

# Vacuum Generation and Monitoring

**Innovation prize  
"Award for Blechexpo"**



AVAC MULTI-CIRCUIT Ejector AMS was appointed the most innovative product in category Handling technology/robotics at the Blechexpo 2017 in Stuttgart, the international trade fair for sheet metal working.



## > Vacuum Generation

Ejectors for efficient vacuum generation

## > Vacuum Monitoring

Vacuum sensors for monitoring of automatic processes



## **AVAC Vakuumtechnik AB**

AVAC Vakuumtechnik AB is located in Mullsjö in the south of Sweden with production and development of vacuum generators. We have a substantial excellence in their respective fields and offers competitive standard as well as customized solutions. The ambition is to create innovative developments to meet the requirements from the market. The product development is focused on handling of air tight materials e.g. sheet metal/glass handling and pick & place applications.

### **Maximum power – optimum energy efficiency!**

Using optimised vacuum generation and vacuum monitoring systems makes workflows not only quicker and more precise, but also more cost-effective.

AVAC Vakuumtechnik can help you optimise your processes no matter where in the world you do business.

We are doing what we can to conserve resources and use them as efficiently as possible

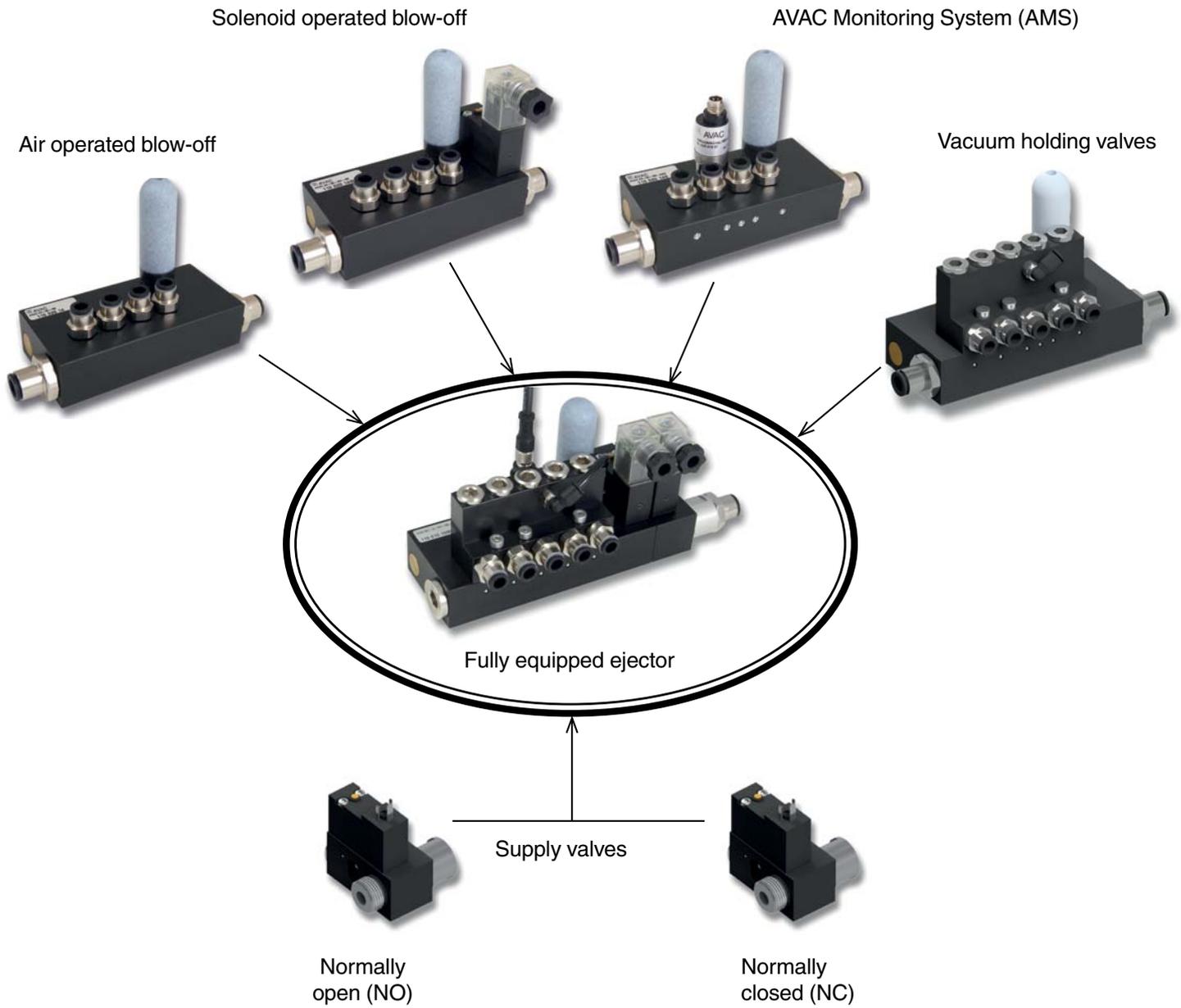
## Content

<p><b>MULTI-CIRCUIT Ejectors</b></p> <p>Independent vacuum circuits and common blow-off. AVAC Monitoring System (AMS) Independent vacuum holding valves.</p>		<p><b>Page 4-13</b></p>
<p><b>BOOSTER RELEASE Ejectors</b></p> <p>Minimum cycle times and blow-off with precision increase the efficiency. Available in two sizes.</p>		<p><b>Page 14-17</b></p>
<p><b>ENERGY SAVING Ejectors</b></p> <p>Pneumatic air saving device reduces the air consumption with up to 99 %. Available in six sizes.</p>		<p><b>Page 18-19</b></p>
<p><b>AUTOVAC MFE</b></p> <p>Multi Function Ejector. Available in 4 sizes. Programmable air saving unit.</p>		<p><b>Page 20-23</b></p>
<p><b>CEA VAKUUMGRIPDON</b></p> <p>Flexible vacuum gripper for use on several robots including so-called “Cobots”.</p>		<p><b>Page 24-25</b></p>
<p><b>Vacuum and Pressure sensing</b></p> <p>This program includes 6 types of vacuum/ pressure sensors for monitoring and controlling the most diverse industrial applications.</p>		<p><b>Page 26-27</b></p>
<p><b>Other Products</b></p> <p>BASE Ejectors, Solenoid operated ejectors, Ejectors with vacuum holding function.</p>		<p><b>Page 28-31</b></p>

AVAC Vakuumtechnik AB is certified according to ISO 9001 Quality Management System.



## Configuration options



**Product Brochure**

<http://www.avac.se/pdf/U-MULTI.pdf>



## Ordering key



Code	Primary nozzle(s) Ø mm
010	0,50
020	0,70
030	0,85

Code	No of circuits
14	4
15	5
16	6
18	8

Code	Function
	Air operated blow-off
M	Solenoid operated blow-off
S	AVAC Monitoring System (AMS)
B	Equipped with vacuum holding valves
C	Supply valve normally closed NC
O	Supply valve normally open NO

### Example

MULTI-CIRCUIT Ejector with ordering key 110 010 14 MSBC is equipped with:

**Bas:**

- 010 = Primary nozzles Ø0,5 mm
- 14 = 4 circuits
- M = Solenoid operated blow-off
- S = AVAC Monitoring System AMS
- B = Equipped with vacuum holding valves
- C = Supply valve, NC

The ejector is delivered without fittings, silencers and cable connectors

## General technical data for MULTI-CIRCUIT Ejectors

Nozzle/ Size	Primary nozzle(s) Ø mm	Air consumption NI/min.	Evacuation time (s)*	Vacuum flow at different vacuum level [NI/min]									
				0%	10%	20%	30%	40%	50%	60%	70%	80%	
10	0,50	10	18	7,5	6,5	5,5	4,0	2,5	1,0	0,8	0,5	0,3	
20	0,70	20	9	14,2	12,5	9,8	6,5	4,0	3,0	2,0	0,9	0,5	
30	0,85	30	6	22,0	19,5	16,5	13,0	9,5	6,0	3,5	1,5	1,0	

\* Time to evacuate 1 litre air from atmospheric pressure to 75% vacuum.

No of circuits	A [mm]	Connecting threads				Weight [g]	Additional weight per function [g]			
		P	V	R	RR		"M"	"B"	"C"	"O"
4	101	2xG3/8	4xG1/8	G3/8	M5	290	+40	+80	+120	+120
5	116		5xG1/8			330	+40	+100	+120	+120
6	131		6xG1/8			370	+40	+120	+120	+120
8	161		8xG1/8			450	+40	+120	+120	+120

## Air Operated Blow-Off

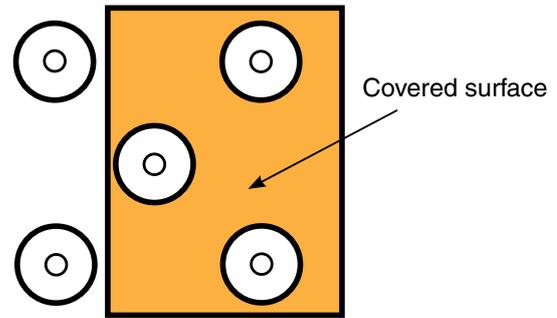


### SIMPLE AND CLEAR INSTALLATION

Simplifies assembly and installation with reduced cost and improved visibility as result.

### 4 TO 8 INDEPENDENT VACUUM CIRCUITS

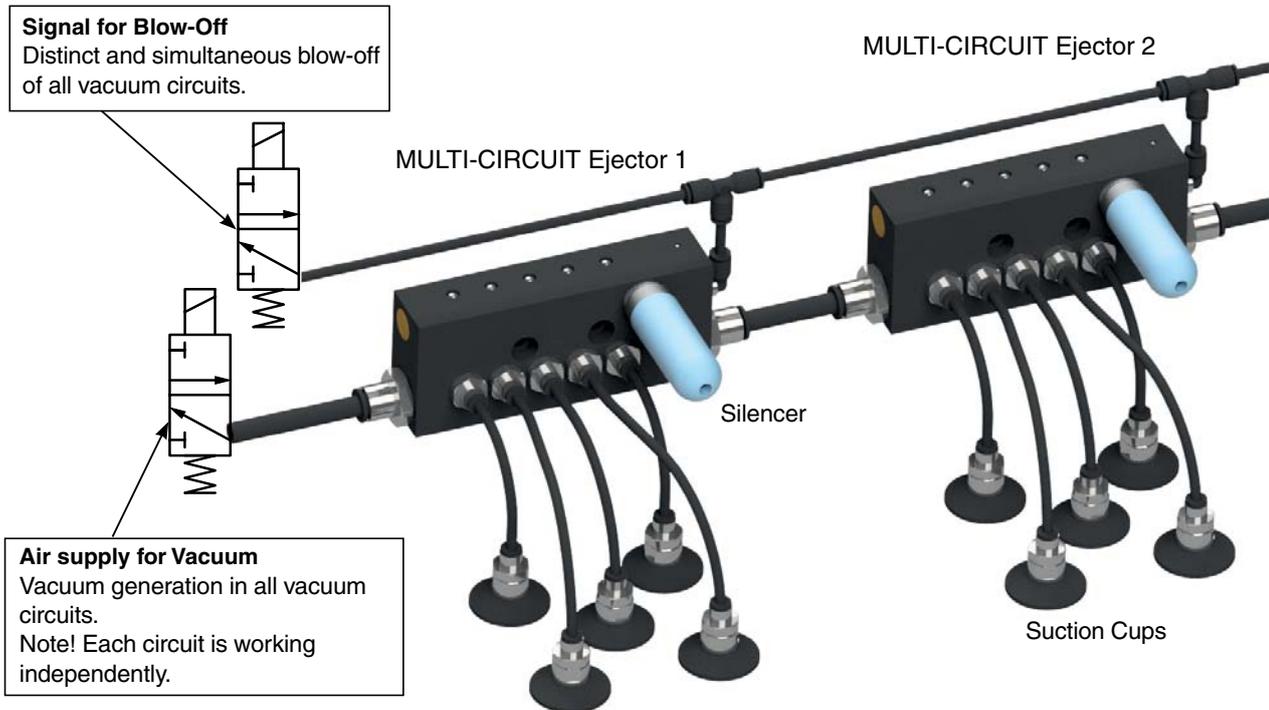
Maintains the vacuum level in other suction cups in case of damaged cup or without contact.



### COMMON BLOW-OFF

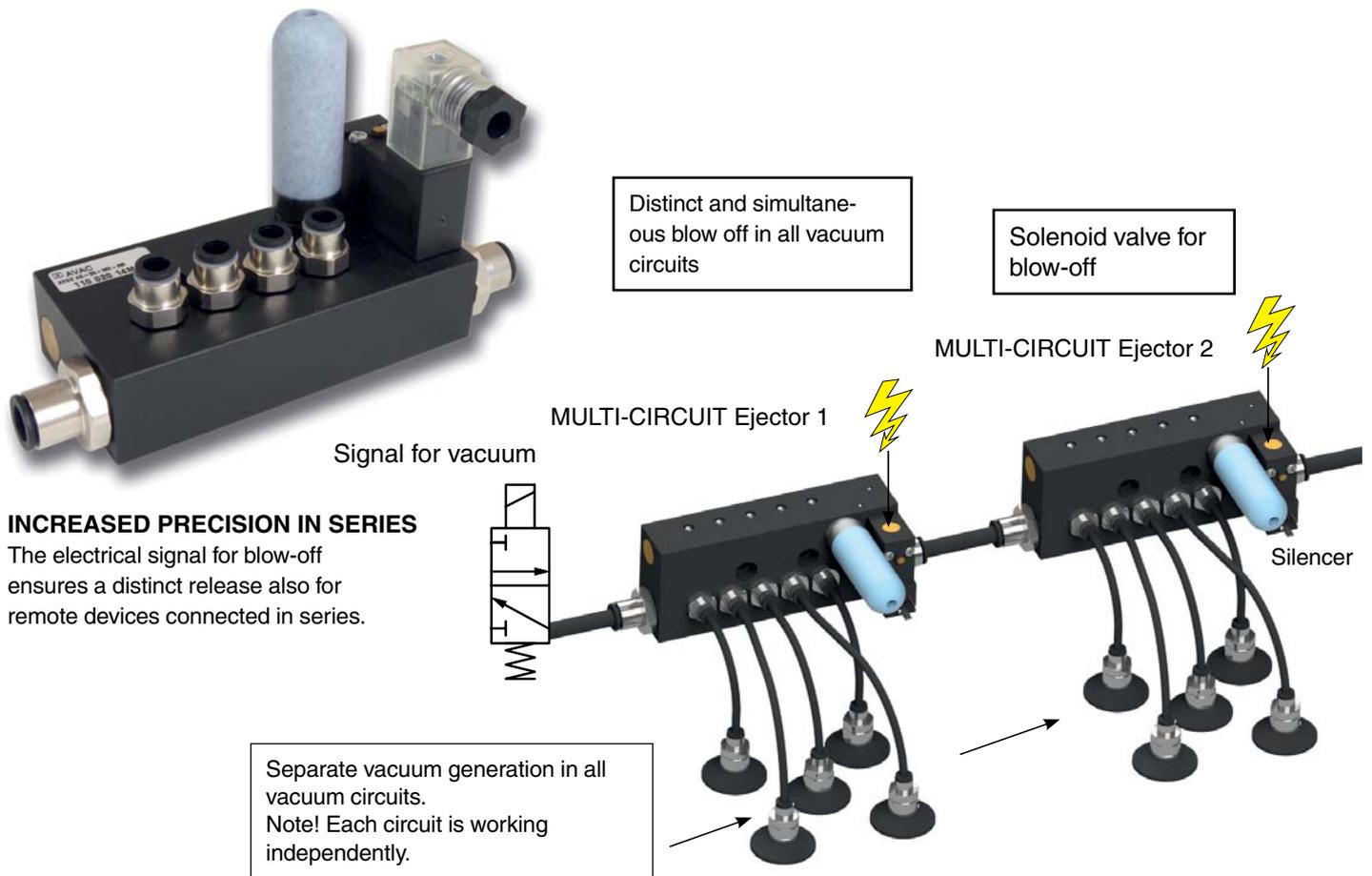
Distinct and simultaneous blow off in all vacuum circuits makes it easier to release the object in the right position.

## AVAC MULTI-CIRCUIT Ejector with common air operated blow-off

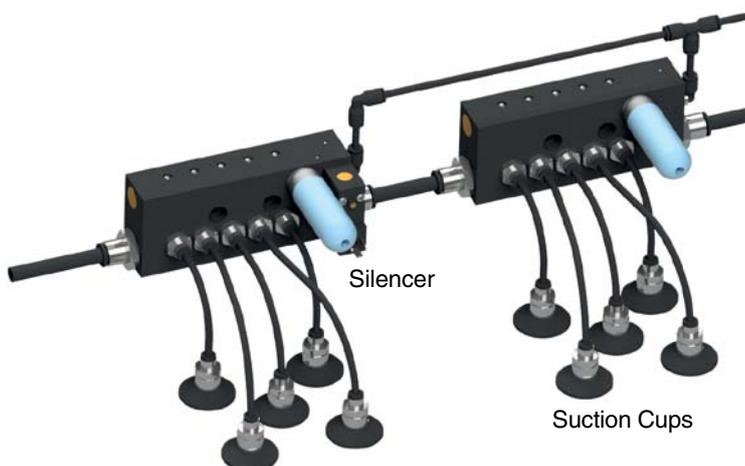


# MULTI-CIRCUIT Ejector

## Solenoid Operated Blow-Off



## Solenoid operated (MASTER) and air operated (SLAVE) blow-off.



### MASTER/SLAVE COMBINATION

By combining one solenoid operated (MASTER) with one or more air operated MULTI-CIRCUIT Ejectors (SLAVES), the internal signal from the solenoid valve for blow-off can be used for blow-off of the slave units by removing the M5 plug and connect the blow-off port of the SLAVE unit(s). Provided that the blow-off capacity is sufficient.

## AVAC Monitoring System (AMS) with independent vacuum circuits & common blow off

# AMS

The MULTI-CIRCUIT Ejector AMS is patented.  
This version has the same features as the other models.  
High safety as the vacuum circuits are separated from each other.

- > 85% vacuum at 4.5 bar
- Very compact
- Low weight
- Quick response
- Controlled Rapid Release (RR)
- Robust
- Easy mounting
- Good overview as it is centrally mounted

### Other features and benefits

- One single vacuum sensor (digital or analog) monitors all vacuum circuits.
- Means a significantly lower cost for vacuum sensors and installation.
- Fewer inputs on the controller reduce the component and programming costs.
- Enables predictive maintenance in case of a system leakage.



**Innovation prize  
"Award for Blechexpo"**

AVAC MULTI-CIRCUIT Ejector AMS was appointed the most innovative product in category Handling technology/robotics at the Blechexpo 2017 in Stuttgart, the international trade fair for sheet metal working.

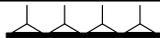
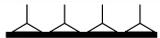
**AWARD**  
ZUR  
2017

Charts for vacuum values in the sensor port as a function of the number of suction cups engaged/open and ejector capacity 85%.

Vacuum level in Multi Circuit Ejector 4K with AMS

	Circuit				Value sensor port S
	1	2	3	4	
	85%	85%	85%	85%	85%
	81%	81%	81%	0%	60%
	80%	80%	0%	0%	21%
	78%	0%	0%	0%	4%

Vacuum level in Multi Circuit Ejector 5K with AMS

	Circuit					Value sensor port S
	1	2	3	4	5	
	85%	85%	85%	85%	85%	85%
	82%	82%	82%	82%	0%	68%
	80%	80%	80%	0%	0%	34%
	78%	78%	0%	0%	0%	13%
	76%	0%	0%	0%	0%	2%

Vacuum level in Multi Circuit Ejector 6K with AMS

	Circuit						Value sensor port S
	1	2	3	4	5	6	
	85%	85%	85%	85%	85%	85%	85%
	82%	82%	82%	82%	82%	0%	72%
	80%	80%	80%	80%	0%	0%	47%
	78%	78%	78%	0%	0%	0%	21%
	76%	76%	0%	0%	0%	0%	8%
	75%	0%	0%	0%	0%	0%	1%

Vacuum level in Multi Circuit Ejector 8K with AMS

	Circuit								Value sensor port S
	1	2	3	4	5	6	7	8	
	85%	85%	85%	85%	85%	85%	85%	85%	85%
	84%	84%	84%	84%	84%	84%	84%	0%	78%
	84%	84%	84%	84%	84%	84%	0%	0%	63%
	83%	83%	83%	83%	83%	0%	0%	0%	43%
	82%	82%	82%	82%	0%	0%	0%	0%	22%
	81%	81%	81%	0%	0%	0%	0%	0%	10%
	81%	81%	0%	0%	0%	0%	0%	0%	4%
	80%	0%	0%	0%	0%	0%	0%	0%	1%

Vacuum levels in the charts are theoretical. The actual values depend on the volume, restrictions and potential leaks in the vacuum circuit. The actual values in the application should be measured so that the sensor can be adjusted accordingly.

## Vacuum holding valves increase safety

This version has all the advantages of the MULTI-CIRCUIT Ejector. Additionally, each vacuum circuit has a separate built-in vacuum holding valve.

As long as the ejector generates vacuum the vacuum holding valves are open. At loss of inlet pressure which interrupts the vacuum generation, the vacuum holding valves close between the ejector and the suction cup. It means that the vacuum in the suction cups remains until system leakage reduces the vacuum level.

At blow-off mode, a common signal is given to all vacuum holding valves to open simultaneously. This results in a system with quick response and with excellent visibility.



Picture of a MULTI-CIRCUIT Ejector with solenoid valve operated blow-out and AVAC Monitoring System (AMS) equipped both with MULTI Supply valve and Vacuum Holding valves.

**Vacuum generation is in progress when the air supply is switched on.**

**In case of air pressure loss, the vacuum generation stops and the ejector vacuum holding valves closes. The vacuum level in the suction cups is maintained, but system leakage reduce the vacuum level.**

**Blow off is achieved by giving the signal for vacuum generation and blow off simultaneously.**

## Reduced air consumption

*An example how to save considerable amount of compressed air, this require an external control system and sensor in the AMS port.*

As the sensor in the AMS port provides an output signal when all vacuum circuits have reached the pre-set vacuum level, the vacuum generation can be switched off, resulting in that all vacuum holding valves are closing.

The vacuum level in the suction cups is thus maintained, but in the event of a system leakage, the vacuum level will gradually decrease in the concerned circuit.

Since the sensor does not continuously monitor the vacuum level, the vacuum generation must be restarted to monitor the actual vacuum level in the suction cups. If the system is air tight,

such a check takes less than 50ms which makes the air consumption for this almost negligible. How often this check should be made depends on the safety requirements for the specific application.

The vacuum level in the circuits are monitored via the AMS-sensor, and at each check, the vacuum generation restarts which restores the vacuum level to the pre-set level.

If the time to restore the vacuum level has increased more than expected, the cause of the leakage should be investigated. Before the leakage has been rectified a more frequent check of the vacuum level should be initiated.

Alternatively, a switch to continuous vacuum generation could be made.

## Materials

Body	Black anodized aluminium
Nozzles	Brass
Piston	Acetal

## Temperature

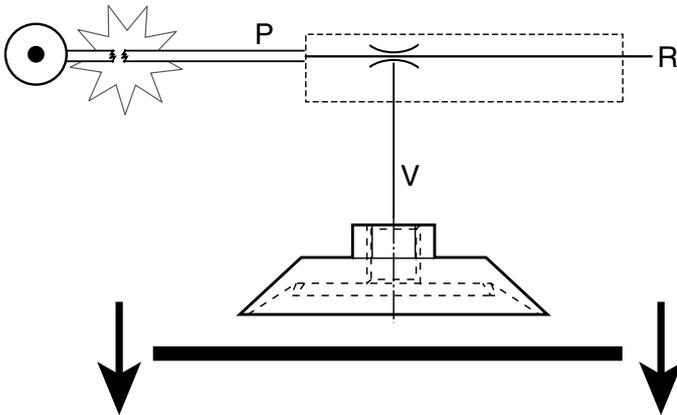
Air operated ejectors	-15 to +60 °C
Solenoid operated ejectors	0 to +50 °C

## Compressed air

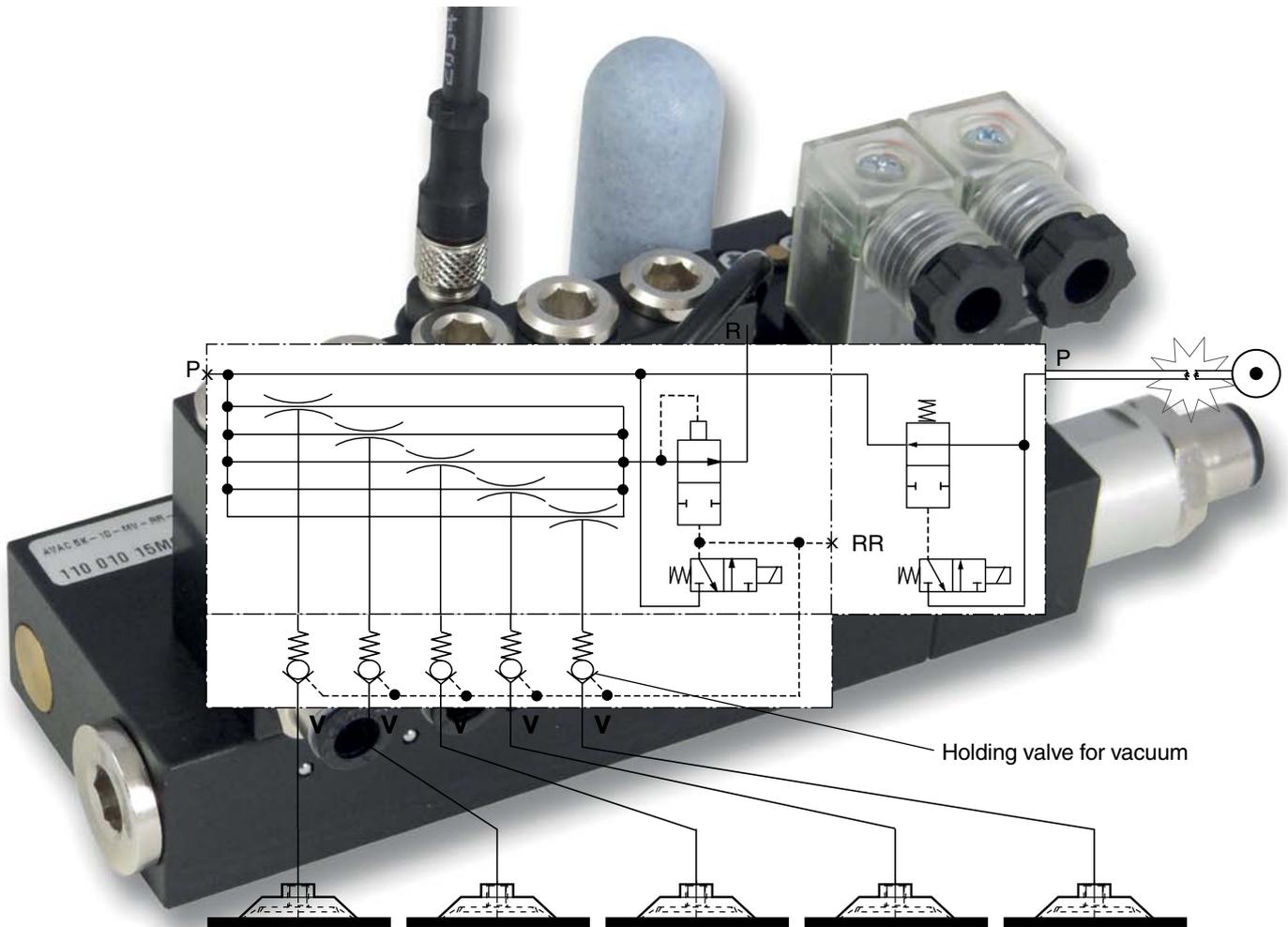
Pressure	max 8 bar
Optimum supply pressure	4.5 bar

# MULTI-CIRCUIT Ejector

## Vacuum holding valves increase safety



Vacuum is generated when the ejector is supplied with air. If the air supply would be interrupted by e.g., a compressor failure, a malfunctioning valve or a loose connection, the vacuum will not be maintained as atmospheric pressure leaks into the suction cup, causing an unforeseen drop of the object.



An ejector equipped with a holding valve prevents the atmospheric pressure from leaking through the vacuum port into the vacuum area.

This is how the holding valve works:  
When the ejector is operating, the holding valve is opens and air can be evacuated from the suction cup.

When vacuum is not created, the valve is closed. The leakage in the vacuum circuit, reduces the vacuum level gradually. How long it will take until the object is dropped depends on the leakage flow.

The holding valve is mainly used in applications where air tight materials are handled e.g. plastic, metal or glass.

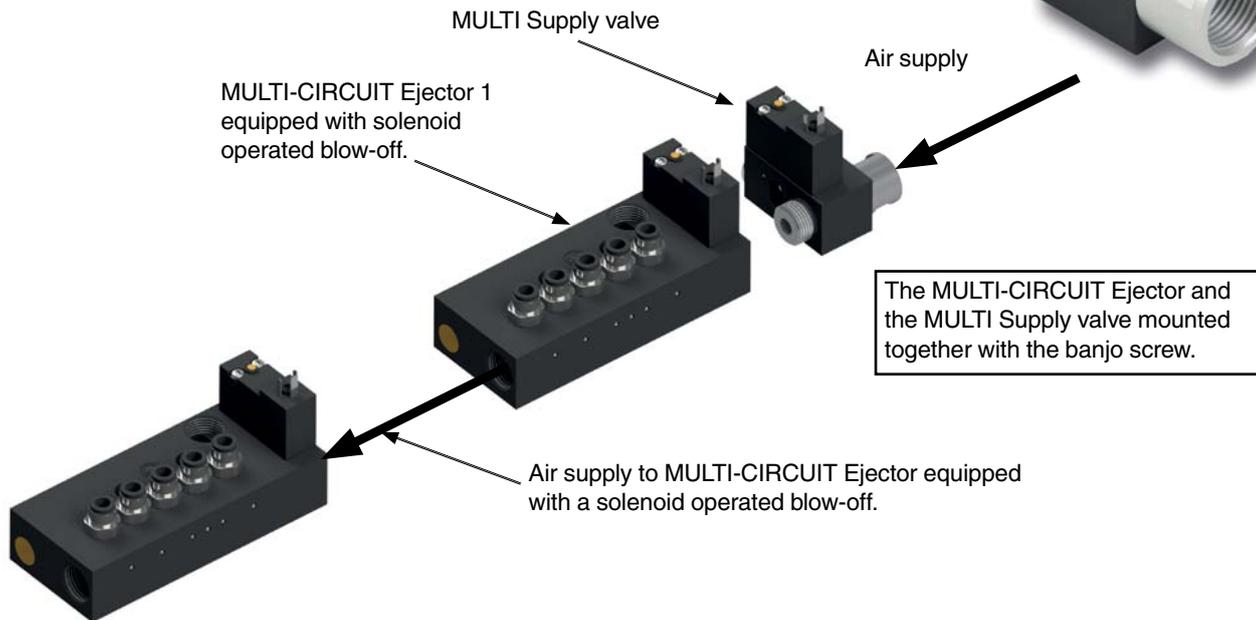
As the vacuum holding valve is maintaining the vacuum level, a blow-off function is required to release the object rapidly and with accuracy.

**NOTE: The holding valve cannot be regarded as a safety product, but to be considered as a possibility to extend the time until the object is dropped.**

## Supply valve NC or NO

Simplified assembly for a stand-alone MULTI-CIRCUIT Ejector or to feed a limited number of ejectors results in an improved overview.

Normally Open (NO) solenoid valve can increase safety as long as the air supply exists, even if an electrical power failure to the solenoid valve occurs.



The solenoid operated supply valve can easily be mounted with the banjo screw in the supply port of the ejector. The air flow of the valve is sufficient to supply an number of ejectors in serie and is only intended to be used in combination with solenoid operated blow-off

### NOTE!

The MULTI Supply valve is only intended to use in combination with MULTI-CIRCUIT Ejectors with solenoid operated blow-off.

See Ordering key on page 5

### Materials

Body:	Black anodized aluminium
Banjo screw:	Anodized aluminium
Piston:	Aluminium
Seals:	Nitril rubber NBR

### Temperature

Temperature range:	0 to +50 °C
--------------------	-------------

### Compressed air

Max pressure:	8 bar
Optimal pressure:	5,5 bar

### Flow capacity:

Flow capacity: 240 NI/min at  $\Delta P$  1bar.  
Sufficient to supply air to:  
24 nozzles size 10,  
12 nozzles size 20,  
8 nozzles size 30,  
Or a mix of nozzle sizes to a maximum of 240

Designation	Weight g	Order no.
MULTI Supply valve NC	120	482 000 00
MULTI Supply valve NO	120	482 000 01

## Evacuation and Blow-off time per circuit for suction cup volumes.

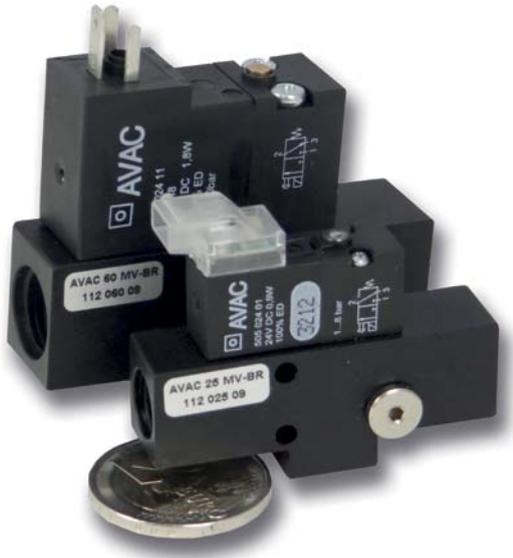
In practice

Multi-Circuit-Ejectors with supply pressure 5 bar				
				
	Flat cup Ø30 mm Volume 1,7 cm <sup>3</sup>	Flat cup Ø50 mm Volume 7 cm <sup>3</sup>	Flat cup Ø80 mm Volume 36 cm <sup>3</sup>	Flat cup Ø100 mm Volume 58 cm <sup>3</sup>
Time to evacuate a suction cup from 0 to 70% vacuum in ms				
Size 10 Nozzle Ø0.5 mm	21	85	436	702
Size 20 Nozzle Ø0.7 mm	12	47	238	383
Size 30 Nozzle ø0,85 mm	8	32	159	255
Blow-off time from 70% vacuum to 0 in ms				
Size 10 Nozzle Ø0.5 mm	2	9	44	70
Size 20 Nozzle Ø0.7 mm	1	5	24	38
Size 30 Nozzle ø0,85 mm	<1	3	15	23

0 = atmospheric pressure

Tubings and connectors volumes not included.

## Patented Blow-Off



### DIRECT MOUNTED ON THE SUCTION CUP

The response time for achieving vacuum and for blow-off is considerably shorter and is done with higher accuracy compared to an ejector remotely located from the suction cup.

### MULTIPLE SUCTION CUPS

One single Booster Release ejector can be used for several suction cups if the capacity to generate vacuum and blow-off is sufficient.

### BLOW-OFF WITH BOOSTER EFFECT

Minimizes the time of blow-off and releases the work piece gentle and with accuracy.

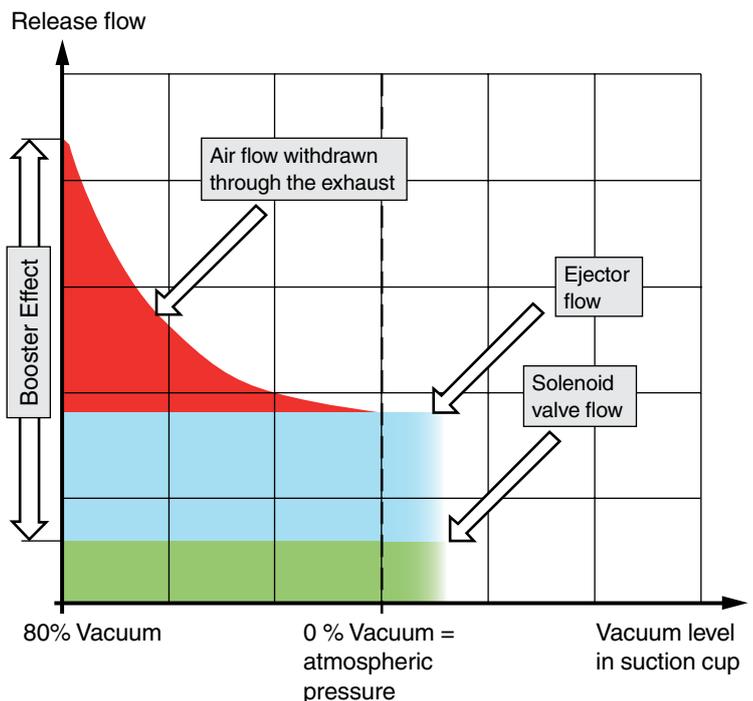
### ADVANTAGE PNEUMATIC SIGNAL

A pneumatic signal is significantly faster than a vacuum signal, therefore it is beneficial to place the ejector near the suction cups. The tube dimensions can be reduced considerably.

### ADVANTAGE ELECTRICAL SIGNAL

At blow-off an electrical signal is given to all ejectors which will release the work piece instantaneously. The switch to blow-off mode takes approximately 5 ms and with a flat suction cup  $\varnothing 50$  mm it releases in 3.5 ms.

### Blow-off with Booster Effect



### SERVICE LIFE

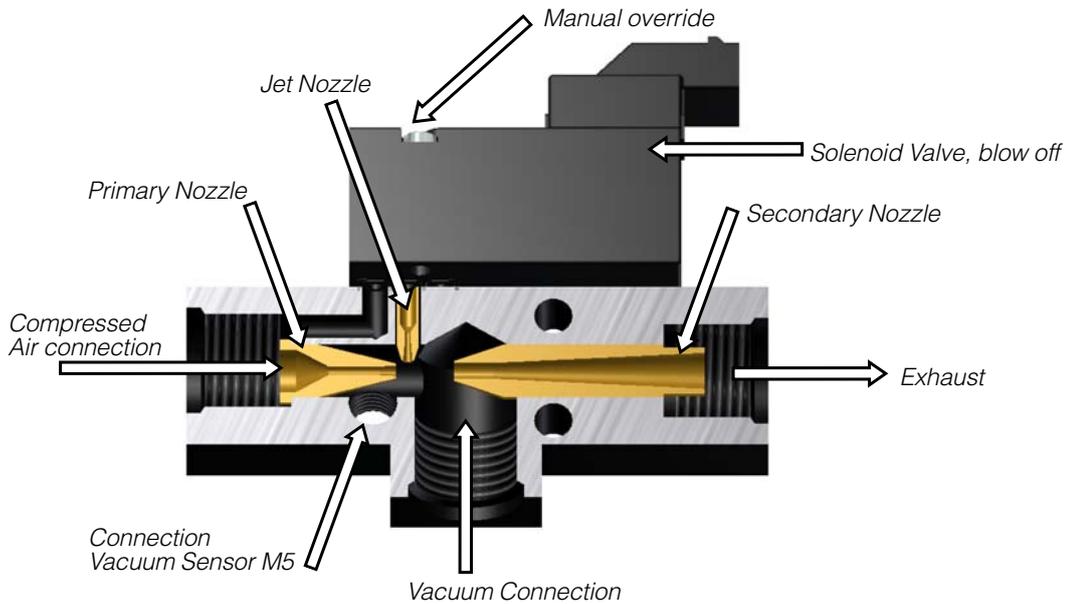
The long service life will ensure a reliable function with reduced air consumption.

### Product Brochure

<http://www.avac.se/pdf/U-BRE.pdf>

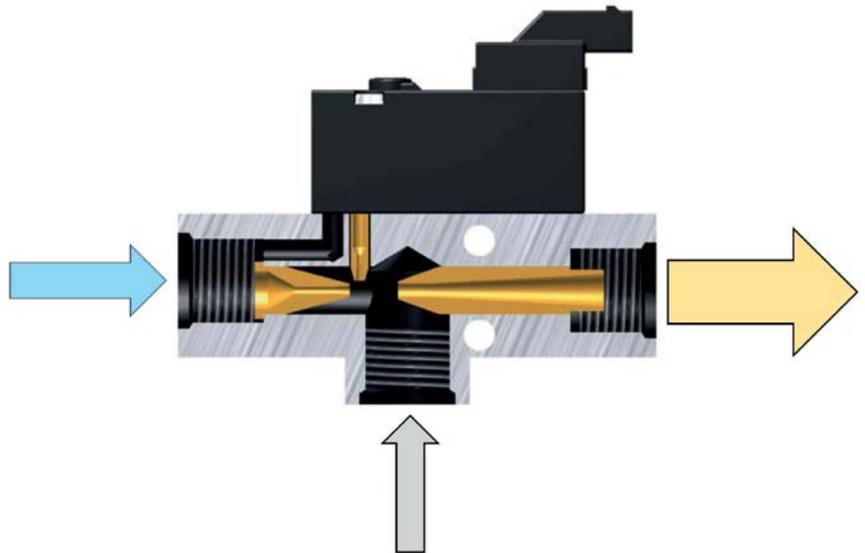


## Functional description



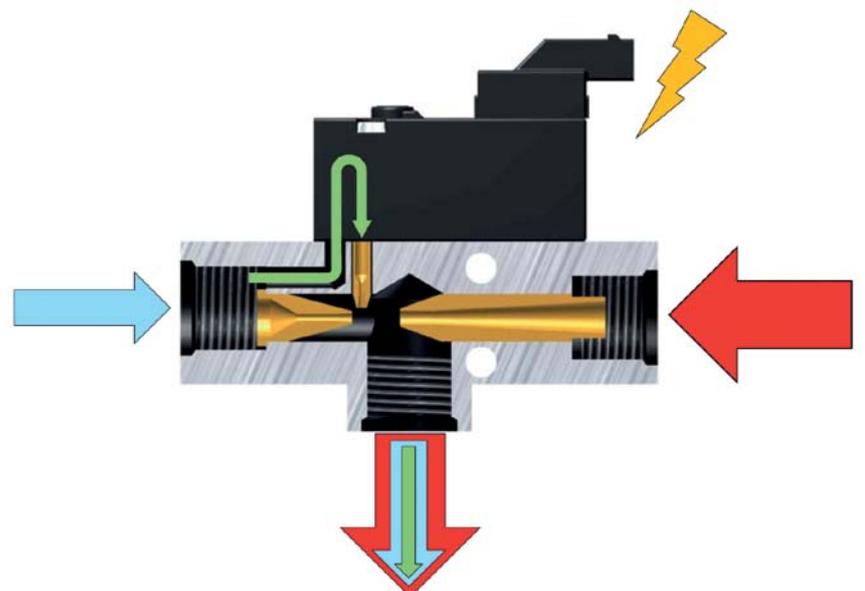
### VACUUM GENERATION

The ejector is supplied with compressed air which is led through the primary nozzle and blown to the secondary nozzle, drawing the air from the vacuum connection where vacuum is achieved.

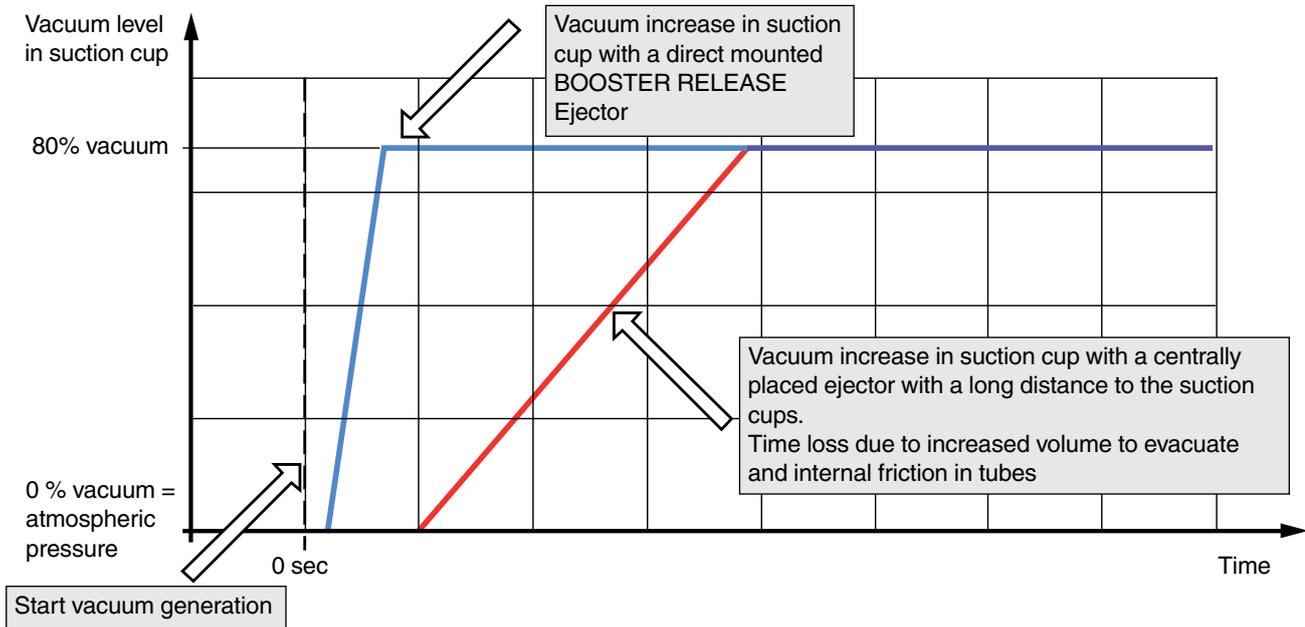


### THE RELEASE PHASE

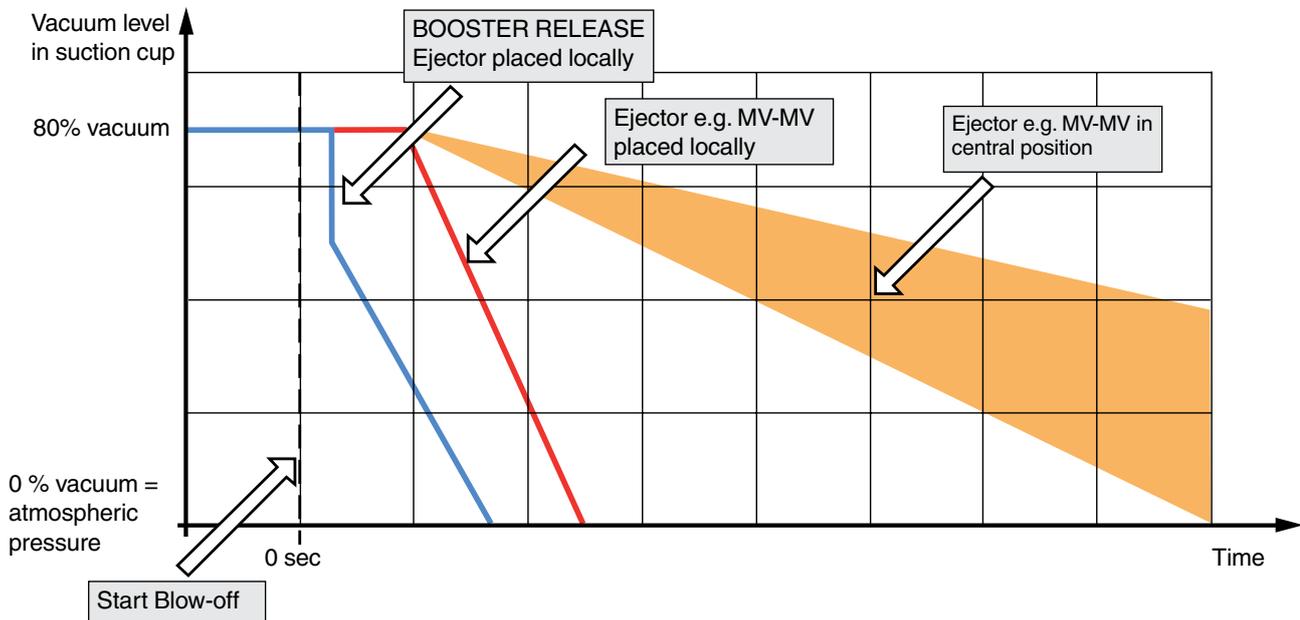
When the solenoid valve is actuated, compressed air is blown through the Jet Nozzle linking off the air from the primary nozzle into the vacuum connection. Additionally air is withdrawn through the exhaust. At the beginning, the withdrawn air signifies the major part of the blow-off. When the vacuum level gradually is sinking the withdrawn air loses importance. At atmospheric pressure only the flow through the jet- and primary nozzles remain.



## Time savings vacuum generation



## Time savings Blow-off



### Materials

Body Black anodized aluminium  
Nozzles Brass

### Temperature

Temperature range -10 to +50 °C

### Compressed air

Pressure max 8 bar  
Optimum supply pressure 5 bar

# BOOSTER RELEASE Ejector



Designation	Primary nozzle Ø mm	Max vacuum flow NI/min	Connecting threads P, V and R	Air consumption NI/min	Solenoid valve flow NI/min	Flow blow off NI/min	Evacuation- / Blow-off time for 1 liter volume to % vacuum / atmospheric pressure			Weight g	Order no.
							0 ⇒ 50% / 50% ⇒ 0 (Sec)	0 ⇒ 60% / 60% ⇒ 0 (Sec)	0 ⇒ 70% / 70% ⇒ 0 (Sec)		
AVAC 25 MV-BR	0,8	26,0	G1/8	30	15	110 - 45	1,80 / 0,50	2,50 / 0,56	3,90 / 0,61	35	112 025 09
AVAC 60 MV-BR	1,2	65	G1/4	75	38	250 - 113	0,68 / 0,17	1,0 / 0,19	1,47 / 0,22	85	112 060 09

## In practice AVAC 25 MV-BR

	BOOSTER RELEASE Ejector placed locally				BOOSTER RELEASE Ejector in central position
					
	Flat cup Ø30 mm Volume 1,7 cm <sup>3</sup>	Flat cup Ø50 mm Volume 7 cm <sup>3</sup>	Flat cup Ø80 mm Volume 36 cm <sup>3</sup>	Flat cup Ø100 mm Volume 58 cm <sup>3</sup>	Unit with 3 flat cups with Ø30 mm, connected to ejector with totally 30 cm tube Ø8/6 mm. Total volume 3 x 1.7 + 10 = 15.1 cm <sup>3</sup>
<b>Evacuation time in ms</b>					
0 ⇒ 50% Vacuum	3	12	65	104	27
0 ⇒ 60% Vacuum	4	17	90	145	38
0 ⇒ 70% Vacuum	7	27	140	226	59
<b>Blow-off time in ms</b>					
50% Vacuum ⇒ 0	<1	3,5	18	29	7
60% Vacuum ⇒ 0	<1	4,0	20	32	8
70% Vacuum ⇒ 0	1	4,3	22	35	9

0 = atmospheric pressure

## In practice AVAC 60 MV-BR

	BOOSTER RELEASE Ejector placed locally				BOOSTER RELEASE Ejector in central position
					
	Flat cup Ø50 mm Volume 7 cm <sup>3</sup>	Flat cup Ø80 mm Volume 36 cm <sup>3</sup>	Flat cup Ø100 mm Volume 58 cm <sup>3</sup>	Flat cup Ø125 mm Volume 120 cm <sup>3</sup>	Unit with 3 flat cups with Ø50 mm, connected to ejector with totally 50 cm tube Ø8/6 mm. Total volume 3 x 7 + 14 = 35 cm <sup>3</sup>
<b>Evacuation time in ms</b>					
0 ⇒ 50% Vacuum	4,7	24	39	81	24
0 ⇒ 60% Vacuum	7,0	36	58	120	35
0 ⇒ 70% Vacuum	10,3	53	85	176	51
<b>Blow-off time in ms</b>					
50% Vacuum ⇒ 0	1,2	6	10	20	6
60% Vacuum ⇒ 0	1,3	7	11	23	7
70% Vacuum ⇒ 0	1,5	8	13	26	8

0 = atmospheric pressure

## Ejector with Vacuum Holding Valve and Air Saving Device



### 2BV AIR SAVE EJECTOR

The ejector is equipped with an integrated full pneumatic control circuit which shuts off the air supply when the preset max vacuum level is reached and restarts when reaching the min level. This enables compressed air savings of more than 95 %.

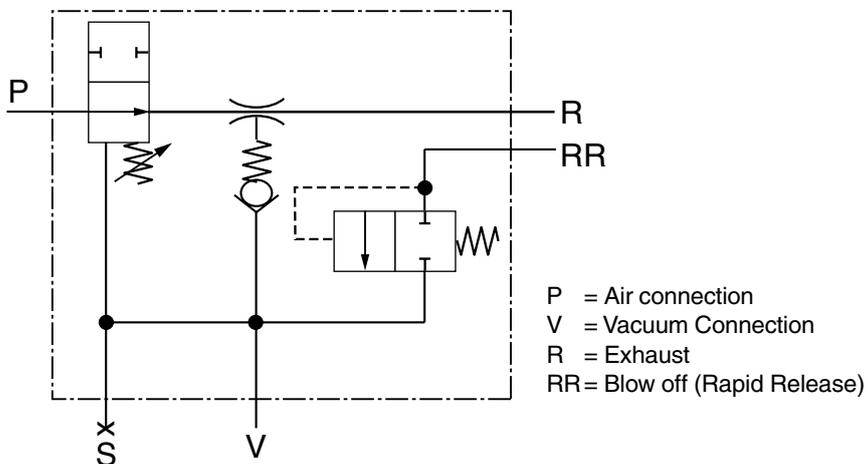
### BLOW-OFF IMPULS

The valve in the blow-off port opens at 0.5 bar, which results in a very quick and controlled blow-off.

### SIMPLE INSTALLATION

Connect the air supply (P) and the blow-off impuls (RR). The internal control circuit monitors the vacuum level and shuts of the air consumption when the max vacuum level is reached and restarts when reaching the min level.

### 2BV AIR SAVE Ejector



#### Materials

Body Black anodized aluminium  
 Nozzle Brass

#### Temperature

Temperature range -10 to +70 °C

#### Compressed air

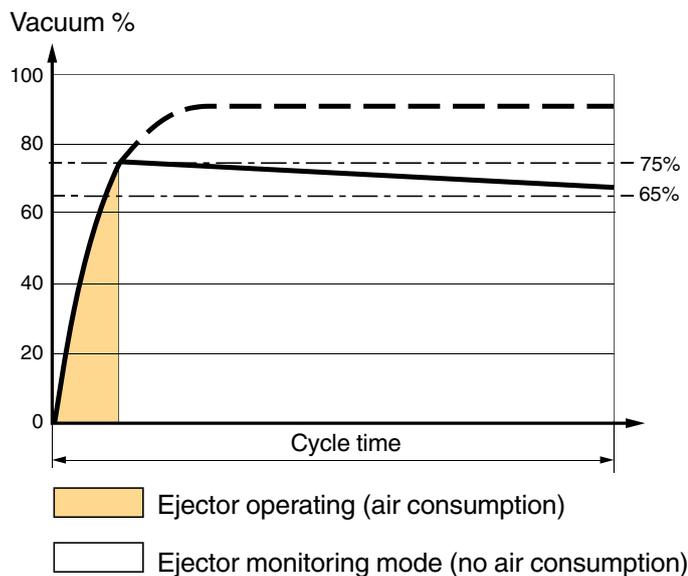
Pressure max 8 bar  
 Optimum supply pressure 4,5 bar

#### Product Brochure

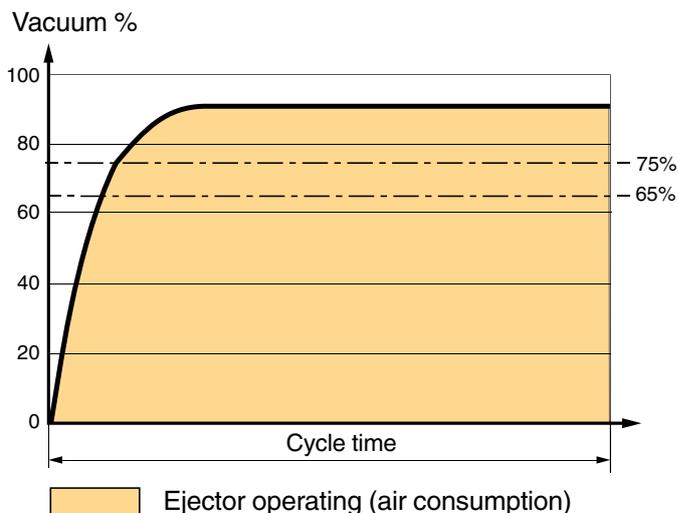
<http://www.avac.se/pdfu/U-2BVAS.pdf>



## Air saving potential with 2BV AIR SAVE Ejector



## Air consumption with a traditional ejector



### Case 1

1. A 0,1 litre volume shall be evacuated to 75% vacuum in 0,3 seconds. An ejector size 60 has been chosen.
2. A cycle time is 120 seconds.
3. By using an ejector without air saving, the total air consumption is 120 litre per cycle.
4. With a 2BV 60 AIR SAVE EJECTOR the air consumption is 0.3 litre under the same conditions.
5. This results in an air saving of more than 99 %.

### Case 2

1. A 0,05 litre volume shall be evacuated to 75% vacuum in 0,36 seconds. An ejector size 30 has been chosen.
2. A cycle time is 10 seconds.
3. By using an ejector without air saving, the total air consumption is 5 litre per cycle.
4. With a 2BV 30 AIR SAVE EJECTOR the air consumption is 0.18 litre under the same conditions.
5. This results in an air saving of more than 96 %.

Designation	Primary nozzle(s) Ø mm	Max vacuum flow NI/min	Connecting threads				Air consumption NI/min.	Evacuation time (Sec)*	Weight g	Order no.
			P	V	R	RR				
AVAC 2BV-AS-20	0,70	12,8	G1/4	G1/2	G1/4	M5	0 to 20	9	310	300 020 07
AVAC 2BV-AS-30	0,95	17,3	G1/4	G1/2	G1/4	M5	0 to 30	6	315	300 030 07
AVAC 2BV-AS-40	1,10	27,6	G1/4	G1/2	G1/4	M5	0 to 40	4,5	320	300 040 07
AVAC 2BV-AS-60	1,25	42,6	G1/4	G1/2	G1/4	M5	0 to 60	3	325	300 060 07
AVAC 2BV-AS-100	2 x 1,1	64,0	G1/4	G1/2	G1/2	M5	0 to 100	2	325	300 100 07
AVAC 2BV-AS-150	3 x 1,1	96,0	G1/4	G1/2	G1/2	M5	0 to 150	1,2	325	300 150 07

\* Time to evacuate 1 litre air from atmospheric pressure to 75% vacuum.

## AUTOVAC MFE (Multi Function Ejector)

### Basic features:

- > 85 % vacuum at 5 bar
- Built-in vacuum holding valve to delay vacuum drop in case of pressure loss
- Solenoid valves for vacuum generation / blow-off
- Large adjustable blow-off for quick and smooth expulsion
- Built-in silencer alternatively G1/2 connection
- Compact design
- Robust design with ejector body in aluminium
- Stackable on multiple manifolds
- Protection class IP65

### Control system characteristics:

- Programmable vacuum range and safety level
- Programmable alternatively self-teaching blow-off
- Indication of predictive maintenance like detection of worn vacuum cups
- Simple communication via a standard M12 connector alternatively cable with M8 connector

### Simple interaction man-machine

The AUTOVAC MFE is equipped with a display which shows the current vacuum level and gives visual feedback at programming. The device has push buttons and LEDs for visual indication and programming. Electrical communication is made via an M12 connector alternatively cable with M8 connector.

### Predictive Maintenance

Possible preventive supervision of functionality. Detection of worn vacuum cups for preventive maintenance.

### Safety

Built-in vacuum holding valve provides secure handling of heavy objects.

### Integrated air saving system and increased safety

The external start signal initiates vacuum generation. The vacuum generation is maintained for as long as the start signal is enabled.

The internal control system switches off the vacuum generation when the set upper limit (70%) is reached and restarts if the lower limit (65%) is reached. This process continues until the start signal is disconnected, resulting in an air saving potential of >95%.

A feedback signal is given when the vacuum level reaches the preset security level (60%) and is interrupted when the vacuum level falls below this level. The signal may be used to e.g. start or stop a process.



### Options to ensure efficient expulsion of material with blow-off:

#### 1. Time set blow-off

When the external start signal for vacuum generation is disconnected, the blow-off automatically starts for a preset time (0.5 s). The blow-off time is programmable.

#### 2. Adaptive blow-off

When the external start signal for vacuum generation is disconnected, the ejector automatically blows-off for a preset time (0.5 s). The blow-off time is programmable. If any vacuum would remain, additional blow-off pulses will be given until the blow-off has been completed.

The blow-off time of the previous cycle also adjusts the time in the following cycle.

Adaptive blow-off is primarily intended for dynamic applications where this self-learning function contributes to minimize blow-out time and thus air consumption.

#### 3. Manual / External blow-off

The blow-off is initiated by an external signal and continues as long as this signal is active.

#### Adjustable blow-off

The adjustable blow-off makes it possible to release the object smooth and gentle or the time for blow-off can be optimized.

#### Silencing

The ejector can be delivered with an integrated silencer or with a G1/2 thread to collect the exhaust air.

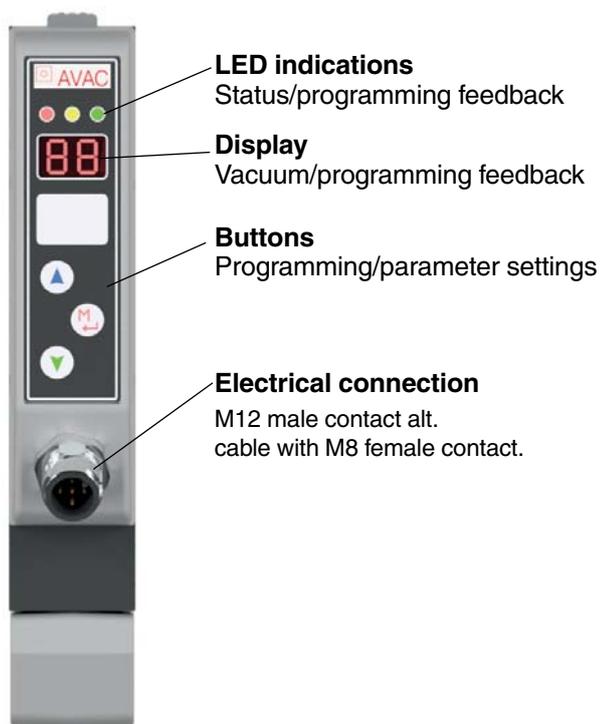
*The given values in brackets are example values*

#### Product Brochure

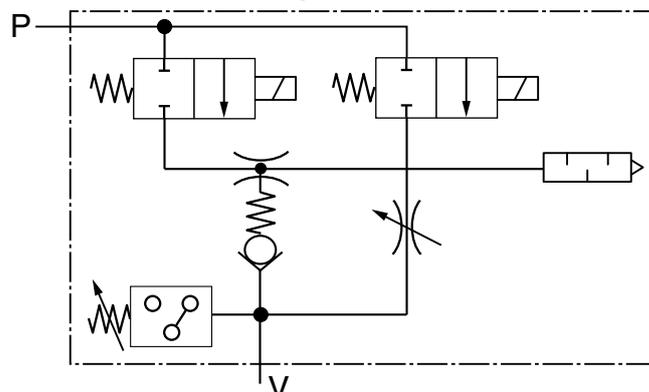
<http://www.avac.se/pdf/U-MFE.pdf>



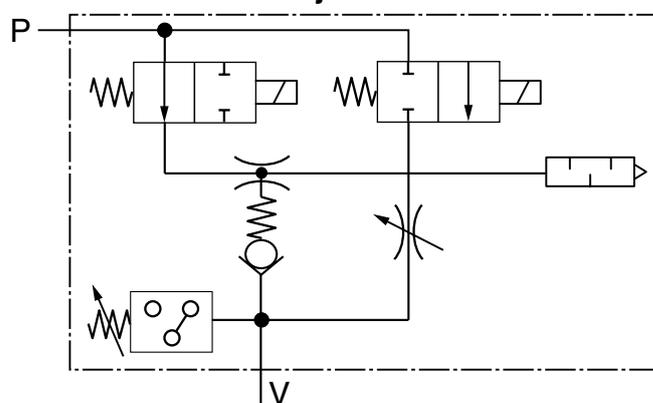
## Controlling/ Programming / Overview



### AUTOVAC MFE NC ejector



### AUTOVAC MFE NO ejector



### Electrical specification

Supply voltage 24 VDC  
 Outputs 24 VDC (PNP) max. 100 mA  
 Inputs 24 VDC (PNP)

### Materials

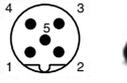
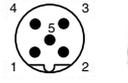
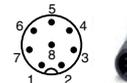
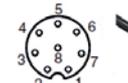
Ejector housing Black anodized aluminium  
 Nozzle Brass  
 Cover and silencer: PC/ABS  
 Cable PUR

### Temperature

Temperature range 0 to +50 °C

### Compressed air

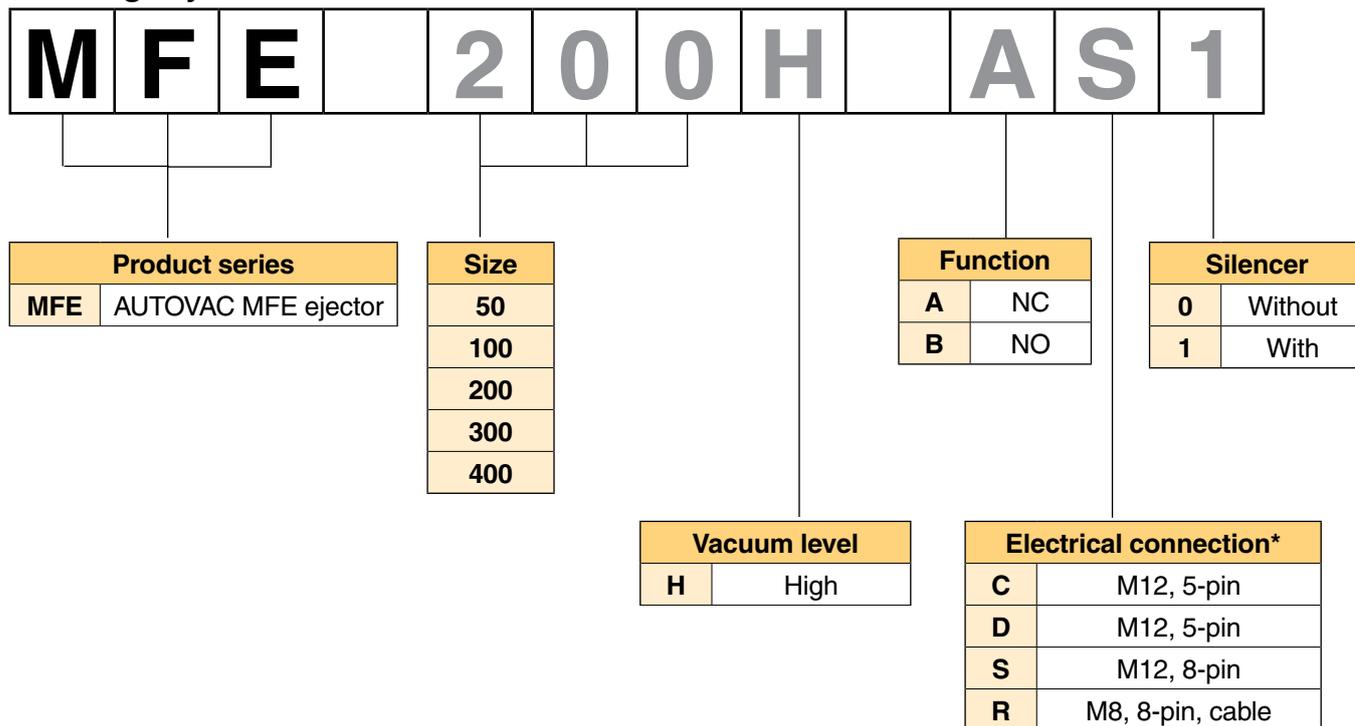
Pressure max 8 bar  
 Optimum supply pressure 5 bar

	Version C, M12 5-pin	Version D, M12 5-pin	Version S, M12 8-pin	Version R, M8 8-pin**
				
Time set blow-off	X	X	X	X
Adaptive blow-off	X	X	X	X
Manual / External blow-off	-	X	X	X
Feedback, Vacuum OK/Blow-off OK	X	X	X	X
Feedback, Predictive Maintenance*	X	-	X	X

\* Feedback when deviations in vacuum generation, e.g. when leakage occur.

\*\* The cable length for version R is 210 mm

## Ordering key



\*See table page 21

Designation	Primary nozzle(s) Ø mm	Max Vacuum flow NI/min	Connecting threads			Air consumption NI/min.	Evacuation time (s)*	Weight g	Air consumption Blow-off l/min
			P	V	R				
AUTOVAC MFE 50H	1,0	43	G1/4	G1/2	G1/2	53	2,30	360	25-400
AUTOVAC MFE 100H	1,5	80	G1/4	G1/2	G1/2	110	1,25	360	25-400
AUTOVAC MFE 200H	2,0	145	G1/4	G1/2	G1/2	200	0,65	360	25-400
AUTOVAC MFE 300H	2,5	195	G1/4	G1/2	G1/2	300	0,55	360	25-400
AUTOVAC MFE 400H	3,0	245	G1/4	G1/2	G1/2	430	0,40	360	25-400

All measurements are made at a supply pressure of 5 bar and without silencer.

\* Time to evacuate 1litre air from atmospheric pressure to 70% vacuum.

## Vacuum flow of the ejector

Designation	Vacuum flow at different vacuum level [NI/min]									
	0%	10%	20%	30%	40%	50%	60%	70%	80%	
AUTOVAC MFE 50H	43	40	36	30	22	16	13	6	2	
AUTOVAC MFE 100H	80	74	67	55	41	29	25	11	3	
AUTOVAC MFE 200H	145	130	113	91	66	48	36	20	5	
AUTOVAC MFE 300H	195	172	153	127	96	70	52	29	8	
AUTOVAC MFE 400H	245	220	195	165	128	101	77	43	11	

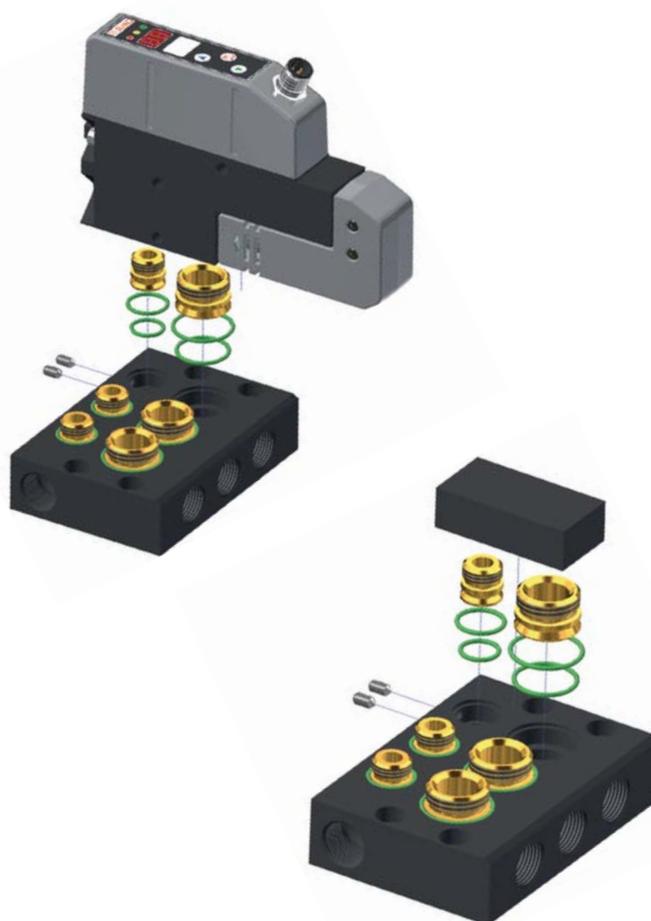
## Multiple manifolds

- Compact block mounting
- For all AUTOVAC MFE sizes
- Excellent overview
- Easy exchange of units
- Easy installation
- To prepare for a potential increase in the number of ejectors on the multiple manifolds, a blind plate is available to reserve one position for this purpose.

The units can also be supplied manifold mounted with two to five ejectors in any size.

1. The ejector is easily mounted onto the manifold by first fastening the brass nipples gently into the ejector or blind plate connections.
2. Then place the attached O-rings in the manifold carefully and push the ejector/blind plate gently together with manifold without damaging the O-rings.
3. Thereafter, tighten the set screws step by step to fix the ejector to the manifold.

The manifold can be connected to the air supply (G3/8) on either side.



*Multiple manifold*

Multiple manifold for quantity of AUTOVAC MFE	Vacuum - connection (V)	Weight g	Order no.
2	G3/8 (x2)	325	410 000 02*
3	G3/8 (x3)	445	410 000 03*
4	G3/8 (x4)	560	410 000 04*
5	G3/8 (x5)	680	410 000 05*
Blind plate		40	410 000 00

\* Screws and O-rings supplied

## Flexible vacuum gripper for use on several robots including so-called „Cobots“.

### Basic functions:

- Robot mounting interface according to ISO 9409-1-50-4-M6.
- Standard MFE ejector, large selection of configuration options.
- Connection threads for Vacuum and Supply selectable.
- Replaceable gripper, mounting interface according to ISO 9409-1-50-4-M6.
- Delivered with or without foam gripper.
- Easy to mount own custom gripper with e.g. suction cups.
- Stackable for several optional vacuum circuits.
- URCap “plugin” software is available for Universal Robots.

### Advantages:

- “Sandwich design”, the same interface on both sides of the bracket.
- Light weight, 810 g complete with foam gripper.
- Ejector easily replaceable for optimal function for e.g. different materials.
- Ejector with many programmable functions and connection options.

### Complete gripper

The gripper contains everything needed for easy handling everything from cardboard to glass, ready to connect and put to work, “Plug & Play”.

### Gripper module without foam gripper

The gripper is developed to be easily adapted to basically all types of applications for custom-designed gripper usages.

Ejector with energy saving as standard, can be easily programmed for manual monitoring. Integrated vacuum holding valve for increased safety. Adaptive blow off with mechanically adjustable flow. For other information, see separate documentation for AUTOVAC MFE. The mounting interface complies with ISO standard ISO 9409-1-50-4-M6 on both sides, which enables mounting of several ejectors i.e. multi-circuit solution.

### Foam gripper

Lightweight design with ISO standard connection. Rubber foam made from EPDM with 27pcs Ø12mm holes for maximum lifting force. In addition, internally integrated vacuum channels for simplified installation.



**Produktbroschyr**

<http://www.avac.se/pdfs/U-CEA.pdf>



## Ordering key

**C E A**    **0 5 0 H R**    **4 4 1**

Product series	
CEA	Cobot Ejector Series

MFE Size
50
100
200
300
400

Vacuum level	
H	High

Supply port	
8	G1/8
4	G1/4

Gripper	
0	Without
1	Foam gripper

Electrical connector*	
C	M12, 5-pin
D	M12, 5-pin
S	M12, 8-pin
R	M8, 8-pin, cable

Vacuum port	
8	G1/8
4	G1/4
3	G3/8
2	G1/2

\*See table page 21

Ex: Complete robot gripper with MFE050H makes Ordering key CEA 050HR 441

Ex: Robot gripper (without foam gripper) for robot with MFE 050H makes Ordering key CEA 050HR 440



### Footprint (mm)

Length 200, Width 130, Height 85.5



### Footprint (mm)

Length 145, Width 101, Height 53

## VS11

Electronic vacuum/ pressure sensors with miniature design. Ideal for applications where every gram counts - e.g. close to the vacuum gripper. The switching point can easily be adjusted with the setting screw. The pressure port is rotatable (360°) to allow a flexible positioning. Pressure ranges from -1 to 0 bar.



Designation	Thread	Order no.
<b>VS11, -1 ...0 bar</b>	<b>M5</b>	<b>1-01-0104-011100*</b>

\*) Stock item

For further information visit our website [www.avac.se](http://www.avac.se)

## F08-K

Electronic pressure/ vacuum sensors with a very compact and robust plastic housing - ideal for many handling applications and industrial automation processes. Switching points as well as the switching logic are programmable (teachable). Pressure ranges from -1 to +12 bar.



Designation	Thread	Order no.
F08-K, -1...0 bar	G1/8	1-02-0201-013100
<b>F08-K, -1...+1 bar</b>	<b>G1/8</b>	<b>1-02-0201-013200*</b>
F08-K, -1...+10 bar	G1/8	1-02-0201-013300
F08-K, 0...+10 bar	G1/8	1-02-0201-013400
F08-K, 0...+12 bar	G1/8	1-02-0201-013500

\*) Stock item

For further information visit our website [www.avac.se](http://www.avac.se)

## F09-T-K

Analog electronic pressure/ vacuum sensors with a very compact and robust plastic housing - ideal for many handling applications and industrial automation processes. Analog output 4...20 mA or 0...10 V. Pressure ranges from -1 to +12 bar.



### Analog output 4...20 mA

Designation	Thread	Order no.
F09-T-K, -1...0 bar	G1/8	2-01-0101-010100
<b>F09-T-K, -1...+1 bar</b>	<b>G1/8</b>	<b>2-01-0101-010200*</b>
F09-T-K, -1...+10 bar	G1/8	2-01-0101-010300
F09-T-K, 0...+10 bar	G1/8	2-01-0101-010400
F09-T-K, 0...+12 bar	G1/8	2-01-0101-010500

\*) Stock item

### Analog output 0...10 V

Designation	Thread	Order no.
F09-T-K, -1...0 bar	G1/8	2-01-0101-030100
<b>F09-T-K, -1...+1 bar</b>	<b>G1/8</b>	<b>2-01-0101-030200*</b>
F09-T-K, -1...+10 bar	G1/8	2-01-0101-030300
F09-T-K, 0...+10 bar	G1/8	2-01-0101-030400
F09-T-K, 0...+12 bar	G1/8	2-01-0101-030500

\*) Stock item

For further information visit our website [www.avac.se](http://www.avac.se)

## FEMTO

Electronic vacuum/ pressure sensors with status & switching indicator and teach buttons. This sensor has a slim and lightweight design - ideal for most handling applications and industrial automation processes. One digital output (NO/NC, hysteresis etc.) and one analog output 1...5 V is available.

Pressure ranges from -1 to +10 bar.



Designation	Thread	Order no.
<b>Femto -1...0 bar</b>	<b>G1/8</b>	<b>1-05-0201-053100*</b>
Femto -1...+10 bar	G1/8	1-05-0201-053300

\*) Stock item

For further information visit our website [www.avac.se](http://www.avac.se)

## PICO-02

Electronic vacuum/ pressure sensors with two digital outputs, display and programming buttons. This accurate and fast switching sensor has a slim and lightweight design - ideal for most handling applications and industrial automation processes.

Pressure ranges from -1 to +12 bar.



Designation	Thread	Order no.
PICO-02, -1...0 bar	G1/8	1-07-0201-033100
<b>PICO-02, -1...+1 bar</b>	<b>G1/8</b>	<b>1-07-0201-033200*</b>
PICO-02, -1...+10 bar	G1/8	1-07-0201-033300
PICO-02, -0...+10 bar	G1/8	1-07-0201-033400
PICO-02, -0...+12 bar	G1/8	1-07-0201-033500

\*) Stock item

For further information visit our website [www.avac.se](http://www.avac.se)

## NANO-02

Electronic vacuum/ pressure sensors with two digital outputs, display and programming buttons. This accurate and fast switching sensor has a slim and lightweight design - ideal for most handling applications and industrial automation processes.

Pressure ranges from -1 to +12 bar.



Designation	Thread	Order no.
NANO-02, -1...0 bar	G1/8	1-06-0801-033100
<b>NANO-02, -1...+1 bar</b>	<b>G1/8</b>	<b>1-06-0801-033200*</b>
NANO-02, -1...+10 bar	G1/8	1-06-0801-033300
NANO-02, 0...+10 bar	G1/8	1-06-0801-033400
NANO-02, 0...+12 bar	G1/8	1-06-0801-033500

\*) Stock item

For further information visit our website [www.avac.se](http://www.avac.se)

## Air Operated Ejectors

### MINI Ejectors

The compact size of the Mini ejector and the low weight makes it suitable for applications in the electronics industry.



**Product Brochure**  
<http://www.avac.se/pdf/U-MINI.pdf>



#### Materials

Body Black anodized aluminium  
 Nozzles Brass

#### Temperature

Temperature range -10 to +70 °C

#### Compressed air

Pressure max 8 bar  
 Optimum supply pressure 4 bar

Designation	Primary nozzle Ø mm	Max vacuum flow NI/min	Air consumption NI/min.	Evacuation time (Sec)*	Weight g	Order no.
AVAC 10	0,5	7,5	10	18	13	110 010 00
AVAC 10E	0,5	7,5	10	18	8	110 010 01

\* Time to evacuate 1 litre air from atmospheric pressure to 75% vacuum.

### INLINE Ejectors

The very compact design and the low weight of the inline ejector makes in suitable for applications in e.g. the electronic industry. Both the compressed air as well as the vacuum connections are available with push-in fittings alternatively external threads which simplifies the installation of the ejector.

The ejectors are available with nozzles for high vacuum (H) alternatively high flow (L) and in two sizes.



**Product Brochure**  
<http://www.avac.se/pdf/U-INLINE.pdf>



#### Materials

Body POM, glass inforced  
 Nozzles Aluminium  
 Seals NBR  
 External thread G1/8 Anodized aluminium  
 Push-in connection Ø 6 mm POM/Brass nickel plated

#### Temperature

Temperature range -10 to +70 °C

#### Compressed air

Pressure max 8 bar  
 Optimum supply pressure 5 bar

Designation	Primary nozzle Ø mm	Max vacu- um flow NI/min	Vacuum level	Vacu- um flow	Connection	Air con- sumption NI/min.	Vacu- um level*	Evacua- tion time (s)**	Weight g	Order no.
AVAC 10 IL-LS	0,5	14		High	6 mm push-in connection	13	63	4,1	12	110 010 20
AVAC 10 IL-HS	0,5	8	High		6 mm push-in connection	13	88	15,2	12	110 010 21
AVAC 10 IL-LG	0,5	14		High	G1/8 external thread	13	63	4,1	15	110 010 22
AVAC 10 IL-HG	0,5	8	High		G1/8 external thread	13	88	15,2	15	110 010 23
AVAC 20 IL-LS	0,7	29		High	6 mm push-in connection	26	62	2	12	110 020 20
AVAC 20 IL-HS	0,7	15	High		6 mm push-in connection	26	90	7,3	12	110 020 21
AVAC 20 IL-LG	0,7	29		High	G1/8 external thread	26	62	2	15	110 020 22
AVAC 20 IL-HG	0,7	15	High		G1/8 external thread	26	90	7,3	15	110 020 23

\* All data at 5 bar supply pressure

\*\* Time to evacuate 1 litre air from the atmospheric pressure to 75% vacuum for HS/HG and 50% vacuum for LS/LG.

## ORIGINAL Ejectors

Our series ORIGINAL ejectors creates a high vacuum at over 85% using only low supply pressure of 4 bar. Rapid Release (RR) connection is used when a quick and controlled release signal of the held object is desired. It can also be used to connect other equipment such as a vacuum sensor, vacuum gauge or similar.



### Product Brochure

<http://www.avac.se/pdf/U-ORIGINAL.pdf>



### Materials

Body Black anodized aluminium  
Nozzles Brass

### Temperature

Temperature range -10 to +70 °C

### Compressed air

Pressure max 8 bar  
Optimum supply pressure 4 bar

Designation	Primary nozzle(s) Ø mm	Max vacuum flow NI/min	Connecting threads				Air consumption NI/min.	Evacuation time (Sec)*	Weight g	Order no.
			P	V	R	RR				
AVAC 20-RR	0,7	14,2	G1/8	G1/8	G1/8	G1/8	20	9	45	110 020 01
AVAC 30-RR	0,95	20,1	G1/4	G1/4	G1/4	G1/8	30	6	72	110 030 01
AVAC 50-RR	1,1	32,0	G1/8	G1/4	G1/4	M5	50	4	45	110 050 01
AVAC 60-RR	1,25	44,0	G1/4	G1/2	G3/8	G1/8	60	3	105	110 060 01
AVAC 120-RR	2 x 1,25	88,0	G1/4	G1/2	G1/2	G1/8	120	1,5	110	110 120 01
AVAC 240-M-RR	4 x 1,25	175,0	G1/4	G1/2	G1	G1/8	240	0,7	225	110 241 01
AVAC 420-M-RR	7 x 1,25	308,0	G1/4	G1/2	G1	G1/8	420	0,4	240	110 421 01
AVAC 720**	2 x 3,1	441,0	G1/4	G1/2	2 x G1/2	-	720	0,25	560	110 720 00

\* Time to evacuate 1l air from atmospheric pressure to 75% vacuum.

\*\* AVAC 720 is not equipped with an RR connection

All ejectors with RR connection are delivered with a G1/8 or M5 plug for use when the need for an RR connection is not in the application

## BLOW-OFF Valve

To be connected to the blow-off port (RR) for increased safety.  
Suitable for all ORIGINAL Ejectors with a RR-connection G1/8.



### Product Brochure

<http://www.avac.se/pdf/U-BLOWOFF.pdf>



### Materials

Body Brass  
Seals FPM

Designation	Function	Weight g	Order no.
Blow Off Valve	Powerful blow off	45	210 018 00
Blow Off Valve	Restricted blow off	45	210 018 01

## Solenoid Operated Ejectors

### MV Ejectors

Solenoid operated MV-ejectors with one integrated solenoid valve for vacuum generation.



**Product Brochure**  
<http://www.avac.se/pdf/U-MV.pdf>



#### Materials

Body Black anodized aluminium  
 Nozzles Brass

#### Temperature

Temperature range -10 to +50 °C

#### Compressed air

Pressure max 7 bar  
 Optimum supply pressure 5 bar

Designation	Primary nozzle Ø mm	Max vacuum flow NI/min	Connecting threads			Air consumption NI/min.	Evacuation time (Sec)*	Weight g	Order no.
			P	V	R				
AVAC 10 MV, 24VDC	0,5	7,5	G1/4	G1/4	G1/4	10	18	185	112 010 04
AVAC 20 MV, 24VDC	0,7	14,2	G1/4	G1/4	G1/4	20	9	185	112 020 04
AVAC 30 MV, 24VDC	0,95	20,1	G1/4	G1/4	G1/4	30	6	190	112 030 04
AVAC 40 MV, 24VDC	1,1	28,0	G1/4	G1/4	G1/4	40	4,5	190	112 040 04
AVAC 60 MV, 24VDC	1,25	44,0	G1/4	G3/8	G1/4	60	3	260	112 060 04

\* Time to evacuate 1 litre air from atmospheric pressure to 75% vacuum.

### MV-MV Ejectors

Solenoid valve-operated MV-MV-ejector with an integrated solenoid valve for creating vacuum and one for controlling the blow off. When directly mounted on the suction cup. The integrated solenoid valves for vacuum and Rapid Release offer a minimum response time and greater accuracy.



**Product Brochure**  
<http://www.avac.se/pdf/U-MV-MV.pdf>



#### Materials

Body Black anodized aluminium  
 Nozzles Brass

#### Temperature

Temperature range -10 to +50 °C

#### Compressed air

Pressure max 7 bar  
 Optimum supply pressure 5 bar

Designation	Primary nozzle Ø mm	Max vacuum flow NI/min	Connecting threads			Air consumption NI/min.	Evacuation time (Sec)*	Weight g	Order no.
			P	V	R				
AVAC 10 MV-MV, 24VDC	0,5	7,5	G1/4	G1/4	G1/4	10	18	280	112 010 05
AVAC 20 MV-MV, 24VDC	0,7	14,2	G1/4	G1/4	G1/4	20	9	280	112 020 05
AVAC 30 MV-MV, 24VDC	0,95	20,1	G1/4	G1/4	G1/4	30	6	290	112 030 05
AVAC 40 MV-MV, 24VDC	1,1	28,0	G1/4	G1/4	G1/4	40	4,5	290	112 040 05

\* Time to evacuate 1 litre air from atmospheric pressure to 75% vacuum.

## EJECTORS with vacuum holding valve

### 2BV Ejector

Our series 2BV EJECTORS is suited best for lifting of glass, metal and other air tight materials. The vacuum holding valve in the vacuum port and the Blow Off Valve in the Rapid Release port, delays the loss of vacuum in the suction cup in case of a broken tube.



**Product Brochure**  
<http://www.avac.se/pdfu/U-2BV.pdf>



#### Materials

Body Black anodized aluminium  
 Nozzles Brass

#### Temperature

Temperature range -10 to +70 °C

#### Compressed air

Pressure max 8 bar  
 Optimum supply pressure 4 bar

Designation	Primary nozzle(s) Ø mm	Max vacuum flow NI/min	Connecting threads				Air consumption NI/min.	Evacuation time (Sec)*	Weight g	Order no.
			P	V	R	RR				
AVAC 2BV-20	0,7	12,8	G1/4	G1/2	G1/4	M5	20	9	180	110 020 06
AVAC 2BV-30	0,95	17,3	G1/4	G1/2	G1/4	M5	30	6	185	110 030 06
AVAC 2BV-40	1,1	27,6	G1/4	G1/2	G1/4	M5	40	4,5	190	110 040 06
AVAC 2BV-60	1,25	42,6	G1/4	G1/2	G1/4	M5	60	3	195	110 060 06
AVAC 2BV-100	2 x 1,1	64,0	G1/4	G1/2	G1/2	M5	100	2	200	110 100 06
AVAC 2BV-150	3 x 1,1	96,0	G1/4	G1/2	G1/2	M5	150	1,2	200	110 150 06

\* Time to evacuate 1 litre air from atmospheric pressure to 75% vacuum.

### AUTOVAC Ejectors

The AUTOVAC series are available in three sizes and offers air savings in combination with an appropriate control system and a vacuum switch. Air savings of >95% are achievable for air tight materials.



**Product Brochure**  
<http://www.avac.se/pdfu/U-AUTOVAC.pdf>



#### Materials

Body Black anodized aluminium  
 Nozzles Brass

#### Temperature

Temperature range -10 to +50 °C

#### Compressed air

Pressure max 7 bar  
 Optimum supply pressure 5.2 bar Size 60  
 Optimum supply pressure 5,6 bar Size 180  
 Optimum supply pressure 6,4 bar Size 360

Designation	Primary nozzle Ø mm	Max vacuum flow NI/min	Connecting threads			Air consumption NI/min.	Evacuation time (Sec)*	Weight g	Order no.
			P	V	R				
AUTOVAC 60, 24VDC, 4,5 W	1,25	42,6	G1/4	G1/2	G1/4	60	3	650	112 060 07
AUTOVAC 180, 24VDC, 4,5 W	2,1	105,0	G1/4	G1/2	G3/8	180	1	820	112 181 07
AUTOVAC 360, 24VDC, 4,5 W	3,1	168,0	G1/4	G1/2	G1/2	360	0,5	900	112 364 07

\* Time to evacuate 1 litre air from atmospheric pressure to 75% vacuum.

## Maximum power – minimal wastage of resources!

Using optimised vacuum generation systems makes processes more economical.

AVAC Vakuumtechnik can provide you with energy-efficient solutions no matter how your automation systems work or what you use them for.

Taking long-term measures to reduce wastage is important for conserving our valuable resources.



### **AVAC Vakuumtechnik AB**

Nykyrkevägen 54  
Box 25  
SE-565 21 Mullsjö  
Tel: +46(0)392-497 85  
Fax: +46(0)392-364 80  
info@avac.se  
www.avac.se

**Product Brochure**  
<http://www.avac.se/en/home/>

