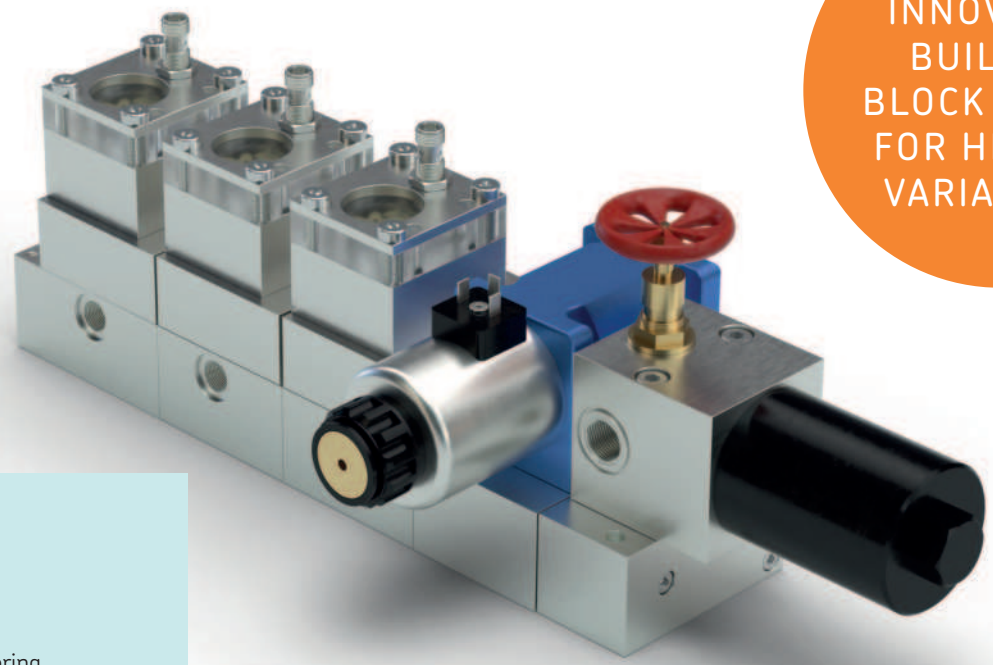
Flow limiter series SMBM

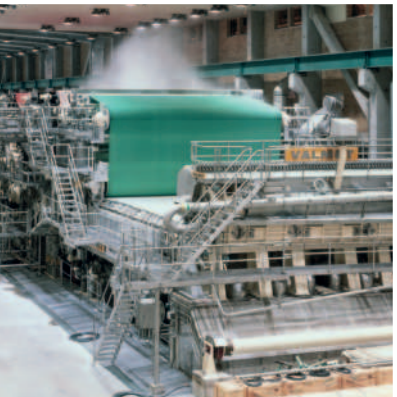
For base plate mounting, for use in oil circulation lubrication systems

INNOVATIVE BUILDING BLOCK DESIGN FOR HIGHEST VARIABILITY



Advantages:

- Modular design
- Constant oil flow
- Self-adjusting metering
- Identical oil flows despite different back pressures
- Wide viscosity range
- Virtually independent of viscosity
- ATEX versions available



- Easy system design
- Space-saving installation
- Easy start-up, no adjustment required
- Effective monitoring of correct oil flow

Oil circulation lubrication systems with SKF flow limiters

Application

Flow limiters are used in oil circulation lubrication systems. They feed specified individual oil flows to each lubrication point of the connected system. These individual oil flows are non-sensitive to system pressure changes and virtually independent of viscosity.

That makes them an ideal solution for applications with changing oil temperatures like in steel mills or mining. Their self-adjusting working principle makes sophisticated pressure control devices obsolete.

The SMBM flow limiter series is designed for base plate mounting in modular banks of 1-6 flow limiters.

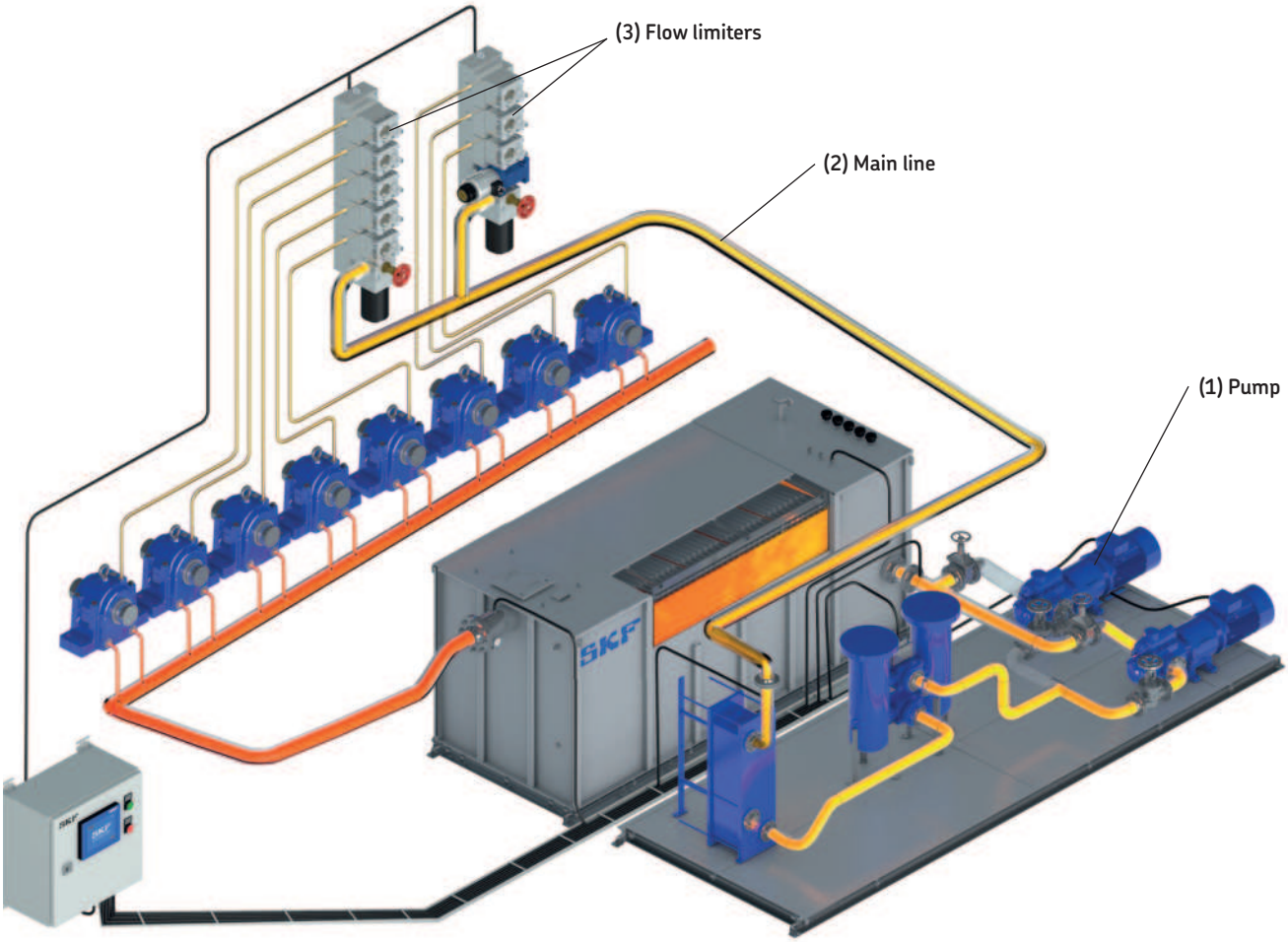
Using interchangeable plug-in nozzles, the oil flow can be set stepwise from 0.08 to 8 l/min *(0.17 to 16.9 pts/min)*.

System set-up

A pump **(1)** sends oil to the main line **(2)**. Attached to the main line are the flow limiters **(3)** or flow dividers which divide the oil flow into constant smaller flows. Optionally, progressive metering devices can be mounted downstream of the flow limiters to further split the oil flow into smaller portions.

Signal transmitters, piston detectors or gear meters mounted on the flow limiters monitor the oil flow for each individual device.

They are connected to a monitoring unit.



How it works

The total oil flow Q_{in} entering a bank of flow limiters mounted on a base plate is divided up into individual oil flows Q_{out}.

The system pressure, being the input pressure p_1, is the same for all flow limiters mounted on the same base plate.

Every flow limiter has a spring loaded control piston with 1 plug-in nozzle **D1** (SMBM-X) or 2 plug-in nozzles **D1/D2** (SMBM-V) which acts as a differential pressure regulator.

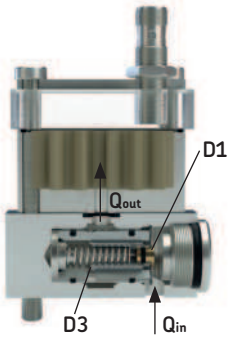
The non-adjustable plug-in nozzles (**D1** or **D1/D2**) on the control piston determine the rated oil flow (→ figure 1 and 2) while **D3** is a variable orifice formed by the circular edge of the control piston and a ring of outlet bores in the piston race.

The opening of this variable orifice **D3** is a result of the pressure **balance between p_1 and p_2** and the spring force on the control piston.

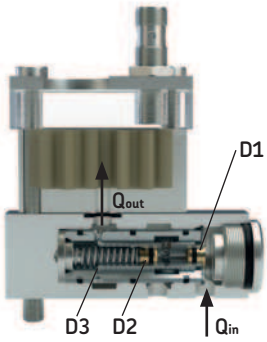
Fig. 1

Working principle

Single-flow version SMBM-X



Dual-flow version SMBM-V



D1	non-adjustable orifice (plug-in nozzle)
D2	non-adjustable orifice (plug-in nozzle)
D3	variable orifice formed by the control piston and the circular openings
p_1	pressure upstream of D1/D2
p_2	pressure downstream of D1/D2
p_3	pressure downstream of D3 (back pressure from the system)
F	spring force
A	cross-sectional area of control piston
Q_{in}	incoming oil flow
Q_{out}	outgoing oil flow

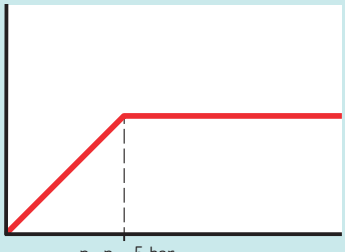
Given the relatively short hydraulic length of the orifice defined by the plug-in nozzles **D1** or **D1/D2**, the influence of viscosity is low. Therefore, the oil flow is only influenced by the differential pressure $p_{1/2}$ which is constant.

Consequently, the resulting oil flow is constant.

Fig. 2

Pressure

Oil flow



$p_1 * A = p_2 * A + F$

$\Delta p = p_{1/2} = p_1 - p_2 = F/A = \text{const.}$

$\Delta p = \text{const.}$

$Q = \text{const.}$ [1)]

[1)] within a wide range of temperature / pressure changes in the same application

Pre-requisites

For the proper function of the flow limiter, p_1 must always be greater than the differential pressure $p_{1/2}$ plus the back pressure downstream of the flow limiter.

$$p_1 > p_{1/2} + p_3$$

We recommend to choose the feeding oil pump with approx. 15 % of reserve.

$$Q_{pump} \geqq 1{,}15 * \Sigma Q_{in}$$

Flow limiter oil circulation lubrication systems involving downstream mounted progressive metering valves are usually operated at 20–25 bar *(290–360 psi)* system pressure. For pure flow limiter systems without progressive metering valves, we recommend 16 bar *(230 psi)*.

Flow limiter series SMBM

Overview

Dual-flow version SMBM-V

Requires use of a change-over valve

Single-flow version SMBM-X

SMBM-X 11/12/13

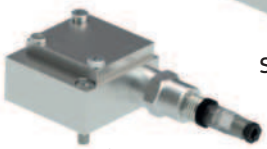
SMBM-V 11/12/13

SMBM-X 31

SMBM-V 31

Attachments

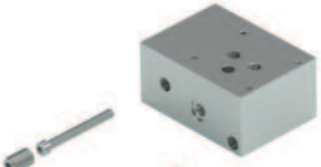
SMBM-V 21/22



SMBM-X 21/22

Change-over valve

Filter



Base section
For 1 flow limiter module

Needed once for every base plate

Extension section
For 1 flow limiter module

Can be extented to max. 5 sections

Inlet section
For base plates without filter

Valve mounting section
For dual flow use only (SMBM-V modules)

Mounted between inlet section and extension section

Filter mounting section
Used as inlet section with a filter mounted

Inlet connection on the filter

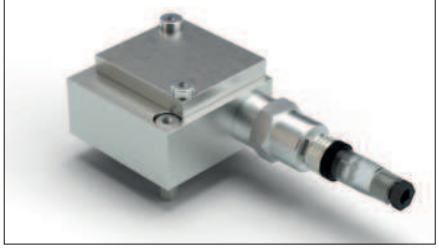
Flow limiter series SMBM

Single-flow with position monitoring – SMBM-X 21/22/31

Flow regulating valve with fixed output based on pressure balance

Functional description →**page 3**

SMBM-X 21/22
Monitoring by signal transmitter



SMBM-X 31
Monitoring by piston detector

Order codes

SMBM-X	→**page 14**
Base plate mounting	→**page 9**
Output oil flow	→**pages 12/13**

Technical data

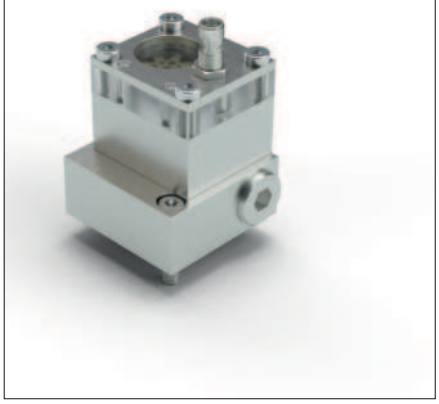
Type/principle of operation	2-way flow control valve with a fixed set-point
Type of monitoring	Signal transmitter or piston detector (go/no-go signal)
Mounting position	Any (w/o filter); Vertical (with filter)
Ambient temperature	0–70 °C *(32–158 °F)*
Lubricant temperature	0–70 °C *(32–158 °F)*
Material	EN AW-6061-T651, anodized
Weight SMBM-X 21/22	0.87 kg *(1.92 lbs)*
SMBM-X 31	0.81 kg *(1.79 lbs)*
Dimensions w/o monitoring (L×W×H)	79×79×45 mm *(3.11×3.11×1.77 in)*
Nominal flow	0.08–8 l/min *(0.17–16.9 pts/min)*
Working pressure p_1	
Without electrical monitoring	5–200 bar *(72.5–2 900 psi)*
SMBM-X 21/22	5–100 bar *(72.5–1 450 psi)*
SMBM-X 31	5–85 bar *(72.5–1 230 psi)*
Required differential pressure (p_3-p_1)	≧ 5 bar *(72.5 psi)*
Lubricant	Mineral oils, synthetic oils
Operating viscosity	20–600 mm²/s

Single-flow with gear meter – SMBM-X 11/12/13

Flow regulating valve with fixed output based on pressure balance

Functional description →**page 3**

SMBM-X 11/12/13
Monitoring by gear meter with screwed-in pulse sensor



Order codes

SMBM-X	→**page 14**
Base plate mounting	→**page 9**
Output oil flow	→**pages 12/13**

Technical data

Type/principle of operation	2-way flow control valve with a fixed set-point
Type of monitoring	Gear meter with pulse sensor
Mounting position	Any (w/o filter); Vertical (with filter)
Ambient temperature	0–70 °C *(32–158 °F)*
Lubricant temperature	0–70 °C *(32–158 °F)*
Material	EN AW-6061-T651, anodized
Weight	1.17 kg *(2.58 lbs)*
Dimensions (L×W×H)	79×79×90 mm *(3.11×3.11×3.54 in)*
Nominal flow	0.08–8 l/min *(0.17–16.9 pts/min)*
Working pressure p_1	5–50 bar *(72.5–725 psi)*
Required differential pressure (p_3-p_1)	≧ 6 bar *(87 psi)*
Lubricant	Mineral oils, synthetic oils
Operating viscosity	20–600 mm²/s

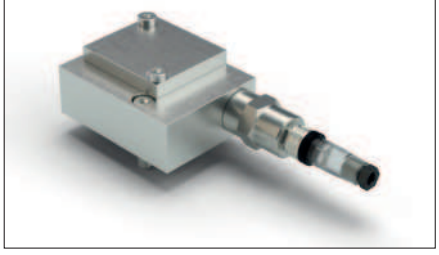
Flow limiter series SMBM

Dual-flow with position monitoring – SMBM-V 21/22/31

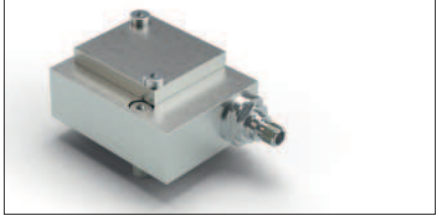
Flow control valve with fixed output based on pressure balance, used with change-over valve

Functional description →**page 3**

SMBM-V 21/22
Monitoring by signal transmitter



SMBM-V 31
Monitoring by piston detector



Order codes

SMBM-V	→**page 14**
Base plate mounting	→**page 9**
Output oil flow	→**pages 12/13**

Technical data

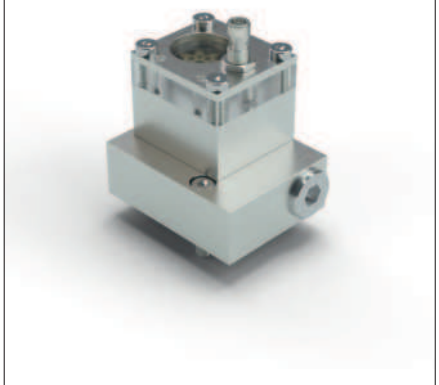
Type/principle of operation	2-way flow control valve with 2 separate fixed set-points
Type of monitoring	Signal transmitter or piston detector (go/no-go signal)
Mounting position	Any (w/o filter); Vertical (with filter)
Ambient temperature	0–70 °C *(32–158 °F)*
Lubricant temperature	0–70 °C *(32–158 °F)*
Material	EN AW-6061-T651, anodized
Weight SMBM-V 21/22	1.03 kg *(2.27 lbs)*
SMBM-V 31	0.97 kg *(2.14 lbs)*
Dimensions w/o monitoring (L×W×H)	100×79×45 mm *(3.94×3.11×1.77 in)*
Nominal flow	0.47–8 l/min *(0.99–16.9 pts/min)*
Working pressure p_1	
Without electrical monitoring	5–200 bar *(72.5–2 900 psi)*
SMBM-V 21/22	5–100 bar *(72.5–1 450 psi)*
SMBM-V 31	5–85 bar *(72.5–1 230 psi)*
Required differential pressure (p_3-p_1)	≧ 5 bar *(72.5 psi)*
Lubricant	Mineral oils, synthetic oils
Operating viscosity	20–600 mm²/s

Dual-flow with gear meter – SMBM-V 11/12/13

Flow control valve with fixed output based on pressure balance, use with change-over valve

Functional description →**page 3**

SMBM-V 11/12/13
Monitoring by gear meter with screwed-in pulse sensor



Order codes

SMBM-V	→**page 14**
Base plate mounting	→**page 9**
Output oil flow	→**pages 12/13**

Technical data

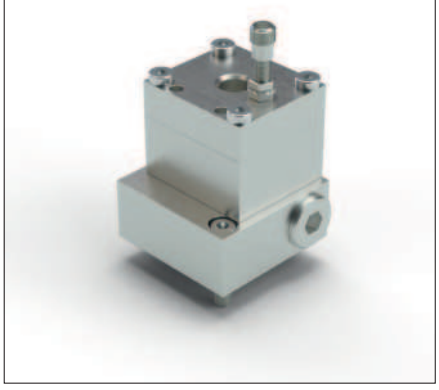
Type/principle of operation	2-way flow control valve with 2 separate fixed set-points
Type of monitoring	Gear meter with pulse sensor
Mounting position	Any (w/o filter); Vertical (with filter)
Ambient temperature	0–70 °C *(32–158 °F)*
Lubricant temperature	0–70 °C *(32–158 °F)*
Material	EN AW-6061-T651, anodized
Weight	1.34 kg *(2.95 lbs)*
Dimensions (L×W×H)	100×79×90 mm *(3.94×3.11×3.54 in)*
Nominal flow	0.47–8 l/min *(0.99–16.9 pts/min)*
Working pressure p_1	5–50 bar *(72.5–725 psi)*
Required differential pressure (p_3-p_1)	≧ 6 bar *(87 psi)*
Lubricant	Mineral oils, synthetic oils
Operating viscosity	20–600 mm²/s

Versions for use in explosive environments

Single-flow with gear meter (ATEX version) – SMBM-X...-EEX

Special version of the SMBM-X 11/12/13 flow limiter
including gear meter with ATEX approved pulse sensor and a full metal cover with sight glass

SMBM-X...-EEX
Monitoring by gear meter with screwed-in pulse sensor



Order codes

SMBM-X	**→page 14**
Base plate mounting	**→page 9**
Output oil flow	**→pages 12/13**

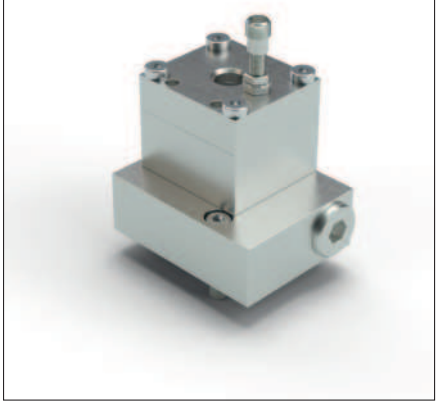
Technical data

Type/principle of operation	2-way flow control valve with one fixed set-point
Type of monitoring	Gear meter with pulse sensor
Mounting position	Any (w/o filter) Vertical (with filter)
Ambient temperature	0–57 °C *(32–134 °F)*
Lubricant temperature	0–57 °C *(32–134 °F)*
Material	EN AW-6061-T651, anodized
Weight	1.17 kg *(2.58 lbs)*
Dimensions (L×W×H)	79×79×90 mm *(3.11×3.11×3.54 in)*
Nominal flow	0.08–8 l/min *(0.17–16.9 pts/min)*
Working pressure p_1	5–50 bar *(72.5–725 psi)*
Required differential pressure (p_3-p_1)	≧ 6 bar *(87 psi)*
Lubricant	Mineral oils, synthetic oils
Operating viscosity	20–600 mm²/s

Dual-flow with gear meter (ATEX version) – SMBM-V...-EEX

Special version of the SMBM-V 1 flow limiter
including gear meter with ATEX approved pulse sensor and a full metal cover with sight glass

SMBM-V...-EEX
Monitoring by gear meter with screwed-in pulse sensor



Order codes

SMBM-V	**→page 14**
Base plate mounting	**→page 9**
Output oil flow	**→pages 12/13**

Technical data

Type/principle of operation	2-way flow control valve with one fixed set-point
Type of monitoring	Gear meter with pulse sensor
Mounting position	Any (w/o filter) Vertical (with filter)
Ambient temperature	0–57 °C *(32–134 °F)*
Lubricant temperature	0–57 °C *(32–134 °F)*
Material	EN AW-6061-T651, anodized
Weight	1.34 kg *(2.95 lbs)*
Dimensions (L×W×H)	100×79×90 mm *(3.94×3.11×3.54 in)*
Nominal flow	0.47–8 l/min *(0.99–16.9 pts/min)*
Working pressure p_1	5–50 bar *(72.5–725 psi)*
Required differential pressure (p_3-p_1)	≧ 6 bar *(87 psi)*
Lubricant	Mineral oils, synthetic oils
Operating viscosity	20–600 mm²/s

Signal transmitters (standard and ATEX versions)

For SMBM-X21/22 and SMBM-V21/22 versions

Signal transmitter

	Standard versions		ATEX version*
Order number	**24-1072-2115**	**24-1072-2114**	**24-1072-2123**
Connectors	→page 14		→page 14
Electrical data			
Switching state indication	LED, yellow	None	None
Switching voltage	24 V DC		30 V DC
Switching current	max. 2 A		max. 100 mA
Switching capacity	max. 40 W		
Contacts	NC (normally closed)		
Type of protection	IP 65		IP 65
Explosion protection	n.a.		n.a.
Recommended cable size	2x0.75 mm²		
Connector	M12x1, PG 7		M12x1, PG 7
Weight	0,2 kg (*0.44 lbs*)	0,12 kg (*0.26 lbs*)	0,2 kg (*0.44 lbs*)
Dimensions			
Length incl. standard connector	128 mm (*5.04 in*)		128 mm (*5.04 in*)
Length signal transmitter only	82.2 mm (*3.25 in*)		82.2 mm (*3.25 in*)
Thread	M26x1.5		M26x1.5
Technical data			
Type/principle of operation	Magnetic switch (Reed contact)		
Mounting position	Any		
Ambient temperature	0–70 °C (*32–158 °F*)		
Lubricant temperature	0–70 °C (*32–158 °F*)		
Max. Working pressure	85 bar (*1 233 psi*)		
Material			
Housing	EN AW-6061-T651, anodized		
Connector	Polyamide		

* This signal transmitter is rated "simple electrical equipment" in accordance with EN 50020:2002 and must only be operated in intrinsically safe electrical circuits (see manual). max. Ui=30V, Ii=100mA, Pi=1W

Pulse sensors for gear meters (standard and ATEX versions)

For SMBM-X/MV 11/12/13..-EEX versions

Pulse sensor standard version

	Standard version	ATEX version*
Order number	**2340-00000030**	**2340-00000091**
Connectors	→page 14	→page 14
Technical data		
Type/principle of operation	Inductive proximity sensor PNP	Inductive proximity sensor 2-wire, NAMUR
Mounting position	Any	Any
Ambient temperature	-40 to +70 °C (*-40 to +158 °F*)	0 to +57 °C (*32 to +134 °F*)
Lubricant temperature	-40 to +70 °C (*-40 to +158 °F*)	0 to +57 °C (*32 to +134 °F*)
Material housing	Brass, nickel plated	Stainless steel
Active area	PBT	PBT
Electrical data		
Switching state indication	LED, yellow	LED, yellow
Switching voltage	10-30 V DC	
Nominal voltage		8.2 V DC
Switching current	0-150 mA	
Power consumption		attenuated ≤ 1 mA unattenuated ≧ 2.2 mA
Contacts	NO (normally open)	NC (normally closed)
Type of protection	IP 67	IP 67
Explosion protection	n.a.	II 1G Ex ia IIC T6 Ga II 1D Ex ia IIIC T135°C Da
Weight	0.02 kg (*0.04 lbs*)	0.02 kg (*0.04 lbs*)
Dimensions (∅×L)	M12x45 mm (*M12x1.77 in*)	M12x55 mm (*M12x2.17 in*)

* This pulse sensor must only be operated in intrinsically safe electrical circuits (see manual). Ui=16V, Ii=25mA, Pi=34mW

Piston detector

For SMBM-X31 and SMBM-V31 versions

Piston detector

Order number	**24-1884-2785**
Technical data	
Type/principle of operation	Inductive PNP
Mounting position	Any
Ambient temperature	0–80 °C *(32–176 °F)*
Lubricant temperature	0–80 °C *(32–176 °F)*
Max. Working pressure	100 bar *(1 450 psi)*
Material	
Housing	Stainless steel
Active surface	Stainless steel
Weight	0.05 kg *(0.11 lbs)*
Length	53 mm *(2.09 in)*
Thread	M26x1,5
Electrical data	
Operating voltage	10–30 V DC
Rated current	max. 100 mA
Short circuit protection	included
Contacts	NC (normally closed)
Type of protection	IP 67
Recommended cable size	3x0.75 mm^2
Connector	M12x1
Switching state indication	LED yellow

Oil filter with shut-off valve

For all versions

Oil filter

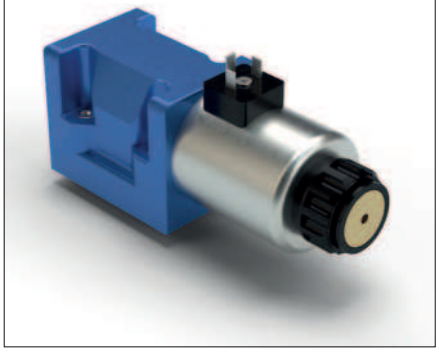
Order number*	**24-0651-3041**
Technical data	
Type	Metal mesh filter
Mounting position	Vertical, with filter cartridge downwards
Ambient temperature	0–70 °C *(32–158 °F)*
Lubricant temperature	0–70 °C *(32–158 °F)*
Material	
Filter flange	EN AW-6061-T651, anodized
Filter body	Cast iron
Filter element	Stainless steel
Shut-off valve	Brass
Connection port	G1/2 BSPP
Filter mesh size	0.1 mm (100 micron)
Weight	2.2 kg *(4.9 lbs)*
Dimensions (L×W×H)	178×69×130 mm *(7.01×2.72×5.12 in)*

* Includes mounting screws and seals
Spare parts →page 14

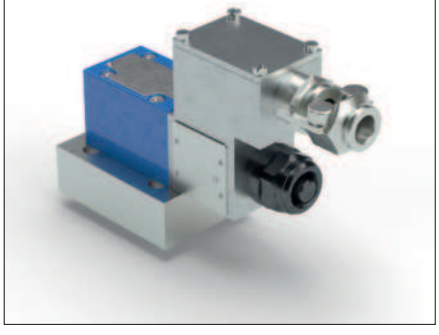
Change-over valve (standard and ATEX versions)

For SMBM-V and SMBM-V...-EEX

Standard version



ATEX version



Technical data		
Type/principle of operation	3/2-way solenoid valve with manual override	
Mounting position	Any	
	Standard version	**ATEX version**
Max. Working pressure	210 bar *(3 045 psi)*	350 bar *(5 075 psi)*
Oil temperature range	-20 to +70 °C *(-4 to +156 °F)*	-20 to +70 °C *(-4 to +156 °F)*
Max. Ambient temperature	+50 °C *(+122 °F)*	+135 °C *(275 °F)*
Viscosity range	2.8–500 mm²/s	2.8–500 mm²/s
Power consumption	40 W	17 W @ 20 °C *(68 °F)*
Protection class with mounted connector	IP 65	IP 66
Isolation class	F	
Explosion protection valve	-	Ex e mb IIC T4 Gb
Explosion protection category cable gland	-	II 2G Ex e IIC Gb
Material	Cast iron	Cast iron
Weight	3.9 kg *(8.6 lbs)*	2.6 kg *(5.7 lbs)*
Dimensions (L×W×H)	201.4×70×117 mm *(7.93×2.76×4.61 in)*	191×70×131 mm *(7.52×2.76×5.16 in)*
Order number		
Change-over valve 24 V DC	**24-1254-2486**	**24-1254-3437**
Mounting block		**24-1503-2552**
Includes connector 24 V DC	**24-1882-2167**	

Base plates

For all flow limiter versions

Flow limiter base plates can be adjusted to the need. Their modular design allows for the use with different combinations.

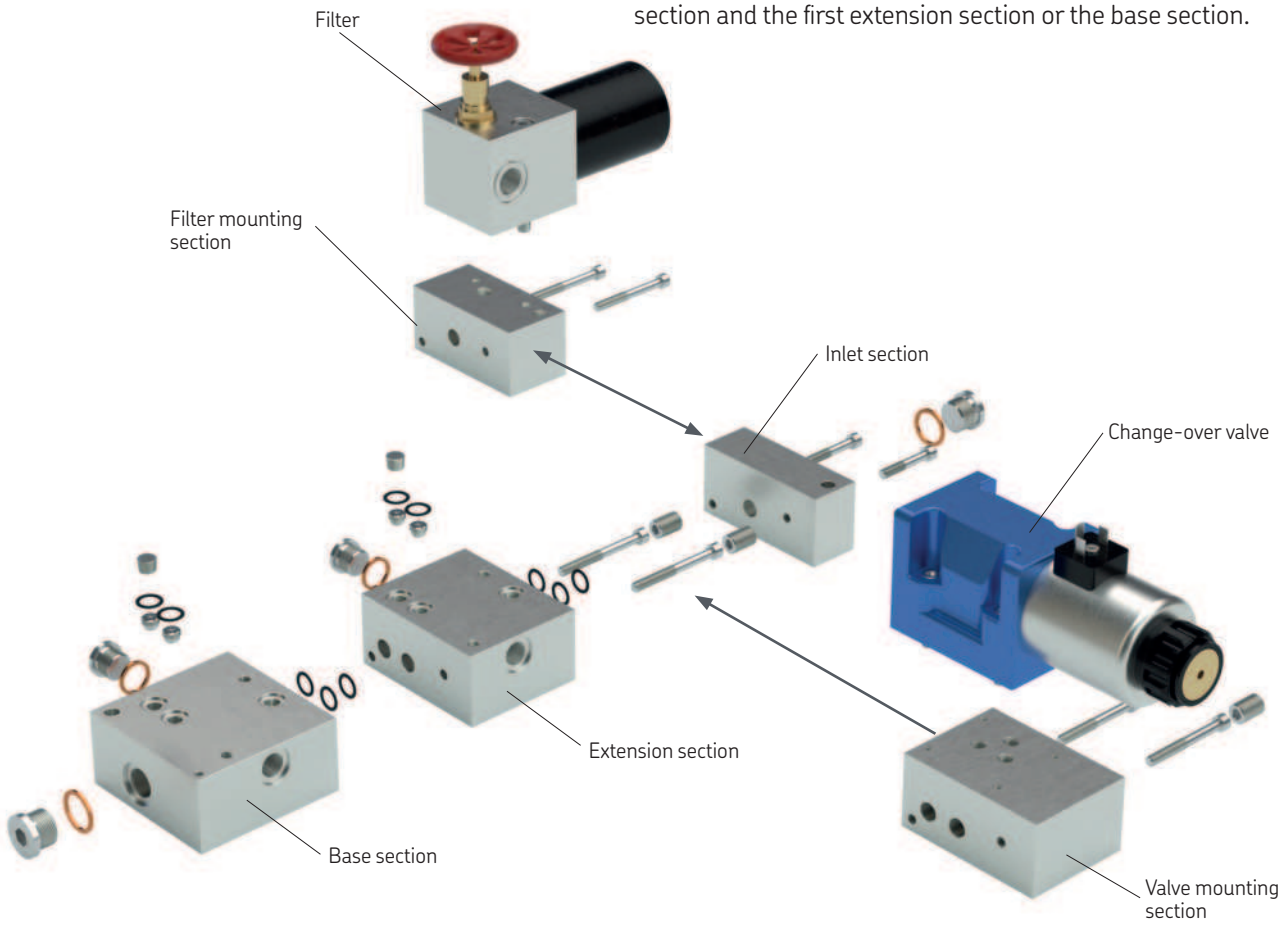
At least two modules are needed to build a complete base plate:

- Inlet section
- Extension section

This combination can be used to mount one flow limiter module of the SMBM-X series. The filter mounting section can be used instead of the simple inlet section if a filter is required.

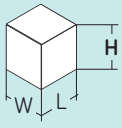
For more than one flow limiter module, extension sections need to be inserted between the inlet section or the filter mounting section and the base section.

For the SMBM-V series, an additional valve mounting section is required between the inlet section or the filter mounting section and the first extension section or the base section.



Technical data

Material	EN AW-6061-T651 anodized
Lubricant inlet	G1/2
Lubricant outlets	G3/8



Dimensions	Length		Width		Height		Weight		Order numbers
	mm	*in*	mm	*in*	mm	*in*	kg	*lbs*	
Base section	98.5	*3.88*	100	*3.94*	48	*1.89*	1.10	*2.43*	**24-0714-3483**
Extension section	81.0	*3.19*	100	*3.94*	48	*1.89*	1.00	*2.21*	**24-0714-3484**
Inlet section	35.0	*1.38*	100	*3.94*	48	*1.89*	0.47	*1.04*	**24-0714-3485**
Valve mounting section	72.0	*2.83*	100	*3.94*	48	*1.89*	0.91	*2.01*	**24-0714-3486**
Filter mounting section	50.0	*1.97*	100	*3.94*	48	*1.89*	0.64	*1.41*	**24-0714-3487**

* Size details for complete flow limiter configurations can be found in the manual (→**operation manual 951-170-238 on skf.com**).

Plug-in nozzles

Table 1

SMBM-X
Correction factor for nozzle indices 050-145 →**diagram 1**

Nominal oil flow [1]		Nozzle index	Order number
l/min	*pts/min*		
0.08	*0.17*	050	**24-0455-2574**
0.12	*0.25*	055	**24-0455-2575**
0.15	*0.32*	060	**24-0455-2576**
0.2	*0.42*	065	**24-0455-2577**
0.25	*0.53*	070	**24-0455-2578**
0.29	*0.61*	075	**24-0455-2579**
0.35	*0.74*	080	**24-0455-2580**
0.41	*0.87*	085	**24-0455-2581**
0.47	*0.99*	090	**24-0455-2582**
0.56	*1.18*	095	**24-0455-2583**
0.65	*1.37*	100	**24-0455-2584**
0.73	*1.54*	105	**24-0455-2585**
0.79	*1.67*	110	**24-0455-2586**
0.88	*1.86*	115	**24-0455-2587**
0.98	*2.07*	120	**24-0455-2588**
1.09	*2.3*	125	**24-0455-2589**
1.18	*2.49*	130	**24-0455-2590**
1.3	*2.75*	135	**24-0455-2591**
1.43	*3.02*	140	**24-0455-2592**
1.56	*3.3*	145	**24-0455-2593**
1.67	*3.53*	150	**24-0455-2594**
1.79	*3.87*	155	**24-0455-2595**
1.92	*4.06*	160	**24-0455-2596**
2.07	*4.37*	165	**24-0455-2597**
2.21	*4.67*	170	**24-0455-2598**
2.36	*4.99*	175	**24-0455-2599**
2.52	*5.33*	180	**24-0455-2600**
2.67	*5.64*	185	**24-0455-2601**
2.8	*5.92*	190	**24-0455-2602**
2.98	*6.3*	195	**24-0455-2603**
3.16	*6.68*	200	**24-0455-2604**
3.3	*6.97*	205	**24-0455-2605**
3.43	*7.25*	210	**24-0455-2606**
3.58	*7.57*	215	**24-0455-2607**
3.79	*8.01*	220	**24-0455-2608**
3.98	*8.22*	225	**24-0455-2609**
4.18	*8.83*	230	**24-0455-2610**
4.37	*9.24*	235	**24-0455-2611**
4.57	*9.66*	240	**24-0455-2612**
4.8	*10.14*	245	**24-0455-2613**
5	*10.57*	250	**24-0455-2614**
5.19	*10.97*	255	**24-0455-2615**
5.37	*11.35*	260	**24-0455-2616**
5.55	*11.73*	265	**24-0455-2617**
5.77	*12.19*	270	**24-0455-2618**
5.99	*12.66*	275	**24-0455-2619**
6.22	*13.15*	280	**24-0455-2620**
6.49	*13.72*	285	**24-0455-2621**
6.74	*14.24*	290	**24-0455-2622**
6.95	*14.69*	295	**24-0455-2623**
7.17	*15.15*	300	**24-0455-2624**
7.31	*15.45*	305	**24-0455-2625**
7.48	*15.81*	310	**24-0455-2626**
7.72	*16.32*	315	**24-0455-2627**
7.98	*16.86*	320	**24-0455-2628**

[1] All oil flow rates related to the indicated nozzle sizes were determined for a service viscosity of 300 mm²/s at a temperature of 20 °C *(68 °F)*. They are approximative values and may need to be adapted to different viscosities →**page 13**.

Table 2

SMBM-V
Start-up oil flow reduction to 25%

Nominal oil flow [1]		Nozzle index	Order number	
l/min	*pts/min*		Nozzle D1	Nozzle D2
0.12 : 0.47	*0.25 : 0.99*	001	**24-0455-2575**	**24-0455-2582**
0.12 : 0.56	*0.25 : 1.18*	002	**24-0455-2575**	**24-0455-2583**
0.15 : 0.65	*0.32 : 1.37*	003	**24-0455-2576**	**24-0455-2584**
0.20 : 0.79	*0.42 : 1.67*	004	**24-0455-2577**	**24-0455-2586**
0.25 : 0.98	*0.83 : 2.07*	005	**24-0455-2578**	**24-0455-2588**
0.29 : 1.18	*0.61 : 2.49*	006	**24-0455-2579**	**24-0455-2590**
0.35 : 1.43	*0.74 : 3.02*	007	**24-0455-2580**	**24-0455-2592**
0.41 : 1.67	*0.87 : 3.53*	008	**24-0455-2581**	**24-0455-2594**
0.47 : 1.92	*0.99 : 4.06*	009	**24-0455-2582**	**24-0455-2596**
0.56 : 2.21	*1.18 : 4.67*	010	**24-0455-2583**	**24-0455-2598**
0.56 : 2.52	*1.18 : 5.33*	011	**24-0455-2583**	**24-0455-2600**
0.65 : 2.80	*1.37 : 5.92*	012	**24-0455-2584**	**24-0455-2602**
0.73 : 3.16	*1.54 : 6.68*	013	**24-0455-2585**	**24-0455-2604**
0.79 : 3.43	*1.67 : 7.25*	014	**24-0455-2586**	**24-0455-2606**
0.88 : 3.79	*1.86 : 8.01*	015	**24-0455-2587**	**24-0455-2608**
0.98 : 4.37	*2.07 : 9.24*	016	**24-0455-2588**	**24-0455-2610**
1.09 : 4.57	*2.30 : 9.66*	017	**24-0455-2589**	**24-0455-2612**
1.18 : 5.00	*2.49 : 10.57*	018	**24-0455-2590**	**24-0455-2614**
1.30 : 5.37	*2.75 : 11.35*	019	**24-0455-2591**	**24-0455-2616**
1.43 : 5.77	*3.02 : 12.19*	020	**24-0455-2592**	**24-0455-2618**
1.56 : 6.22	*3.30 : 13.15*	021	**24-0455-2593**	**24-0455-2620**
1.67 : 6.74	*3.53 : 13.24*	022	**24-0455-2594**	**24-0455-2622**
1.79 : 7.17	*3.87 : 15.15*	023	**24-0455-2595**	**24-0455-2624**
1.79 : 7.48	*3.87 : 15.81*	024	**24-0455-2595**	**24-0455-2626**
1.92 : 7.98	*4.06 : 16.86*	025	**24-0455-2596**	**24-0455-2628**

[1] All oil flow rates related to the indicated nozzle sizes were determined for a service viscosity of 300 mm²/s at a temperature of 20 °C *(68 °F)*. They are approximative values and may need to be adapted to different viscosities →**page 13**.

Especially for low flow rates under 1.60 l/min, the influence of nozzle diameter, viscosity and pressure is quite high. To find a correction factor to compensate for these influences →**Page 13**.

How to select the right nozzle index

Diagram 1

Determination of nozzle indices 050 to 145 at a differential pressure of 250 bar

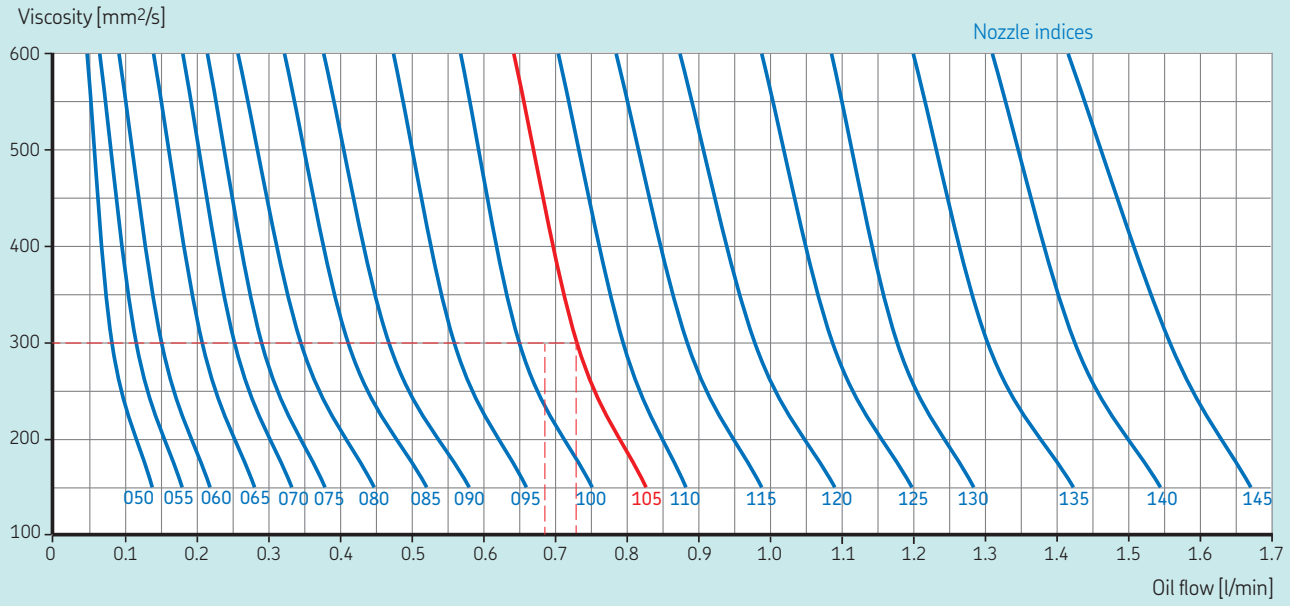
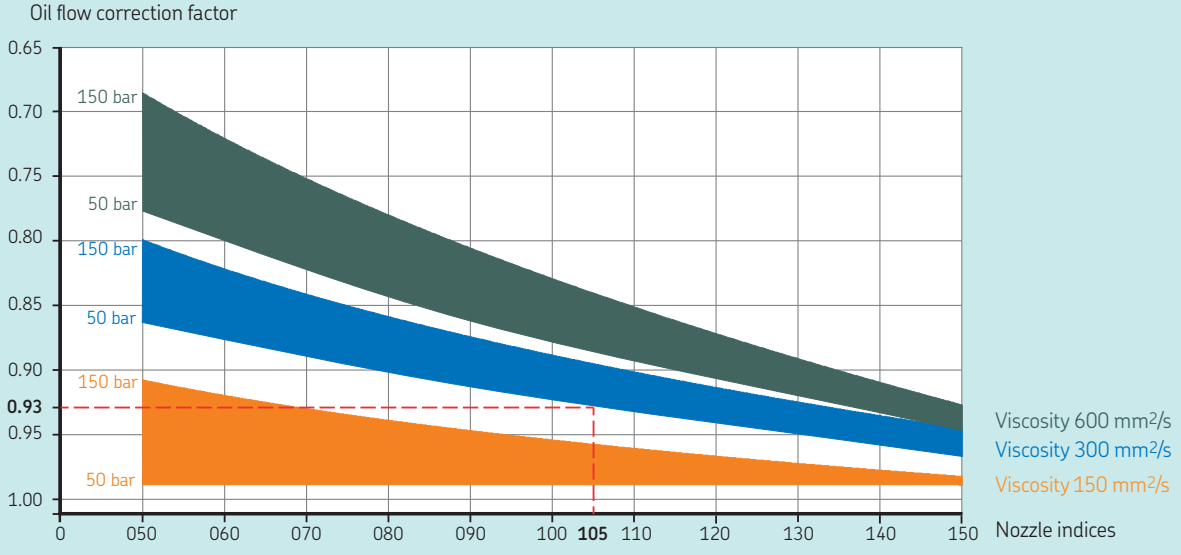


Diagram 2

Viscosity and pressure correction



Example
Given values:

Desired flow rate Q = 0.69 l/min *(1.46 pts/min)*

Operating viscosity v = 300 mm²/s

Differential pressure Δp = 50 bar

1 Pre-selection of nozzle index

Locate the intersection point of the desired flow rate (0.69 l/min) and the operating viscosity (300 mm²/s) **→diagram 1**

Use the curve next to the intersection point to determine the nozzle index (**105**). The nominal oil flow for this nozzle at nominal pressure drop (Δp = 20 bar) can be found at the intersection point of the nozzle index curve and the operating viscosity line (300 mm²/s. The result is **0,73 l/min** *(1.54 pts/min)*

2 Determination of the correction factor and calculation of the actual flow rate

The correction factors for a viscosity of 300 mm²/s can be found in the blue band **→diagram 2**

Locate the vertical intersection point of the nozzle index 105 and the lower limit of the blue band representing a differential pressure of 50 bar. The correction factor can be found at the horizontal intersection with the vertical axis.
The result is **0,93.**

3 Calculation of the resulting oil flow rate

Multiply the result found under 1 by the correction factor found under 2.
> 0.73 l/min. × 0.93 = **0.68 l/min** *(1.44 pts/min)*

How to order

Flow limiter module without base plate

Order code SMB M – [ ] [ ] [ ] [ ] – [ ]

Flow limiter SMB

Mounting

M = Baseplate

Change-over option

V = Dual-flow
X = Single-flow

Type of monitoring

00 = without gear meter, no electric monitoring
01 = with gear meter (333 ppl.), no sensor [1]
02 = with gear meter (167 ppl.), no sensor
03 = with gear meter (83 ppl.), no sensor
11 = with gear meter (333 ppl.), and standard sensor [1] [2]
12 = with gear meter (167 ppl.), and standard sensor [2]
13 = with gear meter (83 ppl.), and standard sensor [2]
21 = with signal transmitter 24 V DC (incl. LED)
22 = with signal transmitter 24 V DC (w/o LED) [2]
31 = with piston detector
41 = with gear meter (333 ppl.), and signal transmitter 24 V DC (incl. LED) [1]
42 = with gear meter (167 ppl.), and signal transmitter 24 V DC (incl. LED) [2]
43 = with gear meter (83 ppl.), and signal transmitter 24 V DC (incl. LED) [2]
51 = with gear meter (333 ppl.), and signal transmitter 24 V DC (w/o LED) [1] [2]
52 = with gear meter (167 ppl.), and signal transmitter 24 V DC (w/o LED) [2]
53 = with gear meter (83 ppl.), and signal transmitter 24 V DC (w/o LED) [2]
61 = with gear meter (333 ppl.), and piston detector [1]
62 = with gear meter (167 ppl.), and piston detector
63 = with gear meter (83 ppl.), and piston detector

Type of connection

XX = without connection cable [3]
CS = connection cable with straight connector
CA = connection cable with angled connector [3]
XS = straight connector, no cable
XA = angled connector, no cable [3]

Nozzle index

→ table 1 and 2 (page 12)

Version code

w/o Suffix = Standard version
EEX = Explosion proof version

1 Max. admissible nozzle indices **295** (for SMBM-X) and **022** (for SMBM-V)
2 EEX versions possible
3 Not for EEX versions

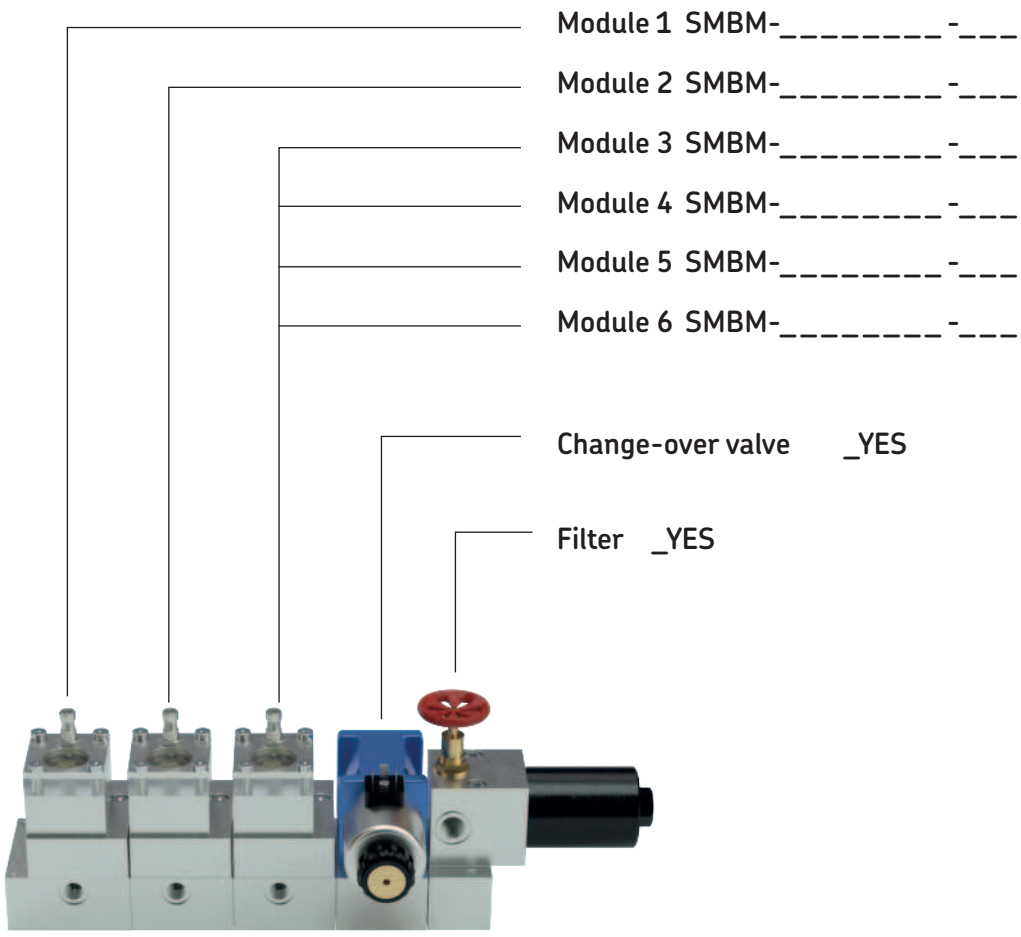
Order examples

SMBM-V11 CS 022
- Flow limiter
- Base plate mounting
- Dual-flow
- With gear meter and standard resolution (333 pulses per liter)
- Incl. connection cable with straight connector
- For a flow of 6.74 l/min (100%) and 1.56 l/min (25%)
- Standard version

SMBM-X22 XS 150 – EEX
- Flow limiter
- Base plate mounting
- Single-flow
- With signal transmitter (24 V DC)
- Without connection cable
- For a flow of 1.67 LPM
- Explosion proof version

How to order

Pre-mounted flow limiter banks



To order a pre-mounted flow limiter, please fill in the boxes matching the ordering code (→page page 14) for each module.

Modules are numbered to fit the mounting direction

For blinded mounting positions, fill the boxes with "NNNNNNNNN-NNNN"

A change-over valve will be added if one or more of the chosen modules require the use of it.

Maximum six modules are possible.

Order example

- Module 1 **SMBM-V11XS003**
- Module 2 **SMBM-V11XS010**
- Module 3 **SMBM-V11XS003**
- Change-over valve **x (Yes)**
- Filter **x (Yes)**

Table 3

Factory-mounted base plates

Flow limiters per base plate	For SMBM-X without filter	For SMBM-V * without filter	For SMBM-X * with filter option	For SMBM-V * with filter option
1	24-0714-3501	24-0714-3511	24-0714-3541	24-0714-3551
2	24-0714-3502	24-0714-3512	24-0714-3542	24-0714-3552
3	24-0714-3503	24-0714-3513	24-0714-3543	24-0714-3553
4	24-0714-3504	24-0714-3514	24-0714-3544	24-0714-3554
5	24-0714-3505	24-0714-3515	24-0714-3545	24-0714-3555
6	24-0714-3506	24-0714-3516	24-0714-3546	24-0714-3556

* Change-over-valves 24-1254-2486 or 24-1254-3437 (EEX) and oil filter 24-0651-3041 need to be ordered separately.

Accessories and spare parts

Table 4

Product group	Description	Order number
Flow limiter housing	SMBM-X without plug-in nozzles	**24-0711-2800**
	SMBM-V without plug-in nozzles	**24-0711-2801**
Signal transmitter (standard version)	Incl. connector, straight (24 V DC), M12x1, LED type	**24-1072-2115**
	Incl. connector, straight (24 V DC), M12x1	**24-1072-2114**
	Without connector	**24-1072-2123**
	Connector, straight (24 V DC), M12x1, LED type	**24-1882-2151**
	Connector, straight (24 V DC), M12x1	**24-1882-2121**
	Connector, straight (24 V DC), M12x1, LED type, with cable 5 m	**179-990-604**
	Connector, angled (24 V DC), M12x1, LED type, with cable 5 m	**237-10319-2**
Signal transmitter (ATEX version) [1)]	Incl. connector, straight (30 V), ATEX version, M12x1	**24-1072-2116**
	Incl. connector, straight, 2 poles, M12x1, with cable 5 m	**24-1882-5005**
	Incl. Connector, angled, 2 poles, M12x1, with cable 15 m	**24-1882-5016**
Piston detector	Without connector	**24-1884-2785**
	Connector, straight, 3 poles, M12x1, with cable 5 m	**179-990-381**
	Connector, angled, 3 poles, M12x1, with cable 5 m	**179-990-382**
	Connector, straight, 4 poles, M12x1	**2360-00000316**
	Connector, angled, 4 poles, M12x1	**2360-00000317**
Gear meter (standard version)	For SMBM-X/MV 11 (333 ppl)	**24-0711-2816**
	For SMBM-X/MV 12 (167 ppl)	**24-0711-2811**
	For SMBM-X/MV 13 (83 ppl)	**24-0711-2812**
	Standard pulse sensor M12x1	**2340-00000030**
	Connector, straight, 3 poles, M12x1, with cable 2 m	**2370-00000053**
	Connector, straight, 3 poles, M12x1, with cable 5 m	**179-990-381**
	Connector, angled, 3 poles, M12x1, with cable 5 m	**179-990-382**
	Connector, straight, 4 poles, M12x1	**2360-00000316**
	Connector, angled, 4 poles, M12x1	**2360-00000317**
Gear meter (ATEX version)	For SMBM-X/MV 11 (333 ppl) EEX	**24-0711-2813**
	For SMBM-X/MV 12 (167 ppl) EEX	**24-0711-2814**
	For SMBM-X/MV 13 (83 ppl) EEX	**24-0711-2815**
	Standard EEX pulse sensor M12x1	**2340-00000091**
	Connector, straight, 2 poles, M12x1, with cable 5 m	**24-1882-5005**
	Connector, angled, 2 poles, M12x1, with cable 15 m	**24-1882-5016**
Monitoring units	IPM 13 digital pulse meter, horizontal design	**A765.78.001**
	IPM 13 digital pulse meter, vertical design	**A765.78.004**
	IPM 29 digital pulse meter, horizontal design	**A765.78.002**
	IPM 29 digital pulse meter, vertical design	**A765.78.005**
	IPM 45 digital pulse meter, horizontal design	**A765.78.003**
	IPM 45 digital pulse meter, vertical design	**A765.78.006**

[1] This signal transmitter is rated "simple electrical equipment" in accordance with EN 50020:2002 and must only be operated in intrinsically safe electrical circuits (see manual).

Table 5

Product group	Description	Order number
Change-over valves (standard version)	Electric change-over valve 24 V DC	**24-1254-2486**
	Connector 24 V DC as a spare part, with built-in rectifier	**24-1882-2029**
Change-over valves (EEX version)	Electric change-over valve 24 V DC	**24-1254-3437**
	Adapter block (to be ordered with the valve)	**24-1503-2552**
Filter	Oil filter with shut-off valve	**24-0651-3041**
	Valve bonnet with hand wheel	**24-2104-2009**
	Filter element 100 micron	**24-0651-2200**
Seal kits	Seal kit for gear meter	**24-0404-2644**
	Seal kit for base section	**24-0404-2645**
	Seal kit for extension section	**24-0404-2646**
	Seal kit for valve mounting section	**24-0404-2647**
	Seal kit for filter	**24-0404-2293**
	Seal kit for top access connection module	**24-0404-2648**
	Seal kit for change-over valve (ATEX version)	**24-0404-2639**
Base plates	Base section	**24-0714-3483**
	Extension section	**24-0714-3484**
	Inlet section	**24-0714-3485**
	Valve mounting section (change-over valve to be ordered separately)	**24-0714-3486**
	Filter mounting section (filter valve to be ordered separately)	**24-0714-3487**
	Top access connection module	**24-0714-3440**
	Dummy element for blinded flow limiter positions	**24-0711-2406**
	Inlet plug G1/2	**95-0012-0908**
	Washer, copper, for inlet plug G1/2	**DIN7603-A21X26-CU**
	Outlet plug G3/8	**95-0038-0908**
	Washer, copper, for outlet plug G3/8	**DIN7603-A17X21-CU**
	O-ring 12x2, for base, extension and filter sections, for SMBM-X and SMBM-V modules	**WVN532-12X2**
	Check valve, needed 2x per base and extension sections with SMBM-V, only	**24-2104-2049**
	Mounting tool for check valve 24-2104-2049	**2350-00000078**
	Plug R 1/8, needed 1x per base and extension sections with SMBM-X, only	**2030-00000002**
	Connection screw for base plate mounting (spare part)	**44-1821-2588**
	Mounting screw for base plate mounting, inlet section (spare part)	**DIN912-M6X40-8.8**
	Mounting screw for base plate mounting, extension section (spare part)	**DIN912-M6X65-8.8**
	Mounting screw for base plate mounting, valve and filter mounting section (spare part)	**DIN912-M6X60-8.8**
Nozzles	For plug-in nozzles please refer to → page 12	

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