CAMAG®

INSTRUCTION MANUAL
DBS-MS 500

Zertifiziertes Managementsystem SQS ISO 9001

Content

1 Introduction

1.1 Intended use of the equipment

The main function of the DBS-MS500 is the fully automated solvent extraction of dried blood spot samples for detection by a mass spectrometer. The samples are delivered on cards, with up to four spots per card. To ensure reliable automated sample extraction and handling, these cards are stored in removable racks which hold them in exactly defined positions inside the instrument. The instruments handling module picks cards out of the rack and carries them to an image processing system and then to an optional station for the application of the internal standard before delivering the card to the extraction unit. Finally, the sampled cards are stored back in the rack position they were picked from. With the image processing system, multiple quality factors and identification features of each card will be measured and checked to ensure the correct spot is sampled and that this spot has not been incorrectly spotted, or previously sampled. The exact positioning of the card in the extraction unit will be made according to these values. The optional IS working solution will be applied at the internal standard station to only the sample to be extracted. At the extraction unit the analyte will be eluted out of the card using the preferred solvents (specific extraction solvent mixture). This extract will then be delivered to the HPLC-MS system for further separation and detection as required. Handling and extraction processes are to be designed for maximum robustness and minimum carryover.

1.2 Basic overview

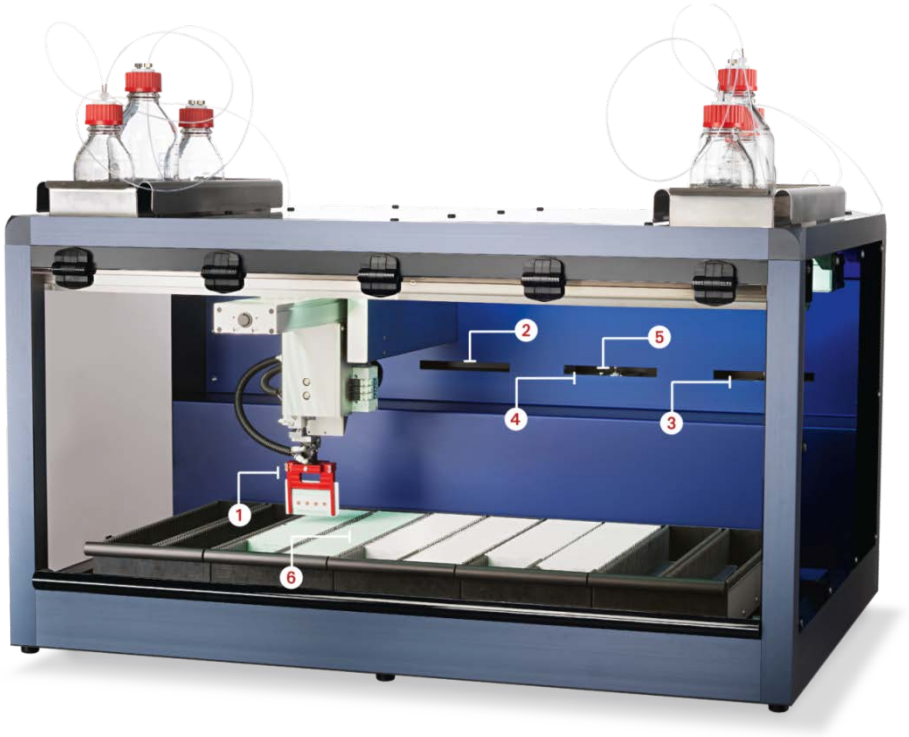


Fig. 1: The DBS-MS 500, Overview of functionalities

1. Pick up DBS cards (Robotic-module)

Highly reliable robotic are used for handling of DBS cards. The cards (type: ID Biological Systems or Whatman) are stored in up to 5 racks each with a capacity of 100 cards. The robotic include a newly developed griping tool specifically adapted to DBS cards. The gripping tool picks up cards and moves them to all of the subsequent processes in the corresponding modules.

2. Optical card recognition (OCR-module)

A digital camera with adapted sensor determines the cards properties: spot number and position, checkbox status and barcode information. The DBS card is only accepted for analysis if all parameters comply. CAMAG has incorporated its knowhow of more than a decade of optical HPTLC image analysis to build this precise and reliable OCR-module.

3. Internal standard application (ISA-module)

Variability in the absolute response of LC-MS systems can now be corrected by applying an internal standard solution onto DBS cards directly before the analysis. This also allows correcting for extraction efficiencies. The application of the internal standard just before the extraction of the DBS card is much easier from a logistic point of view than adding the internal standard before the blood sample is spotted onto the DBS card. CAMAG has been manufacturing high precision application instruments for HPTLC for a long time and has used this experience to build the ISA-module.

4. Extraction of the DBS card (Extraction-module)

The precise extraction process involves a sample loop which is independent from the LC-MS system, thus allowing for high flexibility for differ fluid configurations. Whether you are using a standard sample loop of 20µL or want to flush 200µL of solvent through a trapping column – the system can be configured according to your needs, just like your usual LC-MS system.

5. Wash station (extraction –module)

Requirements regarding carry-over limits are a challenge, particularly for direct sample loop filling without a trapping column. Therefore a designated wash station cleans all parts that are in contact with the DBS cards and additionally flushes the entire tubing to avoid any carry-over. Using this system, independent user tests confirm that carry-over is not an issue.

6. Replace DBS cards

Finally, the robotic gripping tool puts the cards back into their original position in the rack. Depending on user requirements there are additional options, e.g. verification of DBS cards for proper extraction or further tests depending on future requirements.

1.3 Fluidic principle

Fig. 2 shows the fluidic principle diagram with loop valve (V2) in position "Elution". The Elution pump presses the elution solvent through the ambos and DBS card into the DBS-MS500 loop (connection 3 and 8 of loop valve). Meanwhile the flow of the LC pump is bypassed (through connection 4 and 7).

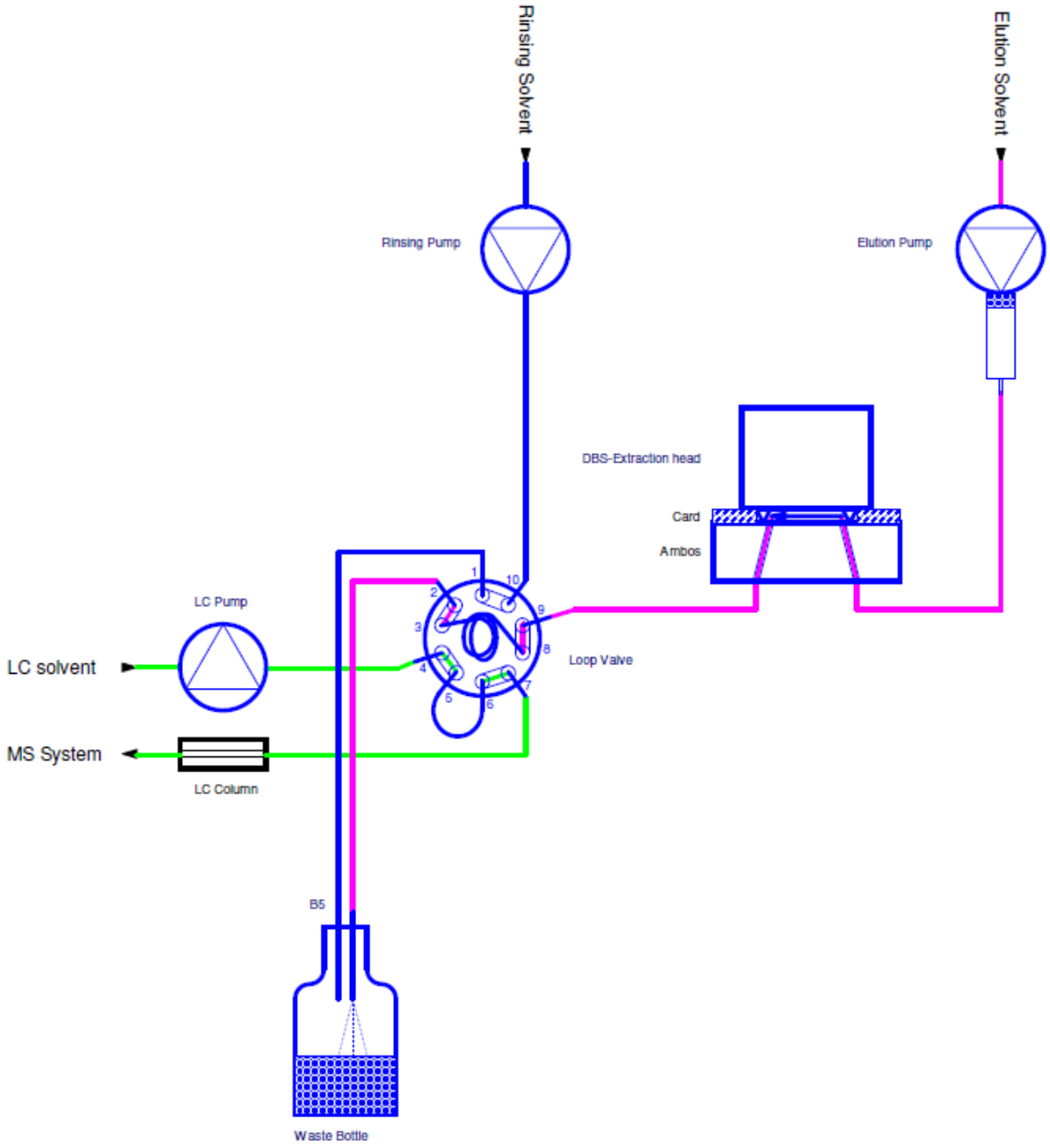


Fig. 2 Fluidic principle diagram in position "Elution"

Fig. 3 shows the fluidic principle diagram in position "Inline". The LC pump generates a steady flow of LC solvent. This transports the elution solvent from the DBS-MS500 loop into the MS system. Meanwhile, the rinsing pump is connected through the port 10 and 9

to ambos. The rinsing unit is placed in-between the ambos and the extraction head. The rinsing solvent is cleaning the ambos and extraction head.

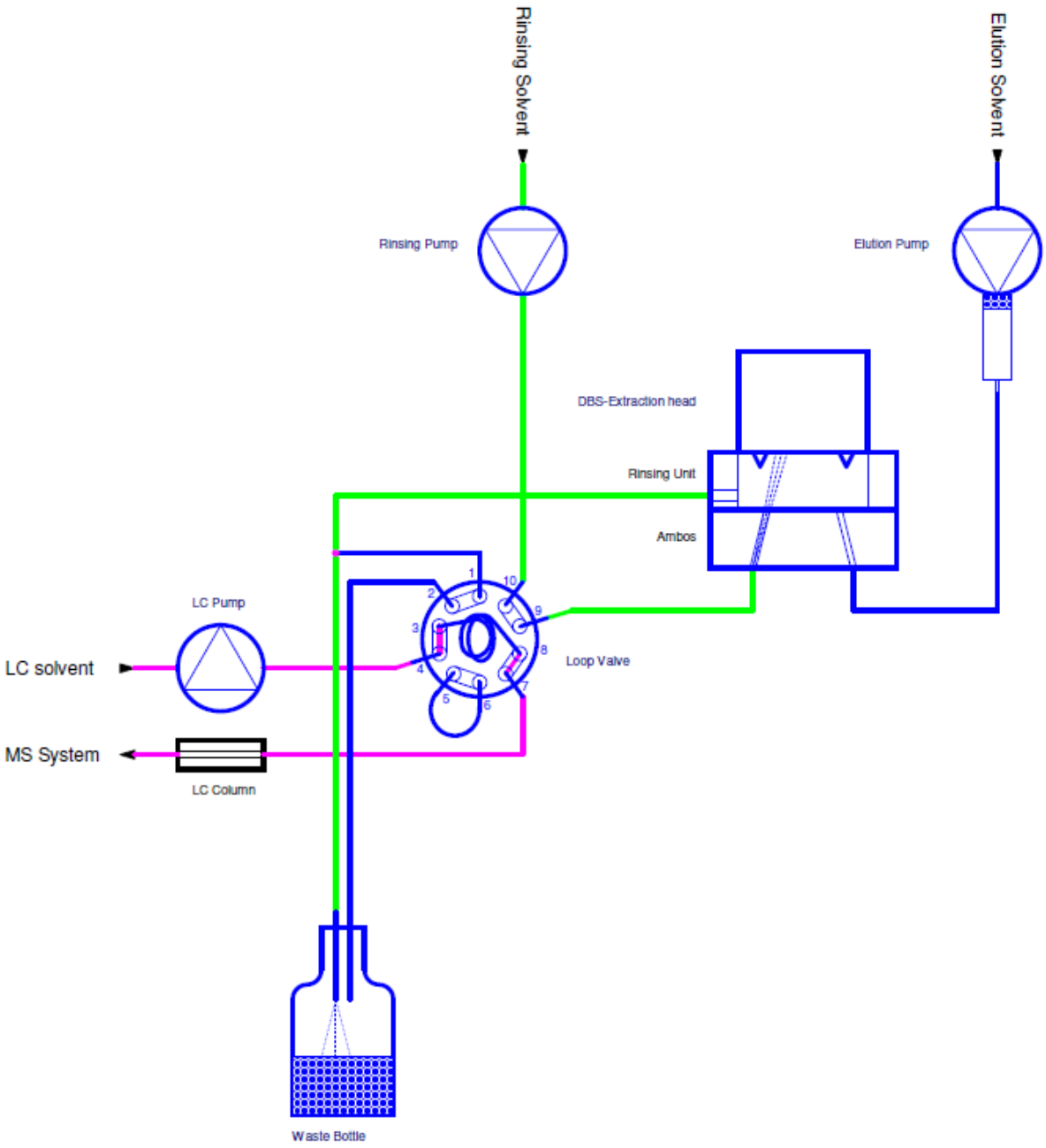


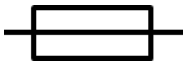
Fig. 3 Fluidic principle diagram in position "Inline"

1.4 Precautions

- Please read this operating manual before starting the installation! This manual contains information and warnings the user has to follow to ensure reliable operation of the instrument

- Some interior parts of the instrument are under AC power. Careless and improper use can cause injury. Unauthorized manipulations can cause damage

- If the instrument is used in a manner not specified in this manual, the protection provided by the equipment may be impaired
- This sign indicates (on instrument and in this manual) that failure to take note of the accompanying information may result in damage of the instrument
- The instrument is manufactured and tested in accordance with the respective European safety publications shown on the Declaration of Conformity (DoC). The instrument complies with safety class 1 and has been designed for indoor use only (IP 20). Further, this device has passed the CAMAG Quality Assurance tests and has been delivered in safe operation condition. For detailed instrument data see chapter technical data
- Attention: For safety reasons the instrument may only be used for the purposes described in the operating manual
- To avoid injury use adequate safety equipment (protective goggles, gloves etc. if applicable) when working with the instrument
- Before first operation, check whether the voltage shown on the instrument matches your local mains voltage. The power cord may only be connected to a grounded, fused (not higher than 16A) outlet. Do not use extension cords without ground contact
- When working with the fluids of the instrument, be sure to take the appropriate caution (protect your eyes from direct contact with liquid)
- Risk of finger squeeze between moving parts; be careful closing the door
- The instrument may be used only by properly trained laboratory staff
- The instrument may not be used in rooms with danger of explosions
- The instrument contains highly sophisticated electronics and optical parts. It may be operated only in a non-condensing atmosphere in the temperature range outlined in the chapter "Technical Data". Before installation and use, the instrument should be acclimated properly
- Use a damp lint free cloth for cleaning the instrument surface. Do not employ aggressive detergents
- Protect yourself and the instrument from electrostatic shock which can cause damage to the electronic parts
- Only authorized personnel may open the instrument. Service and repair is only to be performed by trained specialists. Use spare parts and consumables supplied by CAMAG only. The warranty is voided if parts from other sources are used. Check the service manual before you start service to reduce product-specific risks
- The power cord has to be removed before the instrument is opened. It is not permitted to work on an instrument that has been opened and is connected to the power supply



- Spare fuses must be of the type specified by the instrument manufacturer. It is forbidden to short-circuit or manipulate fuses
- Use only the original, with the instrument delivered power cord type
- If the instrument is found to be defective, it must be switched off and steps must be taken to ensure that it cannot be switched on by mistake
- If liquids penetrate the inside of the instrument, the power has to be disconnected immediately. Small amounts of liquid can be wiped off and/or dried by means of a hairdryer, with larger amounts of liquid a service technician has to be called. A test of functionality has to be performed in all cases
- Carry out all safety checks and the preventive maintenance as recommended by the manufacturer in order to assure your personal safety and the full functionality of the instrument. Have an authorized service specialist perform any service not described by this manual
- See original manufacturers' manuals for further safety data on third party equipment supplied with the system
- Lift/move/transport the system with the necessary care and with sufficient manpower (install the transport security devices if applicable, transport it only in the original packaging)
- The safety of any system incorporate with the equipment is the responsibility of the assembler of the system
- When working with analytical instrumentation, you must know the potential hazards of using chemical solvents. Many organic solvents, mobile phases and samples are harmful to health. Be sure that you know the toxic and infectious properties of all substances you are using

- This sign draws attention to the potential risk of injury due to hot surfaces. Allow to cool down before touching!

- This sign draws attention to the potential risks due to pathogenic or genetically modified organisms and serves to reduce the dispersal and uncontrolled multiplication of organisms and to protect people from unintentional infection. If handling with such substances be aware of the applicable guidelines

- This symbol draws attention to the fact that this equipment must not be disposed of as unsorted municipal waste but is to be collected separately as electrical and electronic equipment (WEEE-Directive 2002/96/EC). To properly recycle the instrument or parts of it you are requested to send the equipment back to the distributor, producer or an adequate collection system at the end of its life. This will have potential effects on the environment and human health

1.5 Parts supplied

DBS-MS 500 basic, parts supplied with the instrument

Part no	Units	Reference
050.0705	1	Chronos Software license
110.5115	1	HMI (user interface)
115.5139	1	Waste canister 10L GL45 including tube/filter
115.5110	5	Rack
125.1035	1	Cable to HMI
125.5152	1	Contact closure cable
305.00xx	1	Power cord
666.0008	2	Fitting Peek long
666.0029	5	Solvent filter solvent/rinsing bottles
672.0002	3m	Tubing Polyurethane (to compressed air)
672.0029	1m	Tubing PVC (to waste canister)
672.1016	2	Tubing clamp
663.1002	1	Seal
720.3095	1	Tubing ferrule
735.3008	2	Vat for solvent bottles
960.0062	2	Bottle for extraction/rinsing 500ml
960.0088	2	Bottle for rinsing 1000ml
960.0087	4	Bottle for internal standard (IS) 25ml
960.0064	1	Bottle for rinsing IS 250ml
B.050.0500E	1	Instruction manual
804.0500	1	Unpacking the DBS
804.5101	1	Entfernen der Transportsicherung D/E

For spare parts and replacement cycles, check the Maintenance Data Sheet (attachment A)

1.5.1 Optional Parts

DBS-MS 500 basic, parts supplied with the instrument

Part no	Units	Reference
050.0590	1	Customer Suitcase
050.0591	1	Maintenance Suitcase

2 Unpacking/Installation

2.1 Unpacking

Check with reference to the parts supplied section whether any parts are missing.

Lift the instrument carefully out of its packaging.

2.2 Installation environment

The place for installation should meet the following requirements:

Connections	115 / 230V AC; 50 / 60Hz; min. 130W; A grounded outlet should be within 2 meters of the instrument Contact closure connector HMI connection Compressed air 5,5 - 8 bar; 6mm tube (outer diameter) Connection from LC pump/ to LC/MS system (as short as possible) Waste canister connecting tube For Chronos: PC with one additional Ethernet port
Bench specification	Width: 1260 mm (including handles) Depth: 800 mm (add 250 mm at the rear for tubing and connections, add 450 mm in front to open the door) Height: 660mm (plus solvent bottles and capillaries) Plus adequate space for the waste canister underneath the instrument Place the instrument at a solid desk with at least 150Kg load-carrying capacity
Operating temperature	The temperature should be within a range of 15 to 30° C and free of significant variations.
Humidity	Humidity and temperature must not cause condensation
Atmospheric conditions	Adequate ventilation free of acidic, alkaline or other gas that may corrode metal or painted surfaces must be secured
PC specification for Chronos	Windows XP SP3, Vista or Windows 7 At least 4GB RAM Microsoft .NET Framework 4.0 has to be installed Additional network connection to DBS-MS500

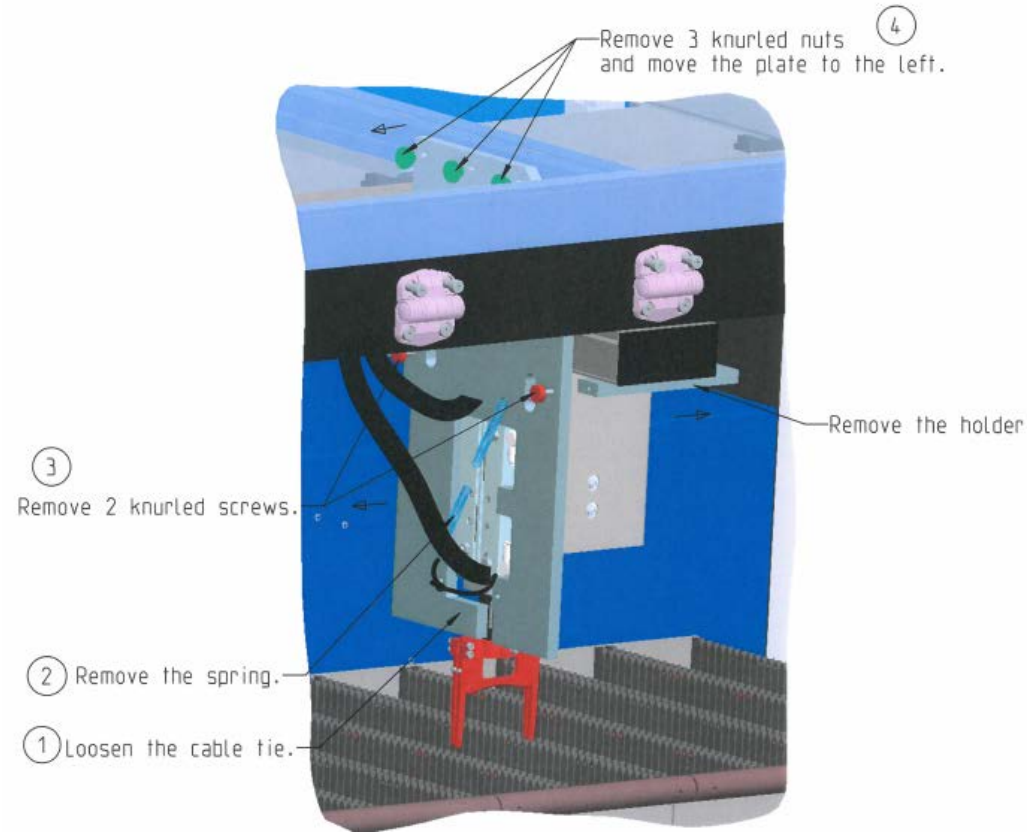
Use only the original power cord delivered with the instrument.
The power cord has to remain accessible at all time.
Add adequate space for the user interface next to the instrument.
Add adequate space in front and above the instrument to open the door.

Other requirements:

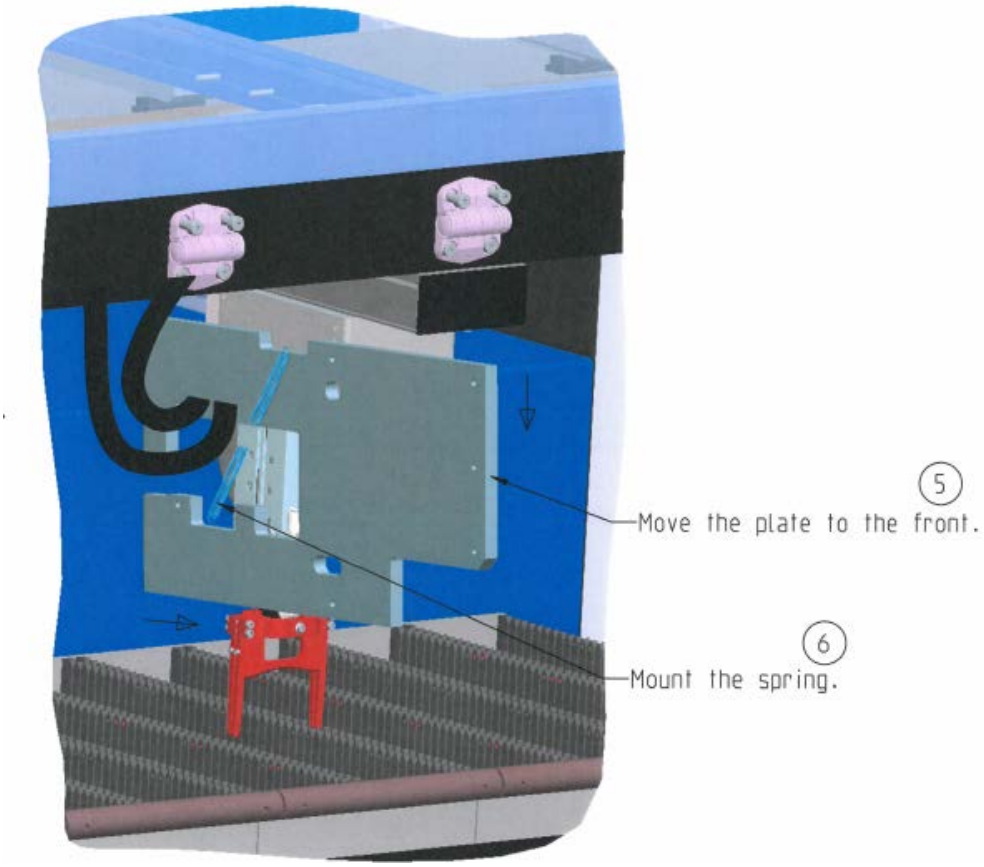
- Do not place the instrument in a location where the temperature undergoes significant changes (e.g. under an air conditioning duct or by a window)
- Significant changes in temperature will affect the performance of the unit
- Do not place the instrument in direct sunlight. Direct sunlight may create significant temperature changes which will affect the performance of the system
- Do not expose the instrument to any strong vibration or shock
- Avoid placing the instrument near equipment that radiates heat. Do not place the instrument near gas burners, electric heaters or ovens
- Do not place the instrument near equipment that generates intense magnetic fields such as electric welding equipment, high frequency furnaces, pole transformers, etc.
- Protect the instrument from excessive dust
- Connect the instrument to power lines that are free from sudden changes or voltage fluctuations
- If you must use power motor driven equipment (such as a stirrer or shaker) in the same line as your instrument, ensure that a noise reduction unit is in the same power line

2.3 Removal of shipping protection

1. Loosen the cable tie
2. Remove the spring of the gripper arm
3. Remove the 2 knurled screws and the gripper arm holder
4. Remove the 3 knurled nuts and move the plate of the shipping protection to the left



5. Move the plate of the shipping protection to the front and
6. Mont the spring of the gripper arm



2.4 Installation of the instrument

- Mount the 5 racks (insert the backside of the racks first)

Fluidics

Empty the waste canister on a regular base, if you refill the extraction/rinsing bottles check the solvent level of the waste canister.
Make sure all bottles are clearly and correctly labelled with their content.
CAMAG strongly recommends using degassed solvents only to reduce micro-bubbles in the system.

- Connect the waste canister according below figure

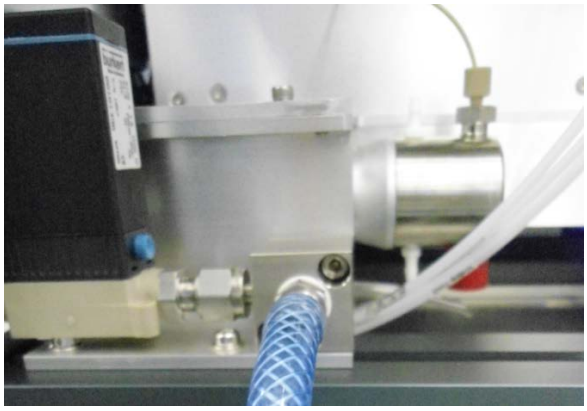


Fig. 4: Waste canister connection

- Fill and connect the solvent bottle 1 (500ml, tube "Elution 1" and "E1/R3") with your appropriate elution solvent
- Fill and connect the solvent bottle 2 (500ml, tube "Elution 2" and "E1/R3") with your appropriate elution solvent
- Fill and connect the rinsing liquid bottle 1 (1000ml, tube "Rinsing R1") with your appropriate rinsing solvent
- Fill and connect the rinsing liquid bottle 2 (1000ml, tube "Rinsing R2") with your appropriate rinsing solvent
- If applicable, fill and connect the internal standards (IS) bottles (25ml, IS1, 2, 3, 4) with your appropriate standard solution
- Fill and connect the IS rinsing bottle (250ml) with your appropriate solution
- Connect the external system pump with 10-32 fittings to Valve3, port 4; according fig. 5 and 6
- Connect the MS with 10-32 fittings to Valve 2, port 7; according the below figure

CAMAG strongly recommends keeping the connection as short as possible (no longer then 2m) to maintain measurement accuracy and quality.

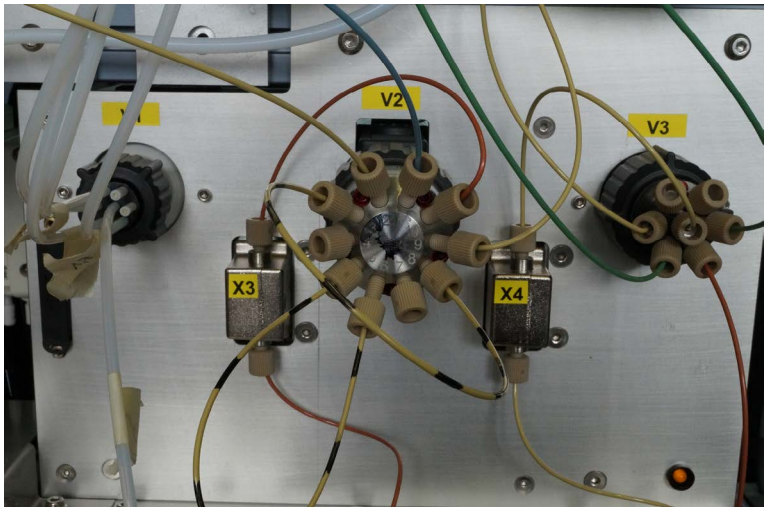
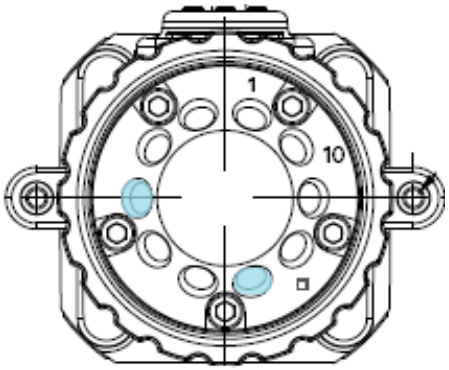


Fig. 5: Fluid Sel F-V1 /Loop F-V2/ CDM F-V3 valvs



Port 4: From LC Pump

Port 7: To LC/MS system

Fig. 6: Loop valve F-V2 connection scheme

Electrics

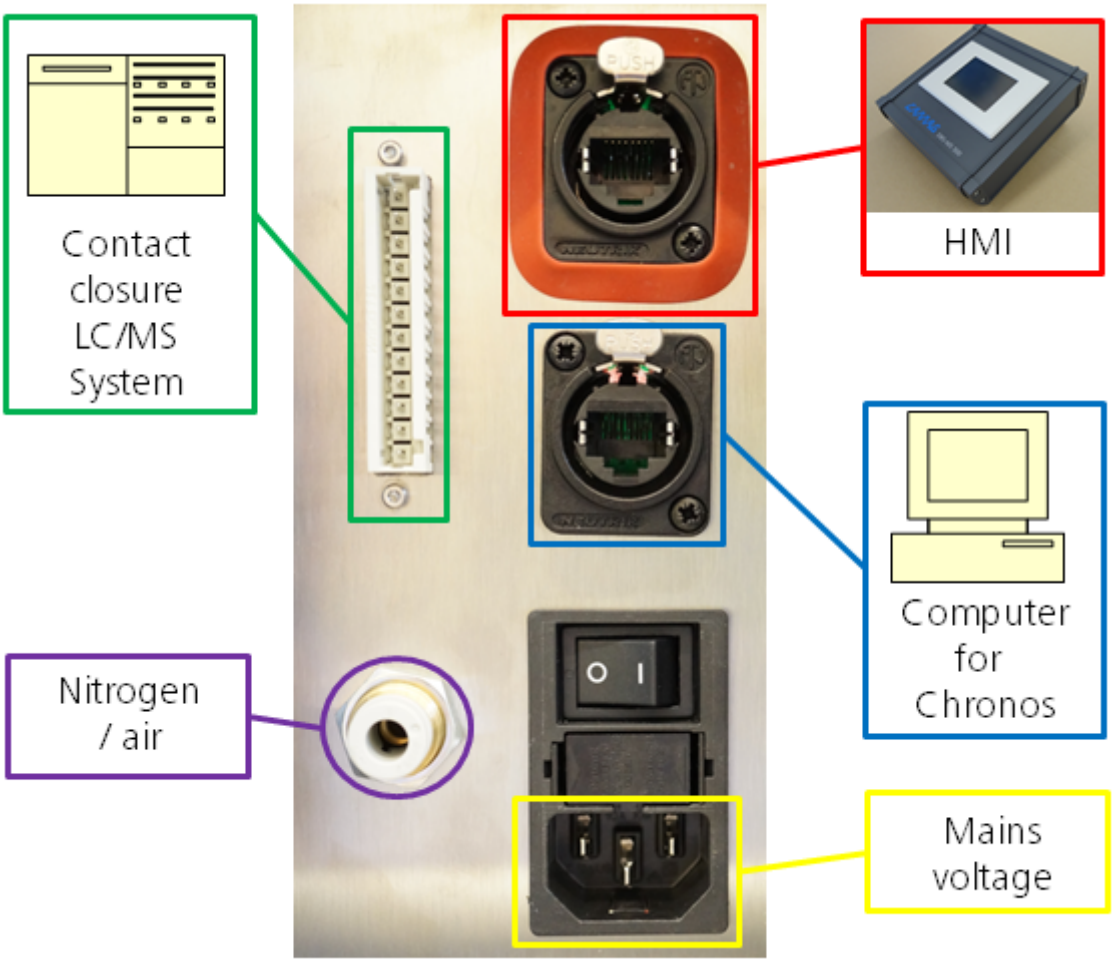


Fig 7. Electric connection panel

- Connect the HMI with the instrument (red)
- Connect the air or Nitrogen pressure (>5.5 bar up to 8 bar) with a 6mm outer diameter hose (purple). Make sure you keep the length of the hose as short and the diameter as big as possible
- Connect the required contact closure according table 1 (green, additional information about the contact closure you can find in the environmental specification of the instrument) to your measurement system control

Pin	Signal	Description
1	NC	Relay 1; Loop Inline (Start signal to LC/MS)
2	NO	
3	COM	
4	NC	Relay 2; DBS Ready (DBS-MS500 is ready)
5	NO	
6	COM	

7	IN+	Opto 1; LCMS Ready (LC/MS is ready)
8	IN- (GND)	
9	IN+	Opto 2; Start NxtExtr (DBS-MS500 can start next extraction)
10	IN- (GND)	
11	+24V	Power
12	GND	Power

Table 1: Contact closure connector

Legend: *NC = normally closed*
NO = normally open
IN+ = optical input positive (24V)
IN- = optical input ground (GND)

- Connect the power cord (use only the original delivered CAMAG power cord)
- Connect the LAN cable to the computer (for use of CHRONOS software)
- Switch on the unit

2.5 Priming

Prior to first use or after a longer period of non-using the instrument, the fluidic has to be filled with the respective solvents (Priming).

Priming of extraction circuit

- Choose "Manual"
- Choose "Extractor"
- For the extraction pump (Prime EX):

If the system was completely empty, priming can take up to 50 cycles

- For the rinsing pump (Prime Ri): Activate the pump for about 60 sec.

If the system was completely empty, priming can take up to 5 min.

Priming of IS circuit

- Choose "manual"
- Choose "Internal Standard"
- Choose the appropriate IS Bottle
- Set the no of Prime Cycles to 5
- Set the destination parameter to "to waste"
- Activate the priming
- Set the destination parameter to "to Needle"
- Activate the priming
- Repeat the steps above until no more air bubbles are visible in the IS syringe

Priming of IS cleaning circuit

- Choose "manual"
- Choose "Internal Standard"
- Set the time parameter to "5'000" (ms)
- Activate the priming by clicking the "cleaning" button
- Repeat the steps above until a nice and constant jet of IS cleaning solvent is visible

At the priming stage, watch out for any signs of leakage at the fluidic part of the instrument.

Your system is now ready to use!

3 Getting started

3.1 The HMI (Human-Machine interface)

The HMI allows you to control and set all parameters of the DBS-MS500.

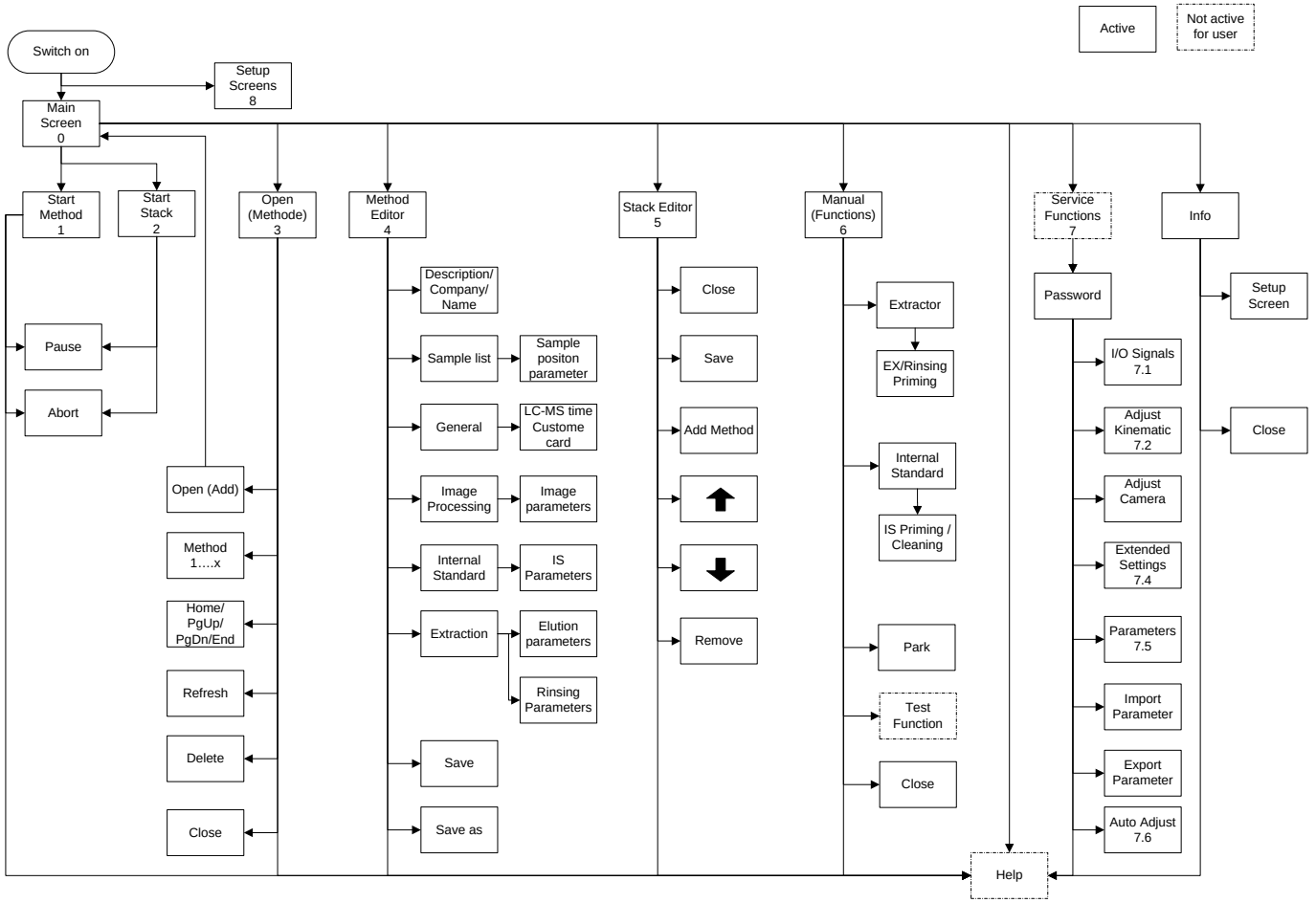


Fig. 8: Overview of HMI menu structure

3.2 Setting up an extraction with HMI support

- Mount the DBS cards (upside down, front side with DBS spots facing towards the back of the instrument) to extract into the racks (in a continuous way)

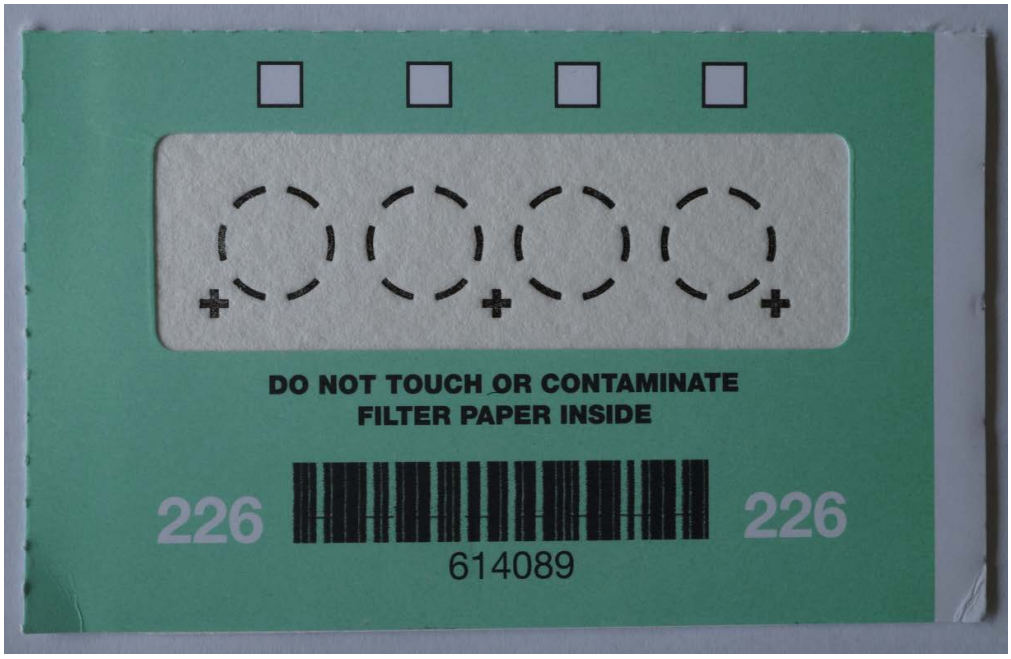


Fig.9: DBS card (front side, upside up)

- Switch the instrument on. Wait until the booting process has ended, the white light goes on and on the HMI the main screen is displayed

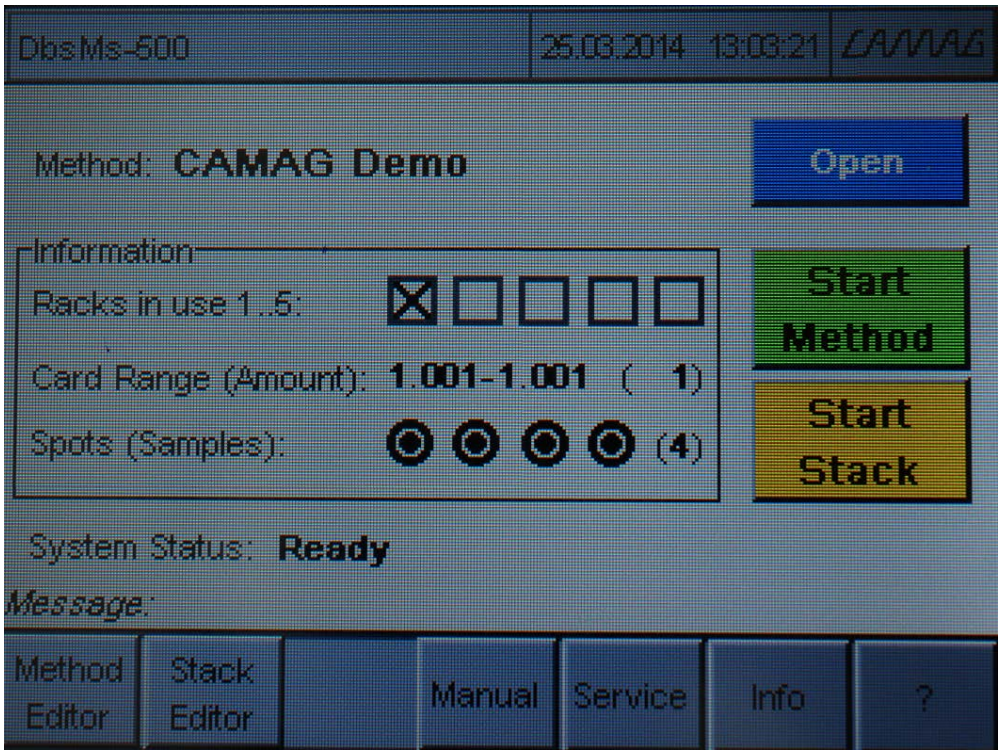


Fig.10: Main screen of HMI

General method settings

- Choose "Method Editor"

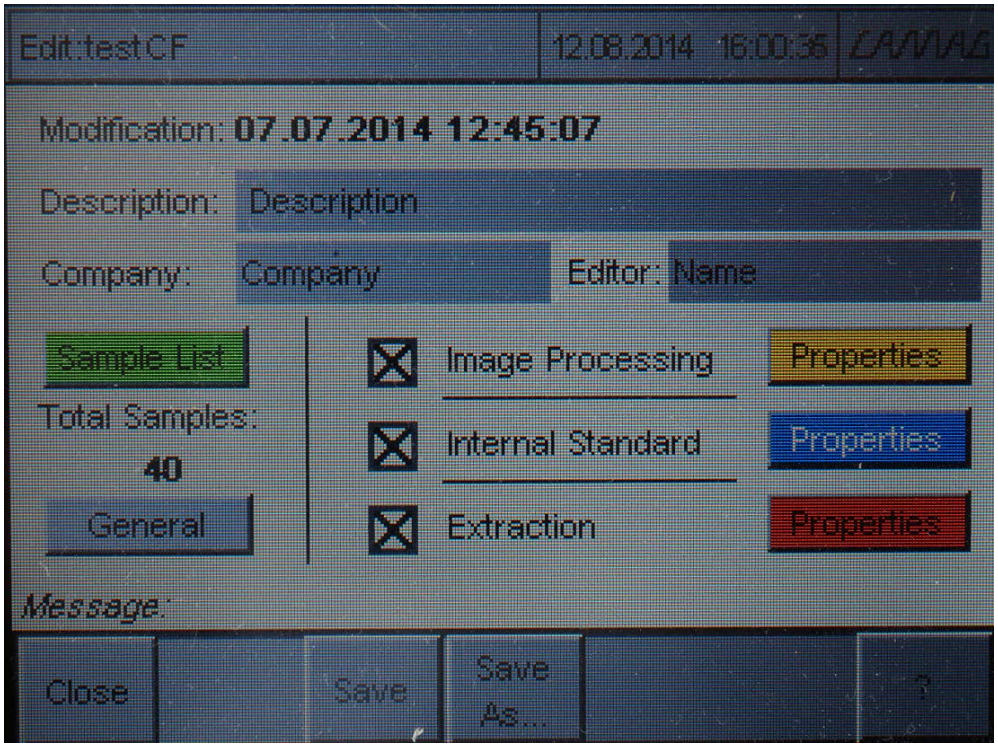


Fig. 11: Method editor screen

- Enter a description, Editor Name and Company if applicable

Sample settings

- Choose "Sample List"

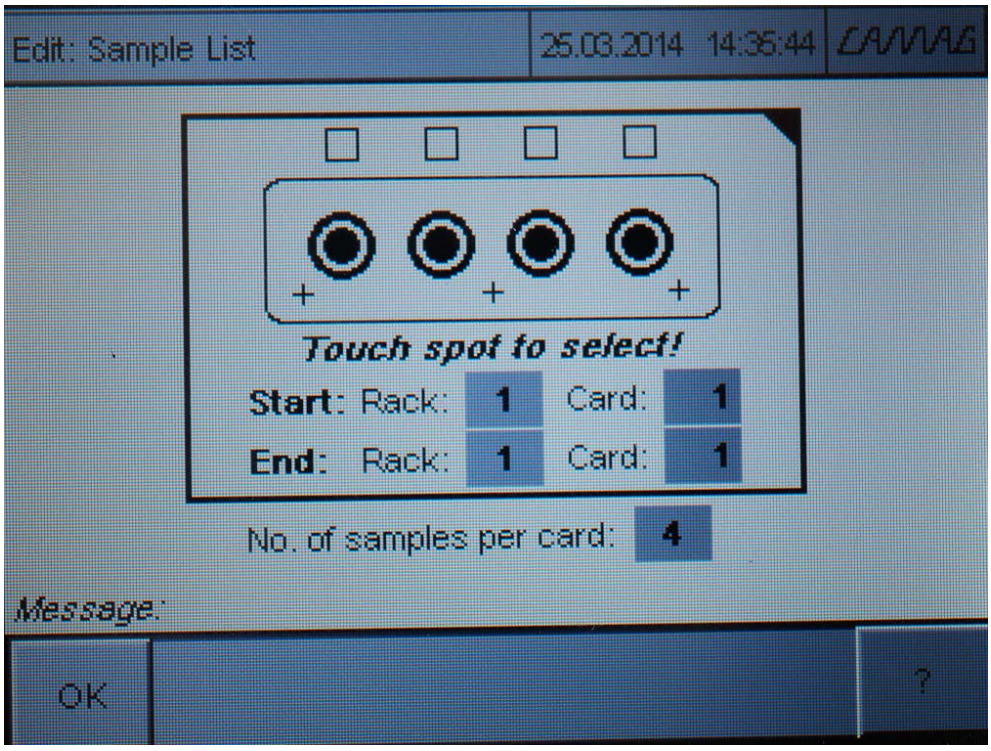


Fig.12: Sample List screen

Settings:

Spot to extract (touch the spot to extract, active ones are black)

Start: (Rack 1 - 5; Card 1 - 100)

End: (Rack 1 - 5; Card 1 - 100)

Card positions:

Every 10th position is marked with a metallic sleeve

Rack 1		Rack 2		Rack 3		Rack 4		Rack 5	
50	100	50	100	50	100	50	100	50	100
49	99	49	99	49	99	49	99	49	99
48	98	48	98	48	98	48	98	48	98
47	97	47	97	47	97	47	97	47	97
46	96	46	96	46	96	46	96	46	96
45	95	45	95	45	95	45	95	45	95
44	94	44	94	44	94	44	94	44	94
43	93	43	93	43	93	43	93	43	93
42	92	42	92	42	92	42	92	42	92
41	91	41	91	41	91	41	91	41	91
40	90	40	90	40	90	40	90	40	90
39	89	39	89	39	89	39	89	39	89
38	88	38	88	38	88	38	88	38	88
37	87	37	87	37	87	37	87	37	87
36	86	36	86	36	86	36	86	36	86
35	85	35	85	35	85	35	85	35	85
34	84	34	84	34	84	34	84	34	84
33	83	33	83	33	83	33	83	33	83
32	82	32	82	32	82	32	82	32	82
31	81	31	81	31	81	31	81	31	81
30	80	30	80	30	80	30	80	30	80
29	79	29	79	29	79	29	79	29	79
28	78	28	78	28	78	28	78	28	78
27	77	27	77	27	77	27	77	27	77
26	76	26	76	26	76	26	76	26	76
25	75	25	75	25	75	25	75	25	75
24	74	24	74	24	74	24	74	24	74
23	73	23	73	23	73	23	73	23	73
22	72	22	72	22	72	22	72	22	72
21	71	21	71	21	71	21	71	21	71
20	70	20	70	20	70	20	70	20	70
19	69	19	69	19	69	19	69	19	69
18	68	18	68	18	68	18	68	18	68
17	67	17	67	17	67	17	67	17	67
16	66	16	66	16	66	16	66	16	66
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9	59	9	59	9	59	9	59	9	59
8	58	8	58	8	58	8	58	8	58
7	57	7	57	7	57	7	57	7	57
6	56	6	56	6	56	6	56	6	56
5	55	5	55	5	55	5	55	5	55
4	54	4	54	4	54	4	54	4	54
3	53	3	53	3	53	3	53	3	53
2	52	2	52	2	52	2	52	2	52
1	51	1	51	1	51	1	51	1	51

Fig.13: card and rack position (seen from front side of the instrument)

No of samples per card: Informs about the maximum number of extractions at one card (up to 4 extractions)

Examples: If 1 is chosen and 4 spots are active (shown black on the sample list screen) the instrument tries to extract the first spot, if not possible it goes on to the second one, if that is not possible to the third one if that is not possible to the forth one.

If 4 is chosen and 1 spot is active only the active spot will be extracted.

- Accept parameters with "ok"
- Choose "General"

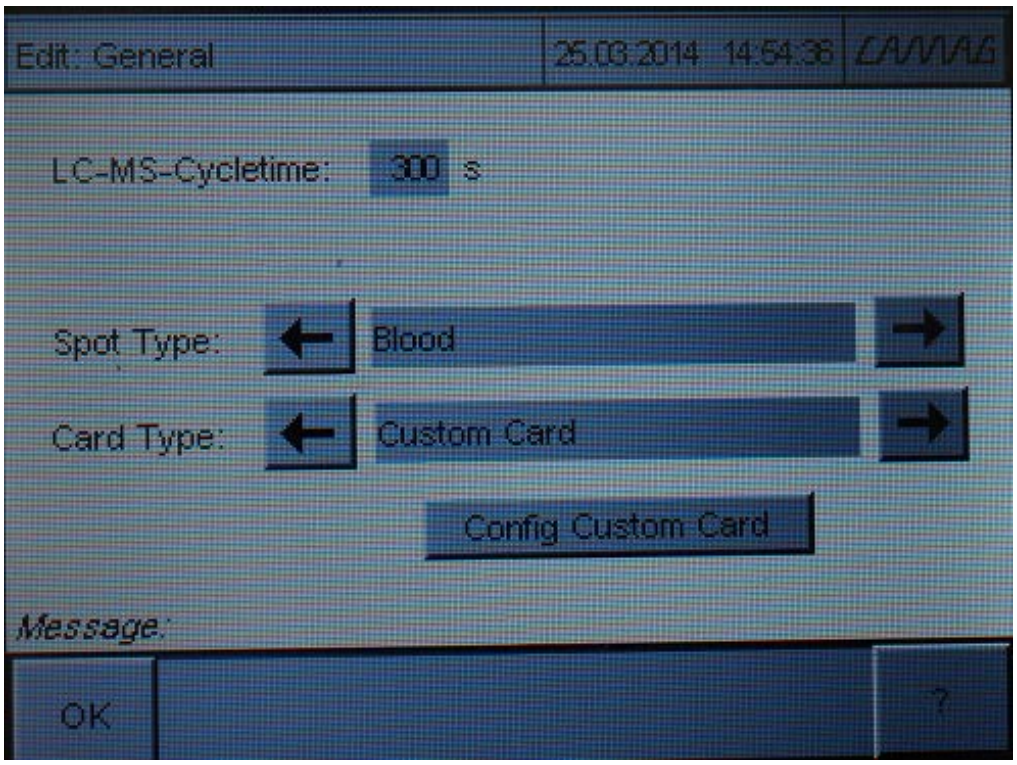


Fig.14: General screen

Settings:

LC-MS-Cycletime: Expected shortest cycle time when no information from the measurement system is received to start new cycle

Spot Type:

Blood

Plasma

Blank

Card Type:

Manufacturer cards

Custom Card

Config Custom Cards:

This screen sets the criteria for customized cards.

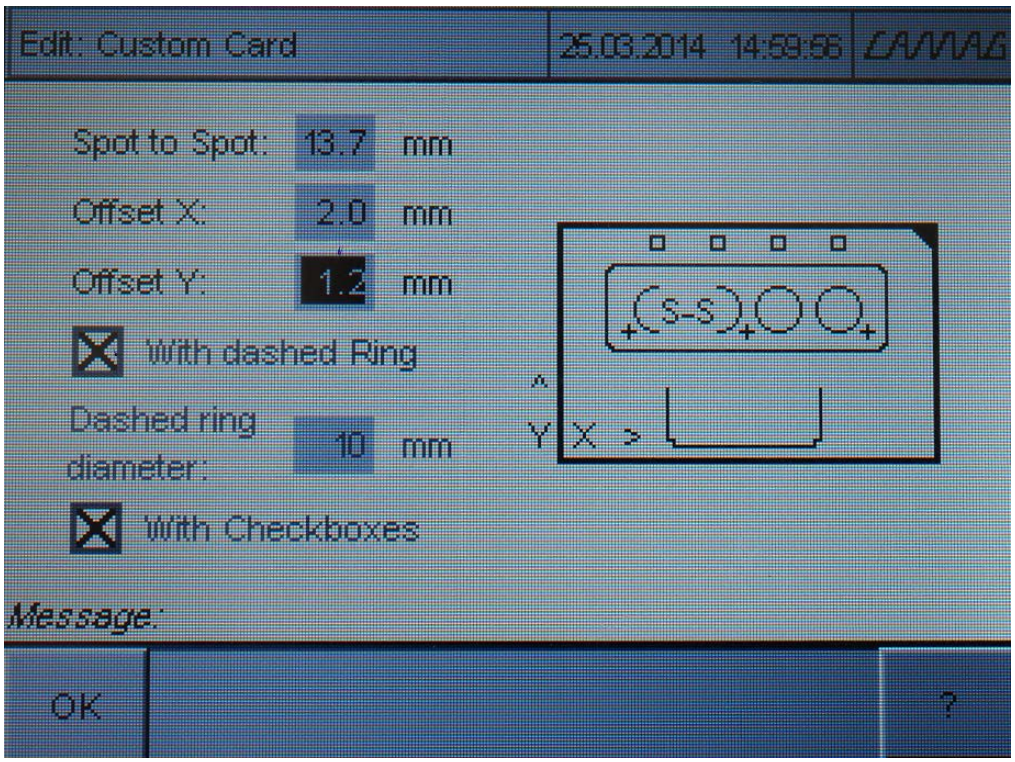


Fig.15: Custom Card screen

Settings:

Spot to Spot: set distance between spots (for standard DBS cards this is 13.7mm)

Offset X: Offset value for left-right direction

Offset Y: Offset value for top-bottom direction

With dashed ring: Set it active when card has dashed rings

Dashed ring diameter: Set to the actual diameter of the dashed ring

With Checkboxes: Activate if checkboxes are used

- Accept parameters by pressing twice "ok"

Image processing settings

- Activate "Image Processing" if applicable
- Choose "properties" next to "Image Processing"

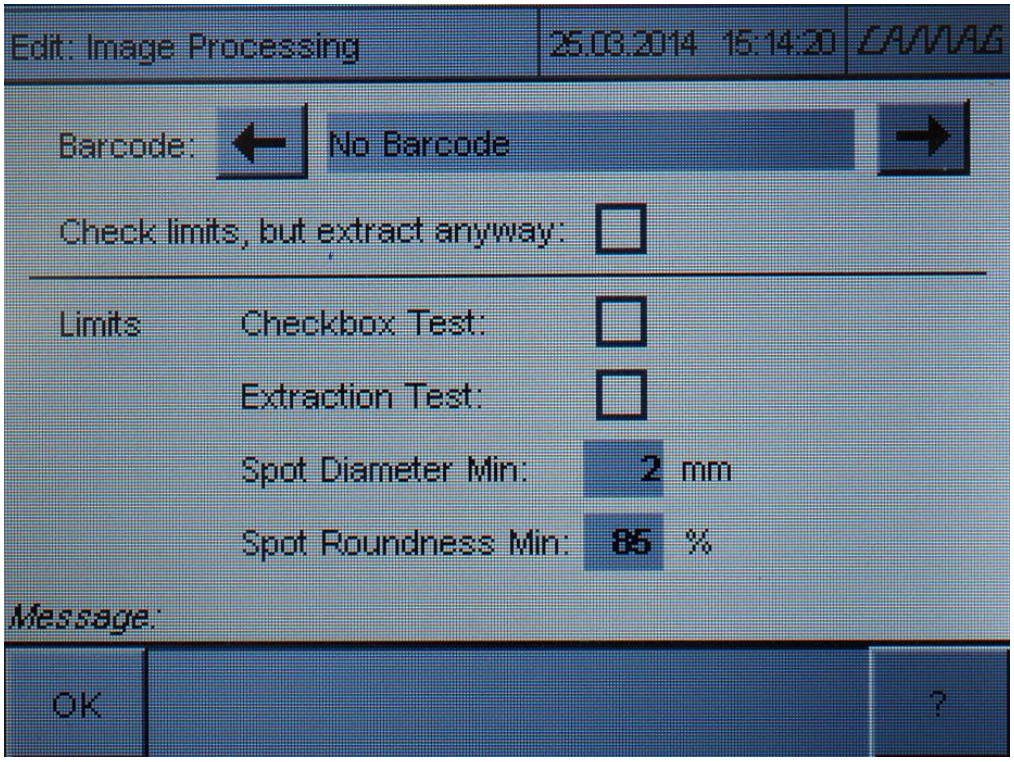


Fig.16: Image processing screen

Settings:

Barcode: Choose the applicable barcode

Code 128

ITF 14

No barcode

Check limits, but extract anyway: If active, the instrument extracts the spot although the spot is not within the below specified specification limits

Checkbox Test: Checkboxes are taken into account if active

Extraction Test: Extraction is checked if active

Spot diameter minimum: Set minimum diameter for spots to be extracted

Spot Roundness Min: Set minimum of roundness for spots to be extracted (the higher the value the more perfect the spot has to be, to be extracted)

- Accept parameters with "ok"

Internal Standard settings

- Activate "Internal Standard" if applicable
- Choose "properties" next to "Internal Standard"

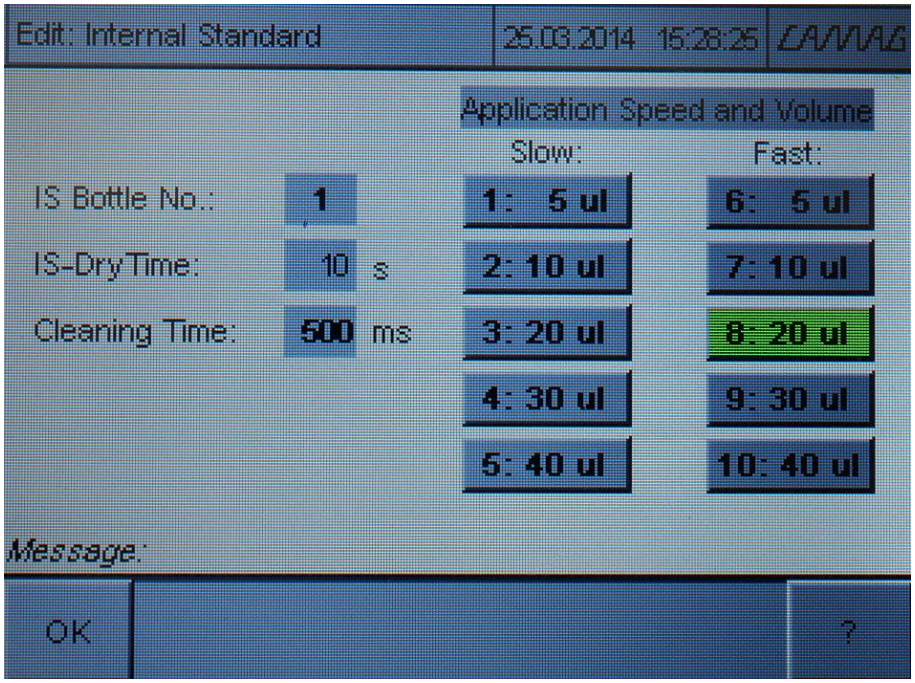


Fig.17: Internal Standard screen

Settings:

IS Bottle No: Choose Is bottle for IS application

IS-Dry Time: Time between spraying IS and extraction

Cleaning Time: Time after each IS application to wash the needle and spray nozzle channel

Application Speed and Volume: Choose the appropriate speed and Volume for IS spraying

- Accept parameters with "ok"

Extraction settings

- Activate "Extraction" if applicable
- Choose "properties" next to "Extraction"

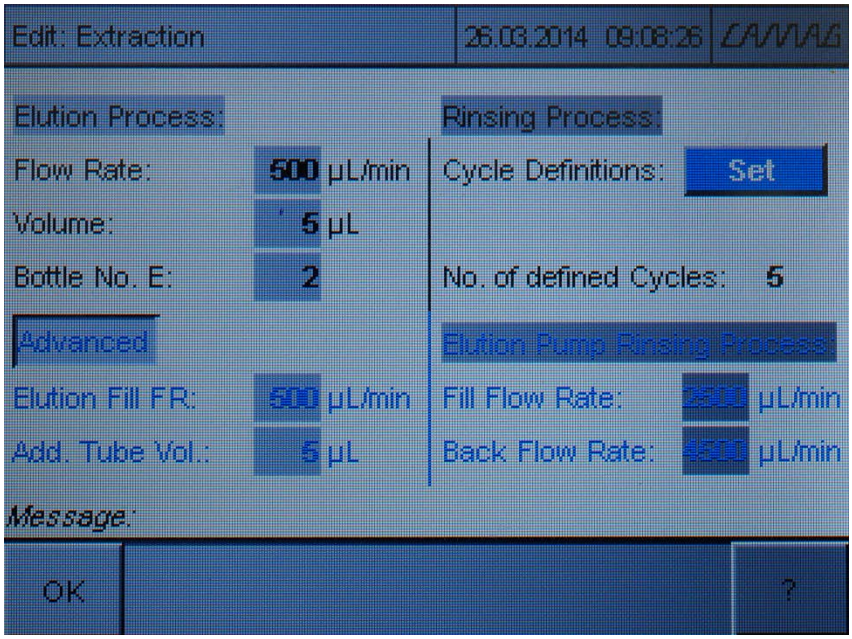


Fig.18: Extraction screen

Settings:

Elution Process

Flow Rate: Flow rate for the extraction process

Volume: Volume to be eluted

Bottle No. E: Choose the appropriate bottle for the extraction solvent

Rinsing Process

- Press "Set"

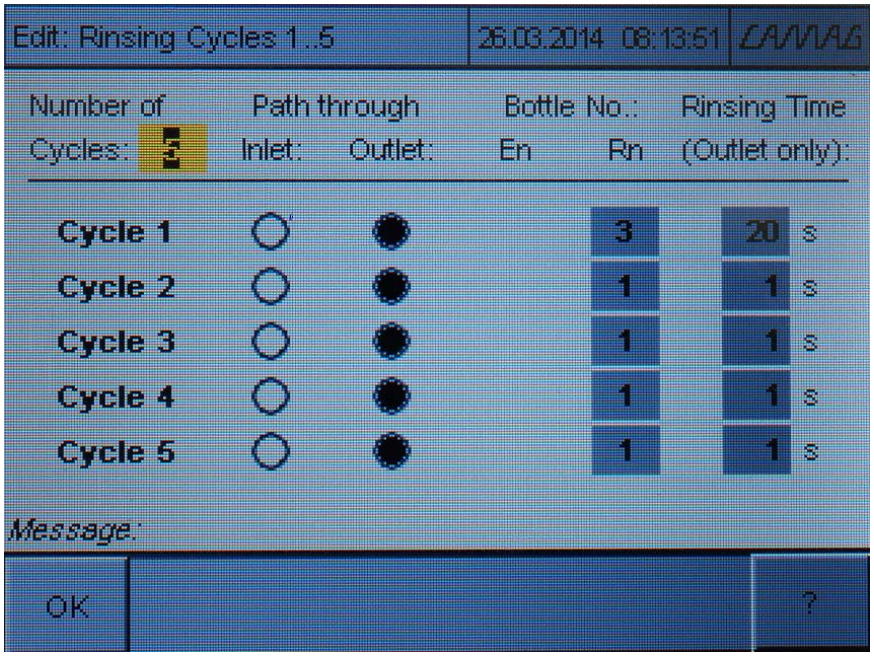


Fig.19: Rinsing process screen

Number of Cycles: Choose the appropriate number of rinsing cycles

Path through:

Inlet: The system is cleaned with the extraction pump through the inlet capillary. (No time can be chosen, one filling volume of syringe per cleaning process, 250µL)

Bottle No. En: Choose the appropriate extraction solvent

Outlet: The system is cleaned with the rinsing pump through the outlet path in reverse direction (back flush of Loop valve F-V2, capillary to the ambos and outlet channel of ambos)

Bottle No.:

En: Choose the appropriate rinsing solvent (2 extraction solvent; Active when "Inlet" is chosen)

Rn: Choose the appropriate rinsing solvent (1-5; 2 rinsing, 2 extraction and one rinsing-spare solvent; Active when "Outlet" is chosen)

Rinsing Time: Rinsing time

- Accept parameters with "ok"

Advanced (Extraction screen) – For experts only!

Elution Fill Flow Rate: filling speed of the extraction pump

Add. Tube Volume: Volume of capillary from ambos to loop valve F-V2, default value is set to 5µL

Elution Pump Rinsing Process

Fill Flow Rate: Flow rate filling up the extraction pump for the inlet rinsing process

Back Flow Rate: Flow rate for inlet rinsing process

Accept the

- Accept parameters with "ok"

Start the method

- Save the changes made with "save" or "save as"
- Choose "Start Method" on the main screen of HMI to start the extraction

The instrument does start the extraction according to the parameter set.

3.3 Setting up a stack extraction method

Multiple methods can be stacked to perform them in one run. Therefore you have to set up the methods and name them respectively.

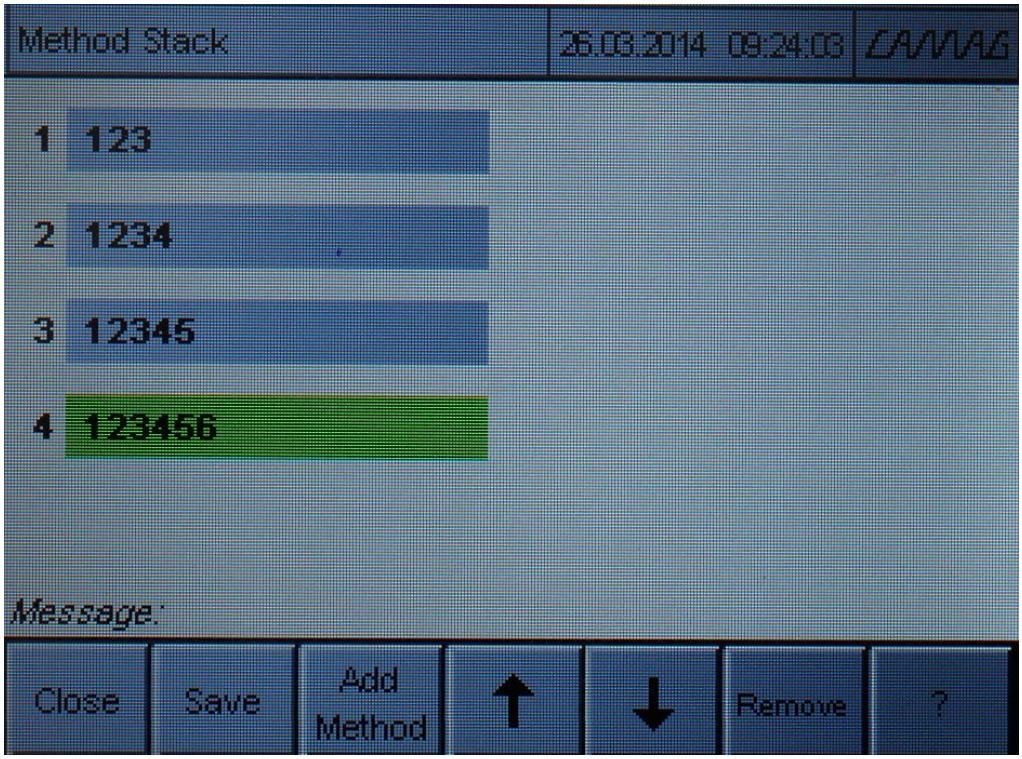


Fig.20: Method Stack screen

- Choose "Stack Editor"
- Choose "Add Method"
- Click on the method to be added
- Choose "Open (add)"
- Choose "Save"
- Proceed with all methods to be executed in this run (stack)
- Start extraction by choosing "Start Stack"

3.4 Additional screens

Active view

The active view screen gives an overview at the operating status of the instrument. It is displayed as soon as a method is started.

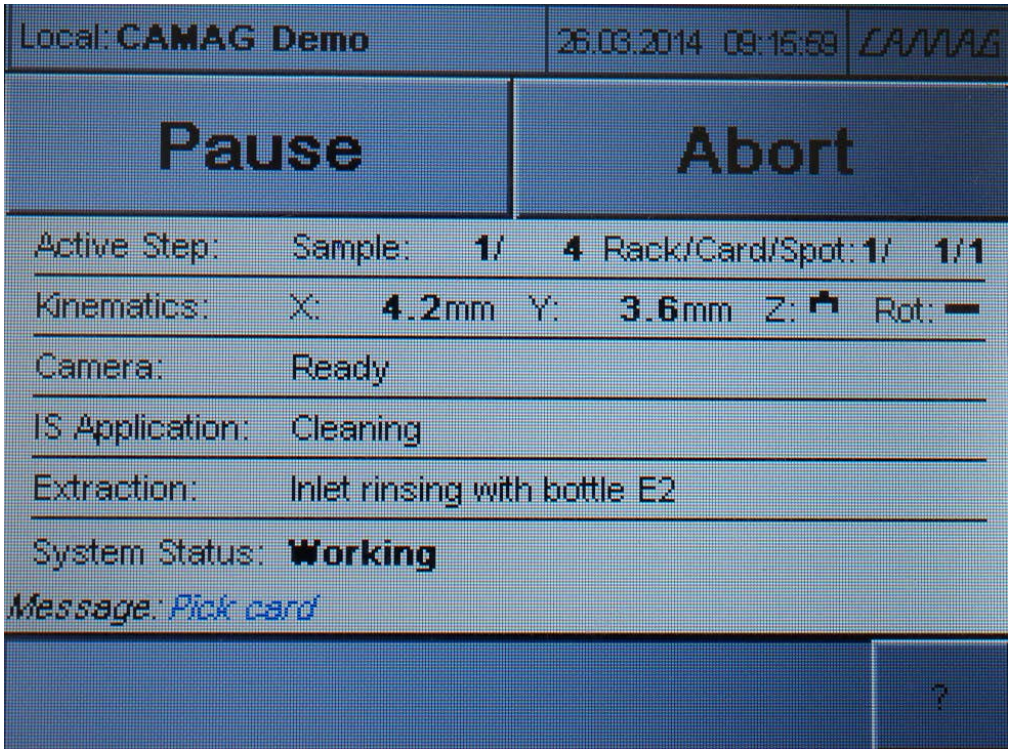


Fig.21: Active View screen

Options:

Pause: Pauses the method

Abort: Ends the method

3.5 Setting up an extraction with software (Chronos for CAMAG) support

Chronos (by Axel Semrau GmbH& CO KG) for CAMAG is a powerful software for efficiently automating complex sample preparation/acquisition steps with CAMAG DBS samplers. Several data system interfaces allow integration into existing systems. Chronos for CAMAG exchanges data with other systems and controls all of the processes.
On the basis of intelligent time management Chronos for CAMAG considerably increases the throughput of the analytical systems. While the analysis is running the next sample preparation is already taking place. Chronos for CAMAG automatically calculates an optimum time schedule for the sample list. Chronos for CAMAG truly simplifies life for users since many of the tasks such as the creation of methods or sample lists are very easy. The computer requirements, installation process and handling are described in the instruction manual of the software.

4 Maintenance and Service

4.1 Cleaning

Clean the instrument on a regular base in an appropriate way to assure problem-free functionality over a long period.

A good way to perform a cleaning would be to follow the decontamination instruction outlined below.

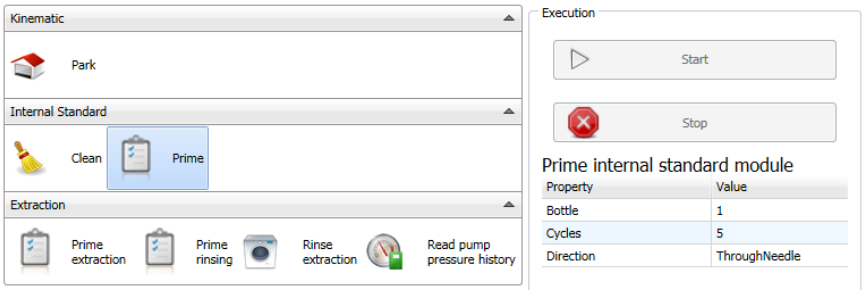
4.2 Decontamination

Before transportation or a longer term of not using your system, decontaminate it in an appropriate manner. The shown decontamination procedure is reflecting the minimal requirement, the procedure for your instrument has to be adapted according the substances used. Fill out the declaration of decontamination form and attach a copy to the instrument.

Declaration of Decontamination

Scientist name	
Date	
DBS-MS 500 Serial number	
What samples have been analyzed on the system during the last 3 months?	

1) Manual priming of all channels with 70/30 methanol/water. You can prepare only one solvent bottle and connect all liquid channels to it.
   a. 5 pump cycles from IS bottle 1-4 through needle 1☐ 2☐ 3☐ 4☐
   b. 5 pump cycle from IS bottle 1 to waste bottle ☐
   c. Clean IS for 4000 ms ☐
   d. Prime extraction from bottle 1 and 2 for 10 cycles 1☐ 2☐
   e. Prime rinsing part with bottle 1-4 for 45 s each 1☐ 2☐ 3☐ 4☐



Chronos rinsing screen

2) Switch off the DBS-MS 500. Remove the extraction head and sonicate it during 10 minutes in methanol/water 70/30. ☐
3) Take a lint free wipe, dip it in the methanol/water 70/30 cleaning solution and manually clean the ambos of the extraction cell. Repeat that with a Pursept® wipe or a similar product for the decontamination of viruses. ☐
4) Remove the waste canister, empty and clean it respectively and store it in your lab (do not returned it to CAMAG). ☐
5) Demount the waste bottle B5 and wash it, the bottle has to be shipped back in a non-mounted state. ☐
6) Mount the extraction head back to the plunger and close all covers of the DBS-MS 500. ☐

I hereby confirm that I performed a decontamination of the DBS-MS 500 according to the above protocol.

Signature: _____ Date: _____

4.3 User maintenance

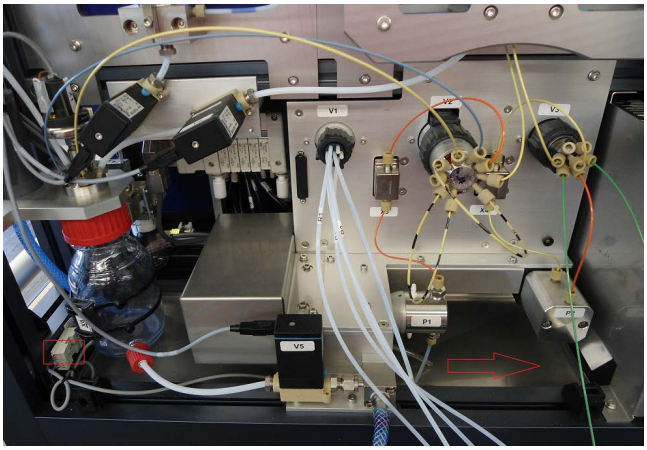
Regular check/maintenance (at least all 3 month) by the user is strongly recommended.

User maintenance procedure:

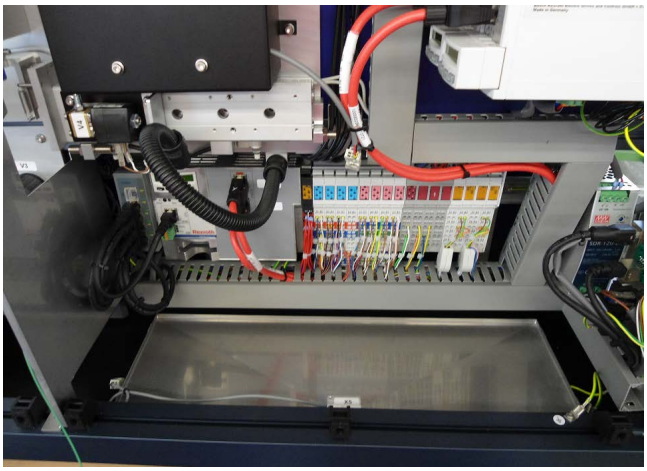
- Check the catch basin at the back of the instrument (underneath the fluidic). It has to be completely dry; no signs of liquid should be present. If there are signs of liquid stop operation, check the fluidic connections for leakage and replace the defective parts. Dry the catch basin. Slight smears of oil next to the exhaust tubing of the vacuum pump are normal and have to be wiped off as well.

  Cleaning the catch basin:

  - Switch off the instrument and remove the power cord
  - Remove both back panels of the instrument
  - Remove the electrical connector of the leakage sensor (upper connector on the left side, next to the waste bottle)



  - Slide the basin carefully to the right side of the instrument



  - Take the basin out of the instrument
  - Clean the catch basin (especially underneath the leakage sensor)
  - Re-mount the basin, connector and both back panels

- Check the vat of the solvent/rinsing/IS bottles. It has to be completely dry; no signs of liquid should be present. If there are signs of liquid stop operation, check the fluidic connections for leakage! Clean and dry the vat.

- Check and if necessary change the filter of the waste canister (after 12 month)
- Check and if necessary change the filter of the rinsing and extraction bottles (after 12 month)
- Check and if necessary change all O-rings of the bottles (after 12 month)
- Check the fluidic tubing for deformation, color cast and dirt. If necessary, change the respective tubes (see chapter "exchange of capillaries").
- Take out the card racks and clean the compartment with a lint free cloth
- Clean the instrument by a lint-free cloth
- Empty the waste canister on a regular base

For in detailed information about replacement parts and cycles, check the Maintenance Data Sheet (attachment A)

4.4 Service Maintenance

A regular maintenance is mandatory to keep the instrument in perfect working condition. CAMAG recommends executing regular maintenance by a qualified service person, for in detailed information about service and replacement cycles, check the Maintenance Data Sheet (attachment A). If the system works in a high throughput environment, shorter maintenance intervalls are strongly recommended!
After Maintenance or/and service, perform a test to get a conclusive evidence that the instrument is working properly.

4.5 Troubleshooting

Change of X/Y drive battery

After 3 years, a change of the 2 batteries backing up the X- and Y-position of the respective drives is necessary.
Call your service to perform the change

Change of extraction head

- Switch the instrument off
- Disconnect the power cable
- Open the backside of the instrument
- Remove the extraction-protection-plate
- Replace the extraction head
- Mount the extraction-protection-plate
- Put the backside back in place

- Connect the power cable
- Switch the instrument on

Fittings and capillaries

In order to connect your different system items; nuts, ferrules, and unions must be used. A ferrule is used to form the seal between components. Utilizing the nut and ferrule combination, tubing is held in place by a compression action.

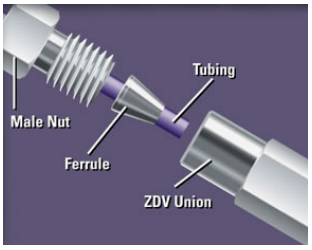


Fig.22: Possible fittings

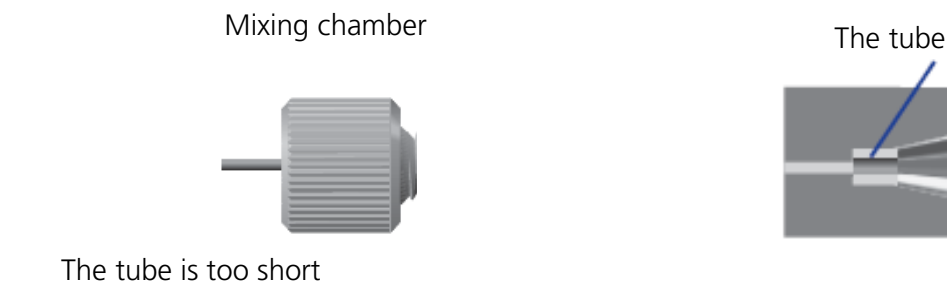
Installing high pressure fittings

Before connecting fittings, ensure the end of the tubing has a clean, square, burr-free cut. This is very important, as the square cut makes a flat surface for the tubing to contact the bottom of the receiving port. Improper cutting of the tubing could lead to dead volume, resulting in peak distortion such as fronting, tailing or broadening.
Procedure with stainless steel nuts and ferrules:
Slide the fitting at least 5 mm from the end of the clean cutting tube.
Insert the assembly into the receiving port, pushing the tubing into the port until it bottoms out.

- Using the delivered wrench, tighten an additional ½ to 1 turn past finger-tight. Remove the fitting to confirm the ferrule is swaged onto the tube.
- Because the ferrule is permanently attached to the tubing CAMAG highly recommends that the fitting only be used in the receiving port into which it was initially swaged. Failure to this may result in dead volume and/or leaks.

Fittings – dead volumes

One of the concerns you will have as a chromatographer is about the dead volume existing in your system. Dead volume is described as a small space within the connections connecting your systems where remixing of the sample may occur or where your sample can be diluted with mobile phase. Dead volume can cause critical problems in your analysis of chemical compounds, as it may bring about band broadening or split peaks in the end result, making it difficult to obtain good data on your samples. You must keep this in mind when making connections throughout your system.



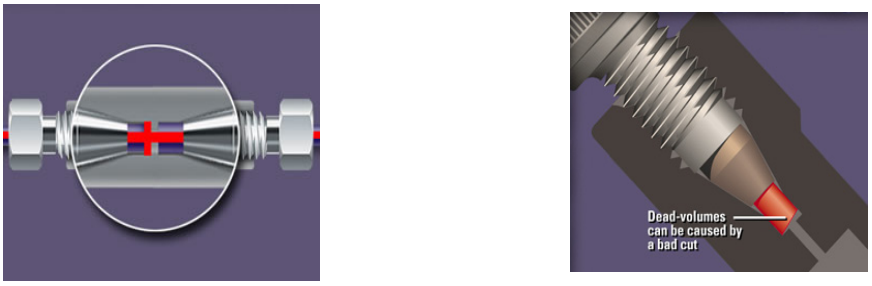


Fig.23: Potential dead volumes in capillary-based applications

Fittings – System leaks

Before you even see your first drip from a fitting, your system can tell you that the problem exists. The most common signs of system leaks are as follows:

- No flow or pressure
- Pump pressures up, but no flow
- Noisy baseline
- Baseline drift

While all of these symptoms could also indicate problems completely unrelated to leaking fittings, it is always easiest to start there. Not only are fitting leaks usually easy to repair, they are also the least expensive part of the system that can cause problems.

Check to make sure your tubing is seated properly

When using finger tight fittings, the tubing must bottom out in the receiving port before the nut and ferrule are tightened. If a gentle tug disengages your tubing after the fittings have been tightened, loosen the fitting, push the tubing to the bottom of the receiving port, and re-tighten the fitting.

The fitting may not be tightened enough

Stainless steel nuts and ferrules require a wrench to tighten them, even after repeated use. Finger tight fittings also require a good turn; how-ever, don't use a wrench unless instructed to do so, or you may damage the fitting.

Notice: Over tightening can cause leakage too!

You may be using incompatible fittings

Make sure you are using a nut and ferrule that are compatible with each other and with the components of your system

Check the condition of the nut and ferrule

After repeated use, nuts (and especially ferrules) will gradually become deformed to the point of being incapable of creating the seal they were designed to make. Always keep an extra supply of all the nuts and ferrules you are using so that you can replace them quickly and avoid un-necessary down time.

Check the receiving port for damage

Sometimes a leaking connection has nothing at all to do with the nut and ferrule, but with the receiving port. Ports that have had stainless steel fittings swaged into them are especially susceptible to damage. Check the receiving port for visible burrs or scratches and replace if necessary.

Evaluate chemical compatibility

Using fittings made of material that is incompatible with solvents used is a sure way of creating leaks and damaging the instrument.

Exchange of capillaries

If capillaries or tubing have to be exchanged, only CAMAG original spare parts have to be used as replacement.

Color table of capillary

color	Inner diameter	Outer diameter	Order no
yellow	0.18 mm	1/16"	696.0003
blue	0.25 mm	1/16"	696.0027
brown	0.51 mm	1/16"	696.0004
green	0.76 mm	1/16"	696.0005

Table 2: Capillary information

5 Technical data

Height	660 mm
Width	1260 mm
Depth	800 mm
Wight	130 Kg
Mains voltage	115 / 230V AC
Frequency	50 / 60 Hz
Power consumption	Max. 130 W
Main fuse	2 AT
Nitrogen connection	5.5 – 8 bar
Ingress protection (IP)	IP20
In- output connections	2 x RJ45 Power supply Gas supply Service connector

CAMAG (Switzerland) · Sonnenmattstrasse 11 · CH-4132 Muttenz 1
Telephone +41 61 467 34 34 · Fax +41 61 461 07 02 · E-Mail: info@camag.com

CAMAG (Germany) · Bismarckstraße 27-29 · D-12169 Berlin
Telephone +49 30 516 55 50 · Fax +49 30 795 70 73 · E-Mail: infoberlin@camag.com

CAMAG Scientific Inc. (USA) · 515 Cornelius Harnett Drive · Wilmington, NC 28401
Telephone 800 334 3909 · Fax 910 343 1834 · E-Mail: tlc@camag.com

www.camag.com

6 Appendix A: Maintenance Data Sheet

The maintenance data sheet informs about maintenance interval of the instrument. In addition, it identifies consumable parts with the respective replacement cycle.

Maintenance interval

User Maintenance	3 Month for average throughput
Service Maintenance	6 Month for average throughput

Consumable parts

Part No.	Description	Replacement time/respective cycles
695.0039	Needle IS plus capillary	Upon need
695.0055	Syringe IS, 125µl	Upon need
115.5111	Spray nozzle IS	Upon need
370.5010	Battery x and Y	3 years
960.1013	Filter set 24g for waste canister	3 month
960.1007	Air filter rinsing/extraction bottles	1 year
666.0029	Solvent filter solvent/rinsing bottles	1 year
115.5138	Extraction head	Upon need
115.5137	Ambos	Upon need
685.5040	CDM valve F-V3	Upon need/1‘000‘000 Switching cycles (2 moves)
050.0566	Loop valve F-V2 head UHP	Upon need/30‘000 Switching cycles (2 moves)
685.5041	Replacement seal for F-V2 UHP type	Upon need /30‘000 Switching cycles (2 moves)
685.5055	Rinsing fluid selector valve F-V1	Upon need/60‘000 Switching cycles (2 moves)
050.0560	Body with rotor seal F-V1	Upon need/60‘000 Switching cycles (2 moves)
362.0008	Fuse 2.0AT	Upon need
960.2000	Waste canister 10L GL45	Upon need
320.0062	Label for tubing	Upon need
660.0048	O-ring seal for bottles	3 year
660.0028	O-ring seal for waste bottle id 3.2	3 year
660.0018	O-ring seal waste bottle id 1.6	3 year
660.0044	O-ring seal IS	3 year
343.5001	Seal to vacuum pump	3 year

DECLARATION OF CONFORMITY

EC – Declaration of Conformity

We, CAMAG Chemie-Erzeugnisse und Adsorptionstechnik AG
Sonnenmattstrasse 11
4132 Muttenz
Switzerland

declare under our sole responsibility that the product

CAMAG® DBS-MS 500

Product name

050.0500

Article number(s)

to which this declaration relates is in conformity with the following provisions of directive(s):

- 2014/35/EU
- 2014/30/EU
- 2002/364/EC

Following standard(s) or other normative document(s):

- EN61010-1: 2011-07
- EN61010-2-081: 2012-09
- EN61010-2-101:2013-01
- EN61326-1:2013-07
- EN61326-2-6:2013-09

Year of the CE characteristic assignment: 2015

Muttenz, 22 August 2018

Walter Rahm, Head of Quality Management

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WWW.CAMAG.COM

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Notes: