CMA/100 MICROINJECTION PUMP USER'S MANUAL

CONTENTS

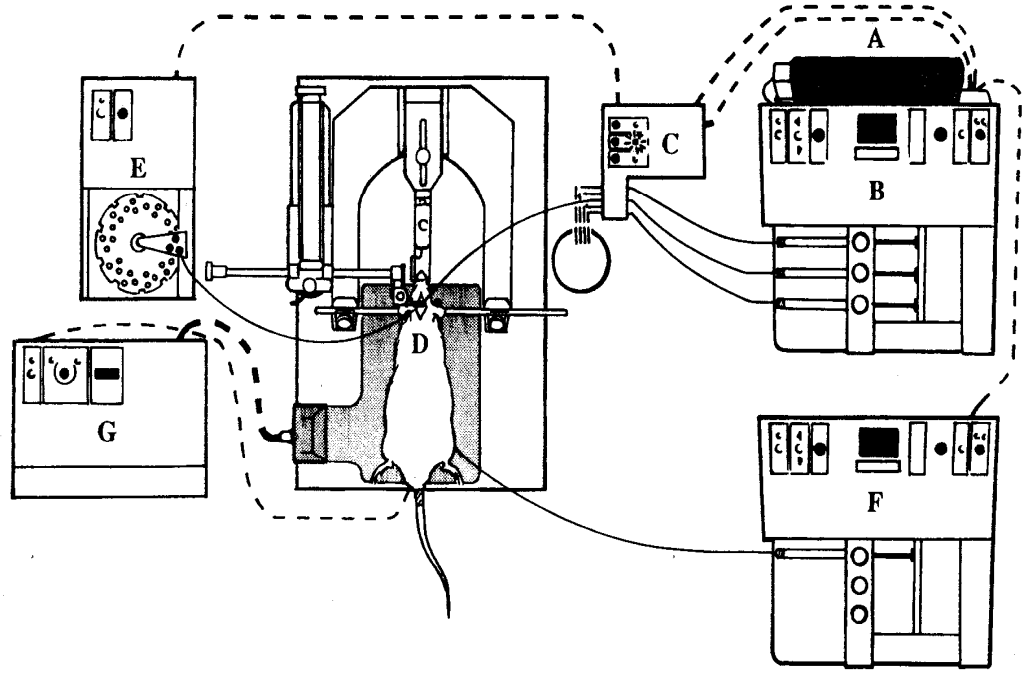
1. INTRODUCTION

The **CMA/100 Microinjection Pump** is the central unit in the Microdialysis set-up. It can perform many different tasks including:

- **Giving continuous injections with a flow rate between 1 nL/min and 1 mL/min.**
- **Giving injections of between 1 nL and 10 mL. The injection volume is preset on the pump.**
- **Giving continuous injections while collecting fractions using the CMA/140 Microfraction Collector connected to the pump. The fraction volume is preset on the pump.**
- **Giving continuous injections while collecting fractions using the CMA/170 Refrigerated Fraction Collector. The fraction volume is set using the computer controlling the microsampler.**
- **Changing injection liquid by using the CMA/111 Syringe Selector connected to the pump.**
- **Collecting fractions for direct injection into an HPLC system by the CMA/160 On-line Injector which is connected to the pump. The injection volume is preset on the pump.**
- **By using the reverse mode the pump can withdraw liquid.**

All these applications can be remotely controlled using the CMA/150 System Controller.

NOTE: When other CMA units are connected to the CMA/100 Microinjection Pump read the respective User´s Manuals for full operational details.



A. CMA/100 Microinjection Pump
B. CMA/111 Syringe Selector
C. Anaesthetized rat mounted in a stereotaxic frame
D. CMA/140 Microftaction Collector
E. CMA/150 Temperature Controller

***Figure 1**. Complete Set-Up*

The CMA/100 Microinjection Pump is specially designed for microdialysis experiments. It is a high precision syringe pump capable of delivering, without pulsation, the very low flow rates necessary for microdialysis. It is also a central unit in a system of instruments for microdialysis: CMA/111 Syringe Selector, CMA/140 Microfraction Collector, CMA/170 Refrigerated Fraction collector and CMA/160 On-line Injector, see figure 1.

The CMA/100 Microinjection Pump can operate with three syringes simultaneously. The syringes can be individually fitted and removed.

The pump is factory calibrated for syringes with a 60 mm stroke and volumes between 10 µL and 10 ml, e.g. Exmire CMA/Microdialysis AB (Type 1).

The flow rate can be preset between 1 nL/min and 1 mL/min and can also be adjusted during an injection. The total injection volume can be set between 1 nanolitre and 10 mL. A four digit LED display shows the flow rate of the injection, or the injected volume. These features can also be used to trigger the CMA/140 Microfraction Collector, CMA/160 On-line Injector or to perform local microinjections or continuous injections.

The pump has a reverse mode function which enables withdrawal of liquid with the same precision as delivery in the forward mode.

2.SAFETY

The CMA/100 Mcroinjection Pump is designed for laboratory use only, e.g. animal experiments, analytical chemistry etc. The CMA/100 Microinjection Pump is therefore not equipped with the special safety functions that are necessary for use in humans. In view of this, the following rules should always apply:

- **The CMA/100 Microinjection Pump should only be used for its intended purpose, namely as a syringe pump for injections, infusions or perfusions.**

- **The CMA/100 Microinjecton Pump should always be used in accordance with the instructions in the User's Manual.**

- **Under no circumstances should the CMA/100 Microinjection Pump be used directly or indirectly on humans.**

- **The CMA/100 Microinjection Pump must be used by trained personnel who understand its proper use and who are familiar with these rules.**

- **If the CMA/100 Microinjection Pump is sold or transferred, the new owner or user should be a scientifically responsible institution or person having the capacity and expertise to use the pump properly and solely for its intended purpose.**

It is in the interests of your organization and of every person who is responsible for the custody, operation and maintenance of the CMA/100 Microinjection Pump that the foregoing rules be complied with at all times. In the event of an accident, failure to comply with these rules could result in legal liability.

3. DESCRIPTION

The CMA/100 Microinjection Pump is delivered complete with a mains cable and plug. Once the plug has been connected to an earthed wall socket, the instrument is ready for use.

3.1 Control Panel

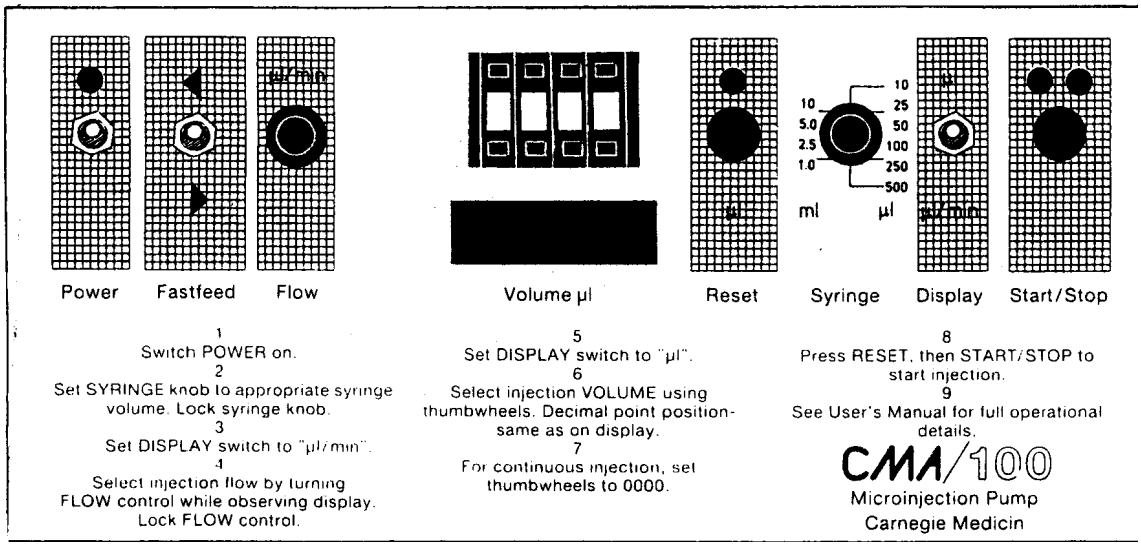


Figure 2. *Control Panel*

The following functions (from left to right) together with a brief set of instructions are located on the panel of the pump (figure 2).

Text	**Function**
Power	Power On/Off switch and LED. The LED illuminates when the switch is in the "On" position.
Fastfeed	Momentary On switch for forward/reverse fastfeed.
Flow	Knob for flow setting. Should be locked in the selected position with the lock screw located on the rear of the instrument, see figure 3.
Volume µL	Thumbwheel for setting volume (in µL) to be injected or for controlling CMA/140Microfraction Collector and CMA/160 Online Injector.

NOTE: The decimal point in the display window is automatically set when the syringe size is chosen. The decimal point position also applies to the thumbwheel.

Display window	Indicates injected volume or flow rate.
Reset	Push button used to reset the control system and to clear the display window when the display is set to "µL". The LED flashes when the injection is finished and goes out when the reset button is pressed. The pump is then ready to be restarted.
Syringe	Knob should be set to correspond to the volume of the syringe. The knob is locked with a lock screw located on the rear of the pump.
Display	Display window switch. “µL” - delivered volume since the last reset. “µL/min” - flow rate.
Start/Stop	Push button, with two LEDs, used to start/stop the PUMP motor. Green LED on - Motor running (pump operating). Yellow LED on - Motor stopped (pump stopped). In the reverse mode, the LEDs flash.
1-7	Concise instructions.

3.2 Rear

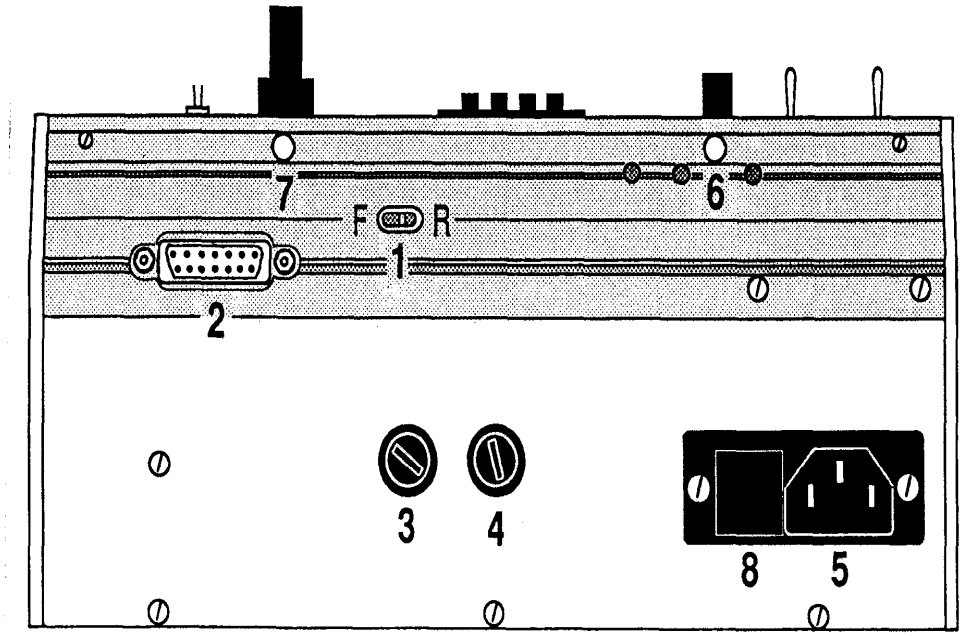


Figure 3. *Rear*

The following are located on the rear of the CMA/100 Microinjection Pump, see figure 3.

1. Switch marked FIR: F - Carriage moves in Forward direction, injection).
   R - Carriage moves in Reverse direction, filling).

   When the switch is set to F, the start/stop LEDs show a steady illumination, but flash when set to R.

   pumps are delivered with the switch set to F.

2. Connector for external equipment.
3. Fuse, (T1A).
4. Fuse, (T1A).
5. Socket for mains cable.
6. Lock screw for flow rate setting.
7. Lock screw for syringe size setting.
8. Main fuse.

3.3 Syringe Holder

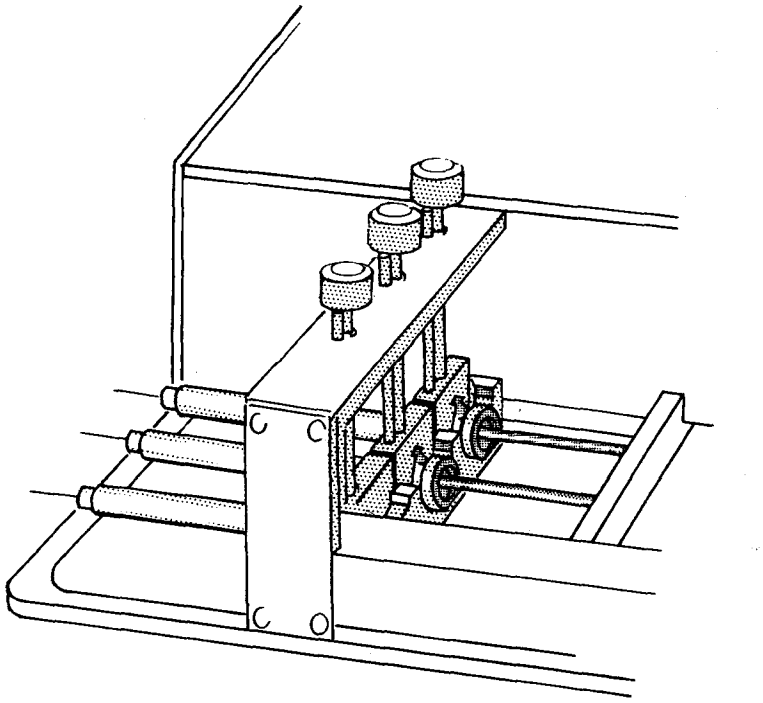


Figure 4. Syringe *Holder*

The CMA/100 Microinjection Pump can operate with three syringes simultaneously. The syringes can be individually fitted and removed.

The holder consists of a fixed bottom block with three V-shaped grooves and three individual top clamps which are secured by means of screws (figure 4). A syringe is placed in one of the grooves in the bottom block and secured by a top clamp.

When the pump is used for injection from a prefilled syringe, the plunger does not need to be attached to the carriage as the latter moves forward and exerts pressure on the plunger.

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 has to be attached to the carriage with a Syringe Clip, see Optional Accessories and Ordering Information. This provides full control over the flow in both directions.

3.4 Safety Devices

The carriage movements are controlled by two limiting switches which stop the motor when the carriage has reached one of its end positions.

If the carriage is obstructed or if either of the limiting switches fails, a built-in friction clutch prevents damage to the drive.

NOTE: The safety friction clutch is finely adjusted so that a badly mounted syringe is likely to be damaged.

WARNING: Keep hands away from moving carriage.

4. UNPACKING & ASSEMBLY

The CMA/100 Microinjection Pump is delivered in a specially designed box to protect the instrument against damage during transportation. The reusable carton provides excellent protection if it should be necessary to transport the instrument or if it i& to be stored for a long period of time.

4.1 Packing List

The CMA/100 Microinjection Pump consists of

- Microinjection Pump

- Mains cable and plug

- 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 CMA/Microdialysis AB or your local supplier.

4.2 Positioning the Unit

The CMA/100 Microinjection Pump can stand directly on a laboratory workbench or any other flat, vibration-free surface. The only other requirement is an earthed wall socket.

4.3 Connections

Please note the following when connecting other CMA instruments to your CMA/100 Microinjection Pump:

- **There have been different model revisions of the CMA/100 Microinjection Pump, depending on the production date. The revision type of your pump can be found on the nameplate on the rear of the pump, see figure 3.**

- **Microinjection pump model revisions A and B must be adjusted to be compatible with other CMA instruments. Please contact CMA/Microdialysis AB or your local supplier for assistance.**

- **Microinjection pumps with the exception of revisions A and B are fully compatible with other CMA instruments which can be connected without any prior adjustments.**

Before connecting the Microinjection Pump to the mains supply, cheek that the input voltage and frequency correspond to the information given on the nameplate on the rear of the instrument.

Cheek the direction of the carriage. Remember that all CMA/100 Microinjection Pumps are delivered with the carriage set in the forward direction.

5. OPERATING INSTRUCTIONS

The CMA/100 Microinjection Pump is easy to use and necessary instructions required are found on the control panel.

It is advisable, however, to read this User's Manual carefully before the initial startup. This will help you to understand the flexibility of the CMA/100 Microinjection Pump and to take full advantage of the many possibilities it has to offer. Thereafter, the brief set of instructions on the control panel will suffice for normal operation.

The instructions below (1-8) are identical to those you will find on the control panel.

1. Switch POWER on.

2. Set SYRINGE knob to appropriate syringe volume. Lock syringe knob.

The CMA/100 Microinjection Pump can operate with three syringes simultaneously. The syringes can be individually fitted and removed.

All three syringes can be connected to the CMA/110 Liquid Switch or to the CMA/111 Syringe Selector making it possible to select the output from any one of the syringes.

The pump is calibrated for syringes having a 60 mm stroke with the following volumes: 10 µL, 25 µL, 50 µL, 100 µL, 250 µL, 500 µL, 1 ml, 2.5 mL, 5 mL, and 10 mL.

Setting syringe size:

- Loosen the Syringe knob lock screw (figure 3).

- Set the Syringe knob to the value corresponding to the volume of the syringe.

- Tighten the lock screw.

Inserting the syringes:

- Switch on “Power”; the green LEDs above “Power” and “Start/Stop” illuminate.

- Press and hold the "Fastfeed" switch in the position. The carriage will start moving backwards and will stop automatically at its end position. Release the switch - it will automatically return to the neutral position.

- Unscrew the top clamp far enough to permit the syringe to be inserted into the holder.

- Insert the syringe in the V-shaped groove in the holder. Push it forward as far as it will go and secure it by screwing down the clamp.

NOTE: The syringe must be inserted as far forward as possible, i.e. the flange should be adjacent to the holder, see figure 4.

- Move the carriage forward by holding the Fastfeed switch in the position until it reaches the plunger.

Withdrawing syringes:

- Reverse the carriage.

- Unscrew the top clamp.

- Withdraw the syringe.

3. Set DISPLAY switch to "µL/min".

The flow rate expressed in µL/min will appear in the display window.

4. Select injection flow by turning FLOW control while observing display. Lock FLOW control.

- Loosen the Flow knob lock screw (figure 3).

- Set the required flow rate using the Flow knob by turning it clockwise/anticlockwise to increase/decrease the flow rate. The flow rate is shown on the display. Flow rate can be preset between 1 nL/min and 1 mL/min. The setting/adjusting of the flow rate can be done at any time - even during injection.

- When setting is completed, lock the knob.

NOTE: If using a syringe which has a shorter stroke than 60 mm or a syringe size that cannot be preset, set the Syringe knob to 10 ml (maximum value) and use the following formula to calculate the flow rate to be set:

$$\text{Flow} = \frac{\text{Desired flow (µl/min)} \times \text{Stroke (mm)} \times 10\,000}{\text{Syringe volume (µl)} \times 60}$$

5. Set DISPLAY switch to "µL".

The display will now show the volume delivered by the pump since the last reset.

NOTE: If using a syringe which has a shorter stroke than 60 mm or a syringe size that cannot be preset, set the Syringe knob to 10 ml (maximum value) and use the following formula to calculate the preset volume.

$$\text{Preset volume} = \frac{\text{Desired volume (µl)} \times \text{Stroke (mm)} \times 10\,000}{\text{Syringe volume (µl)} \times 60}$$

6. Select injection VOLUME using thumbwheels. Decimal point position. - same as on display.

When the pump has delivered the preset volume, it will stop unless the CMA/140 Microfraction Collector or the CMA/160 On-line Injector is connected to the pump.

The imaginary decimal point on the thumbwheel is in the same position as the decimal point on the display.

The setting of the volume can be done at any time, even when the pump is running.

NOTE: If the thumbwheel is set at a lower value than that shown on the display, the carriage will only stop when it reaches the end position. By resetting the pump, it will then stop at the desired volume.

When a CMA/140 Microfraction Collector is connected to the pump, the fraction volume is preset on the pump.

When a CMA/160 On-line Injector is connected to the pump, the injection volume is preset on the pump.

7. For continuous injection, set thumbwheel to 0000.

By setting the four thumbwheels to 0000, the pump will only stop when the carriage reaches the end position.

8. Press RESET, then START/STOP to start injection.

Start the pump by pressing the Start/Stop button. The yellow LED indicates that the pump is off, the green LED indicates that the pump is running. The carriage will move forward pushing the plunger into the syringe at a speed corresponding to the preset flow rate. If the display is set for “µL”, the injected volume value will be continuously shown.

Once the preset volume is reached, the carriage stops and the green Start/Stop LED goes out and the yellow LED illuminates. The yellow Reset LED flashes.

For repeated injections press Reset. The yellow flashing Reset LED will go out and the display is reset to 0. Restart by pressing the Start/Stop button. This can be repeated until the entire syringe contents have been utilized.

After use, move the carriage to the endposition using the fastfeed, and switch off the power. Remove and clean the syringes with distilled water.

6. OPTIONAL ACCESSORIES

6.1 CMA/110 Liquid Switch and CMA/111 Syringe Selector

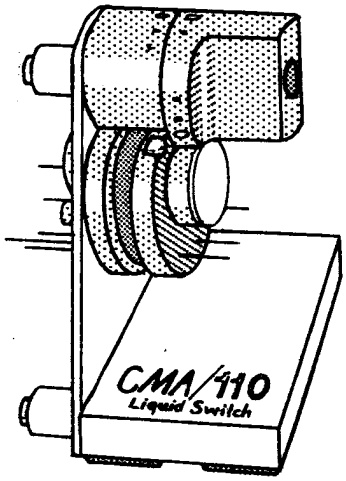


Figure 5*. CMA11 10 Liquid Switch*

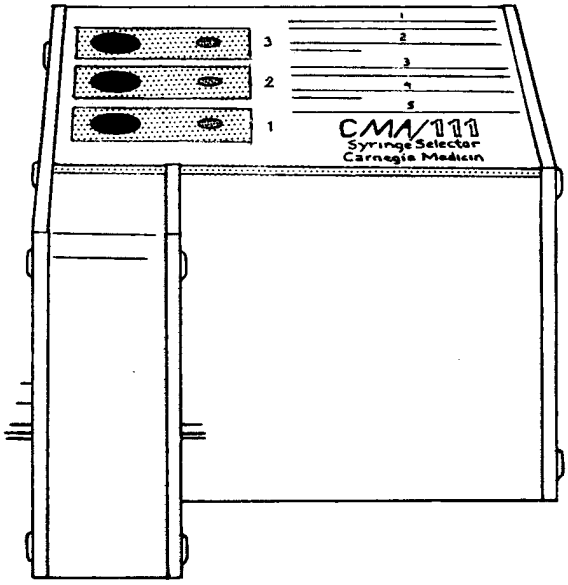


Figure 6. *CMA11 11 Syringe Selector*

The CMA/110 Liquid Switch (figure 5) and the CMA/111 Syringe Selector (figure 6) make it possible to instantaneously change perfusion medium without any risk of introducing air into the system.

The CMA/111 Syringe Selector is powered from the CMA/100 Microinjection Pump and operated manually.

6.2 CMA/140 Microfraction Collector

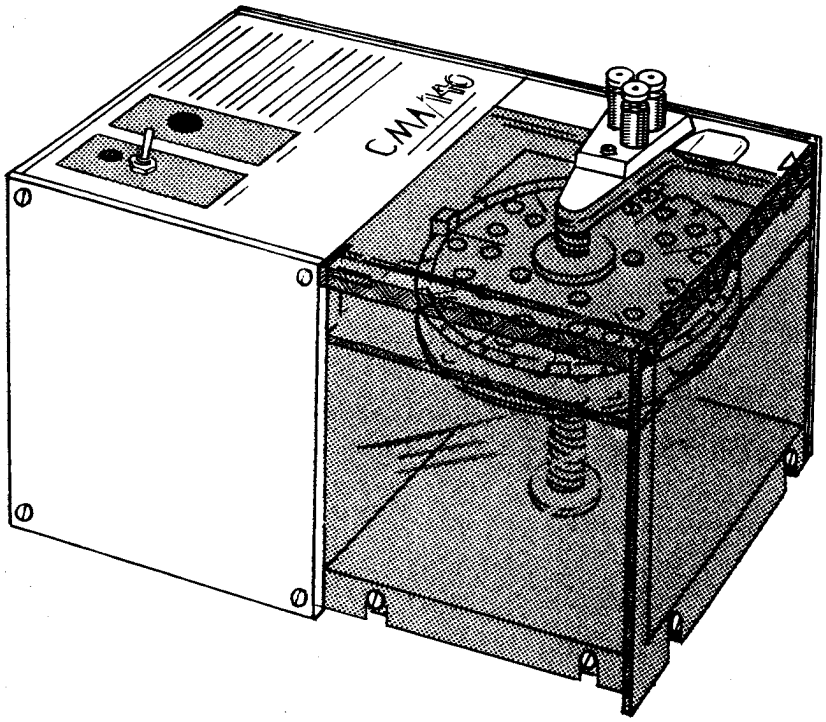


Figure 7. *CMA1140 Microfraction Collector*

The CMA/140 Microfraction Collector (figure 7) has been specially developed to collect microdialysis samples smaller than a falling droplet by allowing the outlet tube of the CMA/Microdialysis Probe to contact the bottom of the collecting vial.

The CMA/140 Microfraction Collector is connected to the remote control of the CMA/100 Microinjection Pump from which it gets its power and control signals. The volume of the fractions to be collected is set on the thumbwheel of the pump. When the pump has delivered the desired volume, the Microfraction Collector moves to the next set of three vials.

The CMA/140 Microfraction Collector uses the same collection vials as the CMA/200 Refrigerated Microsampler. Together they form a complete sample handling system for collecting samples and injecting them automatically into an HPLC system.

6.3 CMA/160 On-line Injector

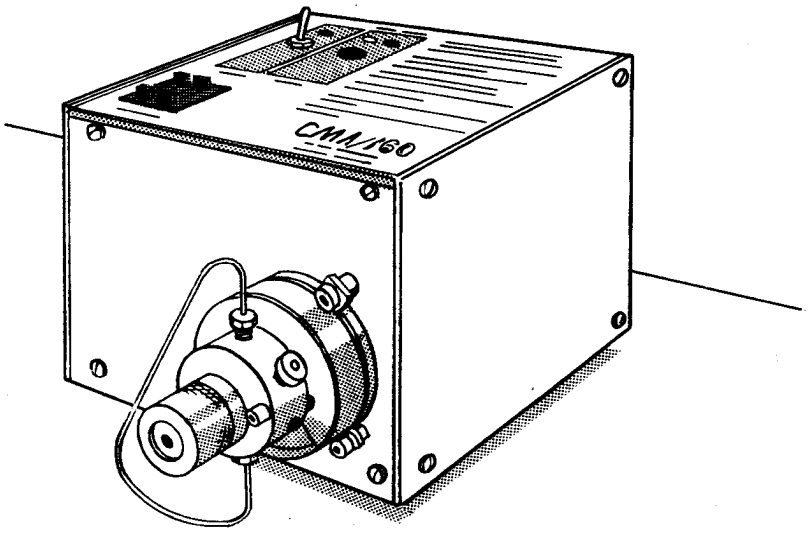


Figure 8*. CMA/160 On-line Injector*

The CMA/160 On-line Injector (figure 8) is a high pressure HPLC valve which is controlled from the CMA/100 Microinjection Pump. The volume to be injected is set on the thumbwheel of the pump. When the preset volume is reached, the valve switches and the sample is injected into the chromatograph. After a preset time, the valve switches back to the load position.

6.4 Syringe Clip

The clip locks the head of the syringe plunger to the carriage. This enables the filling of small syringes (smaller than 1 ml) by using “Fastfeed” backward. This procedure is not recommended for larger syringes because of risk of air bubble formation.

7. MAINTENANCE & SERVICE

The CMA/100 Microinjection Pump is maintenance free. The pump does not require periodical lubrication or changes of any part.

In-built safety devices protect the drive system from overloading. The replaceable fuses protect the electronics and motors.

7.1 Cleaning the Instrument

Keep your CMA/100 Microinjection Pump clean. Wipe off any spillage using a soft cloth with a mild detergent. Do not use alcohol or any other solvent.

7.2 Storage

If the CMA/100 Microinjection Pump is not to be used for a significant length of time:

- clean the instrument.

- disconnect the mains supply.

- store instrument in the shipping carton in a safe place.

The above suggestions will help keep your CMA/100 Microinjection Pump running smoothly and in good condition.

7.3 **Warranty**

The CMA/100 Microinjection Pump carries a twelve month warranty covering any material or manufacturing faults.

For advice, service or technical assistance, contact your local supplier or CMA/Microdialysis AB. Addresses and telephone numbers are included in this manual.

NOTE: Always quote the serial number of the instrument which is found on the name-plate on the rear of the instrument.

8. TROUBLESHOOTING

If the CMA/100 Microinjection Pump does not function, check that:

- the input voltage and frequency correspond to the information given on the nameplate on the bottom of the instrument.

- the wall socket is live.

- the mains cable is undamaged and properly connected both to the wall socket and to the instrument.

If the instrument still does not work:

- switch off "Power".

- check the fuses on the rear of the instrument - replace if necessary.

Should the instrument still not function, contact the service department of the supplier for corrective action.

9. TECHNICAL DATA

Syringes:	1-3 with max. stroke of 60 mm and external diameter of 19 mm. The distance between the plunger top and the syringe barrel should not exceed 15 mm.
Precalibration:	The flow rate and injected volume can be set directly on the control panel for syringes having a stroke of 60 mm. and volumes of 10, 25, 50, 100 µL and 1, 2.5, 5 and 10 mL.
Flow rate:	1 nL/min - 1 mL/min.
Injection volume:	1 nL - 9.999 mL.
Injection motor:	DC motor with variable speed setting. Preset speed is con trolled via an automatic closed-loop speed control.
Fastfeed motor:	DC motor with a carriage movement of 4.5 mm/s in both directions.
Display:	4-digit LED display. Can be toggled between flow (µL/min) and injected volume (µL).
Speed variation:	± 0.5%

Fuses:	2 x 1A, normal action.
Mains voltage:	240 V, 50/60 Hz. 220 V, 50160 Hz. --- Main fuse: 315 mA 115 V, 50/60 Hz. 100 V, 50/60 Hz. ---Main fuse: 630 mA
Dimensions:	230 x 215 x 116 mm
Net weight:	4 kg
Shipping weight:	5 kg
Cable length:	2.4 metres
Remote control:	Pump - 15-pin connector
Signals:	Standard TTL compatible, negative logic Active - Low (0 V) Inactive - High (+5 V)
Pin assignments:	8 7 6 5 4 3 2 1 15 14 13 12 11 10 9 “D-SUB” 1. Power ground 2. Reset/Start 3. Start/Stop 4. Motor On 5. Reset 6. Counter wheel 7. Signal GROUND 8. Preset Value 9. Speed Control 10. Not used 11. + 5 V unreg. 12. + 24 V unreg. 13. Reverse mode 14. Fastfeed forward 15. Fastfeed reverse

10. ORDERING INFORMATION

Name		REF No
CMA/100 Dfficroinjection Pump		8210040
Microsyringes: 1 mL		8309020
2,5 mL		8309021
5 mL		8309022
10 mL		8309023
Syringe Clip: 10 µL - 1 mL		3408300
2.5 mL and 5 mL		3408310
10 mL		3408320
CMA/7 Microdialysis Probe, Cup	1 mm	P000082
	2 mm	P000083
CMA/11 Microdialysis Probe, Cup	1 mm	8309581
	2 mm	8309582
	3 mm	8309583
	4 mm	8309584
CMA/12 Microdialysis Probe, PC	1 mm	8309561
	2 mm	8309562
	3 mm	8309563
	4 mm	8309564
CMA/12 Microdialysis Probe, PES	2 mm	8309662
	3 mm	8309663
	4 mm	8309664
CMA/20 Microdialysis Probe, PC	4 mm	8309570
	10 mm	8309571
CMA/20 Microdialysis Probe, PES	4 mm	8309670
	10 mm	8309671
CMA/7 Guide Cannula	3 pc/pkg	P000137
CMA/7 Guide Cannula	30 pc/pkg	P000138
CMA/11 Guide Cannula	3 pc/pkg	8309017
CMA/11 Guide Cannula	30 pc/pkg	8309018
CMA/12 Guide Cannula	3 pc/pkg	8309024
CMA/12 Guide Cannula	30 pc/pkg	8309025

CMA/110 Liquid Switch	8308200
CMA/111 Syringe Selector	8308210
CMA/140 Microfraction Collector	8214000
CMA/160 On-line Injector	8316000
FEP-tubing (1 m)	3409501
FEP-tubing (1 m x 10)	8409501
Tubing Adapters (pkg=10)	3409500
CMA/10 Clip	8309003
CMA/11 + 12 Clip	8309013
CMA/7 Clip	P000136
Perfusion fluid T1	P000034
Perfusion fluid CNS	P000151

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