

# Diaphragm dosing pump FEM 1.02 / UFEM 1.09

SECTION 200.13



## Concept

The FEM1.02 / UFEM1.09 pumps are based on a very simple design. The 2 phase stepper motor turns an eccentric causing the diaphragm to move up and down. This vertical movement causes pressure changes in the working chamber which in combination with the inlet and outlet valves makes a pumping action.

**• Motor**

The use of a stepper motor ensures that the motor speed can be controlled very accurately giving flexibility and a high level of repeatability.

**• Valves**

Many years of experience have resulted in a valve system which work precisely over a large range of motor speeds, doesn't trap air bubbles and can be easily cleaned.

**• Pump head**

By constructing the pump head to allow the air bubbles to escape easily it is possible to completely fill the pump with only four strokes.


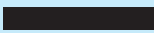
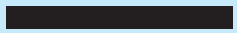

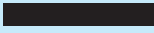
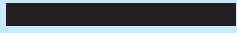
KNF also offers an electronic controller to help test the pump, details of what is possible can be found on the last page. An important option is the possibility of using a Hall Sensor to determine the position of the diaphragm thus allowing every phase of the pumping action to be individually controlled.

## Features

- Excellent repeatability
- Constant results over a long period of time
- Large dosing range 1:100
- High chemical resistance
- Self priming
- Long life > 10,000 hours
- Various control possibilities

## Areas of use

- Medical diagnostics
- Industrial dosing systems
- Fuel cells
- Semiconductor industry
- Water analysis

Performance Data			
Pump type	Flow rate (ml/min)	Suction head (in.Hg)	Pressure head (PSIG)
FEM 1.02	 0.2 - 20	11.5	  87
UFEM 1.09	 0.9 - 90	11.5	  87

# FEM 1.02 / UFEM 1.09

## General note

This data sheet includes information about the technical characteristics of the FEM 1.02/UFEM 1.09 pump types. More detailed information and explanations can be found in the operating instructions (available on request).

## Flow curves

The flow curves show how the performance of the pumps changes relative to different suction heights and pressures. In the case of a combination of both pressure and suction height then we would be very happy to advise what the expected flow rate would be.

The values given in the curves are dependant upon the liquid, choice of head materials and the type of hosing being used therefore a certain deviation is to be expected.

The flow rate is measured with water at 20°C.

## Integrated overpressure relief valve (.27)

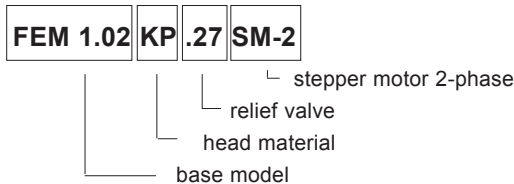
The integrated overpressure relief valve is available for all FEM 1.02 / UFEM 1.09 pumps.

### How it works

If the pump runs against a closed system the pressure will increase rapidly thus exceeding the allowed limits. In order to prevent this from happening a relief valve has been integrated into the head. Should the pressure exceed the adjusted value (min. 0.5 barg), the valve will open allowing the liquid to pass through the built-in bypass from the outlet to the inlet side.

**Note: The valve is adjusted in the factory to a standard value 95 PSIG.**

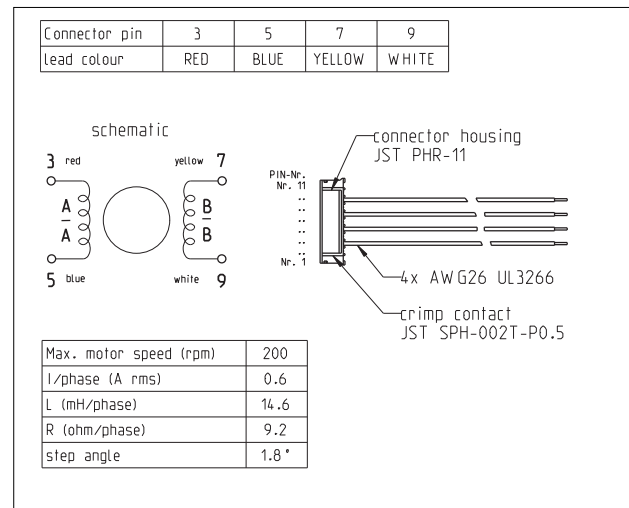
## Pump description



## Motor control.

The pumps are driven by a simple two phase stepper motor. All of the information required to make a controller can be found in the Electrical specifications.

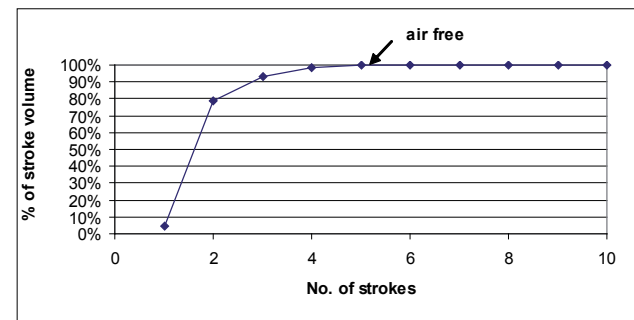
The pumps are tested in the factory to ensure that the flow rate specified is achieved at the nominal motor speed. Every motor comes with a connector plug ,the function of the leads can be seen in the drawing below.



## Air free pump head

If air bubbles are in the pump or in the system then the accuracy may be influenced. Therefore, it was important for us to design a head which allowed the air to pass through easily.

The curve below shows how the pump head is completely filled after just four strokes after which a high level of accuracy is achieved.



## Materials of head components

Type of pump	head	valves / .27 diaphragm	Sealing gaskets	diaphragm
FEM 1.02/UFEM 1.09 KP SM-2	PP	EPDM	EPDM	PTFE-coated
FEM 1.02/UFEM 1.09 KT SM-2	PP	FFPM	FFPM	PTFE-coated
FEM 1.02/UFEM 1.09 TT SM-2	PVDF	FFPM	FFPM	PTFE-coated
FEM 1.02/UFEM 1.09 KP.27 SM-2	PP	EPDM	EPDM	PTFE-coated
FEM 1.02/UFEM 1.09 KT.27 SM-2	PP	FFPM	FFPM	PTFE-coated
FEM 1.02/UFEM 1.09 TT.27 SM-2	PVDF	FFPM	FFPM	PTFE-coated

Full teflon and stainless steel versions with the same performances are available on project

# FEM 1.02\_SM-2

## Performance FEM 1.02

Basic model	Flow rate at atmos. pressure (ml/min)	Max. suction head (in.Hg)	Max. pressure head (PSIG)
FEM 1.02	0.2 - 20	11.5	87

Motor type	2-Phase-stepper motor DC
voltage (V DC) <sup>1)</sup>	5,52
Power rating (W)	15
current [A/phase] rms <sup>1)</sup>	0.6
Noise level (dB)	< 40
Motor protection class	IP 40
Nominal motor speed (rpm)	110
Lifetime (h)	>10,000 (10 <sup>8</sup> cycles)
Accuracy (%)	+/- 10
Repeatability (%)	+/- 1
Dosing range	1 : 100
Flow range (ml/min)	0.2 - 20
Allowed ambient temp. (°C)	+5 ... +40
Allowed liquid temp. (°C)	+5 ... +80
Max. viscosity (cSt)	150
Connections	UNF 1/4"-28
Hose (OD)	1/8" - 1/16" (3.2 - 1.6 mm)
Weight (g)	340
Approx. Volume / Stroke (µl)	180

<sup>1)</sup> Depends on type of controller

# UFEM 1.09\_SM-2

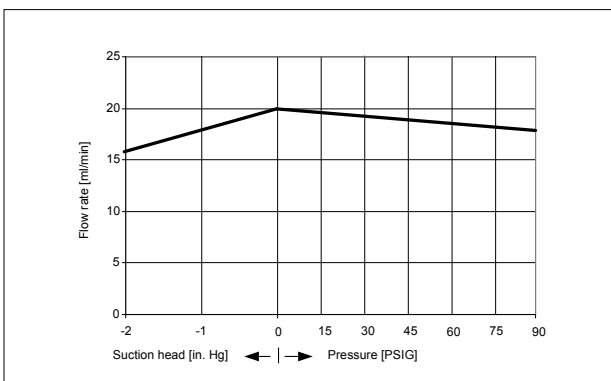
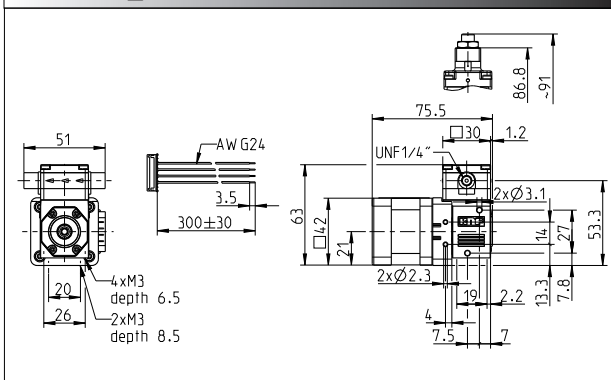
## Performance UFEM 1.09

Basic model	Flow rate at atmos. pressure (ml/min)	Max. suction head (in.Hg)	Max. pressure head (PSIG)
UFEM 1.09	0.9 - 90	11.5	87

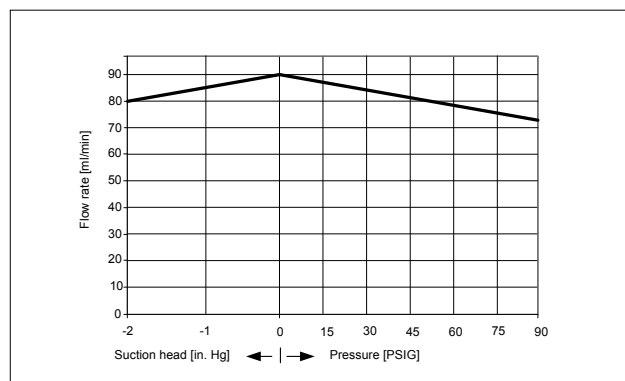
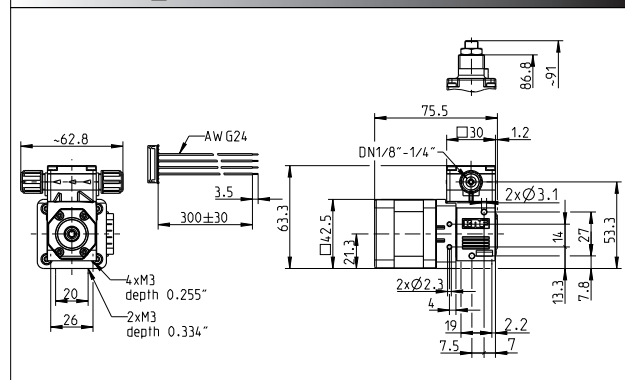
Motor type	2-Phase-stepper motor DC
voltage (V DC) <sup>1)</sup>	5,52
Power rating (W)	15
current [A/phase] rms <sup>1)</sup>	0.6
Noise level (dB)	< 40
Motor protection class	IP 40
Nominal motor speed (rpm)	170
Lifetime (h)	> 10,000 (10 <sup>8</sup> cycles)
Accuracy (%)	+/- 10
Repeatability (%)	+/- 1
Dosing range	1 : 100
Flow range (ml/min)	0.9 - 90
Allowed ambient temp. (°C)	+5 ... +40
Allowed liquid temp (°C)	+5 ... +80
Max. viscosity (cSt)	150
Connections	compression fittings
Hose (ID/OD)	1/8" - 1/4"
Weight (g)	340
Approx. Volume / Stroke (µl)	530

<sup>1)</sup> Depends on type of controller

## FEM 1.02\_SM-2



## UFEM 1.09\_SM-2



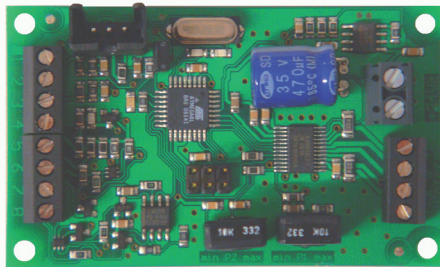
# Options

There are several accessories available for the FEM 1.02 / UFEM 1.09 pump series which can be used to find a solution for your fluidic application. Creating individual customer solutions is our speciality.



## Hall Sensor - position recognition of the diaphragm

A Hall sensor can be integrated into the pump so that it is possible to monitor the position of the diaphragm. This allows the pump to be controlled in different ways: speed of the suction/exhaust stroke can be varied to prevent cavitation, the stroke volume can be split into parts for exact dosing of small quantities or the exhaust stroke speed can be regulated to even out the pulsation.



## Control module

Especially in the development phase it is useful to try different options out without investing a lot of time programming. Therefore, we offer a flexible controller which can be adapted for many different applications.

- 2 phase stepper motor controller
- Motor speed control using a potentiometer
- Motor speed control with an analog signal 0-10V / 4-20mA
- Interface for the Hall sensor
- Customized programming for fast suction / reduced pulsation / partial strokes
- Impulse input – 1 impulse = 1 micro step
- Emergency stop - 1 impulse stops the power supply to the motor
- Dimensions: 72 mm x 43 mm x 16 mm

## KNF NEUBERGER, INC.

Two Black Forest Road  
Trenton, New Jersey 08691-1810  
Phone: 609-890-8600 FAX: 609-890-8323  
Web: <http://www.knf.com>