX) is set to maximum flow and the voltage is set to 10.0V DC. The middle (MID) is auto calculated for a voltage and flow that is centered between the MIN and the MAX. The MID can be adjusted if other profiles are needed. This allows for a three point calibration of the voltage output. The flow is linear between these points. The scaling can be inverted if necessary. **NOTE:** Selecting Voltage Output will not put the user into Remote Control Mode. Only selecting Voltage Input or Current Input will put the user into Remote Control Mode, as indicated by the empty house icon (see position G, Fig. 4). **NOTE:** The Voltage Output indicates the Running Command Speed. Use the Motor Running outputs to indicate if pump is running.

3.2 Step by Step example to do the pump settings:

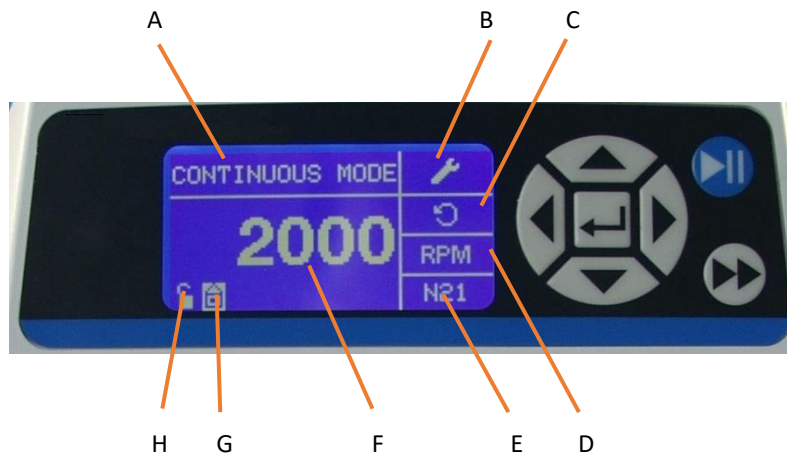


Fig. 6

NAVIGATION: In the Main Menu chose the CONTINUOUS MODE menu.

A.

Mode Display: Shows the current operating mode in which the drive will operate.

Pressing ENTER key when highlighted will cycle through the different operation modes.

Use always only the CONTINUOUS MODE together with the centrifugal pump head.

The other modes TIME DISP. MODE, COPY DISP. MODE, VOL. DISP. MODE, will not work with this type of pump head !!! Please don't use them !

If you press the key to the right you come to

B

Setup : Pressing the ENTER key on this icon brings you to the Setup screen. The Setup screen contains the functions that can be accessed from the Continuous Mode operation screen.

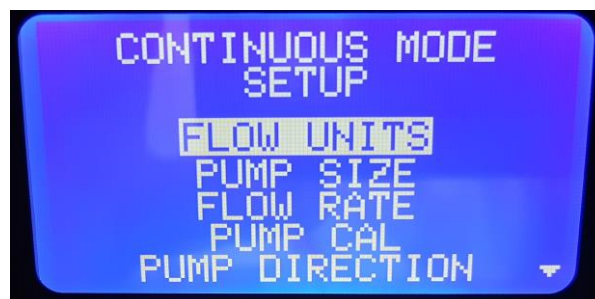


Fig. 7

Select FLOW UNITS and press ENTER, select RPM and quit with ENTER.

Select Pump Size and press ENTER, select N21 and press ENTER

Select FLOW RATE and press ENTER, set e.g. 36 RPM, navigate cursor to EXIT and press ENTER

PUMP CAL can't be used with a centrifugal pump head !!!

Select PUMP DIRECTION and press ENTER, set CCW (counter clock wise) and press ENTER

Navigate Cursor one step down to SOUNDS

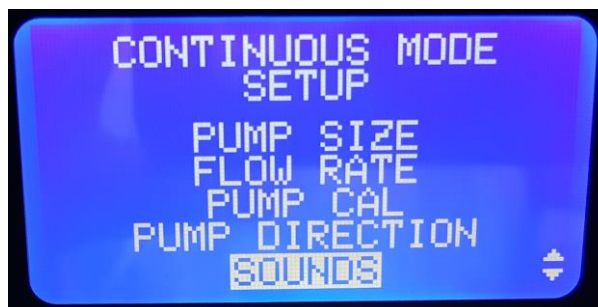


Fig. 8

Select Sounds and press ENTER, set Keypad BEEP to ON and navigate cursor one step down

Set BATCH COMPLETE to OFF, navigate cursor to EXIT and press ENTER

Navigate Cursor one step down to REMOTE CONTROL and press ENTER



Fig. 9

If you select **LOCAL** you have direct control of the Speed via the keypad. This is used if you intend to control the pump speed manually

No need to set **CURRENT INPUT** and **CURRENT OUTPUT**, we normally control the pump with a 10V voltage.

Select **VOLTAGE INPUT** and press ENTER, you will see:

MIN. 0.0 VDC = 0 RPM. If this is not the case set it to 0.0 VDC = 0 RPM

Navigate the cursor down over ESC until you see:

Max. xx.x VDC = yyyy RPM. Set it to 10.0 VDC = 3000 RPM

Navigate the cursor down over ESC until you see:

MID. 5.0 VDC = 1500 RPM, leave this setting

Navigate the cursor down to **EXIT** and press ENTER

VOLTAGE OUTPUT does not need to be set. This is only required if you intend to record the pump speed with a DAQ system. If necessary you can set. Default is 0V for 0 speed and 10V for 3000RPM.

Navigate the cursor down to **START/STOP** and press ENTER

SET to OFF and press ENTER.

Now you are in the CONTINUOUS MODE, remote control and the pump speed can be set by the external voltage.

Now fill the pump head with liquid. The pump head must not be running dry

- Fit tubing and connect to the system
- If necessary, secure the tubing with tubing clips or cable ties against slipping off. Not necessary on a well fitting tubing
- Before starting up, fill the pump head with liquid

3.3 Filling Pump Head bubble free

Add the delivered T-piece with the tube set and 3-way stop cock as shown below.
Connect the inlet tube to this port

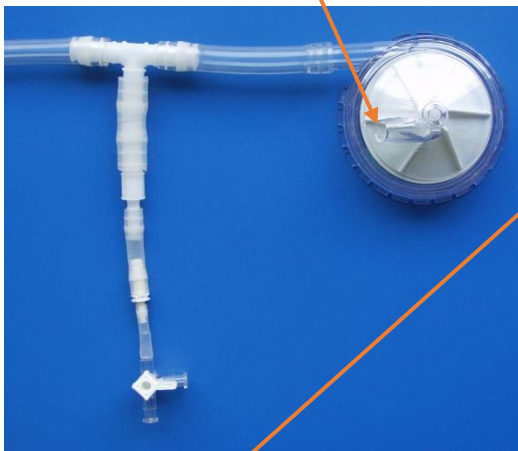


Fig. 10

To fill the pump head bubble free put a tube clamp on this tube.
Open the stopcock, connect the syringe and pull out the air from the pump head with the 50ml syringe. The pump head has a priming volume of 40ml so you may have to repeat the steps a few times until the head is filled with fluid bubble free.



You can also fill the pump head while it is installed on the pump.



Pump drive with AP40 head and tube setup ready for use



3.4 Starting the Pump

It is assumed that at this point you have already pre-programmed the PUMP in LOCAL or REMOTE DIRECT MODE

In both modes you first have to press the blue start button to start the pump



Fig. 11

If you are in LOCAL CONTINUOUS MODE the speed can be altered while the pump is running by changing the displayed RPM.

If you are in REMOTE CONTINUOUS MODE the speed can only be altered by your external control unit. This could be a PID Controller like the SCP Servo Controller or PC controlled D/A converter.

Depending on the given voltage (0...10V) the speed in RPM is displayed.

To perform constant pressure perfusion we recommend to use the PLUGSYS SCP Servo Controller. This is PID Controller which speeds up the pump to reach and hold a certain pressure. (Constant pressure perfusion) More see next chapter.

While the pump is running, always the MAX key >> can be used for rapid filling.



Always remember:

The pump head must not be running dry and the pump head must run counter clockwise !!!

4.0 Application example: Controlling the Centrifugal Pump by PLUGSYS SCP module i.o. to perform a constant pressure perfusion

In this application the Centrifugal Pump is used to perform a constant pressure perfusion i.o. to perfuse an isolated organ under constant pressure conditions.

The perfusion pressure is measured by using an APT300 pressure transducer connected to a TAM-D amplifier.

The TAM-D is internally connected to an SCP Controller module. The SCP module is a PID controller which controls the pump speed. On the SCP module you set your wished perfusion pressure e.g. to 80mmHg.

When you start the SCP in CONTROLLER MODE it adjusts the pump speed so that a pressure of 80mmHg is held constant. The real flow in ml/min in this case is measured by a TTFM-2 Transit Time Flowmeter Module.

Setup for ex-vivo isolated pig kidney perfusion

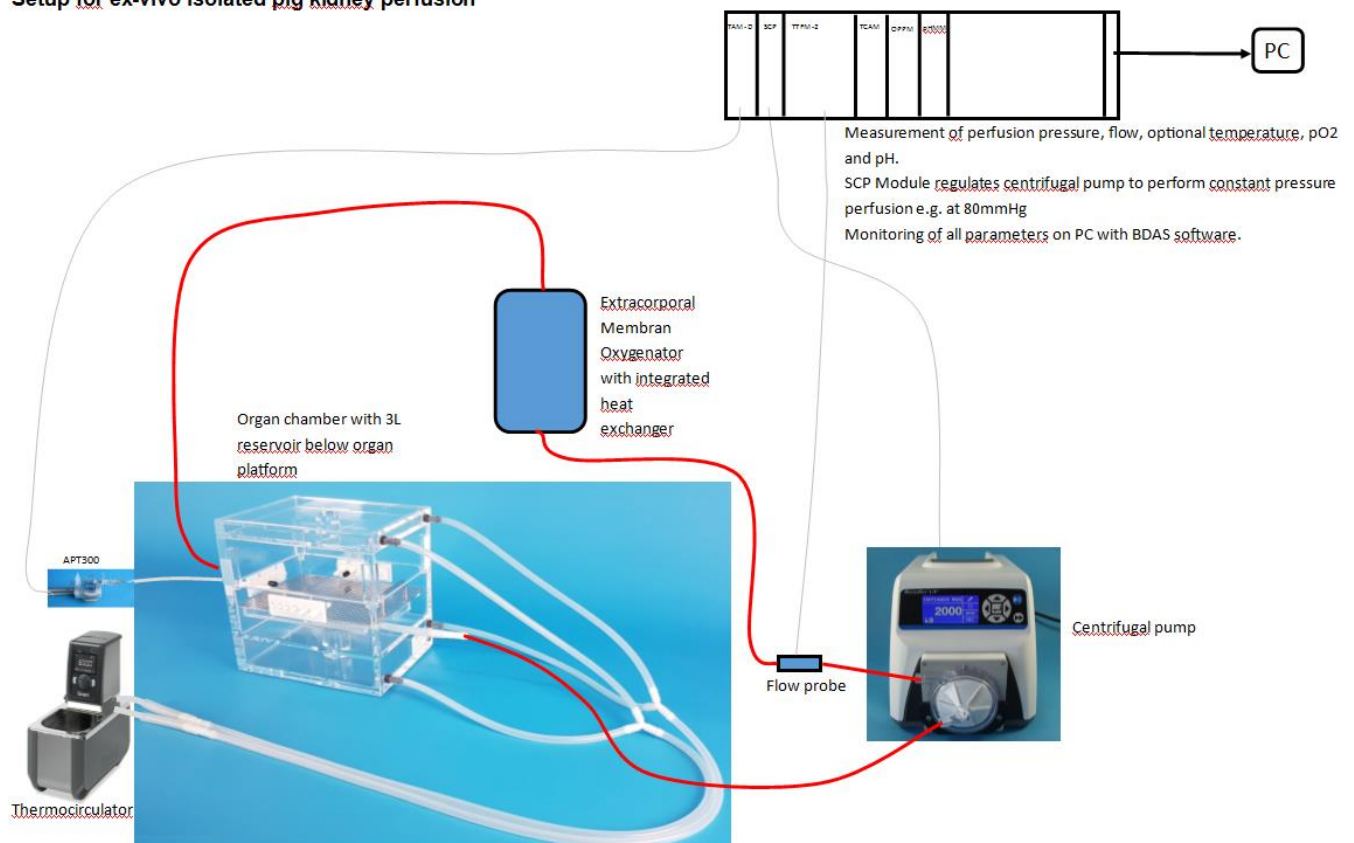


Fig. 12 Example setup with a large organ chamber

5.0 Analog interface connector

See original pump drive manual on the delivered USB stick

No internal adjustment necessary.

All setting run via the keys on the display

6.0 Centrifugal pump head

The pump head described below is especially designed for pumping blood or erythrocyte suspensions. The AP40 (Medtronic) head can be directly clipped into the holder of the pump drive.

NOTE: the information given below refers only to the special application of the heads in conjunction with the digital pump drive. It does not replace the Operating Instructions supplied with these heads.

The pump heads are hermetically sealed, there is no drive shaft taken to the outside. The drive is transmitted through a magnetic coupling. A ring-shaped permanent magnet is located inside the head which is coupled to a similar magnet of the pump drive. Rotation of the drive is transmitted to the pump rotor through the attraction force of the magnets.

Pump head AP40

The pump head AP40 (manufacturer: Medtronic) is specially designed for pumping blood or erythrocyte suspensions. The AP40 has a filling volume of 40 ml. The diameter of the connections is chosen suitable for the flow rate. The INPUT and OUTPUT connections are 9.5 mm OD. See Fig. 13

A pump head AP40 is shown below. Details and pumping function can be seen from the sectional drawing on the next page. The drive fitted with the pump head was already illustrated on page 1.

The cone-shaped white part rotates about a central bearing and is mechanically coupled to the magnet ring. Rotation of the rotor counterclockwise causes the liquid inside the head to rotate through surface friction and to be forced outward by the resulting centrifugal force towards the outlet connection. The resulting pressure-flow diagram is shown in Diagram 1, chapter 6.1 plotted against rotational speed.

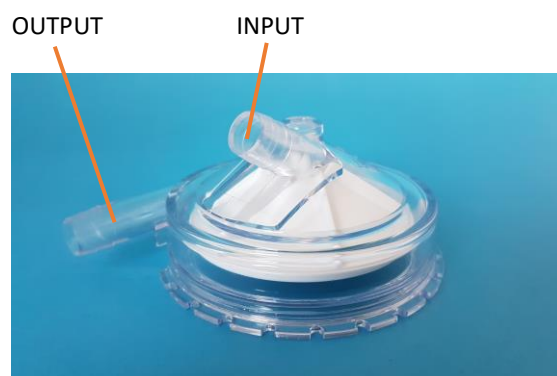


Fig. 13 AP40 pump head

6.1 Output characteristic of an AP40 pump head

Diagram 1 shows the flow-pressure characteristic of the combination digital pump drive with pump head AP40 at varying speed settings. At each speed a particular pressure was produced by squeezing the tubing and the flow was measured. Normal tap water was used as liquid for these measurements.

The pressure-flow diagram shows that there is no exact linear relationship between speed and flow or pressure.

NOTE: the pressure/flow values which can be read from Diagram 1 must be taken only as average values and cannot not be guaranteed!

Pulsation: The pump head AP40 produces no pulsations in the flow of the liquid output!

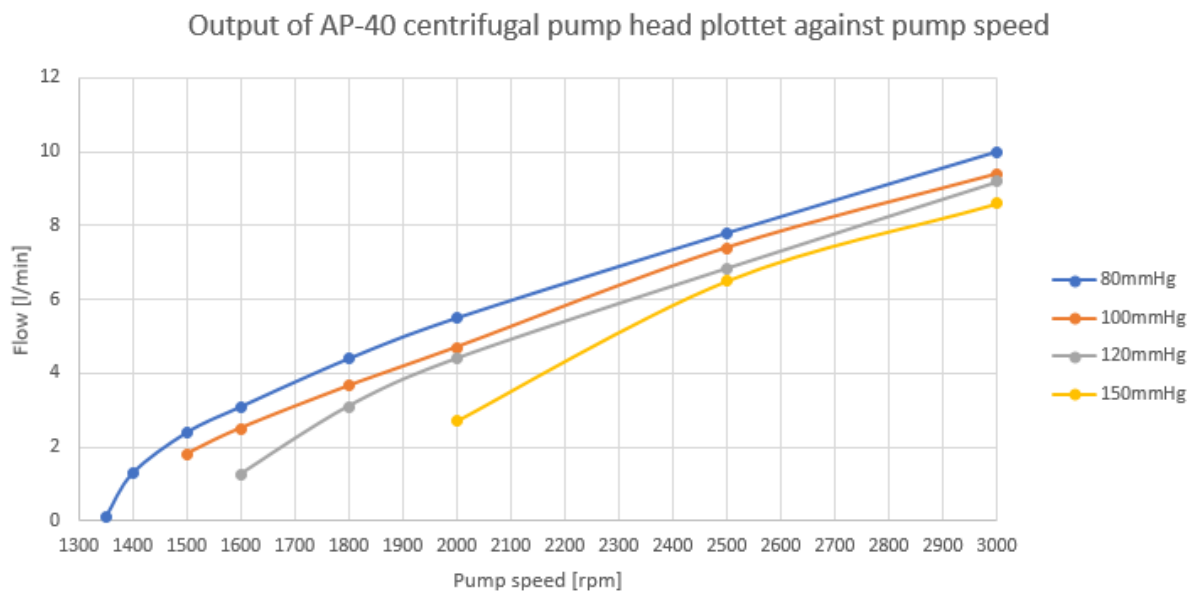


Diagram 1

6.2 Fitting and removing the AP40 pump head

When fitting or removing the pump head the pump drive must be switched off!

The baseplate of the pump head is inserted from above into the slot between magnet box and the black pressure plate and pushed down up to the stop. The head must then be rotated so that the locking pin engages with one of the recesses in the rim. The tubing connection for the outlet should point to the left (as shown in the illustration alongside) so that the pump head can be vented when assembled (escape of trapped air).



Fig. 14 Pull the black pressure plate slightly forward



Fig. 15 Insert pump head into the open slot and push down



Fig. 16 Rotate the head so that the locking pin engages with one of the recesses



Fig.17 Head fixed, pin in the recess



Fig. 18 To remove the head, tilt it slightly forward and then pull it upwards out of the holder.

7.0 Operating notes

Before switch-on

Ensure that the pump head is filled with the liquid to be pumped before you switch on. Operating the pump head dry may damage the rotor bearing.

Pumping against pressure

The maximum flow rate depends on the back pressure (see Diagram 1, chapter 6.1).

Speed setting

In order to keep haemolysis low you should not set a higher speed than necessary. Do not artificially increase the flow resistance (squeezing the tubing) in order to achieve a certain flow rate.

Faulty operation

As described above, the coupling of the drive to the pump rotor takes place through the attraction between the magnets. The coupling force is sufficient for all normal operations as long as the coupling does not become „disengaged“. The pump has a soft start function which should avoid that effect.

The coupling can also become disengaged by careless handling of the tubing so that the pump head briefly does not lie properly against the magnet box of the drive. If drive and pump head have become „out of step“ this becomes evident by a loud rattling or whirring noise. In this case switch off the drive briefly, allow it to come to rest, and switch it on carefully again. Never start the pump at full speed .

Before switching off the pump

When stopping the pump drive it is possible that the liquid flows back.

Stopping the pump

If the pump will be out of use for some time it is essential to clean the pump head thoroughly (see section „Cleaning“ chapter 8.0).



Fig. 19 Pump drive with AP40 head and tube setup ready for use

8.0 Maintenance and cleaning

The pump drive does not require any special maintenance. Any dirt on the housing should be removed immediately. A cloth moistened with water should be used for cleaning. With strongly adhering dirt you can add a little cleaning solution (domestic detergent) to the water.



WARNING:

- Before starting any cleaning operation pull out the power supply plug
- Do not allow any liquid to pass into the pump drive housing

We recommend thorough cleaning of the pump head after each application:

- first wash out with normal tap water
- with proteins in the liquid, wash again with acetic acid (3%) or "MUCASOL" or "Cidex OPA" cleaning solutions
- use distilled water for a final rinse.

The pump heads have to be considered as consumable items with a limited life. In original use (heart-lung machine or ECMO machine) they are disposables where in isolated organ experiments these units can be used multiple times when handled with care and cleaned well after each experiment.

The pump head may be damage when:

- the pump head is operated dry
- unsuitable cleaning agents are used
- the cleaning agent is left inside the head for too long time

If the pump is being used as intended and with the necessary care, only the moving parts are subjected to a certain amount of wear.

Technical data

Speed range:	36 - 3600 rpm
Flow rate and pressure:	depending on pump head (see diagram chapter 6.1)
External control:	via analogue interface 0...10V or 0...5V
Supply:	wide range power supply 115 V - 230 V (50/60 Hz)
Fuses:	1 x 3.15 A T (slow blow)
Operating conditions:	normal laboratory environment temperature +5 to +40°C rel. humidity 80% max.
Dimensions (drive):	10.5 in x 8 in x 8 in (267 x 203 x 203 mm)
Weight:	15.5 lb (7.0 kg)
Enclosure Rating:	IP 33 per IEC 60529
Weight:	15.5 lb (7 kg)
CE conformity:	Conforms to ANSI/UL Std 61010-1 Certified to CAN/CSA Std C22.2 No. 61010-1. This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version of the same standard incorporating the same level of testing requirements. (For CE Mark): EN61010-1 (EU Low Voltage Directive) and EN61326 (EU EMC Directive)

More see original manual for digital drive (delivered USB Stick which came with the pump)