

Ingenieurbüro CAT M. Zipperer GmbH

# **Instruction Manual**

# Multichannel-Pump Tower II



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## 1 User Instructions

### 1.1 Important Instructions for your safety



- Every user must read and understand this manual completely before use. Only instructed users may operate the instrument. Failure to do so can result in serious injury or death.
- Follow general instructions for hazard prevention and general safety instructions, e.g. wear protection clothing, eye protection and gloves.
- This operating manual is part of the product. Thus, it must always be easily accessible.
- Enclose this operating manual when transferring the device to another place.
- If this manual is lost, please request another one. Please contact your dealer or

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### 1.2 Danger symbols in this operating manual

The safety instructions in this manual appear with the following danger symbols and danger levels:

### 1.2.1 Danger symbols:

$\underline{\land}$	Hazard point	$\bigwedge$	Electrical shock
	Risk of fire		Explosion
	Bio hazard		Chemical hazard

# 1.2.2 Danger levels

<b>A</b> DANGER	Will lead to severe injuries or death
	May lead to severe injuries or death
	May lead to light to moderate injuries
NOTICE	May lead to material damage

## 2 General safety warnings and instructions

<ul> <li>A DANGER Risk of explosion.</li> <li>Do not operate the device in the vicinity of highly flammable or explosive substances. The instrument is not explosion-proof.</li> <li>Do not use this device for processing any substances which could generate an explosive atmosphere.</li> <li>Do not use this device to process any explosive or highly reactive substances.</li> </ul>
<ul> <li>ADANGER Electric shock as a result of penetration of liquid.</li> <li>Do not allow any liquids to penetrate the inside of the housing</li> <li>Switch off the device and disconnect the power plug before starting cleaning or disinfection work. The On/Off Switch on the device does not disconnect the device from the power source.</li> <li>Only plug the device back in if it is completely dry, both inside and outside.</li> </ul>
<ul> <li>AWARNING Risk from incorrect supply voltage</li> <li>Only connect the device to an AC power source with an protective earth (PE).</li> <li>Only connect the device to voltage sources which correspondent to the electrical requirements on the type label.</li> </ul>
<ul> <li><b>AWARNING</b> Electric shock due to damage to device or mains cable</li> <li>Only connect the device to the mains supply if the device and the mains cable are undamaged</li> <li>Only use devices that have been properly installed or repaired.</li> <li>I n case of danger, disconnect the device from the mains supply by pulling the power plug from the mains socket or by using the isolating device intended for this purpose (e.g. emergency stop switch)</li> </ul>
<ul> <li><b>AWARNING</b> Lethal voltage inside the device</li> <li>Do not open the device.</li> <li>Ensure that the housing is always closed and undamaged so that no parts inside the housing can be contacted by accident.</li> </ul>

	<ul> <li>Do not allow any liquids to penetrate the inside of the housing.</li> <li>Popairs are only to be carried out by trained service technicians</li> </ul>
	<ul> <li><b>AWARNING</b> Damages to health due to infectious liquids and pathogenic germs.</li> <li>When handling infectious liquids and pathogenic germs, observe the national regulations, the biological security level of your laboratory, the material safety data sheets and the manufacturer's application notes.</li> <li>Wear personal protective equipment</li> <li>For comprehensive regulations about handling germs or biological material of the risk group II or higher, please refer to the "Laboratory Biosafety Manual" in its respectively current valid version from the World Health Organisation</li> </ul>
	<ul> <li>AWARNING Damages to health due to corrosive and noxious substances</li> <li>Always check the pump for leaks and air bubbles. Special attention should be directed to determine that all push-ons, threaded connections and suction tubes are firmly in place before beginning operation.</li> <li>Leaking solutions may endanger persons and materials</li> <li>Observe the nationally prescribed safety environment when working with hazardous, toxic and pathogenic samples. Pay particular attention to personal protective equipment (gloves, clothing, goggles, etc.), extraction, and the safety class of the lab.</li> <li>Decontaminate the device and the accessories before storage and shipping.</li> </ul>
	<b>AWARNING</b> Damages to health due to corrosive and noxious substances Observe all markings on the reagent bottles. Dangerous and fuming chemicals must be dispensed in a fume hood. Only employ the instrument for the purpose intended by the manufacturer, and particularly within the resistance limits of the instrument. If in doubt, contact your supplier, or the manufacturer's factory representative at the phone number shown at the front page of this operating instruction.
	<ul> <li>AWARNING Risk of fire</li> <li>Do not use this device to process any highly flammable liquids</li> </ul>
$\underline{\mathbb{M}}$	<ul> <li>ACAUTION Poor safety due to inadequate fixing of the unit</li> <li>Ensure that the unit is firmly attached to a solid stand.</li> </ul>
	<b>ACAUTION</b> Poor safety due to incorrect accessories and spare parts. The use of accessories and spare parts other than recommended by Ingenieurbüro CAT, M. Zipperer GmbH may impair the safety, function and precision of the device. Ingenieurbüro CAT, M. Zipperer GmbH cannot be held liable or accept any liability for damage resulting from the use of incorrect or non- recommended accessories and spare parts, or from the improper use of such equipment.

• Only use accessories and spare parts recommended by Ingenieurbüro CAT, M. Zipperer GmbH

### 2.1 Warning signs on the device



### **A**WARNING

This symbol indicates to read the instruction manual carefully prior to operation of the instrument. Please mark points which require special attention in your field of application so they are not overlooked. Disregarding of warnings may result in impairment of serviceability as well as impairment of the user.

## **3** General Information

The Multichannel pump Tower II is designed in accordance to state-of-the-art technology and recognized safety regulations.

According to these regulations, the unit is designed to meet the requirements for safe and correct operations. To maintain the proper safety and operational functions of the instrument, the user should follow the instructions and safety guidelines in this manual.

### 3.1 Scope of Delivery

Inspect the content of the package for damage or missing parts: Included with the purchase of this instrument are the following items:

1 Multichannel pump-unit	(part no.: 617xx.xx, x depends on no. and types of the build in pumps)
1 Instruction manual	
1 Power supply cord	(part no.: 30732-0057, with plug DIN 49441 R2

A selection of additional discharge tubes and accessories may be found in the pricelist.

## 4 Intended Use

	<b>ADANGER</b> Do not use flammable or explosive substances near the instrument.			
$\mathbf{A}$	<b>AWARNING</b> It is the responsibility of the user to consult and establish appropriate			
$\overline{}$	safety and health practices, and then determine the applicability of			
	regulatory limitations prior to use.			
	Should there be any additional questions, after reading these instructions,			
	concerning the set-up, operation or warranty, please contact either your distributor,			
	or the manufacturer.			
	<b>AWARNING</b> Use the instrument only in compliance of the intended purpose and			
$\overline{\langle \cdot \rangle}$	in way that neither user nor any other persons are endangered.			
	Please comply with all safety and accident-prevention regulations applicable to			
	laboratory work.			

This instrument is designed for pumping liquids up to a concentration of max. 2 Mol/l, observing the following physical limits:

- 15 to 40 °C of instrument and reagent
- When the instrument is correctly used, the dispensed liquid comes into contact with only the following chemically resistant materials:
  - Al<sub>2</sub>O<sub>3</sub>,
  - PVDF

### 4.1 Operating Exclusions

### Never use this instrument for

- liquids attacking Al<sub>2</sub>O<sub>3</sub>, PVDF
- suspensions (e.g., of charcoal) as solid particles may clog or damage the instrument
- strongly crystallizing solutions, concentrated acids and bases as well as non-polar solvents which effect swelling of PVDF
- carbon disulphide, as this media inflames easily
- The pumpheads must not be autoclaved!

	<b>ADANGER</b> Do not use flammable or explosive substances near the instrument.		
$\wedge$	<b>AWARNING</b> Compatibility of the instrument for the application must be checked		
$\overline{}$ : $\overline{}$	by the user or contact the manufacturer		
$\underline{\mathbb{N}}$	<b>AWARNING</b> It is the responsibility of the user to consult and establish appropriate safety and health practices, and then determine the applicability of regulatory		
	Should there be any additional questions, after reading these instructions		
	concerning the set-up, operation or warranty, please contact either your distributor,		
	or the manufacturer.		

## 5 Unpacking

Unpack the instrument carefully and check to see that it is not damaged. It is important that any damage incurred in transport be recognized at the time of unpacking. Notify your carrier or forwarding agent immediately in case of such damage.

## 

- Read this instruction manual carefully before operating the instrument. Should there be any additional questions, after reading these instructions, concerning the set-up, operation or warranty, please contact either your distributor, or the manufacturer.
- After reading and understanding the instruction manual you may now start operating the unit.
- Store the instruction manual in a place easily accessible to every user.
- When operating the instruments in countries with different AC plug systems, use an approved power supply cord suitable fort the country of operation.
- The instrument is earthed as supplied. When replacing the original power cord, ensure that you use a cord with earth conductor!

## 6 Description of the Multichannel-pump Tower II

The piston and the cylinder of the microdosing pump consist of 99.7%  $AL_2O_3$ . All other material, which come into contact to the media is PVDF.

These materials guarantee a high resistance against aggressive media in the laboratory. The pump unit is driven by a robust stepper motor and is monitored optoelectronically.

Do not attempt electronic or other complex repairs. There are no parts inside the pump or the pumphead that should be serviced by the user. Repairs by the user result in incorrect measurements may also result in loss of warranty.

### different available pumpheads:

type	stroke volume	threads of the inlet and the outlet of the pump	threads of the rinse ports
OEM-20 T or V	20 μl	UNF-1/4"-28	no rinse ports
OEM-20 VCS	20 µl	UNF-1/4"-28	UNF-1/4"-28
OEM-200 T or V	200 μl	UNF-1/4"-28	no rinse ports
OEM-200 VCS	200 μl	UNF-1/4"-28	UNF-1/4"-28
OEM-300 VCS	350 μl	M8	UNF-1/4"-28
OEM-1000 T or V	1000 μl	M10	no rinse ports
OEM-1000 VS	1000 μl	M10	UNF-1/4"-28

**T** = PVDF, without rinse port;

**V** = pump head is integrated into stainless steel, without rinse port;

**VS** = pump head is integrated into stainless steel with rinse port;

**VCS** = pump head integrated into stainless steel with rinse port integrated into ceramic).



## 7 Set-up

## 🛦 DANGER 🔬

- The units are not to be used in rooms with danger of explosion.
- Do not use this device to process any highly flammable liquids
- The unit is not to be used without supervision.

Please put the unit on to a fire-proof respectively non-combustible even surface.

$\underline{\mathbb{N}}$	The power switch does not disconnect the instrument completely from the mains. To disconnect it completely please pull the plug.
$\triangle$	Do not open the instrument. Repairs are only to be carried out by trained service technicians.
$\wedge$	Please make sure that all safety signs, also on the instrument, are visible.

## 8 Purpose, Description, Set-up

### 8.1 Set-up

Ensure that the instrument is standing on a solid surface.

Please observe the specified ambient conditions (temperature and humidity) and mains voltage listed under

"Technical Data" as well as the safety instructions.

### 8.1.1 Transportation lock of the pumpheads

The pumpheads are locked for transportation. Before using the pumps, turn the two black screws beside of each pumphead counter clockwise for about 3 turns to reach a quiet running of the pumps.

### 8.1.2 Discharge tube assembly



Always check the pump for leaks and air bubbles. Special attention should be directed to determine that all push-ons, threaded connections and suction tubes are firmly in place before beginning operation. Leaking solutions may endanger persons and materials

Install the discharge tube at the upper side of the pumphead.

## 8.1.3 Install suction tube

NOTICE	Always use tube diameters as large as possible for the suction tube, to achieve a good flow of the liquid and accuracy.
NOTICE	Loose connections such as incomplete push-ons, loose threaded
fittings or a poorly fitting suction tube lead to ventilation in t	
system. Inaccurate measurements will result !.	

Install the suction tube at the lower end of the pumphead.

## 9 Operating of the Multichannel-pump Tower II

	A DANGER danger!	Do not use the device in potentially explosive areas. Mortal
		Please comply with all safety and accident-prevention regulations applicable to laboratory work.
٨		Before connecting the power cord to the mains make sure that
/!\		Voltage and frequency of the instrument's rating plate correspond
	to the local voltage and frequency.	
	NOTICE	If there is a sign of a potential malfunction (e.g., piston difficult to
		move) never use force.
	Immediately stop dispensing and follow cleaning instructions or contact the	
	manufacturer.	
	NOTICE	Make sure that the unit is only operated under the specified
		ambient conditions listed under "Technical Data". Please study the
	instruction manual before operating the instrument. Please observe all instructions	
	listed in the instruction manual.	

### 9.1 Switching the instrument on/off

The instrument is switched on and off with the rocker switch on the rear of the housing

### 9.2 Using a pump with rinse ports (VS/VCS):

You should use a pump with rinse ports especially when you are operating aggressive media or media which tends to crystallize or to glue. This rinse port protects the pump against destruction by the used media.  $H_2O$  dist. or other corresponding cleaning solutions can be used for these rinse ports. Operating with less aggressive media, just connect both rinse ports with a water filled tube. If you are operating with aggressive media, be sure that the pump is always cleaned with fresh cleaning solution. Connect the output of the rinse pump with the lower rinse port of a pumphead. Connect the upper rinse port of this pump with the lower rinse port of the next pump. Continue this till the last pump is in the rinsing chain. Now the rinsing solution is pumped through the rinsing system of all pumps.

#### NOTICE

The pumphead must be flushed after operation to avoid sticking effects between piston and cylinder. Cleaning is carried out best when operating the pump with

water for about 1 minute at max. speed. Do not forget to also flush the rinse port side of the pump.

### 9.3 Self test and Initialisation of the PCON-E board

At each power up of the PCON-E board, the microcontroller performs a self test of the system. All functions of the microdosing pump and the PCON-E board are checked during this test. After this test, the controller drives the piston of the microdosing pump to a reference position. By this the pumphead is synchronised to the control electronic.

### Note:

The Initialisation after switching on the PCON-E board can take up to 6 seconds. During this time the PCON-E board cannot receive or respond to any RS232 commands.

### 9.4 Synchronisation check of the microdosing pump

The PCON-E has a built in synchronisation error check. This sync check is standard activated. This function allows to detect possible failures of the connected microdosing pump.

A synchronisation error could occur in case of:

- the pump gets stuck
- the counter pressure is too high
- the phase current for the stepper motor is too low -> motor has low torque

#### Note:

After a synchronisation error has occurred the pump can be synchronised on the following ways:

- power down/up of the power supply
- using the serial interface (sending the command: *adr*,SRF,1)
- pressing a button on the hand held remote controller

The serial interface allows to modify the behaviour of the PCON-E on a synchronisation error (RS232 commands RSY and WSY)

### 9.5 Operating components

The pump unit can be operated via interface (see chapter 6) or by the operating components on the front of the housing:



Description of the operating elements:

LCD - Display	The LCD - display shows all relevant system data	
Select Program	This function key is used to select a program.	
Select Pump up/down	With these keys you select the pump you intend to run. The	
	pump number is displayed on the LEDs	
Change Value	By pressing this key, parameters (e.g. flow rate) which are	
	shown in the display can be changed by using the numeric keys	
	or the + or - key.	
Start	With this key, you can start a program, resp. you can execute a	
	programstep.	
Stop	This key interrupts an already started program or a dispensing	
	cycle.	
Manual	Pressing this key a manual dispensing cycle will be executed.	
	The flowrate is set by pressing the +/- keys	
	Pressing the + key increases the flowrate, pressing the - key	
	decreases the flowrate down to zero. This means, the pump unit	
	works like a valve in this mode .	
	Pressing the - key longer changes the flow direction. (Liquid will	
	be pumped back).	
	Press and hold the "Manual-key" as long as you want to	
	dispense manually. Releasing the "Manual-key" interrupts the	
	dispensing and leaves the manual mode.	
Set Flowrate (Hotkey)	This key can be used for a quick flowrate setting. Even, if the	
	pump is running, the flowrate can be set using this key.	
	<b>Press this Hotkey</b> and adjust the flowrate by using the numeric	
	keys or the +/- keys.	

<i>Set Volume</i> (Hotkey)	This key can be used for a quick volume setting.	
	<b>Press this Hotkey</b> and adjust the volume with the numeric keys.	
Numeric keypad	The numeric keypad allows an optional fast and precise numeric	
	input of system parameters (volume, flowrate etc.). Confirm	
	with "enter"	
Delete	numeric values can be corrected using delete	
+/- keys	You can modify a value (volume/flowrate) in connection with	
	the Change Value key	
Switch "start/stop"	As "manual operation" you can run all pumps simultaneous	
	with the individual manual start flow (see Setup menu)	
Switch "normal/reverse"	You can select the flowdirection under "manual operation"	
Switch "manual	You can switch the functions of the "start/stop" and	
operation/TTL in"	"normal/reverse" switches to the socket on the rear side of the	
	pump unit.	



#### the rear socket of the pump unit

The pump unit runs in normal direction when a low TTL signal on pin 1 "Start/stop" is present. An additional low signal on pin 4 "Direction" will change the flow direction into the reverse mode.

### 9.6 Program Selection

After turning the unit on, the version number will be displayed, then you can choose one out of the following programs by using the + or keys.

- PIPETTE simulation of a pipette
- STANDARD DISPENSE dispensing a volume
- DILUTOR diluting a solution
- DELAYED DISPENSE time controlled dispensing
- SETUP changing basic setup data

Press "Select Program" to select one of these programs.

example (for Pipette):

- a. press the "+" key, until "Pipette" is displayed
- b. press "Select Program" to select and switch to the "Pipette" program

### 9.7 Changing of program settings

Changes to the program parameters (e.g. volume, flowrate...) are made by using the functionkey "Change Value" and the + or keys or the numeric keypad

#### Sequence to change program settings:

a. Press the + or - key until the desired parameter is shown on the display

b. change settings

The functionkey "*Change Value*" enables to modify the displayed value. After pressing this functionkey an 'edit-arrow' appears in front of the value to be changed.

A parameter can be changed with I, as long as the 'edit-arrow' appears on the display. You can leave the edit mode on one of the following ways:

a. **press** "Change Value"-key

b. **press** another functionkey

### Changing the flowrate in the program pipette:

- a. choose program "pipette" (see above)
- b. Press the + or key until "Flowrate" is displayed
- c. press the functionkey "Change Value" to switch into the edit mode
- d. Press the + or key or use the numeric keys to adjust the flowrate in program "pipette"
- e. exit the edit mode by pressing the "Change Value" key

### 9.8 Changing the settings by hotkeys

Hotkeys helps to switch very quickly to a desired menu position and to change the parameter by using the numeric keys or the +/- keys

- Set Volume (hotkey for volume)
- Set Flowrate (hotkey for flowrate)

### Sequence:

- a. **choose** a program (e.g. pipette)
- b. press hotkey "Set Flowrate"
- c. Press the + or key or use the numeric keys to adjust the flowrate
- d. exit the edit mode by pressing the hotkey "Set Flowrate" again.

### Examples:

Using the hotkey "Set Flowrate"

- a. **choose** program "e.g. Standard Dispense"
- b. press hotkey "Set Flowrate"
- c. Press the + or key or use the numeric keys to adjust the flowrate
- d. exit the edit mode by pressing the hotkey "Set Flowrate" again.

Using the hotkey "Set Volume"

- a. choose program "e.g. Standard Dispense"
- b. press hotkey "Set Volume"
- c. Press the + or key or use the numeric keys to adjust the set volume
- d. **exit** the edit mode by pressing the hotkey "Set Volume" again.

### 9.9 Changing settings in submenus

Every program of the *HPLH* has special settings seldom changed by the user. These basic parameters can be individually set for every program. This enables the user to assign user units for volume and flowrate to every single program.

A programs submenu can be called up by pressing and holding the functionkey "Select program" for 3 seconds. The items of the submenu can be changed, using the + or - keys in connection with the functionkey "Change Value".

To leave the submenu, press the functionkey "Select program" again.

### Sequence to modify settings in a submenu

a. **select** a program

- b. press "Select program" for 3 seconds
- c. **Press the + or key** until the desired item is displayed
- d. change the value of the item

The functionkey "Change Value" enables you to modify the value displayed in the second line of the LCD-display. After pressing the functionkey "Change Value" an edit arrow appears in front of the value to be changed. As long as the edit arrow appears in the display the value can be changed by using the numeric keys or the +/- keys

The edit mode is left on one of the following ways:

- a. **press** the functionkey "Change Value" again
- b. **press** another functionkey
- c. do not Press the + or key for more than 3 seconds

#### example:

### Change the user units for volume in the program "Pipette"

- a. Select program "Pipette", enter it with "Select program"
- b. press the functionkey ""Select program" again for 3 seconds, you enter the submenu
- c. Press the + or key until the item "Units of Volume" appears in the first display line
- d. press the functionkey "Change Value" to switch into the edit mode
- e. Press the + or key until the desired units appear on the display
- f. leave the edit mode by pressing the functionkey "Change Value" again.
- g. repeat c. f. for other items, if desired
- h. press the functionkey "Select program" to leave the submenu

## 10 Description of the programs

After turning on the unit, the version number will be displayed, then the user can choose a program by using the +/- keys. Pressing the "*Select Program*"-key to switch to the desired program.

If the program is already in execution mode (pump is dispensing), **press STOP** to terminate the actual action, then **press** the "*Select Program*"-key to return to the main menu and to select a different program.

You can start the desired program (e.g. Pipette) on the following way:

- **return** to main menu (STOP/Select Program)
- Press the + or key, until the desired program is displayed (e.g. Pipette)
- press "Select Program" switch to the displayed program
- **modify** the settings of the program (volume/flowrate/flowdirection) using the + or keys in connection with the "Change Value" key
- press START to start the program

A program can consist of max. five programsteps.

example:

- 1. programstep: aspirate air
- 2. programstep: aspirate sample
- 3. programstep: dispense sample
- 4. programstep: wait for 2 seconds, then continue with programstep no. 2

Single programsteps are also executed automatically or via the START-key. The STOP-key interrupts an already started program and stops the pump. Continuing at the interruption point is not possible, but the user can start the program again by pressing the START-key.

Beside the START-key a footswitch or any other switches can be used to execute a step of a program. The expansion port (socket A) can be used to connect these components to the pump unit.

### 10.1 Standard dispense - dispensing a defined volume

The program "Standard dispense" operates the  $pump^{22}$  like a dispenser. This program is suitable for dispensing liquids fast and precise. This electronic dispenser allows to define the volume to be dispensed, the flowrate and the flow direction.

The SUM Volume of all dispensing steps can be displayed and set to zero at any time. *program settings:* 

•	Set Volume	= dispensing volume
•	SUM Volume	= Sum Volume
•	Flow Dir.	= Flow Direction
		normal/reverse
•	Flowrate	= Flowrate

Note: If Set Volume is 0, the pump will run continuously until the STOP - key is pressed

This program consists of only one programstep, which is executed repetitively (e.g. START-key): *programstep: dispensing/aspirating* 

In this programstep the system dispenses the volume defined in "SET Volume", if flowdirection is set to "normal", otherwise the system aspirates the volume into the discharge tube.

press the STOP-key to redefine the program items (Set Volume, flowrate or flowdirection)

### application example (titration):

The program "Standard Dispense" is very useful for titrations. A titration cycle could pass as described below:

### 1. SET SUM Counter to zero

- a. Press the + or key until 'SUM' is displayed
- b. press 'Change Value' -key to set SUM to zero

### 2. Set the volume to be dispense

press the hotkey 'Set Volume', then Press the + or - key or use the numeric keys to adjust the volume to dispense

### 3. Dispense predose volume

- a. **press** 'START' to execute the program
- b. press 'START' again for to dispense the programmed volume

### 4. dispense rest volume (titration point)

- a. press and hold 'Manual' at the remote controller
- b. **adjust** the flowrate by using the + or- key (hold Manual)
- c. **release** the 'Manual'-key at the titration endpoint

### 5. Read the total volume on the display

- a. Press the + or key, until SUM Volume is shown on the display
- b. **read** the value

## 10.1.1 Settings in the submenu of "Standard Dispense"

- **press "Select program" for 3 seconds** to call up the submenu of the program Standard Dispense.
- **Press the + or key** until the desired item is displayed.
- **press** "Change Value" to edit the desired item. Press the + or key or use the numeric keys to modify the value of the item.
- **press** "Select program" to return from the submenu.

	volume units
	μl - microliter
Units of Volume	ml - milliliter
	l - liter
	ga - gallons
	mg - milligram
	g - gram
	kg - kilogram
	oz - ounces
	Flowrate units
Units of Flowrate	μl/s microliter per second
	μl/min microliter per second
	ml/s milliliter per second
	ml/h milliliter per hour
	l/h liter per hour
	ga/h gallons per hour

### 10.2 Dilutor

The program "Dilutor" is suitable for making sample dilutions. Out of the Dilution Ratio, the Target Volume and the Dispense Rate the system calculates all system relevant parameters for the dilution steps.

#### program settings:

•	Disp. Rate	= dispense Flowrate
---	------------	---------------------

- Target Vol = target Volume (sample + dilution)
- Dil. Ratio % = dilution ratio in %
- Air Volume = volume of the air cushion(to separate sample from dilution)

After starting the program (**press** START) the following steps are executed repetitively:

- aspirate air to separate sample from dilution
- aspirate the sample into the discharge tube
- dispense sample and dilution into the target vessel

These dispensing steps can be executed by pressing the START-key at the remote controller.

### 1. programstep: aspirate air

The system aspirates an air cushion to separate sample and dilution. This programstep is only executed, if the value of '*Air Volume*' is not equal to zero.

This programstep is executed automatically, if 'Auto air-aspir.' in the submenu is set to <enabled>.

### 2. programstep: aspirate sample

The system aspirates in this step the calculated "*Sample Volume*" into the discharge tube. The *'Sample Volume'* is automatically calculated as follows:

SampleVol = 
$$\frac{\text{Ratio} * \text{TargetVolume}}{100}$$

### 3. programstep: dispense sample + dilution

The system dispenses the already aspirated Sample Volume, the aspirated air cushion and the calculated amount of dilution into the target vessel.

At the end of the last programstep the system jumps back to the first programstep, and is ready for another dilution cycle.

#### Note:

**Press** the STOP-key if you want to modify the programmed parameters (target volume, dilution ratio or flowrates).

## 10.2.1 Settings in the submenu of the program "Dilutor"

- press and hold *"Select program" for 3 seconds* to call up the submenu of the program Dilutor.
- **Press the + or key** until the desired item is displayed.
- **press** "Change Value" to edit the desired item. Press the + or key or use the numeric keys to modify the value of the item.
- press "Select program" to return from the submenu.

	volume units
Units of Volume	μl - microliter
	ml - milliliter
	l - liter
	ga - gallons
	mg - milligram
	g - gram
	kg - kilogram
	oz - ounces
	Flowrate units
Units of Flowrate	μl/s microliter per second
	μl/min microliter per second
	ml/s milliliter per second
	ml/h milliliter per hour
	l/h liter per hour
	ga/h gallons per hour
auto air-aspir	automatic air aspiration
	ENABLED / DISABLE

### 10.3 Pipette - simulation of a pipette

The program "Pipette" lets the *pump*<sup>2</sup> work similar to normal pipette. This electronic pipette enables you to set the volume, the aspirate and the dispense flowrate in the program settings of "Pipette".

program settings:

•	Pip. Volume (Pipette Volume)	= pipette
•	Disp. Rate (Dispense Flowrate)	= dispense flowrate
•	Aspir. Rate (Aspirate Flowrate)	= aspirate flowrate
•	Airvolume	= air volume

After starting the program "Pipette" (e.g. START-key) the following dispensing steps (programsteps) are executed cyclically:

- aspirate air (to blow out the tube in the last programstep)
- aspirate sample into the tube
- dispense sample and air into the target vessel
- 1. programstep: aspirate air

In this programstep the system aspirates air into the discharge tube, to blow out the liquid completely in the third programstep. This programstep is executed automatically, if the setting *'auto air-aspir.'* in the submenu is set to <enabled>.

2. programstep: fill pipette

In this programstep the system aspirates the volume defined in the parameter '*Pip*. Volume' into the discharge tube.

### 3. programstep: dispense pipette

In this programstep the system dispenses the volumes aspirated in step 2 (sample) and step 1 (air). After this programstep the system returns to programstep no. 1 and is ready for a new pipette cycle.

Press the STOP-key to redefine the program settings (pipette volume, flowrates or your flowdirection)

Settings in the submenu of pipette:

- press "Select program" for 3 seconds to call up the submenu of the program pipette.
- Press the + or key until the desired item is displayed.
- **press** "Change Value"-key to change the displayed item. Press the + or key or use the numeric keys to modify the value of the item.
- press "Select program" to return from the submenu.

	volume units
	μl - microliter
	ml - milliliter
	l - liter
	ga - gallons
Units of Volume	mg - milligram
	g - gram
	kg - kilogram
	oz - ounces
	Flowrate units
	μl/s microliter per second
	μl/min microliter per second
	ml/s milliliter per second
Units of Flowrate	ml/h milliliter per hour
	l/h liter per hour
	ga/h gallons per hour
auto air-aspir (automatic air	automatic air aspiration
aspiration)	ENABLED / DISABLED

### 10.4 Delayed Dispense - time controlled dispense

This program is very useful to dispense liquids time controlled. This means that a specified volume is dispensed repetitively after a programmable delay time.

As the delay time can be adjusted in a very wide range, the resulting average flowrate of the system can be programmed very low.

### program settings:



After starting the program (press the START-key) the following steps are executed cyclically:

- waiting, until the delay time is expired (max. 100 h)
- dispensing the step volume (min. 10  $\mu$ l) with the programmed flowrate

### 1. programstep: delay time

The system waits, until the delay time has expired.

### 2. programstep: dispense

The system dispenses in this step the programmed step volume with the programmed flowrate. After this step the system jumps automatically back to the first programstep, waiting until the delay time has expired again.

**Notice: Press** the STOP-key if you want to modify the programmed parameters (step volume, delay time or flowrate).

If you choose the value zero for 'cycles', then the program is executed until the **STOP**-key is pressed. This means, the system runs endless, until the user stops the program.

## **10.4.1** Settings in the submenu of the program "Delayed Dispense"

- press and hold *"Select program" for 3 seconds* to call up the submenu of the program Delayed Dispense.
- **Press the + or key** until the desired item is displayed.
- **press** "Change Value"-key to edit the desired item. Press the + or key or use the numeric keys to modify the value of the item.
- press "Select program" to return from the submenu.

Units of Volume	volume units μl - microliter ml - milliliter l - liter ga - gallons
	mg - milligram g - gram kg - kilogram oz - ounces
Units of Flowrate	Flowrate units µl/s microliter per second µl/min microliter per second ml/s milliliter per second ml/h milliliter per hour l/h liter per hour ga/h gallons per hour

### 10.5 Manual

This mode is very useful for manual dispensing, manual titration, but also to fill and empty the system. The + or - keys operates in this mode as a water tap.

In contrast to all other programs, this mode is not an independent program. To call up the "*Manual*"-Mode, press the *Manual-key* on the remote controller. This mode can be called from all programs, on condition that the pump is not running.

Releasing the "*Manual-key*", the user returns automatically to the program where the *Manual*"-Mode has been called up.

- press and hold the Manual-key on the remote controller
- **Press the + or key** to the right to increase the flowrate
- **Press the + or key** to the left to decrease the flowrate
- release the Manual-key, if you want to stop the manual dispensing

The starting flowrate can be defined in the setup menu (see changing basic settings in the setup menu)

The SUM Volume can be set to zero with the *"Change Value"-key* at the remote controller.

### **10.6** Changing basic settings in the setup menu

All basic data are stored in the setup-menu. These global settings match for all programs. These basic settings can be modified with the + or - keys, in connection with the "*Change Value*" -key.

#### the following settings can be adjusted in the setup menu:

- specific weight
  - specific weight of the pumped liquid in kg/liter This value is only evaluated, if mass units like mg, gr.. are selected for the volume. *factory setting: 1.000 kg/liter*
- Slave Address of the HPLH
  - The address (Pump number) definition of the HPLH (1-255)
- Manual Startflow

This setting defines the starting flowrate in the Manual-Mode. The value for Manual Startflow can be negative and also positive. A positive flowrate means, that the unit dispenses liquid, on the other side a negative flowrate means, that the unit tries to aspirate liquid back into the reservoir.

To call up the Manual-Mode without dispensing, nor aspirating any liquid the value for Manual Startflow must be set to zero. The unit starts then dispensing or aspirating liquid when using the + or - keys

factory setting: 0

• Syncron. Check

This setting is used to select the response to a step loss of the opto-electronically monitored stepper motor. These selections are possible:

disabled:	pump stops at oncr
display message:	message on the display, the pump continues
stop pump:	pump stops at once
check at stop:	Display message after finishing of the pumping process

Autostart

This setting allows to start a program (Standard Dispense, Delayed Dispense, pipette or diluter) automatically after the pump is turned on. To start a program automatically this value must be set to <enabled>.

#### Note:

When switching on, the micro-metering pump starts automatically the last executed program (program in which the pump was turned off), if Auto Start is set to <enabled>.

• Volume Round Factor and Flow Round factor

These factors define the rate of changing the flowrate and volume when you use the +/buttons. The rates increase when using a larger factor.

• Send RDY

When this setting is set to <enabled>, the pump sends "*adr*,HS,RDY" via interface when a dosing cycle has finished

• Execute reset

Used with the calibration function. See Service manual Ch. 9

### 11 Checking the volume

In line with ISO 9000 "Monitoring of Testing Apparatus" and GLP or when using a medium with different density and viscosity other than distilled water there is a possibility to calibrate the pumps. For adjustment of the unit please see Service manual.

#### 11.1 Procedure of checking

- Fill the pump with distilled water, using the buttons "manual" and "+", dispense the water into a separate vessel until there are any bubbles are in the dispensing tube left.
- 2. Dispense 5 ml into a vessel.
- 3. Weigh the dispensed quantity with a precision balance.
- 4. Calculate the volume, taking the temperature into account.
- 5. Repeat step 2-5 at least 10 times.
- 6. Calculate the accuracy A% and coefficient of variation CV% by means of the formulas of the statistical computation.

#### **Calculations:**

Mean value	$\overline{\mathbf{m}} = \frac{\sum m_{\perp}}{\mathbf{n}}$	m <sub>i</sub> : results of weighing, n : number of weighing
Mean	_ v = Z	volume Z : Correction factor
Accuracy	$A \% = \frac{\overline{V} - V_0}{V_0}$	V <sub>0</sub> : Nominal volume
Coefficient of varia	tion CV % = $\frac{100 \text{ s}}{\overline{V}}$	$s$ : Standard deviation of the results of weighing $m_{\rm i}$

A detailed description of this test procedure you find e.g. in DIN EN ISO 8655-6.

Table 1: Correction factors 7	(ul/mg at 1013 hPa abstract of	EN ISO 8655-6)
	(µi) ing at 1013 in a, abstract of	LIN 130 0033 0)

Temperature	Correction factor Z	Temperature	Correction factor Z
°C		°C	
15,0	1,00090	23,0	1,00247
15,5	1,00098	23,5	1,00259
16,0	1,00106	24,0	1,00272
16,5	1,00114	24,5	1,00284
17,0	1,00123	25,0	1,00297
17,5	1,00132	25,5	1,00310
18,0	1,00141	26,0	1,00323
18,5	1,00150	26,5	1,00336
19,0	1,00160	27,0	1,00350
19,5	1,00170	27,5	1,00364
20,0	1,00180	28,0	1,00378
20,5	1,00190	28,5	1,00393
21,0	1,00201	29,0	1,00408
21,5	1,00212	29,5	1,00422
22,0	1,00223	30,0	1,00437
22,5	1,00236		

## 12 The RS232 and RS485 interface of the PCON-E

The RS232 interface enables remote control of all functions as well as readout and change of all system parameters (e.g. programs, flow-rates, volumes, user-units, setup-parameters etc.). In this configuration a computer can access each connected unit via a sub address (daisy chaining). This address is programmable for every unit ( $\rightarrow$ Setup menu, slave address).

For addressing a specific unit, each pump controller carries a so called 'slave address' which can be any number from 1 to 255.

The slave address can be set/changed in the Setup-menu.

#### The new RS485 interface is for connecting other devices with RS485.

A *Windows*<sup>2</sup> driver for easy control of every connected unit is optional available.



socket of the serial interface (view on socket - 9 pin Sub-D socket)

parameters of the serial interface (1200-4800,8,N,1):

Baudrate:	4800 baud
Databits:	8 Bit
Parity:	none
Stopbits:	1

#### Pinout of the RS232 connector:

Description	pin number
TxD	2
(transmit data)	
RxD	3
(receive data)	
GND	5
(GROUND)	

(female 9 pin SUB-D socket)

### 12.1 RS232 Connection configuration between PC and the PCON-E

#### a) PC with 9-pin RS232-plug



#### b) PC with a 25-pin RS232-plug



### 12.2 Format of a RS232-Command

Each command which is sent to the device must have the format:

#### ADR , CMDCODE , PARAMETERLIST <CR>

Description:

ADR: Slave Address of the unit to execute the command

CMDCODE: Command-code

**PARAMETERLIST:** 1 to 6 parameters separated by commas

CR:The command string must be terminated by Carriage/Return (ASCII 13)Instruction ManualTower II05/2019V3.2Page/Seite 30von/of 43

### 12.3 RS232 - COMMANDS

CMD. CODE	Explanation	Parameter list	Range	not allowed modes
	Program-handling			
CI	Generate continue- / start- impulse	1. Dummy parameter to initiate transfer	1	1/2
EP	Start program	1. Program number	17	2/4/5
PA	Abort execution of actual program step	1. Dummy parameter to initiate transfer	1	1/5
PAX	Abort program completely and return to mode 1	1. Dummy parameter to initiate transfer	1	1/5
RAP	Read actual (real) parameters:	1. Dummy parameter to initiate transfer	1	
	- Flow rate	ightarrow Controller sends in handshake:		
	- Set volume	1. Flow rate in user units	х	
	- dispensed volume	2. Set volume in user units	х	
	- Total volume	3. Dispensed volume in user units	х	
	- Elapsed time	4. Total volume in user units	х	
		5. Elapsed time in seconds	х	
RSS	Read system status	1. Dummy parameter to initiate transfer	1	
	- System status code	$\rightarrow$ Controller sends in handshake:		
	- Actual program number	1. Actual system status code	16	
	- Actual step number	$(1 \rightarrow \text{ in command mode } 2 \rightarrow \text{ in program execution})$		
	- Synchronisation error flag	mode (pump is running) $3 \rightarrow in 'stop-mode' (pump is$		
		halted) $4 \rightarrow in' wait-mode'. (controller waits for a$		
		start impulse to execute the program step) $5 \rightarrow \text{sync}$		
		error stop mode, $6 \rightarrow$ reserved)		
		2. Actual program number	0/17	
		3. Actual program step number	15	
		4. Sync error flag (0 - no sync error /		
		1 - sync error occurred)	0/1	
RUL	Read limits for user entries:	1. Program number	17	
	- Flow rate	$\rightarrow$ Controller sends in handshake:		
	- Volume	1. Min. allowed value for flow rate	x	
		2. Max. allowed value for flow rate	x	
		3. Flow rate round	x	
		4. Min. allowed value for volume	x	
		5. Max. allowed value for volume	x	
		6. Volume round	х	
WS0	Set 'Total Sum' counter to zero	1. Dummy parameter to initiate transfer	1	
	Program definitions			
RAM	Read Analog Input setting	1. Dummy parameter to initiate transfer	1	
		$\rightarrow$ Controller sends in handshake:		
		1. Analog input select	02	
		$(0 \rightarrow \text{disabled}, 1 \rightarrow \text{current}, 2 \rightarrow \text{voltage})$		
		2. Analog input low	030	
		3. Analog input high	030	
		4. Hand manipulator mode(0 $\rightarrow$ disabled / 1 $\rightarrow$ enabled)	0/1	
		5. Manual start flow rate	х	

RFR	Read step data:	1. Program number	17	
	flow setting	2. Step number	15	
	5			
	- Flow rate	Controller sends in handshake:		
	Elow direction	-> Controller series in nanushake.	Y	
		1. Flow rate at the beginning (in user units)	<b>^</b>	
		2. Flow rate at the end (in user units)	x	
		3. Flow direction (0 $\rightarrow$ normal, 1 $\rightarrow$ reverse)	0/1	
RPA	Read step data:	1. Program number	17	
	analog input, digital output setting	2. Step number	15	
		$\rightarrow$ Controller sends in handshake:		
	- Analog input mode	1 Analog input mode ( $0 \rightarrow \text{disabled} \ 1 \rightarrow \text{enabled}$ )	0/1	
	, malog input mode	1. Analog input mode ( $0 \rightarrow \text{disabled}, 1 \rightarrow \text{enabled}$ )	0/1	
	Continuous accention	2. Continuous-Operation ( $\cup \rightarrow No, 1 \rightarrow Yes$ )	0/1	
	- Continuous operation	3. 2 bit output value at digital port before trigger	03	
	- Output value on dig. port	4. 2 bit output value at digital port after trigger	03	
RPI	Read auxiliary program configuration	1. Program number	17	
	- Number of loops	$\rightarrow$ Controller sends in handshake:		
	- Repeat number	1. Number of execution cycles (loops)	0100000	
	- Number of steps	2 Step number after the first cycle	15	
	- Program namo	2 Last stop number of program	1 5	
	- Program name	5. Last step number of program	15 Taut	
		4. Describing text for the program	Text	
RPU	Read specific user units for:	1. Program number	17	
	- Volume	$\rightarrow$ Controller sends in handshake:		
	- Flow rate	1. Unit code for 'volume'	07	
	- Specific weight	$(0 \rightarrow \mu 1 \rightarrow m 2 \rightarrow 1 \rightarrow a \rightarrow a \rightarrow m 2 \rightarrow a$		
		$(0, \mu)$ $(1, 1, 1)$ $(1, 2, 1, 3, 2)$ $(1, 2, 1, 3, 2)$ $(1, 2, 1, 3)$		
		$b \rightarrow kg, 7 \rightarrow 02$	0 6	
		2. Unit code for flow rate	00	
		$(0 \rightarrow \mu l/s, 1 \rightarrow \mu l/m, 2 \rightarrow m l/s, 3 \rightarrow m l/m in, 4 \rightarrow m l/h,$		
		$5 \rightarrow l/h, 6 \rightarrow ga/h)$		
		3. Specific weight (kg/l)	0100	
RSC	Read step data:	1. Program number	17	
	start condition	2. Step number	15	
			_	
	- 'Start' kov	Controller sends in handshake:		
		Controller sends in nandshake.	0 1	
	- 11L1	1. Walt for Start key	04	
		0 - not defined		
		1 - high		
		2 - low		
		3 - high $\rightarrow$ low		
		4 - low $\rightarrow$ high		
		2. Wait for TTI 1	04	
		$0_{-}$ not defined		
		2 - Iow		
		3 - high $\rightarrow$ low		
		4 - low $\rightarrow$ high		
RVT	Read step data:	1. Program number	17	
	volume or time parameter	2. Step number	15	
			_	
	- Operation mode (Time ()(olume)	Controller sends in handshake:		
	- Time or volume	1 Operation mode:	0/1	
		r. operation mode:	0/1	
	- Text for step	$(0 \rightarrow Volume controlled, 1 \rightarrow Time controlled)$		
		2. The volume or the execution time	x	
		3. Describing text for the step	Text	
WAM	Write analog input setting	1. Analog input select	02	
		$(0 \rightarrow \text{disabled}, 1 \rightarrow \text{current}, 2 \rightarrow \text{voltage})$		
		2 Analog input low	030	
		3 Analog input high	0.30	
			0.30	
		4. Tand manipulator mode (U $\rightarrow$ disabled / 1 $\rightarrow$ enabled)	0,1	
		5. Ivianual start flow rate (in user units)		
			х	

WFR	Write step data:	1. Program number	17	
	Flow settings	2. Step number	15	
		3. Flow rate at the start	Min Flow	
	- Flow rate	4. Flow rate at the end	Max Flow	
	- Flow-direction	5. Flow direction (0 $\rightarrow$ forward, 1 $\rightarrow$ reverse)	0/1	
WPA	Write step data	1. Program number	17	
	Input/Output Setting	2. Step number	15	
		3. Analog input mode (0 $\rightarrow$ disabled, 1 $\rightarrow$ enabled)	0/1	
	- Analog input mode	4. Continuous operation ( $0 \rightarrow$ no, $1 \rightarrow$ yes)	0/1	
	- Continuous operation	5. 2 bit output value at digital port before trigger	03	
	- Output value on dig. port	6. 2 bit output value at digital port after trigger	03	
WPI	Write auxiliary program configuration	1. Program number	17	
	- Number of loops	2. Number of execution cycles (loops)	0100000	
	- Repeat number.	3. Step number after one cycle	15	
	- Number of steps	4. Last step number of program	15	
	- Program name	5 Describing text for the program	Text	
	i rogram name	(max 12 Characters)	TCAL	
W/DLL	Write specific user units for:	1 Brogram number	1 7	
WFO	write specific user units for.	2 Unit codo for 'volumo'	17	
	Volumo		06	
		$0 \rightarrow \mu$ i, $1 \rightarrow i$ iii, $2 \rightarrow i$ , $3 \rightarrow ga$ , $4 \rightarrow i$ iig, $5 \rightarrow g$ ,		
	- Flow Tale	$b \rightarrow kg, / \rightarrow oz$	0 7	
	- Specific weight	3. Unit code for flow rate	07	
		$0 \rightarrow \mu$ l/s, $1 \rightarrow \mu$ l/m, $2 \rightarrow$ ml/s, $3 \rightarrow$ ml/m, $4 \rightarrow$ ml/h,		
		$5 \rightarrow l/h, 6 \rightarrow ga/h$		
		4. Specific weight (kg/l)	030	
WSC	Write step data	1. Program number	17	
	'Start signal'	2. Step number	15	
		3. Wait for 'Start' button from the Remote Controller	04	
		0 - not defined		
		1 - high (not pressed)		
		2 - low (pressed)		
		3 - high $\rightarrow$ low		
		4 - low $\rightarrow$ high		
		4. Wait for TTL1	04	
		0 - not defined		
		1 - high		
		2 - low		
		3 - high $\rightarrow$ low		
		$4 - \log \rightarrow high$		
W/V/T	Write step data	1 Program number	1 7	
***	write step data	2 Step number	17	
		2. Operation mode	0/1	
		(0, x) (alumn controlled 1, x) Time controlled)	0/1	
		$(0 \rightarrow v)$ where $v$ is the controlled, $1 \rightarrow 1$ intercontrolled)		
		4. Volume (in user units) of execution time	X Toyt	
		5. Describing text for the step	TEXL	
		(IIIdX 13 CIIdIdCleIS)		
	additional commands			
RAN	Read analog inputs	1. Dummy parameter to initiate transfer	1	
		$\rightarrow$ Controller sends in handshake:		
		1. Analog input voltage (10 bit input code)	01023	
		2. Analog input current (10 bit input code)	01023	
RAS	Readout autostart setting	1. Dummy parameter to initiate transfer	1	
		$\rightarrow$ Controller sends in handshake:		
		1. Program select	17	
		2. Autostart (0 $\rightarrow$ disabled / 1 $\rightarrow$ enabled)	0/1	
RDC	Read digital output port control	1 Dummy parameter to initiate transfer	1	
NDC			<b>–</b>	
		$\rightarrow$ Controller sends in handshake:		
		1 TTI 1 output	0/1	
			0/1	
			0/1	
			0/1	
	1	4. IIL4 Output	0/1	

RDD	Read digital state on dose	1. Dummy parameter to initiate transfer	1	
		$\rightarrow$ Controller sends in handshake:	0.14	
			0/1	
		2. TTL2 output	0/1	
		3. TTLA output	0/1	
			0/1	
		5. Read TL output on dose ( $0 \rightarrow no, 1 \rightarrow auto$ )	0/1	
RDI	Read digital input port	1. Dummy parameter to initiate transfer	1	
		$\rightarrow$ Controller sends in handshake:		
		1. TILI input status	0/1	
		2. TTL2 input status	0/1	
		3. TTLA input status	0/1	
DCV	Deedlacks in a second second second	4. 11L4 input status	0/1	
RSY	Read behaviour on synchronisation	1. Dummy parameter to initiate transfer	1	
	error	. Controller and to be added a	0.2	
		$\rightarrow$ Controller sends in handshake:	03	
		1 - display message		
		2 - stop pump		
DTV	Deed Information	3 - CHECK at Stop	1	
RIY	Read Information	1. Dummy parameter to initiate transfer	1	
		. Carta lla constata in han debala		
		$\rightarrow$ Controller sends in handshake:	DCONC	
		1. name of connected device	PCONC 1.2	
695		2. firmware version number	1.3	0/1/5
SRF	Initialises pump heads	1. Security parameter to initiate transfer: 1	1	2/4/5
	$(\rightarrow \text{ set reference})$			. /=
WAF	Set actual flow rate	1. Flow rate in actual user units	0MaxFlow	1/5
WAS	Write autostart setting	1. Auto start program number	17	
		2. Autostart (0 $\rightarrow$ disabled / 1 $\rightarrow$ enabled)	0/1	
WBD	Set baud rate	1. Baud rate	02	
		0 - 1200		
		1 – 2400		
		2 – 4800		
WDC	Set digital output port control	1. TTL1 output	0/1	
		2. TTL2 output	0/1	
		3. TIL3 output	0/1	
			0/1	-
WDD	Set digital state on dose	1. TIL1 output	0/1	
			0/1	
		3. TTLA output	0/1	
		4. ITL4 OULPUL E. Set TTL output on does $(0, \infty, \infty, 1, \infty, \infty, \infty)$	0/1	
		5. Set TTL output on dose ( $U \rightarrow HO$ , $I \rightarrow auto)$ Romark: This is useful for switching a value on dose	0/1	
WDO	Sot digital output port	1 TT11 output	0/1	
0000	Set uigitai output port		0/1	
			0/1	
			0/1	
\W/FE	Save changes	1 Saving mode	21/20/	
VVLL		21 – Program 6 7	2010	
		30 – only Settings	2010	
		2010 – all		
\M/SA	Set BS232 slave address	1 New beginning slave address of controller	1 255	
WCV	Write behaviour on synchronisation	1. Rehaviour on sync orror	1255	2/1/5
10.00	error	$\Omega = n_0$ behaviour	03	2/4/3
		2 - stop nump		
		3 - check at stop		
	special commands			

WA1	Write step data	1. Program number	17	
		2. Step number	15	
	- Flow rate	3. Flow rate	Min Flow	
			Max Flow	
	- Flow direction	4. Flow direction (0 $\rightarrow$ forward, 1 $\rightarrow$ reverse)	0/1	
	- TTL	5. 3 bit output value at digital port before and after trigger	07	
	- Sets 'Start signal' to not defined			

#### **Operation modes:**

- 1 Command mode (default mode)
- 2 Program execution mode (pump is running)
- 3 Stop mode (pump is stopping)
- 4 Wait mode (pump waits for a start impulse to execute a program step)
- 5 Sync Error Stop mode (Safety feature)

#### 12.4 Format of the Controller Handshake

After receiving an RS232-command the PCON-E will :

- 1. Send the received command back to the PC (echo for the enhanced feature daisy chaining)
- 2. Answer with a handshake string, which is defined as follows:

#### ADR , "HS", RETCODE , PARAMETERLIST CR

#### Explanation:

ADR:	Slave address of the controller sending the handshake
RETCODE:	Error code (see table 2 below)
PARAMETERLIST:	1 to 6 parameters (see table 1), each parameter is separated by a comma ","
CR	the handshake as any command, is terminated by ASCII-code 13 (CR)

#### TABLE 2:

Return Code	Explanation	Parameter list
ОК	command executed, no error	see table 1
UC	unknown command	none
PA	wrong parameter number	none
	(too few or too many parameters specified)	
NA	command is not allowed in actual operation	actual operation mode
	mode	
PR	at least one parameter is out of range	none
PL	at least one parameter is too long	none
DF	unknown data format	none

### 12.5 Writing parameters to the Controller

If, for example the flowrate in program no. 5, step no. 3 should be 500, the following command string has to be sent to the controller with slave address 2:

### 2,WFR,5,3,500,500,0

The Controller then sends the following two strings to the next Controller (or to the PC):

### 2,WFR,5,3,500,500,0 2,HS,OK

The first string is the Echo of the received command.

The second string indicates that the command was accepted and will be executed.

### 12.6 Reading parameters from the Controller

To read the program information of program no. 3 send the following command to the Controller with Slave Address 1.

### 1,RPI,3

The Controller then sends the following two strings to the next Controller (or to the PC):

#### 1,RPI,3

#### 1,HS,OK,10,2,4,Rep. Dispense

The first string is the Echo of the received command.

The second string indicates that the command was accepted and will be executed it also contains the following information (see table 2):

- the program makes 10 loops
- the program will repeat with step no. 2 after one cycle
- the program consists of 4 steps
- the name of the program is "Rep. Dispense" (Repeat Dispense)

### 12.7 Codes to dispense a defined volume

This example program lets the Controller with Slave Address 1 dispense a defined volume. The program is loaded in program location no. 5.

volume to dispense:	100 μl
flowrate:	10 µl/second
flowdirection:	normal (forward)

The following commands have to be sent the Controller:

1,WPU,5,0,0,1.0	;setting user units μl // μl/sec
1,WPI,5,1,1,1,Disp10ul	;writing program information
1,WVT,5,1,0,10,dispense	;volume and step name
1,WFR,5,1,10,10,0	;flowdirection and flowrate
1,WSC,5,1,0,0	;starting conditions

after definition of the program, by sending these commands to the PCON-E, this program can be started by sending:

1,EP,5

## **13 Cleaning and Maintenance**

Surface and operating elements may be cleaned with a mild dishwashing detergent (water and a standard dishwashing detergent) and a soft, non-fuzzing <u>moist</u> cloth. Do not use a wet cloth. Use only a small amount of dishwashing detergent. Do not use chlorine bleach or other chlorine-based cleaning products with metallic components under any circumstances. These will damage the surface of the instrument. If you use any other cleaning method please make sure that the intended method does not cause any damage tot he instrument.

The pumpheads must be cleaned as follows to assure proper functioning and continued accuracy.

- *immediately,* if the motor becomes sticky or jammed.
- daily, after use of these liquids
  - Solutions prone to crystallisation
  - Alkaline solutions, aromatics, chlorinated hydrocarbons scintillation liquids
  - inorganic solutions such as buret reagents
- *periodically,* to increase the lifetime of the instrument
- *always* after long term storage

**NOTICE** The ceramic parts are subject to binding or freezing if stored after improper cleaning.

### 13.1 Cleaning the pumpheads

**AWARNING** Be careful to avoid any personal injury from used chemicals. While and even after dispensing liquids, the instrument, the filling and the discharge tubes contain the used reagent. Make sure, that during cleaning and maintenance you avoid splashing chemicals. Wear face screens, protective gloves and protective clothes.

- 1. Select the pump No. with the "Select pump" buttons
- 2. Hold the discharge tube over any designated dispensing receptacle and dispense the remaining reagent (press at the same time "Manual" and "+").
- 3. Put the suction tube into cleaning solution designated for that purpose
- 4. Clean the instrument by pumping We recommend to pump a minimum volume of 50 times the amount of the strokevolume through the pump for a good cleaning.
- 5. Insert the suction tube into distilled water (or other liquids for sterilisation) for rinsing.

type	strokevolume	min. cleaning volume
HPLH 20	20 µl	1 ml
HPLH 200	200 µl	10 ml
HPLH 300	350 μl	20 ml
HPLH 1000	1000 μl	50 ml

#### Important:

The HPLH-PCON-C is a measuring instrument and designed to provide high accuracy. To maintain this accuracy we recommend that this instrument be tested at regular intervals, especially after any mishandling (such as hitting or dropping) of the instrument. Testing of the instrument is provided by the manufacturer for a small fee. Under §4 of the Weights and Measuring Standards of 12.08.88 Germany, it is required that regular testing and inspections be performed when the *HPLH* is used as a medical instrument.

## 14 Dismantling and Disposal

### 14.1 Dismantling



AWARNING Pumpheads and tubing may content reagents, which endanger persons and material. Make sure of cleaning pumphead and tubing according Chapter 7 before removing tubing.

- 1. Switch the instrument off.
- 2. Disconnect the instrument from the mains.
- 3. Disconnect the tubing
- 4. Now the instrument may be removed from the working area.
- 5.

### 14.2 Disposal



Please dispose of used instruments and defective components at your local recycling collection point. Prior to disposal, sort according to materials: metal, glass, plastic, etc. Also be sure to dispose of the packing material in an environmental-friendly manner.

## 15 Transport and Storage

### 15.1 Transport/Storage



AWARNING Pumpheads and tubing may content reagents, which endanger persons and material. Make sure of cleaning pumphead and tubing according Chapter 7 before removing tubing.

Prior to transport:

Switch the instrument off and unplug the power supply.

Remove tubing and cables

Do not subject the instrument to mechanical shocks or vibration during transporting.

Place the instrument and its parts in its original packaging or another suitable container to protect it during transport. Close the packaging with adhesive tape.

In case you do not use the original packaging please mark the box with the following notes:

- Glass symbol (handle with care, fragile)
- Umbrella (keep dry)
- Content (list of content)

Store the instrument in a dry environment. Please observe the specified conditions of the ambient:

Ambient temperature: 5-40°C

Max. relative air humidity: 80%

#### 15.2Return for repair or calibration



**AWARNING** For a maximum of protection from health hazards caused by contaminated instruments clean and decontaminate the instrument carefully before returning.

We intend to give our staff a maximum of protection from health hazards caused by contaminated instruments. We therefore ask for your understanding that we cannot carry out any calibration / repair unless the

#### **Declaration on the Absence of Health Hazards**

is submitted completed and signed.

Please copy the declaration in the appendix and attach it completed and signed to the instrument when returned to your distributor or to the manufacturer.

Please provide us with the following supplementary information:

- Detected defect
- Media which the instrument has been used with

## 16 Technical Data



**AWARNING** The user has to determine, if the instrument is suitable for his specific application. If there are any further questions, contact your local dealer or the manufacturer.

Min step volume	Strokevolume 20µl : :	1µl		
	Strokevolume 200µl : 10µl			
	Strokevolume 300µl :	Strokevolume 300µl : 20µl		
	Strokevolume 1000µ	l : 50µl		
Max step volume	100 l			
Min delay time in delay mode	1 second			
Max delay time in delay mode	100 hours	100 hours		
Min flow-rate in continuous mode	Strokevolume 20µl : : Strokevolume 200µl: Strokevolume 300µl : Strokevolume 1000µ	Strokevolume 20μl : 1 μl/min Strokevolume 200μl: 5 μl/min Strokevolume 300μl : 10 μl/min Strokevolume 1000μl : 30 μl/min		
Min flow-rate in delay mode	Strokevolume 20µl : : Strokevolume 200µl : Strokevolume 300µl : Strokevolume 1000µ	1μl/100h : 10μl/100h : 20μl/100h l : 50μl/100h		
Max flow-rate	Strokevolume 20µl : : Strokevolume 200µl : Strokevolume 300µl : Strokevolume 1000µ	Strokevolume 20μl : 10 ml/min Strokevolume 200μl : 100 ml/min Strokevolume 300μl : 150 ml/min Strokevolume 1000μl : 400 ml/min		
Precision	EV <= 1 %			
Accuracy	CV <= 0.5 %	CV <= 0.5 %		
Counter pressure	up to 5 bar, depends	up to 5 bar, depends on viscosity and max flow rate		
Serial interface	RS232 (4800,8,N,1) Data transfer rate: Databits: Parity: Stopbits:	(1200, 2400 or) 4800 Baud 8 Bit no parity 1 Stopbit		
Electrical power requirements	100 - 240 VAC 50/60	100 - 240 VAC 50/60 Hz 156 W		
Fuse	115 VAC: IEC 60127-2	115 VAC: IEC 60127-2 2A T , 230 VAC: IEC 60127-2 1A T		
Dimensions ( W x H x D)	218 mm x 475 mm x	218 mm x 475 mm x 300-330 (depends on type of pumphead)		
Ambient temperature	5 - 40 °C	5 - 40 °C		
Max. air humidity	80 % relative humidit	80 % relative humidity		
Protection class (DIN 40050)	IP40	IP40		
Protection class (DIN EN 61140)	Protection class I	Protection class I		
Weight	10-15 Kg, depends or	10-15 Kg, depends on type and numbers of pumpunits		

### 16.1 Chemical resistance:

The materials, which come into contact with the delivered medium are either

Aluminium oxide (99,7 % Al<sub>2</sub>O<sub>3)</sub> or

PVDF

These materials guarantee a high resistance against almost all aggressive media.

## **17 Warranty and Liability**

The manufacturer agrees to correct for the original user of this product, either by repair, or at the manufacturer's discretion, by replacement, any defects in material or workmanship which develop within 24 months after delivery of this product to the original user. In the event of replacement, the replacement unit will be warranted for the remainder of the original twelve (24) months period of ninety (90) days, whichever is longer.

If this product should require service, contact your distributor or manufacturer for necessary instructions.

This warranty shall not apply if the defect or malfunction was caused by accident, neglect, unreasonable use, improper service, or other causes not arising out of defects in material or workmanship.

There are no warranties, expressed or implied, including, but not limited to, those of merchantability or fitness for a particular purpose, which extended beyond the description and period set forth herein.

The manufacturer's sole obligation under this warranty is limited to the repair or replacement of a defective product and the manufacturer shall not, in any event, be liable for any incidental or consequential damages of any kind resulting from improper use or misuse or possession of the product.

$\wedge$	<b>AWARNING</b> In case of malfunction do not try to carry out any repair works. The instrument does not consist of any part which may be serviced or maintained by the user. Any attempt by the user to repair the unit will cancel the warranty.	
$\wedge$		Do not open the instrument. Any work on the electronics of the unit should only be done by knowledgeable and trained personnel.

## **18 Declaration on the Absence of Health Hazards**

Please copy this declaration and attach it completed and signed to the instrument

Device designation:....

Serial No.: .....

#### The Undersigned hereby declares:

- That the instruments have been carefully cleaned and decontaminated before shipment.
- That the instruments pose no danger through bacteriological, chemical, radiological or viral contamination.
- To be authorised to make declarations on behalf of the Institution represented.
- That he / she is aware that shipment of contaminated instruments is a violation of law, and that he / she
  personally and the Institution represented may be held liable for any damages caused by contaminated
  instruments.
- For calibrating service only: minor repairs of a value up to € 30,--+ VAT will be carried out and invoiced without further queries (cross out if not applicable).

Sender: Firm / Laboratory:

.....

Address:

.....

Tel. for enquiry:

.....

Name

Position

Data	Signaturo

.....

Date, Signature

• In case of Return for Repair, please provide us with the following supplementary information: Detected defect:

.....

Media which the instrument has been used with:

.....



Ingenieurbüro CAT M. Zipperer GmbH

Wettelbrunnerstr.6 79282 Ballrechten-Dottingen Tel.: +49 (0) 7634 5056800 Fax: +49 (0) 7634 5056801 E-Mail: <u>info@cat-ing.de</u> Internet: <u>http://www.cat-ing.de</u>

#### EG - Konformitätserklärung nach Niederspannungsrichtlinie 2014/35/EU EG - Declaration of conformity in accordance with the EEC low voltage directive 2014/35/EU appendix III Déclaration de conformité EG selon Directive Européenne 2014/35/EU relative aux bassetension appendice III

Wir erklären in alleiniger Verantwortung, dass dieses Produkt (siehe Tabelle) den Bestimmungen der Richtlinien entspricht und mit den folgenden Normen oder normativen Dokumenten übereinstimmt:

We declare under our sole responsibility that this product (see table) corresponds to the regulations and conforms with the standards or standardized documents:

Nous déclarons sous notre propre responsabilité que ce produit est en conformité avec les normes ou documents normalisés suivant:

#### Folgende weitere EU-Richtlinien wurden angewandt :

The agreement with further valid guidelines/regulations following for the product is explained: Les autres directives européennes sulvantes ont été appliquées:

EMV – Richtlinie 2014/30/EG RoHS – Richtlinie 2011/65/EU

Folgende harmonisierte Normen wurden angewandt :

Applied one harmonized standards in particular: Les norms harmonisées suivantes ont été appliquées:

DIN EN 61326-1:2013-07 DIN EN 61010-1-:2011-07

DIN EN ISO 12100 :2011-03

# Bei einer nicht mit uns abgestimmten Änderung des Gerätes verliert diese Erklärung ihre Gültigkeit und die Gewährleistung erlischt.

In the case of a modification of the unit which has not been agreed on with us, this declaration becomes null and void and the warranty expires.

Dans le cas d'une modification de l'apparail qui n'a pas été convenue avec nous, cette déclaration perd sa validité et la garantie expire.

Ingenieurbüro CAT M. Zipperer GmbH

Alexander Schecklein CE-Bevollmächtigter

79282 Ballrechten-Dottingen, den 04.01.2017

Туре

Mehrkanalpumpen Serie: HPLH