LAUDA PVS

Modular processor viscosity measuring system for efficient system solutions

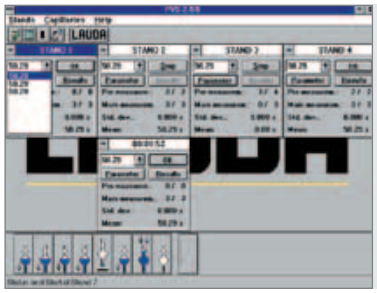
Application examples

- Production-accompanying specification of viscosity numbers for technical plastics
- Measurement of the viscosity index for classification of motor oils
- Determining absolute viscosities of fuels at application temperatures
- Determining chain lengths of hyaluronic acid products and resorbable polymers

Modular and flexible

The modular structure of the LAUDA **PVS** system permits efficient system solutions which are perfectly adapted to the needs of users. This way, you can design the configurations very flexibly for a higher number of samples and new tasks by integrating special components and software modules. The extensive automation; for example, with the cleaning of the glass capillary viscometers, the sample preparation and sample loading, maximizes efficiency while keeping manual efforts to a minimum. The associated reduction in use and contact with chemicals makes a telling contribution to occupational safety and environmental protection. LAUDA PVS is made up of stand-alone, independent functional units. Measuring stands, cleaning modules, automatic samplers and dosing systems are controlled centrally from an easy to operate Windows measuring program.

Your advantages at a glance

	The PVS advantages	Your benefits
	• Modular principle • Easy to upgrade • Flexible combinations possible • Replaceable	• Good value, application-specific system designs • Higher sample throughput • Adaptable to new applications • High redundancy and system stability • Fast error-correction
	• Central control unit • Slot system • RS 232 interface • Universal power adapter	• Time-saving thanks to “multi-tasking“ of intelligent micro-processor controlled components • Connection of up to eight measuring stations and other components • Secure communication via PC • Power supply globally compatible
	• PC measuring program fully compatible with all standard Windows versions • Parallel view of all measuring processes • Application-specific software modules • GLP compatibility with password-protection	• Every PC compatible with COM interface • Measuring results and system condition at a glance • No individual evaluations or calculations necessary • Program interventions and measurement data are always traceable
	• Compact • Clear design • Pneumatic components right beside the measurement location	• Powerful despite small footprint • Fully automatic machines fit into laboratory fume hoods • Measurement processes can be easily followed • Dead volumes are avoided • Solvent savings and quick system response
	• Software modules and components for the preparation of polymer solutions	• Everything from a single source • Saving of labor even as early as specification • High precision with the least effort

PVS
Viscometer basic modules

The measuring stand S 5

The S 5 is the actual measuring station of the PVS system. The head of the stand-alone measuring stand S 5 is comprised of the opto-electronic meniscus detectors as well as the entire micro-processor control of the measuring process including miniature pump and valves in the head of the unit. The measuring time of the sample is determined to the millisecond using a processor-controlled infrared light sensor. The robust micro-pump for pushing the sample up into the measuring ball as well as the chemical-resistant valves in the head of the stand make reliable continuous operation possible.

The control unit PVS 1

The PVS 1 control unit is the core of the system as well as the switching station between the PC and individual components. It can be equipped with up to four inserts depending on the configuration.

Measuring stand S 5

Control unit PVS 1

Special features S 5/PVS:

- Completely micro-processor controlled
- Highly precise time measurement
- Intelligent infrared (NIR) detection
- Short tubing to the viscometer
- Electrical connections only
- For Ubbelohde, Micro-Ubbelohde, Cannon-Fenske-Routine, Micro-Ostwald
- Interface to the PC via RS 232 control unit can be easily extended with insert cards for:
  - Up to eight S 5 stands
  - Up to four VRM modules
  - Up to four MT dosing systems
  - Four motor locks on the VAS auto-sampler systems

Included accessories:
Software PVS on CD-ROM · RS 232 cable · connection caps for glass viscometer · connection cable

Additional accessories:
Adapter for Micro-Ubbelohde · suitable viscothermostats · cleaning modules VRM · dosing systems · software modules

Technical features		Measuring stand S 5
Meniscus detection		Optical (infrared)
Light sensor control		Digital (µP)
Sample temperature range	°C	-65...160*
Measurement range Time	s	0…9,999.99
Recommended measurement range	s	30...1,000
Viscosity range	mm^2/s	0.3...50,000
Resolution of time measurement	s	0.01
Error in time measurement	ppm	1
Dimensions (WxDxH)	mm	90x90x500
Weight, net	kg	4.5
Cat. No.		**LMVZ 948**

Technical features		PVS 1/2	PVS 1/4	PVS 1/6	PVS 1/8
Measuring stations		2	4	6	8
Interface		RS 232 C	RS 232 C	RS 232 C	RS 232 C
Dimensions (WxDxH)	mm	340x270x105	340x270x105	340x270x105	340x270x105
Weight, net	kg	4,6	4,6	4,6	4,6
Ambient temperature	°C	10…45	10…45	10…45	10…45
Total power consumption	kW	0,1	0,1	0,1	0,1
Cat. No. 90-240 V; 50/60 Hz		**LMV 812**	**LMV 813**	**LMV 814**	**LMV 815**

* Higher temperatures on request

VRM
Cleaning modules

The cleaning modules enable the fully automatic cleaning and drying of the viscometers. Depending on the fittings, one or two viscometers can be connected and two different cleaning liquids can be selected separately. Even very hot samples of up to 160 °C or highly viscous samples with 1,000 mm²/s can be pumped out into waste bottles with pre-dilution. The glass viscometers can then be cleaned using cleaning solvents and dried with a volatile solvent and ambient air. High-quality materials guarantee resistance to many common solvents. With the VRM 4 S, even concentrated sulfuric acid can be used for cleaning.

Cleaning module VRM 4

Special features:

- Automatic (online) rinsing of the viscometer
- Inert and corrosion-free for all standard solvents
- Individual specification of cleaning procedures using PC software
- Automatical filling and draining
- Two different rinsing agents (the first for cleaning, the second for drying)
- VRM 4 (except for sulfuric acid)
- VRM 4 S (for sulfuric acid)
- VRM 4 HT (for high temperatures and high viscosity), external pump necessary
- No external connections necessary

Included accessories:
Connection cable to PVS · 2 connection stoppers for GL 45 vessels · tubing set for filling bottles and waste bottles

Necessary accessories:
Connection sets with sample locks suitable for capillary viscometers · suction pump (for VRM 4 HT) · mounting sets for viscothermostats

Additional accessories:
Filling level safety set

Technical features		VRM 4	VRM 4 S	VRM 4 HT ①
Temperature range	°C	20....100	20....100	20....160
Viscosity range samples	mm*/s	0,3....100②	10....50	0,3....1000
Max. cleaning agents		2	2	2
Solvent resistance		++③	+④	++③
Acid resistance		+⑤	++⑥	+⑤
Dimensions (WxDxH)	mm	130x160x130	130x160x130	130x160x130
Weight, net	kg	4,8	4,8	4,6
Cat. No.		**LMR 911**	**LMR 912**	**LMR 913**

① Only operable with external suction pump or vacuum connection ② Expandable using special cleaning routines ③ Resistant to all solvents common to the plastics and mineral oil industry
④ Except for ketones (e.g. acetone) ⑤ Except for sulfuric acid ⑥ Resistant to all acids common to solution viscosity

VAS
Fully automatic sampler

The sampler based on the Combi-PAL sampler of CTC offers the convenience of full automation at the highest sample throughput rate as an add-on to the two-station (VAS 1/2) or four-station (VAS 1/4) measuring systems. Depending on the size of the sample bottles, up to 63 samples can be processed in one session. Heated sample racks with similarly thermostated syringes guarantee trouble-free measurement of hot polymer solutions or oils without the samples cooling down over the course of the process. The system is controlled using a special PVS program which permits the safe application-specific allocation of the measurement samples to the matching glass viscometers, e.g. through direct "drag & drop" from the task list which was generated during sample preparation. The measurement of the samples is done in the S 5 measuring stand, while the cleaning of the glass capillary viscometers and dosing syringes is done via suitable VRM modules.

Special features:

- Retrofittable two-station measuring system VAS 1/2
- Four-station measuring system VAS 1/4 for the highest sample throughput
- Heatable sample rack and syringe for highly-viscous samples or temperature-critical samples
- Easy to program sample processing
- Fast sample switching possible
- Assignment of processing priorities
- Sample-specific applications can be defined (e.g. kinematic and relative viscosity, IV and K-values)
- Direct injection into viscometers without contamination at the tubing
- Optional rinsing with two solvents or with next sample
- Automatic program-controlled sample locks

Included accessories:
2 (VAS 1/2) or 4 (VAS 1/4) measuring stands S 5 · pre-configured control panel PVS 1 · mounting plate for clear-view viscothermostats PV 24 · software VAS on CD-ROM

Necessary accessories:
Control unit for CombiPAL · connection sets with motor locks (suitable for glass capillary viscometers) · various sample racks · syringe rinsing station · cleaning modules · viscothermostat PV 24

Additional accessories:
Insert filter · syringe heating · sample bottles 30/50 ml

Technical features		VAS 1/2	VAS 1/4
Temperature range	°C	20....135	20....135
Viscosity range samples	mm²/s	0.3....100①	0.3....100①
Syringe volumes	ml	5	5
Measuring stands S 5		2	4
Control panel PVS		PVS1/4	PVS1/6
Interfaces		2 x RS 232	2 x RS 232
Applications (sample types)		1②	2②
Sample counts 50 ml		35/24①	35/24①
Sample counts 30 ml		63/43	63/43
Dimensions (WxDxH)	mm	1200x600x1200	1200x600x1200
Weight, net	kg	56	68
Cat. No.		**LMV 818**	**LMV 819**

① Expandable using special cleaning routines ② Samples with incompatible solvents or cleaning agents

Automatic sample preparation for polymer solutions

These stations are based on the dosing units of Mettler-Toledo and are operated for PC-controlled solvent loading, e.g. in order to determine the limiting viscosity number (intrinsic viscosity and molecular mass) with programmable concentration levels. In this regard, special dilution viscometers are used in viscothermostats equipped with magnetic stirrers (see from page 10).

In connection with Mettler-Toledo XP-type laboratory balances and an additional software module, the preparation of well-defined polymer-solutions can be carried out quickly and safely via PC in a stand-alone dissolving station with just a few manual operations and without the common and laborious weighing process. The proper, standards-compliant solution concentration is always automatically produced according to standards while taking the filler content into account.

Special features:

- Automatic dilution series can be executed on up to four measuring stations simultaneously
- Specially developed RS 232 interface box
- Multiple dosing systems can be controlled via PC or plug-in board for PVS
- Can also be combined with VRM
- Can also be used in connection with integrated magnetic stirrers for “in-situ“ sample preparation
- High-quality XP balance and special software module for gravimetric or volumetric dosing
- No influence on the solvent temperature and pre-thermostating not necessary
- Direct transfer of concentration and initial weight to the PVS software
- User navigation via high-resolution display on the balance
- Input of sample data via PC or barcode reader
- Multiple solvents – can be added for different sample types

Included accessories:
Dosing units MT · replaceable burets 20 ml · RS 232 interface boxes with power adapter · weighing balance XP 204 with dosing attachment and software module

Necessary accessories:
Hose sets and adapters for viscometer and weighing balance

Additional accessories:
Centrifuge · barcode reader · crushing pliers · magnetic stirrer (heatable) · funnel for granules

Technical features		Set 1	Set 2
Total dosing systems[1]		1	2
Viscosity range	mm²/s	0.5...20	0.5...20
Dosing volumes	ml	10…100 ml	10…100 ml
Grain size ^{d}max.	mm	3	3
Interface		RS 232 C	RS 232 C
Balance[1]		XP-204	XP-204
Cat. No.		**LMVZ 977**	**LMVZ 978**

[1] Technical data, see Mettler-Toledo documentation

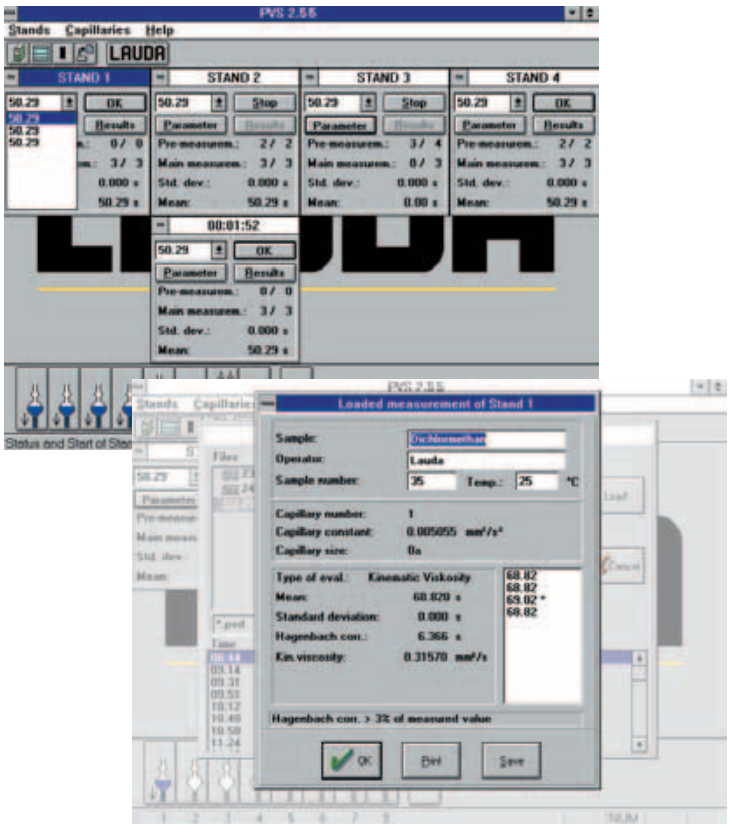
LAUDA PVS

Software based on Windows

All PVS system configurations are controlled by a standard PC through an interface. In addition, the high-performance and user-friendly standard version of the PC program calculates the kinematic, dynamic, relative, reduced and inherent viscosity and the K-value from the measured running times. Further key material figures can be determined using additional software modules.

The user is given comprehensive support by the program. All parameters are entered on the PC via mouse-click and keyboard and transferred via the interface to the PVS system.

The measuring results and evaluations can be printed out in the form of a log and saved in a file in ASCII format. The measurements report logs all measuring data on a day in chronological order and saves them in a file marked with the day's date. This data can be viewed at all times which means that consistent documentation is guaranteed. Further processing in other programs, like MS Excel for example, and in other networks can be accomplished without any problems.



Software basis:

- Windows software, runs on all conventional PCs and operating systems
- Parallel operation of up to eight measuring stations
- Calculation and display of:
  - Processing times and their mean values
  - Standard deviation
  - Kinetic energy correction (e.g. according to Hagenbach or ISO 1628/6)
  - Absolute kinematic viscosity
  - Absolute dynamic viscosity
  - Relative viscosity
  - Reduced viscosity (viscosity number)
  - Inherent viscosity (logarithmic viscosity number)
  - K-value according to Fikentscher
- Communication with preparation software and LIMS

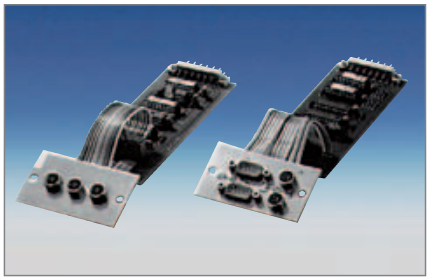
Additional software modules:

- INV-DLL: Intrinsic viscosity of polymers (mean molar mass)
- VID-DLL: Viscosity index of oils
- ENZ-DLL: Reaction activities of specific enzymes (time dependence of the viscosity)
- TEMP-DLL: Setting and control of the thermostat temperature (temperature-dependence of the viscosity)
- Special version for VAS 1 sampler systems

PVS and iVisc accessories

Plug-in boards and software

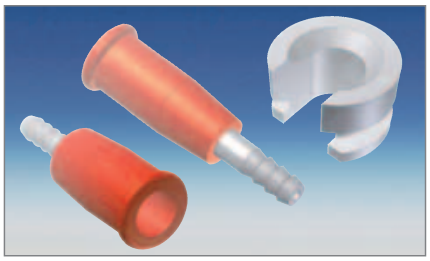
Cat. No.	Description
LMVZ 930	2-stands measuring plug-in ME 2
LMVZ 932	Control plug-in for dilution series
LDVM 2015	Software module INV DLL (intrinsic viscosity)
LDVM 2016	Software module VID DLL (viscosity index according to ISO 2909)
LDVM 2017	Software module ENZ DLL (enzyme activity)
LDVM 2023	Software module TEMP DLL (temperature display and control)
EKS 037	RS 232 connection cable, 1.5 m
UK 230	Connection cable S 5, VRM, PVS



LMVZ 930 LMVZ 932

Additional accessories

Cat. No.	Description
HKA 001	Small connection cap, silicone
HKA 002	Large connection cap, silicone
HKB 532	Adapter MUO (for Micro-Ubbelohde and Micro-Ostwald)
RKJ 014	Silicone tubing, 3x1.5 mm (unstable for H_2SO_4, silicone oil)
RKJ 020	Viton tubing, 3x1.5 mm (unstable for acetone)
LZB 011	Labosol S for viscometer cleaning, 1 liter
LMC 001	Windows PC (type on request)
LMC 003	Printer (type on request)
EBK 008	Barcode reader



HKA 002 HKA 001 HKB 532

LZB 011 EBK 008

Accessories for sample preparation

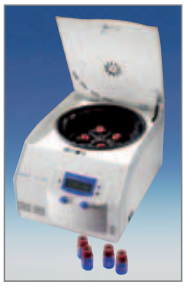
Dosing, dilution and initial weighing

Cat. No.	Description
EBK 016	Dosing unit MT
EBK 017-1	Replacement buret MT, 20 ml
LMVZ 876	Control box MT
UD 652	Valve unit for connecting up 2 dosing units
UK 233	Connection cable for UD 652
HKA 118	Large connection cap, Viton, for connecting to dosing unit
EBK 006	Analytical balance Mettler XP 204
LMVZ 976	Attachment for gravimetric dosing on XP 204

EBK 016, EBK 017-1 EBK 006

Dissolving and filtering

Cat. No.	Description
EBK 010	Magnetic stirrer RT35, 35 positions
EBK 013	Magnetic stirrer block MRH15, heated, 15 positions
EBK 014	Centrifuge for separating filler materials
EG 062	Sample bottles GL 32, 50 ml
EZV 100	Connection screw cap with hole, GL 32
EZ 195	PTFE stirrer, small



EBK 014

EBK 013

VRM accessories

Connection sets and software

For connecting a viscometer to a VRM module. One connection set is required for each viscometer.

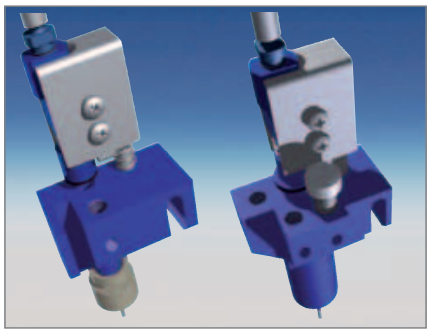
Cat. No.	Description
LMRZ 909	Connection set 1 (only for viscometers with aspirating tube and screw connection)
LMRZ 910	Connection set 2 (only for viscometers without aspirating tube)
LMRZ 920	Connection set 6 (only for viscometers without aspirating tube and dilution viscometers)
LMRZ 923	Connection set 9 (only for viscometers with aspirating tube and screw connection and at viscosities >100 mm²/s)

Mounting sets for thermostats

Cat. No.	Description
LMRZ 904	For PV 15/PVL 15 (for 1 VRM)
LMRZ 905	For PV 24/PVL 24 (for up to 2 VRM)
LMRZ 906	For PV 36 (for up to 3 VRM)
LMRZ 908	For ET 15 S/G (for 1 VRM)
LMRZ 916	For ET 15 S/G (for up to 2 VRM)
LMRZ 927	For Viscotemp 15/Viscotemp 24 (a fastening set is required for each VRM)

Additional accessories

Cat. No.	Description
EGP 012	Single-use syringe, 20 ml, 100 units
EGZ 015	Steel needles for EGP 012, 100 units
LMVZ 959	Filling tips PVDF, 100 units
EG 060	Glass funnel for liquid samples
HX 615	Funnel for granules
UD 410	Filter insert for funnel EG 060
UD 404	Filter for cleaning agent
EG 058	Glass bottle GL 45, 1 liter
EG 059	Glass bottle GL 45, 2 liter
EG 064	Glass bottle GL 45, 5 liter
LMRZ 907	Stopper for glass bottles
EBK 019	Fill level monitoring set
EBK 018	5-channel signal box
EYS 014	Pane sensors, separate
EKN 020	Extension cable, 3 m
EKN 021	Extension cable, 5 m
LMRZ 809	Suction pump VRP, for connecting to VRM modules



LMRZ 909 LMRZ 910

LMRZ 904 LMRZ 927

EGP 012 + EGZ 015

EG 058 EG 060

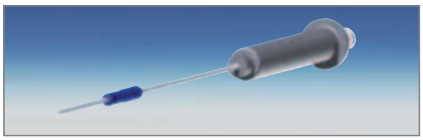
EBK 019

Sampler accessories

Dosing syringes

Cat. No.	Description
LMVZ 970	Syringe rinsing station
LMVZ 972	Syringe rinsing station (temperature-adjustable)
UD 442	Dosing syringe for VAS 1
UD 556	Dosing syringe for cartridge filter LMVZ 958
UD 442-1	Dosing syringe for dichloroacetic acid, Titan, 5 ml
EZ 261-1	Syringe protecting tube for dichloroacetic acid, Titan

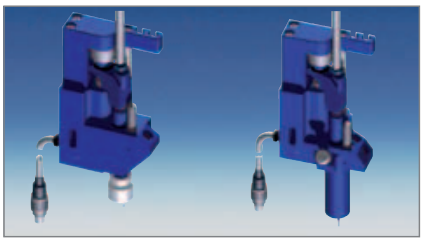
LMVZ 970



UD 556

Connection sets for cleaning modules

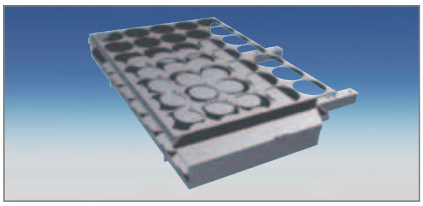
Cat. No.	Description
LMRZ 924	Connection set 3 (for viscometers with aspirating tube and screw connection)
LMRZ 925	Connection set 5 (for viscometers without aspirating tube)
UD 701-B	Automatic sample locks 1 (included in LMRZ 924)
UD 703-B	Automatic sample locks 2 (included in LMRZ 925)
LMRZ 902	Tubing set 1 (included in LMRZ 924)
LMRZ 912	Tubing set 3 (included in LMRZ 925)



UD 701-B UD 703-B

Sample racks and accessories for 50 ml bottles

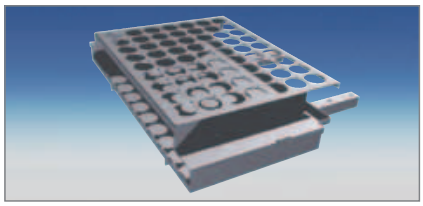
Cat. No.	Description
LMVZ 939	Sample rack PG 50, 35 positions
LMVZ 946	Sample rack PGH 50, 24 positions max. 160 °C
LMVZ 969	Sample rack PGH 50 MR, 15 positions max. 200 °C, with magnetic stirrer block EBK 013
EG 062	Sample bottles with thread GL 32 for PG 50, 50 ml
EZV 100	Connection screw cap with hole, 1 for each EG 062
EDF 122	Sealing rings for EZV 100, 50 units
EDF 093	Small aluminum plates for EG 062, 1,000 units each



LMVZ 939

Sample frames and accessories for 30 ml bottles

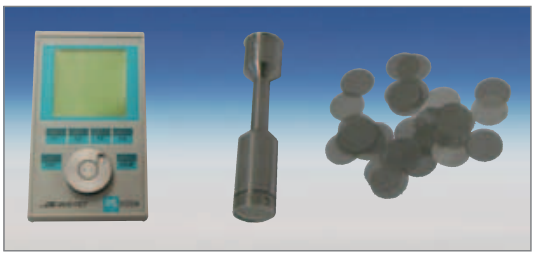
Cat. No.	Description
LMVZ 947	Sample rack PG 30, 63 positions
LMVZ 964	Sample rack PGH 30, 43 positions max. 160 °C
EG 066	Sample bottles with thread GL 32 for PG 30, 30 ml
EZV 104	Connection screw cap with hole, 1 for each EG 066
EDF 124	Sealing rings for EZV 104, 50 units
EDF 092	Small aluminum plates for EG 066, 1,000 units



LMVZ 947

Additional accessories

Cat. No.	Description
EBE 038	Operating unit for VAS
EBE 037	Heating block for dosing syringe UD 442 or UD 556
LMVZ 958	Insert filter incl. 100 small filter plates EZ 209
EZ 209	Small filter plates for LMVZ 958, 100 units
LMVZ 157	Vacuum pump, controlled



EBE 038 LMVZ 958 EZ 209