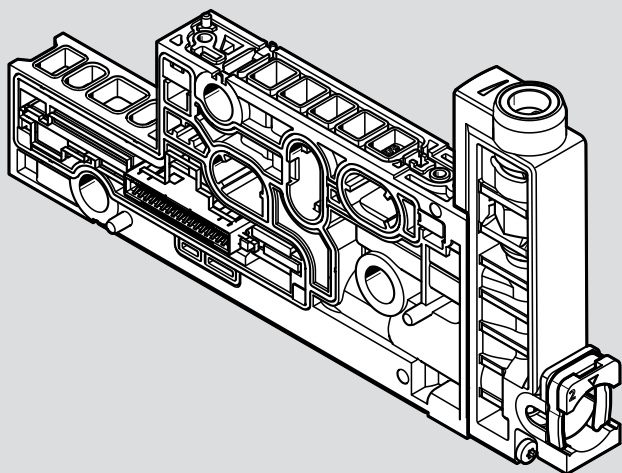
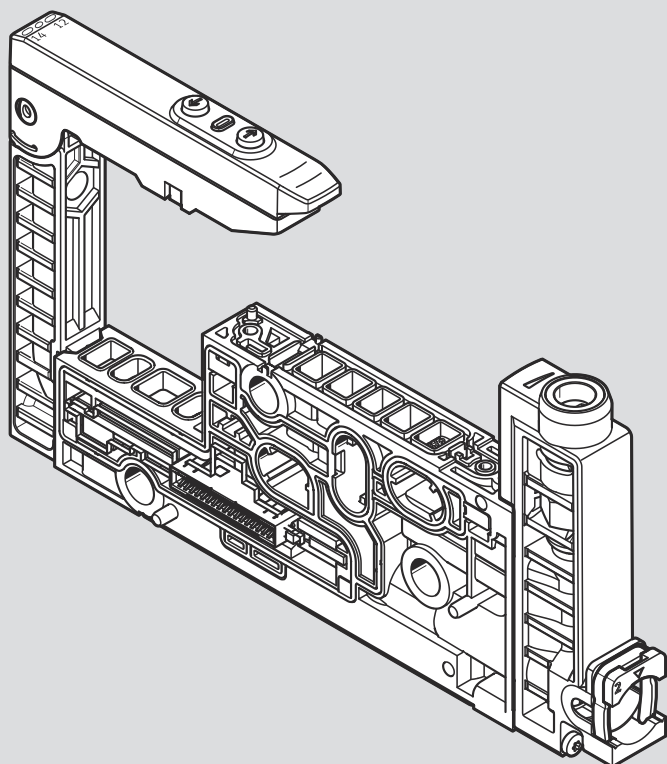


VABX-A-S-VP

Manifold sub-base for vacuum

FESTO

Operating instructions



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2025-12
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Original instructions

Table of contents

1	About this document.....	6
1.1	Applicable documents.....	6
1.2	Product version.....	6
2	Safety.....	6
2.1	Safety instructions.....	6
2.2	Intended use.....	6
2.3	Training of qualified personnel.....	7
2.4	Permissible components.....	7
3	Additional information.....	7
4	Product overview.....	8
4.1	Product design.....	8
4.2	Product labelling.....	9
4.3	Display module.....	9
5	Function.....	11
5.1	Function.....	11
5.2	Switching functions/status bits.....	12
5.2.1	Switching point logic.....	12
5.2.2	Switching point mode.....	13
5.2.3	Hysteresis.....	13
5.3	Measured variables.....	13
5.4	Response with emergency stop.....	14
5.5	Ejector pulse.....	14
5.6	Operating states.....	14
6	Mounting.....	15
7	Installation.....	15
8	Commissioning.....	15
8.1	Pneumatic supply.....	15
8.2	Adjusting ejector pulse.....	16
8.3	Functional test by manual override (MO).....	17
8.4	Teach-in function.....	17
8.5	Conducting teach-in.....	18
9	Parameterisation.....	20
9.1	Permanent parameter storage.....	20
9.2	System parameters.....	21
9.3	Module parameters.....	22

10	Operation	22
10.1	Process data	22
10.2	Operation via the display module	24
10.2.1	Run mode	24
10.2.2	SHOW mode	24
10.2.3	Force mode	26
11	Maintenance	27
11.1	Maintenance information	27
11.2	Maintenance of the filter element	27
12	Diagnostics	28
12.1	Diagnostics on the product via LEDs	28
12.2	Diagnostic messages	29
12.3	Monitoring the process	31
12.4	Process quality	32
13	Malfunctions	33
13.1	Communication interruption	33
14	Modification	33
14.1	Conversion, general	33
14.2	Valve replacement	33
15	Technical data	34
15.1	Technical data, general	34
15.2	Technical data, pneumatic	34
15.3	Technical data, electrical	34

1 About this document

1.1 Applicable documents



All available documents for the product → www.festo.com/sp.

Document	Contents
Valve terminal VTUX-A-S operating instructions	Description of the valve terminal and its components with instruction manual and important information on assembly, pneumatic and electrical installation and conversion
Remote I/O System CPX-AP-I operating instructions	Description of the remote I/O system and its components with instruction manual and important information on assembly, electrical installation, conversion and diagnostics
Remote I/O system CPX-AP-A operating instructions	

Tab. 1: Applicable documents

1.2 Product version

Product details	Version
Manifold sub-base for vacuum VABX-A-S-VP	– Hardware from revision 1 – Firmware version 1.6.13 or later

Tab. 2: Product version

The product version can be determined from the product labelling or with the Festo Automation Suite (FAS).

The Festo Automation Suite is available in the Festo Support Portal

→ www.festo.com/sp. Information on using the software can be found in the integrated Help function.



An updated version of this document may be available for these product versions or newer versions → www.festo.com/sp.
In the case of older firmware versions please refer to the corresponding previous version of the document. → www.festo.com/sp

2 Safety

2.1 Safety instructions

- Only use the product if it is in perfect technical condition.
- Observe the identifications on the product.
- Take into account the ambient conditions at the location of use.
- Store the product in a cool, dry environment protected from UV and corrosion. Keep storage times short.
- Before working on the product, switch off the compressed air supply and lock it to prevent it from being switched on again.
- Before working on the product: Switch off the power supply, ensure that it is off and secure it against being switched on again.

2.2 Intended use

The manifold sub-base for vacuum VABX-A-S-VP switches externally supplied vacuum and an adjustable ejector pulse in combination with a valve VUVX-...CD-... The manifold sub-base for vacuum is intended exclusively for use in a Festo valve terminal VTUX-AS.

2.3 Training of qualified personnel

Work on the product may only be carried out by qualified personnel who can evaluate the work and detect dangers. The qualified personnel have skills and experience in dealing with electropneumatic (open-loop) control technology.

2.4 Permissible components



If the original configuration of the valve terminal is changed by replacing components:

- Check the new configuration in the online configurator to ensure that it is valid.
- In the event of uncertainty contact the regional Festo representative
➔ www.festo.com.

3 Additional information

- Contact the regional Festo contact if you have technical problems
➔ www.festo.com.
- Accessories and spare parts ➔ www.festo.com/catalogue.

4 Product overview

4.1 Product design

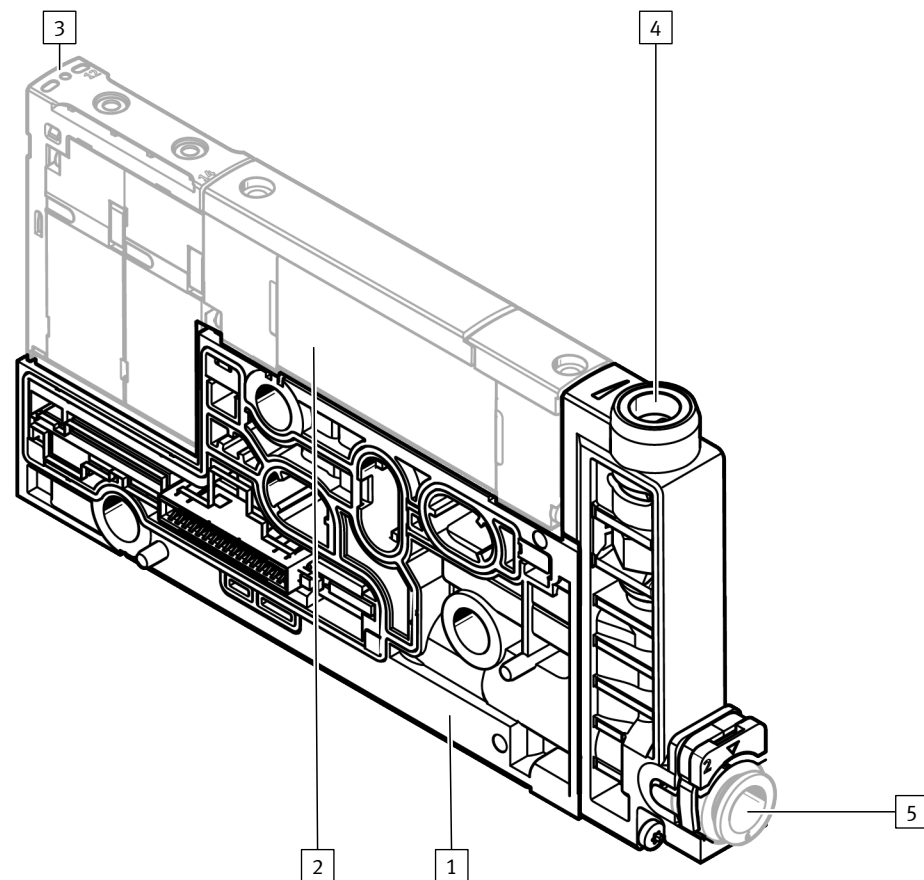


Fig. 1: Product design of manifold sub-base for vacuum with valve

- | | | | |
|---|--|---|---|
| 1 | Manifold sub-base for vacuum | 4 | Flow control screw to adjust the intensity of the ejector pulse |
| 2 | Valve VUVX, mandatory | 5 | Vacuum working port, duct (2) |
| 3 | LED display for switching positions and operating status of the manifold sub-base for vacuum and the valve | | |

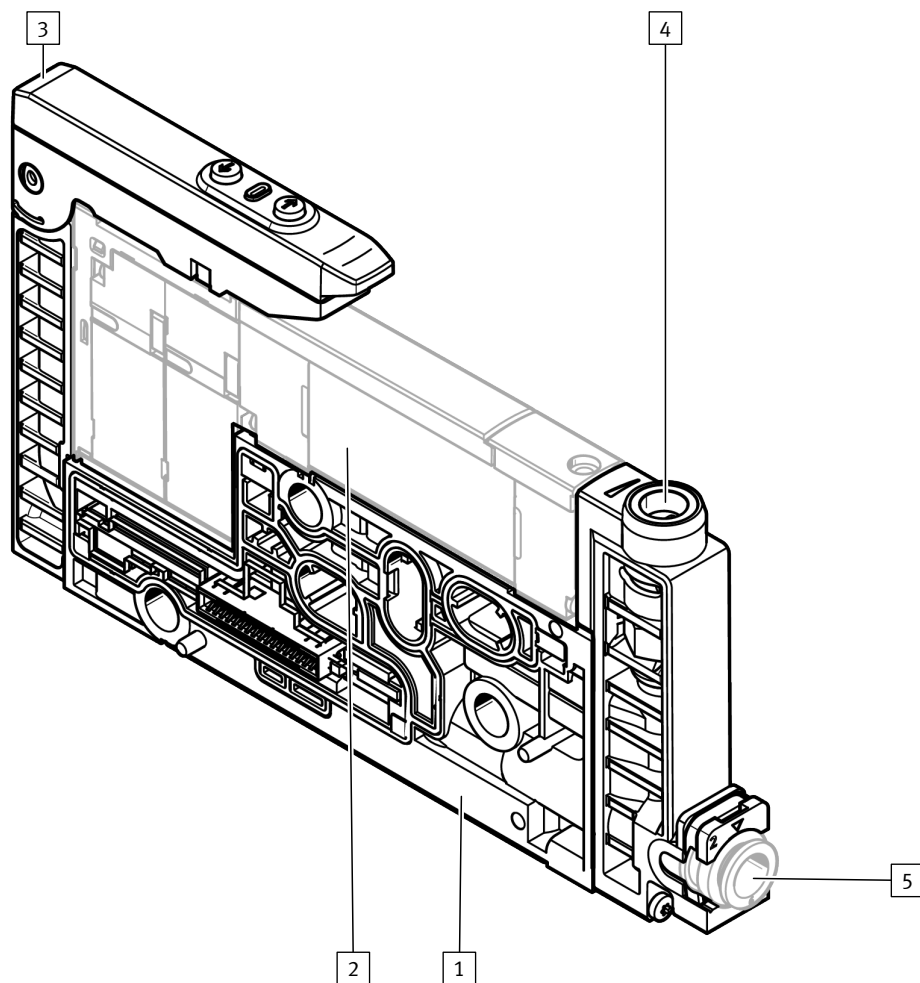


Fig. 2: Product design: Manifold sub-base for vacuum with optional display module and valve

- | | |
|--|---|
| 1 Manifold sub-base for vacuum | 4 Flow control screw to adjust the intensity of the ejector pulse |
| 2 Valve VUVX, mandatory | 5 Vacuum working port, duct (2) |
| 3 LED display for switching positions and operating status of the manifold sub-base for vacuum and the valve | |

4.2 Product labelling

The product labelling is located on the front panel of the manifold sub-base for vacuum above the working port (2).

4.3 Display module

The display module is used to display vacuum values, pressure values, parameters and error codes.

Optional component

The display module is an optional component of the manifold sub-base, which can be selected when configuring a valve terminal VTUX or a valve station VABX. The display module is factory-installed and cannot be retrofitted.

Display elements

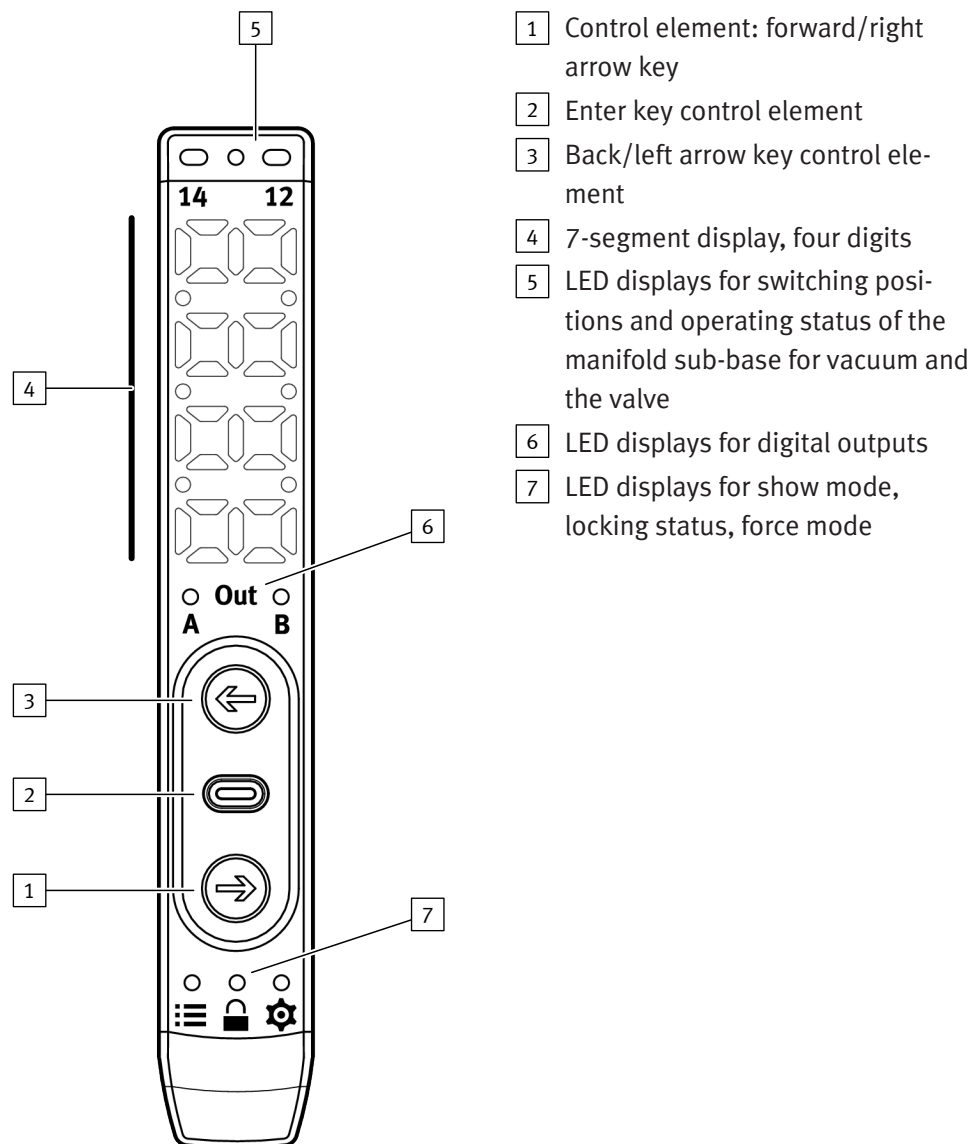


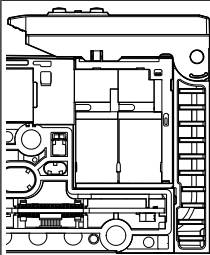
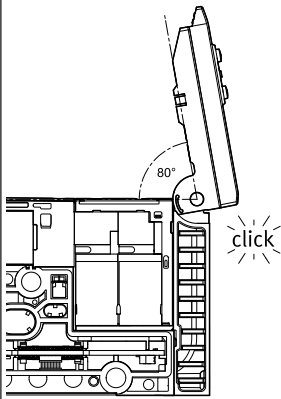
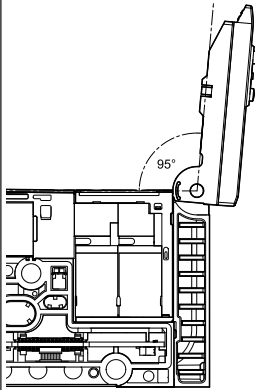
Fig. 3: Display elements of the optional display module

Status LEDs

The status LEDs of the display module are identical to the status LEDs on the valve of the manifold sub-base for vacuum → 12 Diagnostics.

Folding mechanism

The display module can be folded up for valve replacement. The display module can have the following positions:

Position	Description		
	0°	Closed	IP protection is guaranteed.
	<80°	Open without locking/latching mechanism	Reduced IP protection: IP20
	80°	Open, in the rest position	– Reduced IP protection: IP20 – The valve is accessible and removable. – The manual override (MO) can be operated mechanically.
	95°	Fully open	– Reduced IP protection: IP20 – Mechanical stop

Tab. 3: Positions of the display module

5 Function

5.1 Function

The manifold sub-base for vacuum is a functional element of the valve terminal VTUX-AS and is already installed at the factory in an appropriately configured valve island. For expansion of an existing valve terminal with a manifold sub-base for vacuum → Conversion in the operating instructions of the valve terminal → 1.1 Applicable documents.

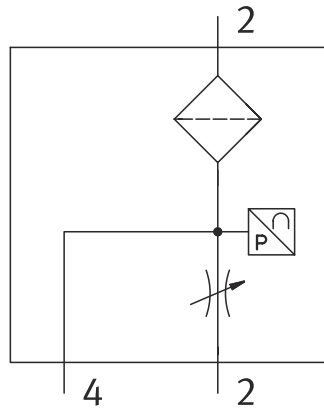


Fig. 4: Pneumatic circuit symbol of the manifold sub-base for vacuum

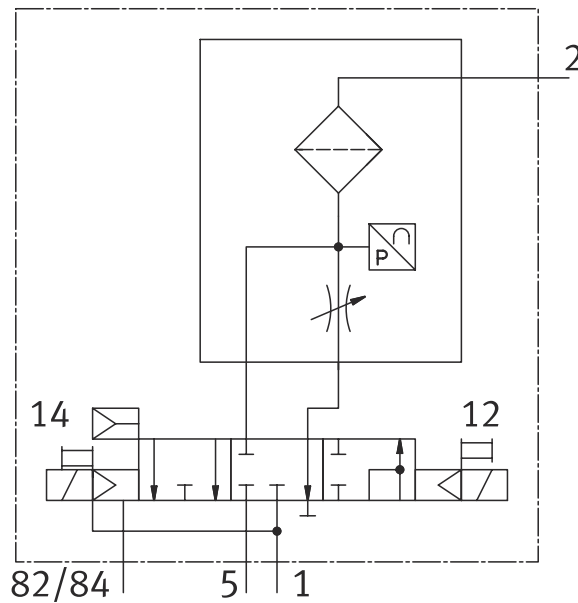


Fig. 5: Pneumatic circuit symbol of the combination of manifold sub-base for vacuum and valve VUVX-...-P53CD-..., ID code NL

The externally supplied vacuum is taken from channel (5) of the valve terminal or the associated pressure zone.

5.2 Switching functions/status bits

The binary output bits OUT A and OUT B can be configured with the switching functions. The switching state information is available via the process input data, byte 2 → 10.1 Process data.

The switching response can be parameterised by the "SwitchPointLogic" (ID 20253) and "SwitchPointMode" (ID 20254) parameters and also the corresponding ID 20245 ... 20250 threshold values.

- OUT A: switching point SP_{A1}, HysteresisA, switching point SP_{A2}
- OUT B: switching point SP_{B1}, HysteresisB, switching point SP_{B2}

5.2.1 Switching point logic

The "SwitchPointLogic" parameter (ID 20253) defines the high/low switching response of the input bits OUT A and OUT B. The parameter setting applies to both inputs.

5.2.2 Switching point mode

The "SwitchPointMode" parameter (ID 20254) describes how the switching information is processed depending on the switching point and the current measured value and when the switching status is changed. Threshold value comparators and window comparators are supported.

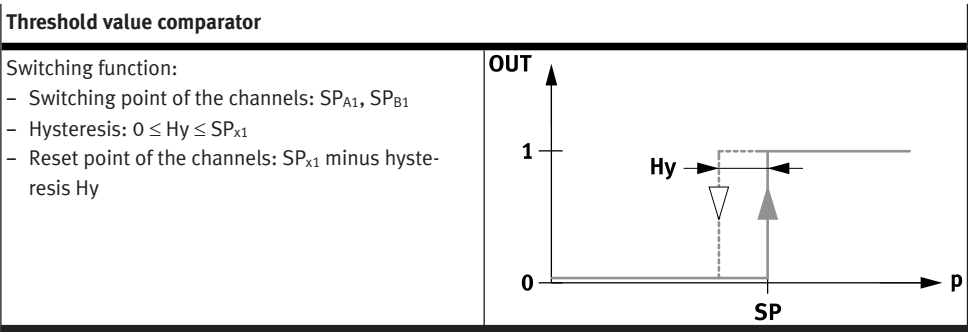
5.2.3 Hysteresis

The configuration of the hysteresis depends on the current switching point mode and is checked for plausibility after transmission to the manifold sub-base for vacuum if the "ConfigurationErrorDiagEnable" parameter (ID 20030) is activated.

Threshold value comparator

In threshold value comparator mode the hysteresis Hy must not be less than or equal to 0 and not greater than the distance between SP_{x1} and 0 kPa. The switching status at the switching output (outputs OUT A and OUT B) changes as soon as the current measured value exceeds the switching point or falls below the reset point. The reset point of the switching output is shifted by the hysteresis value.

The process data input bit for OUT A or OUT B is switched as soon as the switching point SP is exceeded. The bit is reset as soon as the reset point is undershot.

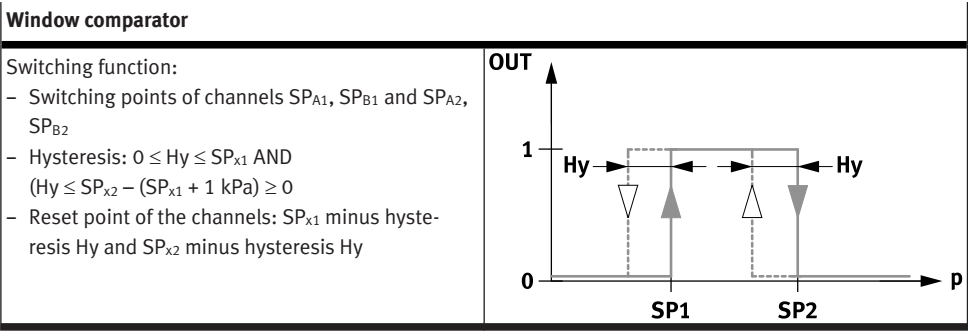


Tab. 4: Threshold value comparator with non-inverted switching output

Window comparator

In window comparator mode the hysteresis Hy must not be less than 0 and not greater than the distance between switching point SP_{x1} and 0 kPa. The hysteresis must also not exceed a distance between SP_{x2} minus (SP_{x1} + 1 kPa). The factory-set hysteresis is 2 kPa and can be adjusted to suit the application.

The switching status of the process data input bits for OUT A or OUT B changes as soon as the current measured value exceeds the switching point SP_{x1} or SP_{x2} or falls below the reset point. The reset points depend on the set hysteresis.



Tab. 5: Window comparator with non-inverted switching output

5.3 Measured variables

Pressure value (vacuum) The pressure value (vacuum) is continuously measured in the channel (2). The current pressure value is transmitted via the process input data.

Cycle time

A cycle covers the time from the start of evacuation through ejection to the start of the new evacuation.

Evacuation time and pressurisation time

The evacuation time t_E is measured from the beginning of the evacuation until the switching point SP_{A1} is reached. The air supply time t_B is measured from the start of air supply to the time at which the pressure value (vacuum) exceeds -5 kPa.

5.4 Response with emergency stop

In an emergency stop (switching off the load voltage supply) the valves of the manifold sub-base for vacuum can still be controlled because they are supplied by the electronics power supply.

If the "InterlockEjectorPulse" parameter (ID 20212, deactivated by default) is activated, an ejector pulse is not triggered in an emergency stop and the switched vacuum is retained.

Complete shutdown

If the electrical energy is switched off completely, the response of the manifold sub-base for vacuum depends on the prior switching position → 5.6 Operating states.

5.5 Ejector pulse**Automatic ejector pulse**

The "AutomaticDropImpulse" parameter (ID 20243) controls an automatically generated ejector pulse that is automatically triggered after the vacuum is switched off. The ejector pulse length can be set with the "AutoDropTime" parameter (ID 20242).

Ejector pulse controller

The automatically generated ejector pulse is controlled by the "ejector pulse" process data output bit.

If the "InterlockEjectorPulse" parameter (ID 20212) is activated and load voltage supply is not present, the ejector signal is ignored. The valve remains in the vacuum position or in the normal position.

5.6 Operating states

Operating status	LED 14 ¹⁾	LED 12 ²⁾	Explanation
Switch on the vacuum			Actuation of the solenoid coil 14 is pending. The vacuum switching is active.
Vacuum reached			Actuation of the solenoid coil 14 is pending. The set vacuum is reached (switching point SP_{A1}).
Pressurise (ejector pulse)			Actuation of the solenoid coil 12 is pending. The vacuum is reduced faster by pressurisation.

Operating status	LED 14 ¹⁾	LED 12 ²⁾	Explanation
Normal position			Actuation of the solenoid coils 12 and 14 is not pending. – The normal position/block position is only active if solenoid coil 12 was previously actuated. – If solenoid coil 14 was previously actuated, the vacuum switch remains active due to the self-holding of the valve.
Two-sided actuation			Actuation of the solenoid coils 12 and 14 is pending. Undefined switching position, which may result in malfunction.

1) switching vacuum

2) ejector pulse

Tab. 6: Operating status of the manifold sub-base for vacuum

If the electrical power supply fails, the operating status will change as follows:

Shutdown or failure	Operating status before change of state	Operating status without electrical power supply
– of the electronic supply PS	Normal position	The normal position is retained.
	Switch on the vacuum	The switching position is maintained by the self-holding mechanism of the valve.
	Pressurise (ejector pulse)	The normal position is set.
– of the load voltage supply PL	Normal position	The normal position is retained.
	Switch on the vacuum	The switching position is maintained. A change of status depends on the "InterlockEjectorPulse" parameter (ID 20212).
	Pressurise (ejector pulse)	Pressurise (ejector pulse) is retained.

Tab. 7: electrical power supply and status change

6 Mounting

The manifold sub-base for vacuum is a functional element of the valve terminal VTUX-A-S and is already installed in a factory-configured valve terminal. For expansion or conversion of an existing valve terminal with a manifold sub-base for vacuum → Operating instructions for valve terminal → 1.1 Applicable documents.

7 Installation

The manifold sub-base for vacuum is a functional element of the valve terminal VTUX-A-S. Installation information → Operating instructions for valve terminal → 1.1 Applicable documents.

8 Commissioning

8.1 Pneumatic supply

The compressed air supply for the ejector impulse is taken from channel (1) of the valve terminal or the associated pressure zone.

The externally supplied vacuum is taken from channel (5) of the valve terminal or the associated pressure zone. The following requirements must be met for vacuum supply:

- Use of a manifold sub-base with electrical power supply and integrated supply plate (left end plate) or
- Use of a VABX-A-...-BU supply plate
- and the use of an exhaust air cover with channel (3/5) closed by blanking plugs

The manifold sub-base for vacuum must be mounted fully assembled and connected on the valve terminal. Perform the following steps for the power supply:

1. Supply the manifold sub-base for vacuum with vacuum via the valve terminal.
2. Switch on the logic supply PS and the load voltage supply PL of the valve terminal.
 - ⇒ Briefly actuate the solenoid coil 12 to set the valve to the pressurise operating status (ejector pulse) and then it is returned to the normal position after the signal is cancelled. This blocks all channels.
 - ⇒ The manifold sub-base for vacuum is ready for operation.

8.2 Adjusting ejector pulse

Ejector pulse duration The ejector pulse pressurises the vacuum port (2). It is controlled by the process data and continues for the duration of the actuation of solenoid coil 12. The ejector pulse can also be controlled automatically → 5.5 Ejector pulse.

Checking intensity of the ejector pulse The valve terminal with manifold sub-base for vacuum is ready for operation. The flow control screw is preset at the factory to a medium intensity of the ejector pulse.

1. For handling small or light workpieces → "Set pulse intensity".
2. Switch the vacuum.
 - ⇒ Negative pressure is available at the vacuum port (2).
3. When the vacuum is generated: switch on the ejector pulse at the valve terminal.
 - ⇒ The ejector pulse is generated.
 - ⇒ If an ejector pulse is not generated or if it requires adjustment → "Set pulse intensity".

Setting the intensity of the ejector pulse The valve terminal with manifold sub-base for vacuum is ready for operation.

1. Turn the flow control screw fully clockwise to close it. Maximum torque at the end stop of the flow control screw stroke: 0.5 Nm.
2. Switch the vacuum.
 - ⇒ Negative pressure is available at the vacuum port (2).
3. Switch on the ejector pulse via the valve terminal.
 - ⇒ The ejector pulse is generated. The workpiece is prevented from being ejected with the flow control screw closed.
4. Switch off the ejector pulse via the valve terminal.
5. Slowly turn the flow control screw for regulating the ejector pulse anticlockwise to open it. Maximum torque at the end stop of the flow control screw stroke: 0.5 Nm.
6. Switch on the ejector pulse via the valve terminal.
 - ⇒ The ejector pulse is generated.
 - ⇒ If an ejector pulse is not generated, the switching response of the valve can be checked with the mechanical manual override.

7. Repeat steps 1 to 7 until the required intensity of the ejector pulse is set.

8.3 Functional test by manual override (MO)

The functionality and effect of the switching positions of the valve on the manifold sub-base for vacuum can be checked by operating the corresponding manual override → Valve terminal operating instructions → 1.1 Applicable documents. If the optional display module is installed, it must be folded up so that the mechanical MO can be operated → 4.3 Display module. The switching positions of the valve can also be tested by forcing the solenoid coils → 10.2.3 Force mode.

8.4 Teach-in function

The teach-in function can be used to configure the switching points and the monitoring functions during operation.

The teach-in process is controlled by the process output data, byte 1, from the higher-level controller or by the Festo Automation Suite (FAS). On completion of the teach-in process, the derived values are saved in the parameters belonging to the channel. They can then be read out from the parameters.



If controllers overwrite the parameters during start-up: read the derived values during teach-in from the manifold sub-base for vacuum and save them in the controller.

Static teach-in

During static teach-in the derived switching points remain constant throughout the entire teach-in process.

Dynamic teach-in

During dynamic teach-in the switching points are derived over a selectable time period. The procedure is used to specify evacuation times and pressurisation times.

Process times

After the start of the dynamic teach-in the evacuation times t_E and pressurisation times t_B are measured at each clock cycle. These times are averaged over all clock cycles (maximum 150 cycles) of the selected time period and stored as setpoint values in the "LimitTimeEvacuation" (ID 20240) and "LimitTimeVenting" (ID 20241) parameters. On completion of the teach-in process a functional reserve of 100% is added to the averaged values.

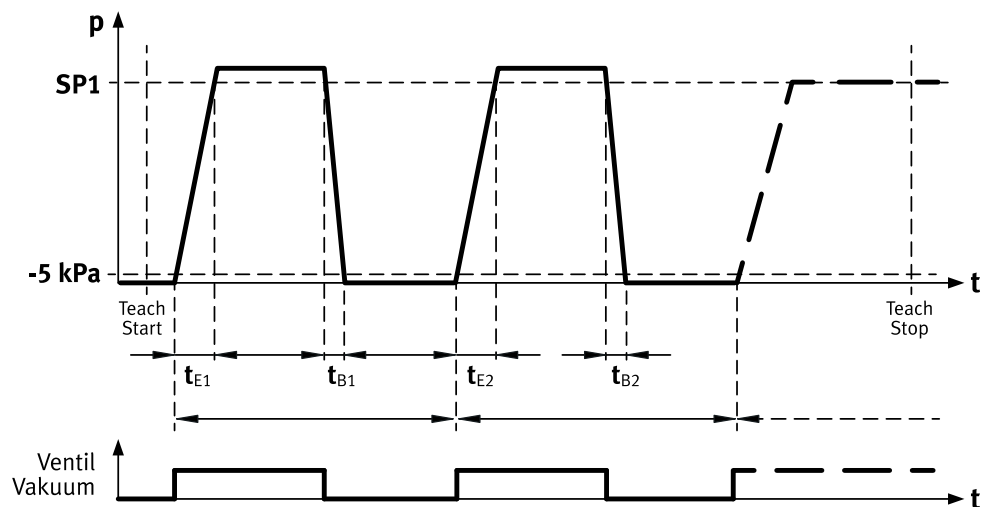
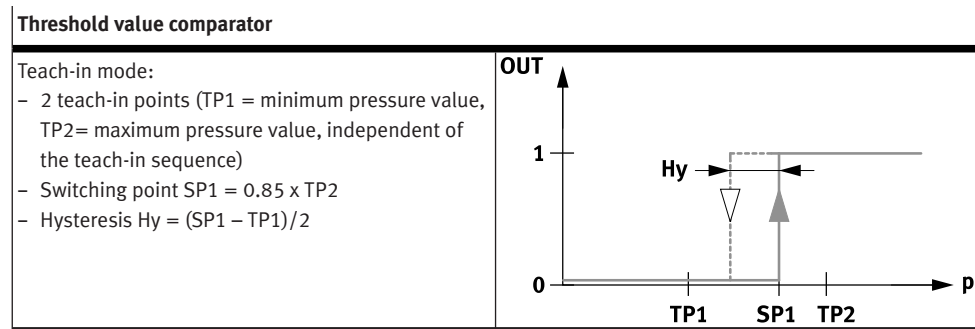


Fig. 6: Dynamic teach-in mode of operation

8.5 Conducting teach-in

Threshold value comparator

During the static teach-in function with threshold value comparator a switching point SP1 and the hysteresis are derived from 2 teach-in points. Switching point SP1 is calculated from the upper teach-in point TP2 with the empirically derived factor 0.85. Half of the difference between switching point SP1 and the lower teach-in point TP1 forms the corresponding hysteresis.



Tab. 8: Threshold value comparator

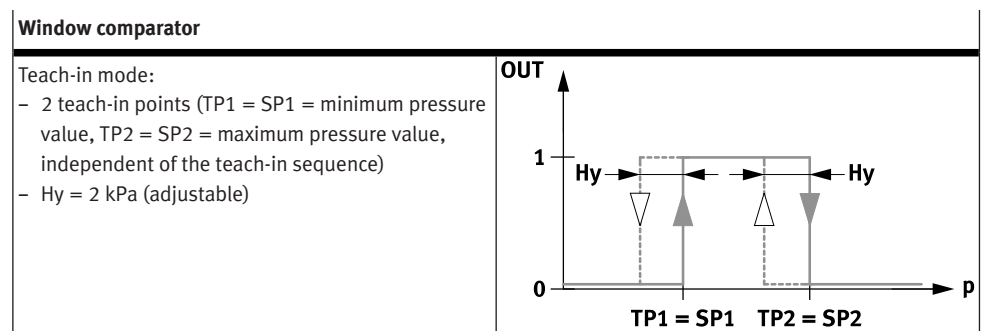
Teach-in threshold value comparator

- The valve of the manifold sub-base for vacuum is in its normal position.
 - The teach-in byte must be reset (process output data, byte 1: all values at '0').
 - The supply pressure is switched on.
 - The "SwitchPointMode" parameter (ID 20254) is FALSE.
1. Select the desired parameter set (process output data, byte 1, bit 4: '0' = OUT A, '1' = OUT B).
 2. Set teach-in mode statically (process output data, byte 1, bit 2 = '0').
 3. Start the teach-in process by setting the teach-in bit (process output data, byte 1, bit 0 = '1').
 - ⇒ The manifold sub-base for vacuum checks the settings and starts the teach-in process.
 - ⇒ The active teach-in process is reported back to the controller by the teach-in status bit (process input data, byte 2, bit 3 = '1').
 4. Reset the teach-in bit (process output data, byte 1, bit 0 = '0').
 5. Switch the vacuum.
 - ⇒ The workpiece should not be gripped by suction.
 6. To accept the pressure value set the bit for the first teach point (TP1) (process output data, byte 1, bit 5 = '1').
 - ⇒ The first teach-in point (TP1) is set with the vacuum value at which the workpiece is released from the fixing.
 - ⇒ If necessary, adjust the input pressure and re-peat the process for the first teach-in point (TP1).
 7. If not already started: switch the vacuum.
 8. Drawing in the workpiece.
 9. To accept the pressure value, set the bit for the second teach-in point (TP2) (process output data, byte 1, bit 6 = '1').
 - ⇒ The second teach-in point (TP2) is set with the vacuum value at which the workpiece is gripped.
 - ⇒ If necessary, adjust the input pressure and repeat the second teach-in point (TP2).

10. Set the bit to terminate the teach-in process (process output data, byte 1, bit 7 = '1').
 - ⇒ The teach-in points (TP1, TP2) are checked for plausibility and saved if they are valid.
 - ⇒ The teach-in points (TP1, TP2) are checked for plausibility and ignored if they are invalid. The "parameter set invalid" diagnostic message (ID 100991074) is output.
 - ⇒ The SP_{A1} and Hy_A (OUT A used) or SP_{B1} and Hy_B (OUT B used) parameters are written.
 - ⇒ The teach-in status bit is reset (process input data, byte 2, bit 3 = '0').
11. Reset the teach-in bit (process output data, byte 1, bit 0 = '0').

Window comparator

During the static teach-in function with window comparator a teach-in point is derived for every switching point. A constant hysteresis value is also defined. It can be selected depending on the application and is factory set to 2 kPa. It corresponds to 2% of the maximum vacuum of 100 kPa = 1 bar.



Tab. 9: Window comparator

Teach-in window comparator

- The valve of the manifold sub-base for vacuum is in its normal position.
 - The teach-in byte must be reset (process output data, byte 1: all values at '0').
 - The supply pressure and vacuum are switched on.
 - The "SwitchPointMode" parameter (ID 20254) is TRUE.
1. Select the desired parameter set (process output data, byte 1, bit 4: '0' = OUT A, '1' = OUT B)
 2. Set teach-in mode statically (process output data, byte 1, bit 2 = '0').
 3. Start the teach-in process by setting the teach-in bit (process output data, byte 1, bit 0 = '1').
 - ⇒ The manifold sub-base for vacuum checks the settings and starts the teach-in process.
 - ⇒ The active teach-in process is reported back to the controller by the teach-in status bit (process input data, byte 2, bit 3 = '1').
 4. Reset the teach-in bit (process output data, byte 1, bit 0 = '0').
 5. If not already started: switch the vacuum.
 6. Grip the workpiece with the minimum vacuum sufficient for handling the workpiece.
 7. To accept the pressure value set the bit for the first teach point (TP1) (process output data, byte 1, bit 5 = '1').
 - ⇒ The teach-in point has been set.
 - ⇒ If necessary, adjust the input pressure and repeat the teach-in point.
 8. Draw in the workpiece with the maximum vacuum specific to the application.

9. To accept the pressure value, set the bit for the second teach-in point (TP2) (process output data, byte 1, bit 6 = '1').
⇒ The teach-in point has been set.
10. Set the bit to terminate the teach-in process (process output data, byte 1, bit 7 = '1').
⇒ The teach-in points (TP1, TP2) are checked for plausibility and saved if they are valid.
⇒ The teach-in points (TP1, TP2) are checked for plausibility and ignored if they are invalid. The "parameter set invalid" diagnostic message (ID 100991074) is output in this case.
⇒ The SP_{A1} , SP_{A2} and Hy_A (OUT A used) or SP_{B1} , SP_{B2} and Hy_B (OUT B used) parameters are written.
⇒ The teach-in status bit is reset (process input data, byte 2, bit 3 = '0').
11. Reset the teach-in bit (process output data, byte 1, bit 0 = '0').



If the supply pressure or the vacuum supply is changed, the teach-in must be repeated.

Teach-in process times

- The valve of the manifold sub-base for vacuum is in its normal position.
 - The teach-in byte must be reset (process output data, byte 1: all values at "0").
1. Activate dynamic teach-in (process output data, byte 1, bit 2: '1' = dynamic)
 2. Start the teach-in process (process output data, byte 1, bit 0: '0' = disable, '1' = enable) and let it run for one or more clock cycles.
⇒ An average value is calculated from the derived evacuation times and pressurisation times of all cycles.
⇒ The active teach-in process is reported back to the controller by the teach-in status bit (process input data, byte 2, bit 3 = '1').
 3. Reset the teach-in bit (process output data, byte 1, bit 0 = '0').
 4. Stop the teach-in process (set process output data byte 1, bit 7: '1' = teach-in stop).
⇒ The derived values are stored in the "LimitTimeEvacuation" (ID 20240) and "LimitTimeVenting" (ID 20241) parameters.
 5. Reset the teach-in bit (process output data, byte 1, bit 0 = '0').



If the maximum possible number of 150 cycles is reached, the teach-in process is automatically aborted and reported as an error. In this case the "Parameter set invalid" diagnostic message (ID 100991074) is output.

9 Parameterisation

9.1 Permanent parameter storage

Calculated and input parameter values can be stored permanently in the manifold sub-base for vacuum. This requires, after changing the parameters in the process output data, byte 0, setting bit 7 (rising edge: '0' → '1'). After successful saving bit 4 is set in the process input data, byte 2 (rising edge). Bit 4 remains set until the manifold sub-base for vacuum is restarted or it is reset when the save process is restarted. After a successful teach-in, the calculated data are automatically transferred permanently to the memory of the manifold sub-base for vacuum and is available again at the next restart.



Fieldbus startup parameters can be automatically overwritten by the higher-level controller.

9.2 System parameters

Various parameters are available to read out information about the manifold sub-base for vacuum. The parameters can be accessed with the Festo Automation Suite via the remote I/O system CPX-AP and typically with a higher-level controller using the specific device description of the host system.

A variable number of instances are available for the parameters. The manifold sub-base for vacuum does not always use the maximum possible number of instances.

Fieldbus startup parameters

ID	Parameters	Number of instances ¹⁾	Data type	Access ²⁾	Array size
20021	ValveDefectDiagEnable (Factory setting: FALSE)	1	BOOL	rw	–
20022	Setup monitoring load supply PL – 0: Load supply monitoring inactive – 1: Load supply monitoring active, undervoltage diagnosis suppressed in case of switch-off (default)	1	UINT8	rw	–
20052	Behaviour in fail state (communication error) – 0: Reset Outputs (default) – 1: Hold last state	1	UINT8	rw	–

1) counting starting at '0'

2) ro = read only; rw = read write

Tab. 10: Fieldbus startup parameters

AP parameter

ID	Parameters	Number of instances ¹⁾	Data type	Access ²⁾	Array size
246	Fieldbus Serial Number	1	UINT32	ro	–
791	Product key	5	CHAR	ro	12
960	Firmware version	1	CHAR	ro	30
20000	Modul Code	1	UINT32	ro	–
20085	Temperature Value AP-ASIC [°C]	1	INT16	ro	–
20087	Current value logic supply PS [mV]	1	UINT16	ro	–
20093	Hardware version	1	UINT8	ro	–
20204	RevisionValve	1	INT16	ro	–
20205	Valve function	1	CHAR	rw	32

1) counting starting at '0'

2) ro = read only; rw = read write

Tab. 11: AP parameter



The parameter tables refer to the specific parameters of the manifold sub-base for vacuum VABX-A-S-VP.

- The parameters of the valves and other valve terminal components can be found in the applicable operating instructions → 1.1 Applicable documents.
- The AP parameters can be queried with suitable software, e.g. with the Festo Automation Suite. The Festo Automation Suite is available in the Festo Support Portal → www.festo.com/sp.

9.3 Module parameters

Fieldbus startup parameters

ID	Parameters	Number of instances ¹⁾	Data type	Access ²⁾	Unit
20212	InterlockEjectorPulse (Factory setting: FALSE)	1	BOOL	rw	–
20240	LimitTimeEvacuation (Factory setting: 0)	1	UINT16	rw	[ms]
20241	LimitTimeVenting (Factory setting: 0)	1	UINT16	rw	[ms]
20242	AutoDropTime (Factory setting: 200)	1	UINT16	rw	[ms]
20243	AutomaticDropImpulse (Factory setting: FALSE)	1	BOOL	rw	–
20245	SwitchingPointA1 (Factory setting: 40)	1	UINT16	rw	Dependent on ID 20251
20246	HysteresisA (Factory setting: 25)	1	UINT16	rw	
20247	SwitchingPointB1 (Factory setting: 20)	1	UINT16	rw	
20248	HysteresisB (Factory setting: 10)	1	UINT16	rw	
20249	SwitchingPointA2 (Factory setting: 67)	1	UINT16	rw	
20250	SwitchingPointB2 (Factory setting: 41)	1	UINT16	rw	
20251	PressureUnit – 0: kPa (factory setting) – 1: mbar – 2: PSI – 3: % (pct)	1	ENUM {0}	rw	–
20252	Lockcode (Factory setting: 0)	1	UINT16	rw	–
20253	SwitchPointLogic – FALSE: non-inverted logic N/O – TRUE: inverted logic N/C (Factory setting: FALSE)	1 Applies to OUT A and OUT B.	BOOL	rw	–
20254	SwitchPointMode – FALSE: threshold value comparator – TRUE: window comparator (Factory setting: FALSE)	1 Applies to OUT A and OUT B.	BOOL	rw	–
20255	NozzleSize (Factory setting: 0, as it is not applicable)	1	UINT8	ro	–

1) counting starting at '0'

2) ro = read only; rw = read write

Tab. 12: Fieldbus startup parameters

10 Operation

10.1 Process data

The manifold sub-bases for vacuum for switching valves set 4 bytes of process input data for transmission to the remote I/O system CPX-AP or the higher-level controller and 2 bytes of process output data for receiving at the manifold sub-base for vacuum.

Process input data

Byte	0	1
Description/ contents	The pressure values (vacuum) are continuously measured in the channel (2) and transmitted as two's complement [INT16]. Unit of measurement for the pressure range and factors (relevant only for process data): – mbar: –1000 ... +1000 (value/10 = mbar) – kPa: –100 ... +100 (value/100 = kPa) – psi: –14503 ... +14503 (value/1000 = psi) – % (vacuum): 100 ... 0 (value = %)	

Tab. 13: Process input data, byte 0 and 1

Byte	2							
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description/ contents	Reserved	Reserved	Reserved	Save permanent data – '0': default after reset or restart – '1': save process successful	Teach-in – '0': teach-in not active – '1': teach-in active	Ejector pulse successful – '0': default – '1' pulse: pressure at vacuum port (2) > – 0.05 bar	OUT B	OUT A

Tab. 14: Process input data, byte 2

Byte	3
Description/ contents	Reserved

Tab. 15: Process input data, byte 3

Process output data

Byte	0							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description/ contents	Trigger data save – rising edge: '0' → '1': start save process	Reserved	Reserved	Reserved	Reserved	Reserved	Ejection – '0': off – '1': on	Switch on the vacuum – '0': off – '1': on

Tab. 16: Process output data, byte 0

Byte	1							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Description/ contents	End teach-in – rising edge: '0' → '1': terminate save process/teach-in	Teach-in for TP2 – rising edge: '0' → '1': accept value	Teach-in for TP1 – rising edge: '0' → '1': accept value	Select output – '0': OUT A – '1': OUT B	Reserved	Teach-in mode – '0': static – '1': dynamic	Select channel – '0': channel 1 – '1': reserved	Start teach-in – rising edge: '0' → '1': start teach-in

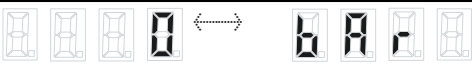
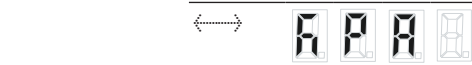
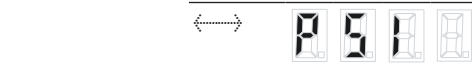
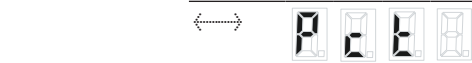
Tab. 17: Process output data, byte 1

10.2 Operation via the display module

10.2.1 Run mode

After switching on the valve terminal, the display of the display module is in its default status, the run mode, while a button on the display module has not been pressed or after 40 seconds of inactivity.

In Run mode, the current pressure value is displayed alternately with the unit of measurement: negative values for switching vacuum or positive values for pressurisation. The unit of measurement can be parameterised with the controller: "PressureUnit" (ID 20251).

Alternating display of pressure value and unit of measurement	7-segment display
Unit of measurement in bar	
Unit of measurement in kPa	
Unit of measurement in psi	
Unit of measurement in percent	

Tab. 18: Run mode

10.2.2 SHOW mode

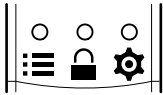
Show mode allows various parameters of the manifold sub-base for vacuum to be displayed.

Access mode



- Press one of the two arrow keys to enable show mode.
⇒ The LED for show mode switches on.

Exiting mode



- To exit the mode, press and hold the Enter key for ≥ 3 s.
⇒ The display module switches back to run mode.
⇒ The display module automatically switches back to run mode after an inactivity period ≥ 40 s.

Navigating in the menu

- The sequence of parameters is a closed loop through which navigation in both directions is possible.
- To navigate in the menu, press one of the two arrow keys once or more times.
⇒ The display switches between the parameter name and the corresponding value.

Reset

- Applies only to minimum and maximum measured values:
- To reset minimum and maximum measured values, press and hold both arrow keys simultaneously ≥ 3 s.
⇒ The display briefly shows 'rES'  for confirmation, then the parameter name reappears.

10.2.2.1 Display of minimum and maximum measured values

7-segment display	Description
	Minimum measured pressure
	Maximum measured pressure
	Minimum measured evacuation time
	Maximum measured evacuation time
	Minimum measured pressurisation time
	Maximum measured pressurisation time

Tab. 19: Show mode: minimum and maximum measured values



The same unit of measurement applies as in run mode. The unit of measurement (kPa, bar, psi, %) can be parameterised with the controller: "PressureUnit" (ID 20251).

The minimum and maximum measured values are not permanently saved but are limited to the run time since switching on or to the manual reset.

10.2.2.2 Parameter status

7-segment display	ID	Parameter name - module parameter
	20245	SwitchingPointA1
	20246	HysteresisA
	20249	SwitchingPointA2
	20247	SwitchingPointB1
	20248	HysteresisB
	20250	SwitchingPointB2
	20244	AirSaveFunction is not available. The value is therefore always 'OFF'
	20241	LimitTimeVenting
	20240	LimitTimeEvacuation
	20212	InterlockEjectorPulse
	20242	AutoDropTime
	20243	AutomaticDropImpulse
	–	Firmware version of the display module

Tab. 20: Show mode: parameter status

10.2.2.3 Error messages

In the event of an error message on the manifold sub-base for vacuum, the diagnostic LED will indicate the error. The corresponding error message ID can be retrieved from the controller or the display module. For more information about the error messages → 12 Diagnostics.

7-segment display	Error message
	- Error messages, displayed as hexadecimal error codes → 12.2 Diagnostic messages - The display shows '0'  when an error is not diagnosed. Example: '0016'  for 'Undervoltage in logic supply (PS) 24 V DC'

Tab. 21: Show mode: error codes

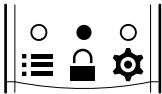
10.2.3 Force mode

Valve solenoids and digital outputs can be manually activated in force mode, e.g. for testing or commissioning purposes. Force mode can be locked with an Lockcode to prevent unintentional or unauthorised access.

Setting Lockcode

The module parameters of the manifold sub-base for vacuum are accessed at the higher-level control system.

1. Configure Lockcode in module parameter ID 20252.
The default value is '0000': a Lockcode is not active.
2. To activate the Lockcode: set value > '0000'.
⇒ The LED for the locking status lights as soon as a value other than '0000' is set.

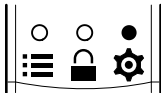


Unlocking Lockcode

The force mode is opened on the display module of the manifold sub-base for vacuum by pressing the Enter key.



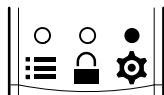
1. Press the Enter key.
⇒ The display module switches from the run mode to force mode.
⇒ The display shows 'Forc' , then 'Lock'  after pressing the Enter key.
⇒ The LEDs for force mode and lock status are on.
2. Press the Enter key.
⇒ The display shows 'Lock' .
3. Press the back/left and/or forward/right arrow keys as long as necessary until the four-digit Lockcode is set.
4. Press the Enter key to activate the entered Lockcode.
⇒ If the correct Lockcode has been entered: the display will show 'coil' .
- ⇒ If an incorrect Lockcode has been entered: the display will show for 3 s 'lock'  again.
- ⇒ The display switches to '0000'  and the input can be repeated with the arrow keys.



The configured Lockcode is automatically activated after an inactivity ≥ 40 s or after being switched back on.

Forcing solenoid coils

The solenoid coils can be controlled manually in force mode.
To force the solenoid coils, proceed as follows:



1. Press the Enter key.
 - ⇒ The display module switches from the run mode to force mode.
 - ⇒ The display shows 'Forc' **Forc**.
 - ⇒ The LED for force mode is on.
2. Press the Enter key again.
 - ⇒ If the display shows 'lock' **lock**, first input the Lockcode; see above.
 - ⇒ If the display shows 'coil' **coil**, proceed to the next step.
3. Actuate the solenoid coils with the arrow keys:

Press the forward/right arrow key to actuate solenoid coil 14 and/or press the backward/left arrow key to control solenoid coil 12.

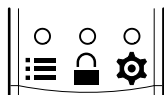
 - ⇒ The solenoid coil remains actuated while the corresponding arrow key is pressed and held.
 - ⇒ The display shows the actuated solenoid coil: '14' **1414**, '12' **1212** or '14.12' **1412**.
4. Press the Enter key.
 - ⇒ The display module switches to forcing the outputs.

Forcing outputs

In force mode the output signals can be set manually, e.g. during a setup process. To force the outputs, proceed as follows:

1. Press the Enter key repeatedly until 'outA' **outA** or 'outb' **outb** is displayed.
2. Press the forward/right arrow key.
 - ⇒ The output signal is activated.
3. Press the back/left arrow key.
 - ⇒ The output signal is deactivated.

Exiting mode



- To exit the mode, press and hold the Enter key for ≥ 3 s.
 - ⇒ The display module switches back to run mode.
 - ⇒ The display module automatically switches back to run mode after an inactivity period ≥ 40 s.

11 Maintenance

11.1 Maintenance information

The filter element is integrated into the housing of the manifold sub-base for vacuum. It is located in channel (2) immediately behind the cartridge. The externally generated vacuum is transmitted through the complete unit, including the valve. The filter element reduces the penetration of particles $> 40 \mu\text{m}$ into the valve. The filter element can be removed for cleaning or replacement.



Regular inspection and cleaning or replacement of the filter element is recommended to maintain the performance of the vacuum switching unit. In the presence of heavily polluted process air or in dusty environments use an additional external filter, e.g. OAF inline filter.

11.2 Maintenance of the filter element

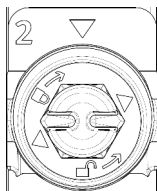
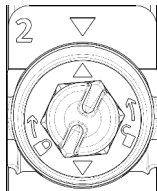
Required tools

- Allen key, size 6 mm

- Recommendation: Allen key with guard ring or spring pressure piece
- Slotted head screwdriver
 - Optional: needle-nose pliers

Removal

- The compressed air supply and the vacuum supply to the valve terminal are switched off.
 - The power supply to the valve terminal is switched off.
1. Use a narrow slot screwdriver to lever the clamping clip over the locking lugs and pull it out.
 2. Pull the cartridge out of the connection hole with an attached section of tubing.
 3. Insert the Allen key into the hexagon socket of the filter element. Turn the Allen key approximately 65° counterclockwise until the triangle markings are opposite each other.
⇒ The bayonet catch is unlocked.
 4. Use the Allen key to pull the filter element out of the manifold sub-base.
 5. If the filter element is stuck in the housing: pull out the filter element with needle-nose pliers.
 6. Inspect the filter element and clean or replace it as required.
 7. Reinstall the filter element: turn the Allen key approximately 65° clockwise until it stops. Tightening torque of the bayonet catch: ≤ 0.5 Nm
⇒ The bayonet catch is locked.
 8. Insert the cartridge into the connection hole and press it in against the slight resistance to the stop.
 9. Insert the clamping clip into the locking grooves on both sides.
 10. Push the clamping clip over the locking lugs to the end position and the clamping clip no longer protrudes.
 11. Check that the cartridge is securely locked to prevent it from accidentally coming loose.



12 Diagnostics

12.1 Diagnostics on the product via LEDs

LED	Meaning	Possible error
 off	– A signal to switch the valve is not pending; logic 0	–
 blue light	- LEDs of solenoid coils 12 and 14 light: – The signal to switch the valve is pending; logic 1 – The vacuum switching is active.	–
 green light	- LED of solenoid coil 14 on: – The signal to switch the valve is pending; logic 1 – The vacuum has been reached.	–

Tab. 22: Signal status display of the solenoid coils

Diagnostics LED	Meaning and possible errors
 off	– OK – diagnostics not active – power supply not active
 green light	– Valve ID chip is mounted (possible depending on configuration).
 flashing green (2 Hz)	– Module identification
 flashing green (0.5 Hz)	– Diagnostics active, severity "Information", e.g. load voltage supply PL switched off.
 flashing yellow (1 Hz)	– Diagnostics active, severity "Information", e.g. teach-in active.
 red light	– Diagnostics active, severity "Error", e.g. AP communication/system communication not available/interrupted.
 flashing red (2 Hz)	– Module ramp-up not yet completed. System communication not yet initialised.
 flashing red (1 Hz)	– Diagnostics active, severity "Warning", e.g. parameterisation error

Tab. 23: Signal state of the diagnostics LED

12.2 Diagnostic messages

ID hex (dec)	Message	Description
02 01 0016 (33619990)	Undervoltage in logic supply PS 24 V DC	Undervoltage in logic supply PS was detected.
		Remedy – Check logic supply PS.
		Diagnostics status Error
02 01 0017 (33619991)	Overvoltage in logic supply PS 24 V DC	Overvoltage in logic supply PS was detected.
		Remedy – Check logic supply PS.
		Diagnostics status Warning

ID hex (dec)	Message	Description
02 01 0106 (33620230)	Load supply PL 24 V DC switched-off	A switch-off of the load supply PL was detected. The cause may be a intentional switch-off by emergency stop.
		Remedy – Check if emergency stop has been activated. – Check load supply PL.
		Diagnostics status Information
07 06 0268 (117834344)	Valve defect	A short circuit or wire break (open load) was detected on the solenoid coil of a valve.
		Remedy – Check and/or replace valve.
		Diagnostics status Error
0C 01 01B5 (201392565)	Condition counter value for valve coil reached.	The specified setpoint of the condition counter for the valve coil was reached.
		Remedy – Reset condition counter for valve coil.
		Diagnostics status Maintenance
08 01 0124 (134283556)	AP master lost	No communication with AP master possible.
		Remedy – Restart AP master. – Check AP communication cable.
		Diagnostics status Error
08 01 0130 (134283568)	AP module output process data Watchdog timed out	The process data Watchdog for the outputs timed out in the AP module (valve terminal).
		Remedy – Restart AP master. – Check wiring.
		Diagnostics status Error
08 01 0131 (134283569)	AP module input process data Watchdog timed out	The process data Watchdog for the inputs timed out in the AP module (valve terminal).
		Remedy – Restart AP master. – Check wiring.
		Diagnostics status Error
08 01 01A2 (134283682)	Device in System State Emergency Operation	The system initialization (module recognition/valve recognition) failed. The AP system is in Maintenance mode. No I/O function is available.
		Remedy – Restart AP system. – Update firmware of the AP system and/or of the AP module (valve terminal) to latest version. – Contact Festo service.
		Diagnostics status Error
0C 01 01B3 (201392563)	Lifecycle counter limit reached	The configured valve life cycle counter limit has been reached.
		Remedy – Replace valve. – Increase the lifecycle counter limit.
		Diagnostics status Maintenance
0C 01 01B4 (201392564)	Wrong valve installed	Deviation detected between configured and mounted valve.
		Remedy – Update configuration. – Connect/install a suitable valve.

ID hex (dec)	Message	Description	
0C 01 01B4 (201392564)	Wrong valve installed	Diagnostics status	Maintenance
04 01 0246 (67174982)	Vacuum not reached	The vacuum could not be established.	
		Remedy	– Check supply pressure. – Check for leaks.
		Diagnostics status	Warning
07 03 0248 (117637704)	Evacuation or pressurisation time exceeded	The measured evacuation time or pressurisation time has exceeded the set parameter values.	
		Remedy	– Check for leaks. – Extend pressurisation time. – Check throttle valve.
		Diagnostics status	Error
07 03 0249 (117637705)	Process quality below critical limit	Process quality below the critical limit	
		Remedy	– Check for leaks.
		Diagnostics status	Warning
06 05 0062 (100991074)	Parameter set invalid	The set parameters are contradictory or the teach-in has failed.	
		Remedy	Overwriting (saving) the parameter set
		Diagnostics status	Error
04 01 0247 (67174983)	Control function malfunction	Defect in the controller function (e.g. setpoint value cannot be reached). Vacuum switching is activated.	
		Remedy	– Check supply pressure and drive power supply. – Check for leaks.
		Diagnostics status	Warning
0B 07 00CC (185008332)	Initialisation fault	Factory parameters are invalid or are not written.	
		Remedy	– Restart AP system. – Contact Festo service.
		Diagnostics status	Error
06 05 0339 (100991801)	Teach-in active	The teach-in process is running.	
		Remedy	–
		Diagnostics status	Information

Tab. 24: Diagnostic messages

12.3 Monitoring the process

Monitoring functions

Monitoring functions enable early detection of malfunctions or faults during operation:

- Monitoring of process parameters (pressure value at vacuum port, critical limits, evacuation time t_E , pressurisation time t_B)
- Monitoring based on parameter values
- Fault detection with diagnostic messages

The monitoring functions are activated at the factory. Monitoring of evacuation and pressurisation times can be activated by setting the critical limits for the evacuation time and pressurisation time.

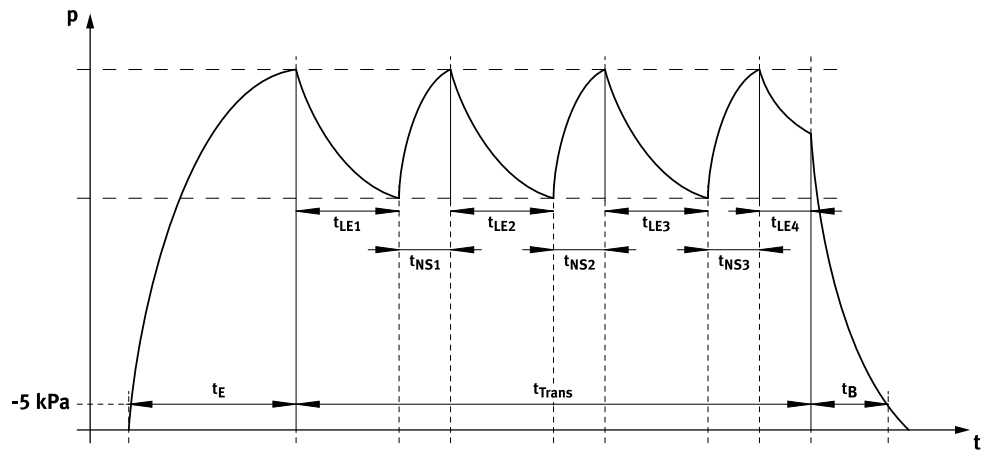


Fig. 7: Process parameters

Legend	Meaning
t_E	Evacuation time
t_{LE}	Leakage time
t_{NS}	Post-suction time
t_{Trans}	Transport time
t_B	Pressurisation time
-5 kPa	Threshold value from which the vacuum is considered decayed.

Tab. 25: Legend for the process parameters

Evacuation time and pressurisation time

The evacuation time t_E is measured from the beginning of the evacuation until the switching point SP is reached. The air supply time t_B is measured from the start of air supply to the time at which the pressure value (vacuum) exceeds -5 kPa.

12.4 Process quality

The process quality depends on the leakage in the overall system. It is transmitted in operation during the leakage period so its progression can be monitored. The greater the leakage the lower the process quality.

The process quality is determined by the vacuum decay rate (VDR = Vacuum Drop Rate [kPa/s]). To express the change in percent, the maximum vacuum decay rate is based on a reference value of 50 kPa/s = 0%. This reference value is based on a hysteresis of 50 kPa and a maximum switching frequency of 1 Hz. A process quality of 0% corresponds to a vacuum decay rate of 50 kPa/s (100% = 0 kPa/s).

Example 1

- Hysteresis – 5 kPa = 25 kPa
- Leakage time = 3 s

Value	Calculation	Result
VDR	25 kPa ÷ 3 s	8.33 kPa/s
Reference to 50 kPa/s (VDR)	8.33 kPa/s ÷ 50 kPa/s	0.166
Process quality	(1 – 0.166) × 100	83%

Tab. 26: Example 1 for calculation of the process quality

Example 2

- Hysteresis – 5 kPa = 25 kPa
- Leakage time = 2 s

Value	Calculation	Result
VDR	$25 \text{ kPa} \div 2 \text{ s}$	12.5 kPa/s
Reference to 50 kPa/s (VDR)	$12.5 \text{ kPa/s} \div 50 \text{ kPa/s}$	0.25
Process quality	$(1 - 0.25) \times 100$	75%

Tab. 27: Example 2 for calculation of the process quality

13 Malfunctions

13.1 Communication interruption

If the communication between the controller and the valve terminal/manifold sub-base for vacuum is interrupted, a defined status is set. The following settings are defined for this "FailStateBehaviour" (ID 20052):

- If the "Vacuum switching" operating status was active:
The "Vacuum switching" operating status remains active.
- If the "pressurisation" (ejector pulse) operating status was active, the status change depends on the parameterisable "FailStateBehaviour".

14 Modification

14.1 Conversion, general

The manifold sub-base for vacuum is a functional element of the valve terminal VTUX-AS and is already installed in a configured valve terminal at the factory. Basic information on conversion → Operating instructions for valve terminal → 1.1 Applicable documents.

14.2 Valve replacement

1. Switch off the electrical and pneumatic power supplies and exhaust channel (2).
2. If an optional display module is available, fold it up and lock it in the open position.
3. Unscrew the valve retaining screws.
4. Remove the valve.
5. Install a valve with the same identity code.
6. Tighten the retaining screws → tightening torque: $0.3 \text{ Nm} \pm 25\%$.
7. Fold an optional display module down and lock it in the closed position.
⇒ This will guarantee the IP protection.

15 Technical data

15.1 Technical data, general

VABX-AS-...-VP	
Certificates, declaration of conformity	➔ www.festo.com/sp
General technical data for the valve terminal	Valve terminal VTUX operating instructions ➔ 1.1 Applicable documents
Operating medium/control medium	Compressed air in accordance with ISO 8573-1:2010 [7:4:4]
Information on the operating or control medium	Ester oil < 0.1 mg/m ³ , in accordance with ISO 8573-1: [:-:2] Lubricated operation not possible
Grade of filtration [μm]	40
Filter surface [mm ²]	324
Ambient temperature [°C]	-5 ... +50 Applicable for the following installation situations: - ≤ 4 manifold sub-bases for vacuum side by side - ≥ 5 Manifold sub-bases for vacuum with supply plate VABX-A-...-BU after every 4 manifold sub-bases for vacuum -5 ... +40 Applies to the following installation situation: - ≤ 7 manifold sub-bases for vacuum side by side - ≥ 8 Manifold sub-bases for vacuum with supply plate VABX-A-...-BU after every 4 manifold sub-bases for vacuum
Storage temperature [°C]	-20 ... +70
Max. storage time [months]	36
Relative humidity [%]	5 ... 95, non-condensing

Tab. 28: Technical data, general

15.2 Technical data, pneumatic

VABX-AS-...-VP-...	
Nominal operating pressure	[MPa] 0.6 [bar] 6 [psi] 87
Operating pressure	[MPa] 0.2 ... 0.7
Pilot pressure	[bar] 2 ... 7 [psi] 29 ... 101.5
Pilot air supply	internal, from supply of the manifold sub-base for vacuum with operating pressure, channel (1)
Operating pressure of the vacuum supply from channel (5)	[MPa] -95 ... 0 [bar] -0.95 ... 0 [psi] 13.775 ... 0
Pressure measuring range	[MPa] -0.1 ... +0.1 [bar] -1 ... +1 [psi] -14.5 ... +14.5
Overload pressure at vacuum port (2)	[MPa] 1.0 [bar] 10 [psi] 145

Tab. 29: Technical data, pneumatic

15.3 Technical data, electrical

VABX-AP-...-VP		
Protection against electric shock (protection against direct and indirect contact in accordance with IEC 61010-1)		by the use of SELV/PELV circuits (safe extra-low voltage/protected extra-low voltage)
Nominal operating voltage of electronics/sensors (PS)	[V DC]	24 ± 10 % ¹⁾
Intrinsic current consumption at nominal operating voltage for electronics/sensors	[mA]	Typically 27
Nominal operating voltage load (PL)	[V DC]	24 ± 10 %
Intrinsic current consumption at nominal operating voltage load	[mA]	Typically 2.5
Power consumption at nominal operating voltage for electronics/sensors	[W]	0.65
Power failure buffering	[ms]	10
Accuracy	[% FS]	± 3
Repetition accuracy of switching value	[% FS]	1
Electrical isolation		
Between PS and PL		Yes
Between the channels		No
Short-circuit protection		
Per channel		Electronic
Response after end of overload		No automatic recovery

1) Reduced tolerance range of the electronics power supply required to ensure the power supply of the valve.

Tab. 30: Technical data, electrical

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