CMA 402 **Syringe Pump**

CMA 402 SYRINGE PUMP USER'S MANUAL

CONTENTS

800 3101 Rev 1.0

Figure 1. CMA 402 Syringe Pump.

1 INTRODUCTION

The CMA 402 Syringe Pump is a compact, flexible dual syringe pump designed for pulse-free low flow rates, suitable for microdialysis experiments.
The pump can also be recommended for use in many other applications.
The flow rate can be individually selected in a range between 0.1 - 20 µL/min and can be in injection or suction mode, or in combination.
The pump is pre-calibrated for glass syringes of 1 mL, 2.5 mL and 5 mL with a scale length of 60 mm.
With Microdialysis CAD, software included, experiments can be planned and controlled in endless variations.

2   SAFETY

The CMA 402 Syringe Pump is designed for laboratory use only, e.g. animal experiments, analytical chemistry, etc, and is therefore not equipped with the special safety functions that are necessary for use with humans. In view of this, the following considerations should always apply:

•   **The CMA 402 Syringe Pump should only be used for its intended purpose, namely as a syringe pump for infusions, perfusions or injections in laboratory studies.**

•   **The CMA 402 Syringe Pump should always be used in accordance with the instructions in the User's Manual.**

•   **Under no circumstances should the CMA 402 Syringe Pump be used directly or indirectly on humans.**

•   **The CMA 402 Syringe Pump should be used by trained personnel who understand its proper use.**

•   **If the CMA 402 Syringe Pump is sold or transferred, the new owner or user should be scientifically responsible and have the capacity and expertise to use the pump properly and solely for its intended purpose.**

It is in the interest of your organization and of every person who is responsible for the custody, operation, and maintenance of the CMA 402 Syringe Pump that the foregoing guidelines are complied with at all times. In the event of an accident, failure to comply could result in legal liability.

3   UNPACKING & ASSEMBLY

The CMA 402 Syringe Pump is delivered in a specially designed box to protect the instrument against damage during transportation. The reusable carton provides excellent protection when transporting the instrument or storing it for a long period of time.

3.1   Packing list

The CMA 402 Syringe Pump with accessory Kit, Ref No 800 3100 consists of:

- Syringe Pump
- External Power Supply
- EU Power Cable
- US Power Cable
- CMA RS232 PC/RJ-45 cable
- CMA/142 interface cable
- Microsyringes 1 mL, 2 pcs
- Vial holder
- CMA/11-12 Clip
- CMA/10 Clip
- Eppendorf vials 10 pcs
- Micro T
- Microdialysis CAD Software
- User's Manual

The CMA 402 Syringe Pump, Ref No 800 3110 consists of:

- Syringe Pump
- External Power Supply
- EU Power Cable
- US Power Cable
- CMA RS232 PC/RJ-45 cable
- CMA/142 interface cable
- Microdialysis CAD Software
- User's Manual

After unpacking the instrument, check the contents against the above packing list to ensure that the shipment is complete. Inspect all items for damage. Any damage or missing parts should be reported immediately to your local supplier or CMA/Microdialysis AB.

3.2   Positioning the Unit

The CMA 402 Syringe Pump can stand directly on a laboratory workbench or in any other stabile position on a vibration-free surface adjacent to a wall socket.

3.3   Connections

Please note the following when connecting other CMA instruments to your CMA 402 Syringe Pump:

Before plugging the Syringe Pump into the socket, check that the input voltage and frequency correspond to the information given on the nameplate on the power supply for the instrument.

Check the direction of the carriages. All CMA 402 Syringe Pumps are delivered with the carriages set in the forward direction.

3.4   Power Supply

For connection to the mains, use the included external adapter (power supply) with 10 W.
The CMA 402 Syringe Pump can be powered from a 12 VDC battery. Power consumption 600mA. Cable is not provided. Battery connection should be fused with T800mA.

4   DESCRIPTION

The CMA 402 Syringe Pump is delivered complete with a power cable and multi voltage power converter. Once the plug has been connected to a wall socket, the instrument is ready for use.
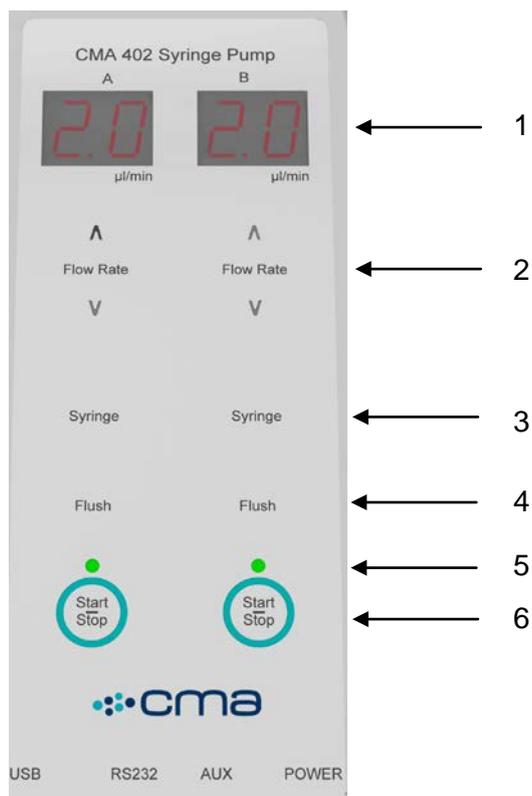
4.1 Control Panel

Figure 4.1 Control panel

Locate the following items on the control panel of the CMA 402 Syringe Pump. The separate controlled pumps are marked A and B, see Figure 4.1

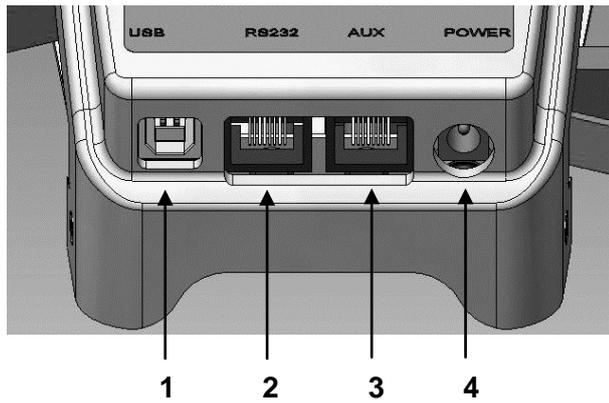| Item	Description
1. Display window	Indicates flow rates in µL/min. Indicates flow direction. Indicates the volume of the syringe.
2. Flow rate	Press the up arrow button to increase the flow rate. Press the down arrow button to decrease the flow rate. By pressing both arrow buttons simultaneously, the direction of the flow will be changed. Display window shows I for injection and S for suction. See also under Start/Stop.
3. Syringe	Press and hold the button to change the syringe size. The display indicates the size of the syringe, 1, 2.5 or 5 mL. See also under Start/Stop.
4. Flush	Push the button for a flush speed of 20 µL/min (with 1 ml syringe).
5. Green LED	Green LED on – Pump is running. Constant light indicates injection flow direction. Twinkling light indicates suction flow direction.
6. Start/Stop	Push the button to start/stop the pump motor.

4.2 Rear

Figure 4.2 Rear

The following are located on the rear of the CMA 402 Syringe Pump, see Figure 4.2

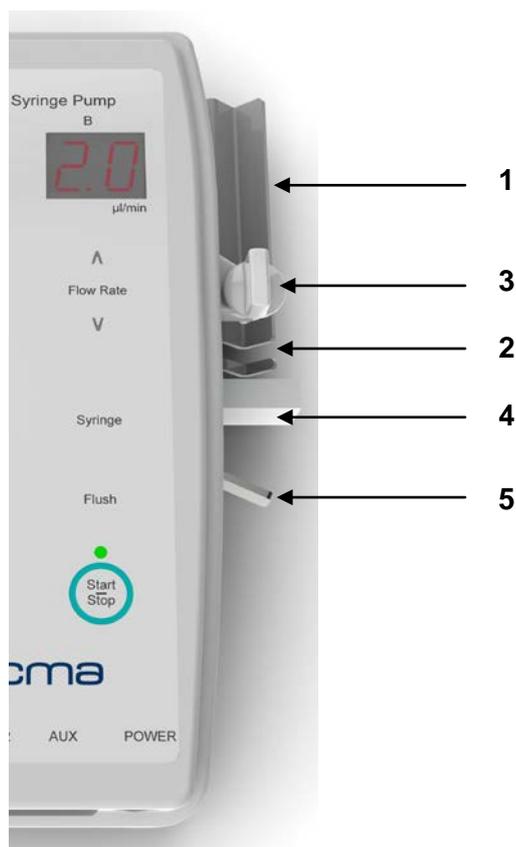| Item	Description
1. USB	Socket for USB connection to PC or other device with USB host port.
2. RS232	Socket for RS232 interface for connection to PC or other device with serial port.
3. AUX	Socket for digital Input/Output for external equipment such as CMA/142 or other instruments.
4. Power	Socket for 12 VDC inlet. Connection for power supply.

4.3   Syringe Holder

Figure 4.3 Syringe Holder

The CMA 402 Syringe Pump can operate two syringes individually.
The holder consists of a fixed bottom block (1), a V-shaped groove with an open gap (2) where the syringe flange shall be positioned and a locking screw (3).
A carriage (4) will exert pressure on the syringe plunger. Adjust the carriage to the plunger by pressing it together with the carriage locker (5).
If the flow is to be reversed or if a syringe needs to be filled/flushed without being removed from the pump, the plunger head must be attached to the carriage with a Syringe Clip, see Optional Accessories and Ordering Information, 9.2 and 14. This provides full control over the flow in both directions.

4.4   Safety Devices

The carriage movements are controlled by two limiting end sensors that will stop the motor when the carriage has reached one of its end-positions.

WARNING: Moving parts can cause injury and/or damage syringe.

5 OPERATING INSTRUCTIONS

The CMA 402 Syringe Pump is easy to use. It is advisable to read this instruction carefully before starting to use the instrument.
The CMA 402 Syringe Pump can operate two separate controlled syringes. The syringes can be individually fitted and removed.

5.1 POWER on

Connect to the AC adapter. The display illuminates.

5.2 Set flow mode

Press both arrow buttons simultaneously. In the display window, either "I" for injection mode or "S" for suction mode is shown. Stop at appropriate mode.
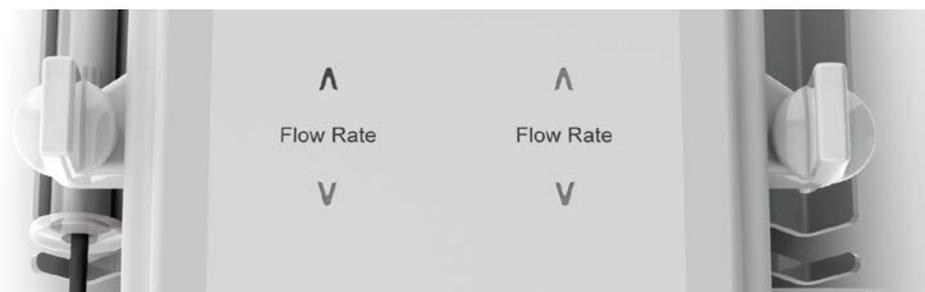

Figure 5.2 Setting flow mode

5.3 Set syringe size

The pump is pre-calibrated for microdialysis syringes having a 60 mm stroke with 1, 2.5 or 5 mL volume.

NOTE: Pump will not auto-stop with a 5ml syringe.

Setting syringe size: Press and hold the Syringe button once at the time to change the syringe size. In the display window 1, 2.5 or 5 mL is shown.
Stop at appropriate size. See also under 5.8 Start/Stop.
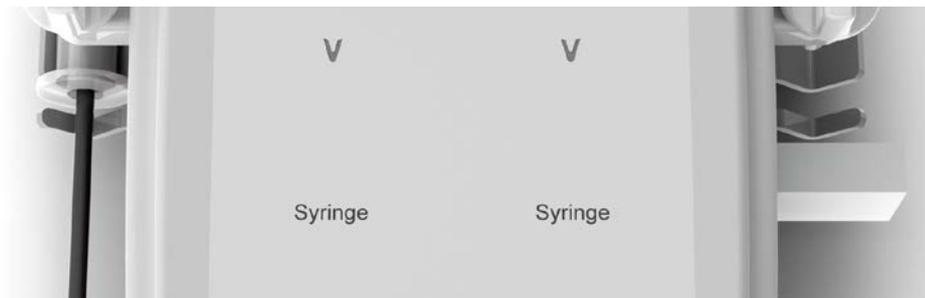(See fig 5.3).

Figure 5.3 Setting syringe size

5.4 Inserting the syringe

Insert the filled syringe in the groove in the bottom block (1), slide the syringe flange into the gap in the block (2) and secure the syringe using the locking

screw (3). Move the carriage (4) by pressing the carriage locker (5) and slide it to the syringe plunger (see fig 5.4).

Withdrawing the syringe

Press the carriage locker (1) and slide the carriage (2) backwards. Unscrew the locking screw (3). Withdraw the syringe (4).

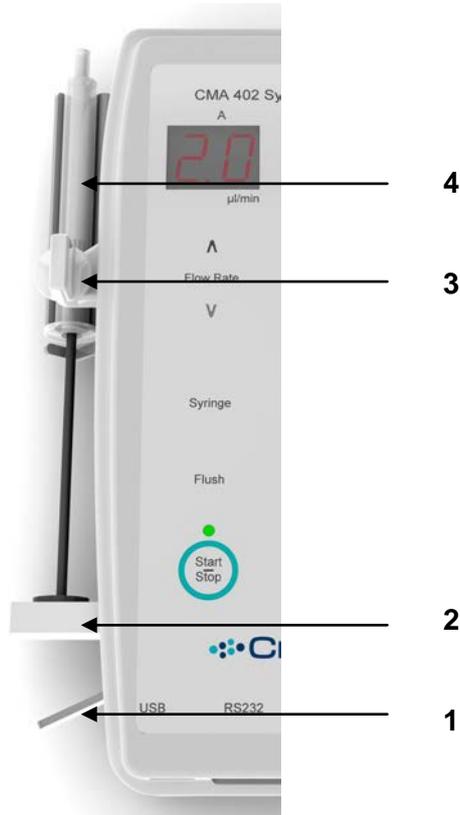**Figure 5.4** Inserting / withdrawing the syringe

5.5   Set flow rate

The flow rate in µl/min will appear in the display window. The flow rate can be preset between 0.1 µl/min and 20 µl/min. The setting can be made during operation (see fig. 5.6).

Increase flow rate: Press the up arrow.

Decrease flow rate: Press the down arrow.

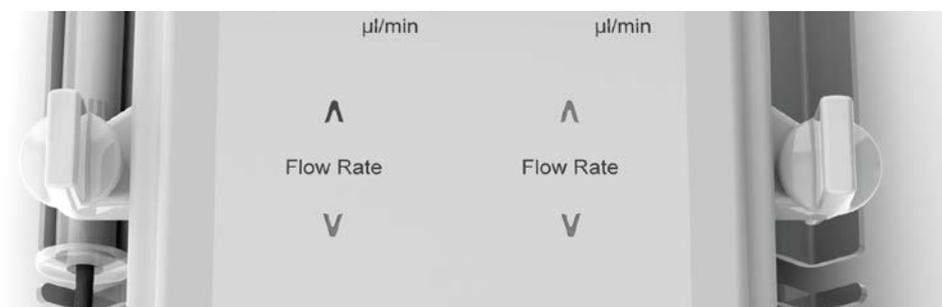**NOTE:** For other syringes sizes or other flow rates, see section 7.

Figure 5.6 Set flow rate

5.6 Flush the system

Press the "flush" button to fill the system, with a momentary flush speed of 20 µL/min (1 mL syringe).

Figure 5.7 Press "flush" to fill the system

5.7 Start/Stop

Start the pump by pressing the "start/stop" button.
The selected syringe size is shown for a short while (approx. 5 sec) in the display window, followed by the actual flow rate. The green LED indicates that the pump is running. Constant light indicates injection flow direction and a twinkling light indicates suction flow direction.
The settings will be stored when pressing the start/stop button.
At the injection mode the carriage will move forward, pushing the plunger into the syringe at the speed corresponding to the preset flow rate. At suction mode the carriage will pull the plunger backwards (syringe clip is needed, see 9.2).

NOTE: The product includes electronics, motors, gears and mechanics. Depending of the small variations in these parts, a small variety of noise or sound can occur. This can occur between individuals or within system with "identical" multiple mechanics parts. This is normally not a sign that the equipment is defective or deviate from the specification.

Figure 5.8 Press "start/stop" to start operation

6 ADVANCED OPERATION

Commands for controlling the CMA 402 Syringe Pump via the RS-232 serial or USB 1.1 socket.

The CMA 402 Syringe Pump can be controlled by a computer or terminal connected to the serial port on the pump. The CMA 402 has a simplified RS-232 RJ-45 connector suitable for direct connection to an IBM PC-compatible serial port. The following signals are available:

Pin 3: Data out (TXD)
Pin 5: Signal earth
Pin 6: Data in (RXD)

The serial port on the computer should have the following settings:
Baud rate: 9600 bps
Data bits: 7
Parity: Odd
Stop bits: 1

Control commands from the computer consist of a number of two letter combinations, with extra parameters where required (followed by <Enter>)

Command	Description
RE	Reset pump to power on condition. Response: "E RE"
SA,SB	Stop syringe A, Stop syringe B. Stops normal flow or flush. Response: "E SA" or "E SB"
DA,DB	Dispense syringe A or Dispense syringe B with preset flow. Response: "E DA" or "E DB"
FA x, FB x	Set Flow to x µl/minute for syringes A and B respectively. Flow range values 1 to 200 in steps of 1/10 µl/minute. Response: "E FA" or "E FB"
VA x, VBx	Syringe Volumes in µl. Values 1000 or 2500 µl Response: "E VA" or "E VB"
PA, PB	Parameter/Status Response: "A On = 0" "A Error = 0" "A Flow = 20" "A Size = 1000"

Programmed example:
REM This is a BASIC "sample" program for CMA 402 Syringe Pump

```
init:
OPEN "com1:9600,o,7,1,cd0,cs0,ds0,op0,rs,tb2048,rb2048" FOR RANDOM AS #1
CLS
GOSUB help
main:
WHILE com$ <> "QUIT"
LINE INPUT "Command> "; com$
com$ = UCASE$(com$)
PRINT #1, com$
IF com$ = "HELP" THEN GOSUB help
IF com$ = "?" THEN GOSUB help

WEND
```

```
CLOSE
END
help:
PRINT "CMA Microdialysis AB, SWEDEN"
PRINT "Command for CMA 402 Syringe Pump "
PRINT
PRINT "RE = Reset CMA102"
PRINT "SA = Stop syringe A"
PRINT "SB = Stop syringe B"
PRINT "DA = Dispense syringe A"
PRINT "DB = Dispense syringe B"
PRINT "FA = Flow rate in 1/10 off µl/minutes, syringe A"
PRINT "FB = Flow rate in 1/10 off µl/minutes, syringe B"
PRINT "HELP = This help info"
PRINT "QUIT = Return to DOS"
PRINT
RETURN
```

7   MICRODIALYSIS CAD SOFTWARE

The Microdialysis CAD software allows the pump to be computer-controlled in many ways. By connecting the CMA/142 Fraction Collector, through the RS232 port with the cable, the software can control the collection of fractions in time mode.
By inputting the internal volumes of tubing and probe, the appropriate calculations will be made. Also other syringe sizes can be of use.
See more information on the CD for the software.

8   ACCESSORIES KIT

The CMA 402 Syringe Pump with Accessory Kit includes an In Vitro stand and clips for use in a stereotaxic instrument.

Accessory Kit includes:

- Microsyringes 1 mL, 2 pcs
- Vial holder, for probe preparation and In Vitro test (1)
- CMA 11+12 Clip, for use in Stereotaxi instrument (2)
- CMA Probe Shaft Clip, for use in Stereotaxi instrument (3)
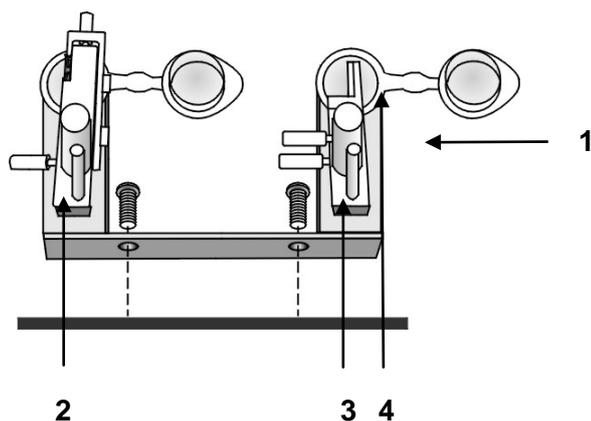- Eppendorf vials 10 pcs (4)
- Micro T, a three way connector

Figure 8.1 In Vitro stand with clips

9   OPTIONAL ACCESSORIES

9.1   Syringe

The pump is calibrated for syringes having a 60 mm stroke with the following volumes: 1 ml, 2.5 mL and 5 mL.

9.2   Syringe Clip

The clip locks the head of the syringe plunger to the carriage to enable the filling of syringes in the suction mode. This procedure is not recommended for higher flow rates because of risk of air bubble formation.

9.3   Cables

CMA 400 RS232 PC cable for computer control of CMA 402.

USB cable type A-B for computer control of CMA 402.

10   MAINTENANCE & SERVICE

The CMA 402 Syringe Pump is maintenance-free. The pump does not require periodic lubrication or changes of any parts.

10.1   Cleaning the instrument

Keep your CMA 402 Syringe Pump clean. Wipe off any spillage using a soft cloth with mild detergent or 70% alcohol.

10.2   Storage

If the CMA 402 Syringe Pump is not to be used for a significant length of time:

Disconnect the mains supply.
Clean the instrument.
Store the instrument from dust and moisture.

10.3   Warranty

CMA/Microdialysis AB (called CMA) guarantees all components of the CMA 402 Microdialysis Pump to be free from defects of material and workmanship for a period of one year after initial purchase.
For warranty service or repair, all CMA products must be returned to CMA or to an authorized representative.
The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Owner, Owner-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.
For any product expressly covered under this warranty, CMA is liable only to the extent of replacement of the defective items. CMA shall not be liable for any personal injury, property damage, or consequential damages of any kind whatsoever. The foregoing warranty is in lieu of all other warranties of merchantability and fitness for a particular purpose.

10.4 Damaged shipments

Breakages of any part of this instrument during shipping should be reported immediately to CMA Customer Service or an authorized representative. You must retain the original packing box and contents for inspection by the freight handler. CMA will replace any new instrument damaged in shipping with an identical product as soon as possible after the claim filing date. Claims not filed within 30 days after the shipping date will be invalid. Do not return damaged goods to CMA without first contacting Customer Service.

10.5 Service

CMA and CMA distributors have skilled service staff to solve your technical problems if an equipment-oriented problem should arise. For further details, call/email/fax first your local CMA distributor and secondly direct to CMA.

Headquarters:
Service Department
CMA Microdialysis AB
Pyramidvägen 9A
SE-169 56 Solna
Sweden
phone: +46-8-4701033
e-mail: service@microdialysis.se
fax: +46-8-4701050

US Office:
Service Department
Harvard Apparatus
84 October Hill Road
Holliston
MA 01746 USA
phone: (800) 272-2775
bioscience@harvardapparatus.com
fax: (508) 429-5732

11 TROUBLESHOOTING

The product includes electronics, motors, gears and mechanics. Depending of the small variations in these parts, a small variety of noise or sound can occur. This can occur between individuals or within system with "identical" multiple mechanics parts. This is normally not a sign that the equipment is defective or deviate from the specification. Would there be problems with performance, function or unwanted noise arises we will of course investigate and resolve errors that are within our warranty policy.

Error code 1:
Syringe may have reached its end stop.

12 TECHNICAL DATA

Number of syringes:	2, independently controlled
Syringe sizes:	1, 2.5 and 5 mL, piston stroke 60 mm
Flow rate range:	0.1 µL/min – 20 µL/min
Calibration:	Pre-calibrated for 1, 2.5 and 5 mL syringes
Accuracy:	± 1.5%
Speed variation:	± 1.5 %
Piston carriage speed:	2.4 µm/min - 1.2 mm/min
Fast Feed:	Approx. 20 µL/min (with 1 mL syringe)
Operation temperature:	10 – 35 °C
Display:	2-digit LED display showing flow rate or syringe size
Memory:	Non – volatile. Stores all settings
Motor:	High resolution step motor system
Voltage:	Input 100 – 240 VAC, 50 – 60 Hz, output 12 VDC (adapter included)
Power consumption:	External adaptor max 10W
External connections:	General purpose digital Input/Output
Computer connection:	RS 232 serial interface and USB interface (for user software)
Syringe size with Micro-dialysis CAD software:	Variable
Flow rate with Micro-dialysis CAD software:	Variable
Dimensions:	207 x 135 x 48 mm (W x D x H)
Weight:	Approx. 1.4 kg
Standards:	IEC 61010-1 and EN 61326-1
Directives:	

CMA 402 is designed to operate in a controlled electromagnetic environment, i.e. where radio frequency transmitters such as mobile telephones may not be used in close proximity.

13 TEXT AND SYMBOL EXPLANATION

⚠ User must consult user manual before handling

$C\!E$ The product meets EU directives for EMC and LVD

🗑 Do not dispose of this product as unsorted municipal waste.
Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of waste electrical and electronic equipment (WEEE).
European Union customers:
Contact your local CMA Microdialysis representative or your local authority for guidance.

14 ORDER INFORMATION

	Ref No
CMA 402 Syringe Pump with Accessory Kit	8003100

Including:
Microsyringes 1 mL, 2 pcs
Vial holders 2 pcs
CMA/11-12 Clip
CMA/10 Clip
Eppendorf tubes 1.5 mL, 25 pcs
Microdialysis CAD Software
Micro T

CMA 402 Syringe Pump	8003110

Including:
Microdialysis CAD software

Accessories

Microsyringe 1 mL, glass	8309020
Microsyringe 2.5 mL, glass	8309021
Microsyringe 5 mL, glass	8309022
Syringe Clip, medium, for 1 - 2.5 mL syringes	3408310
Syringe Clip, large, for 5 mL syringe	3408320
Syringe Needle, 5/pkg	7431083
Micro T	P000043
FEP Tubing 1 m	3409501
FEP Tubing 10 x 1 m	8409501
Tubing Adapters	3409500

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