Motion Terminal

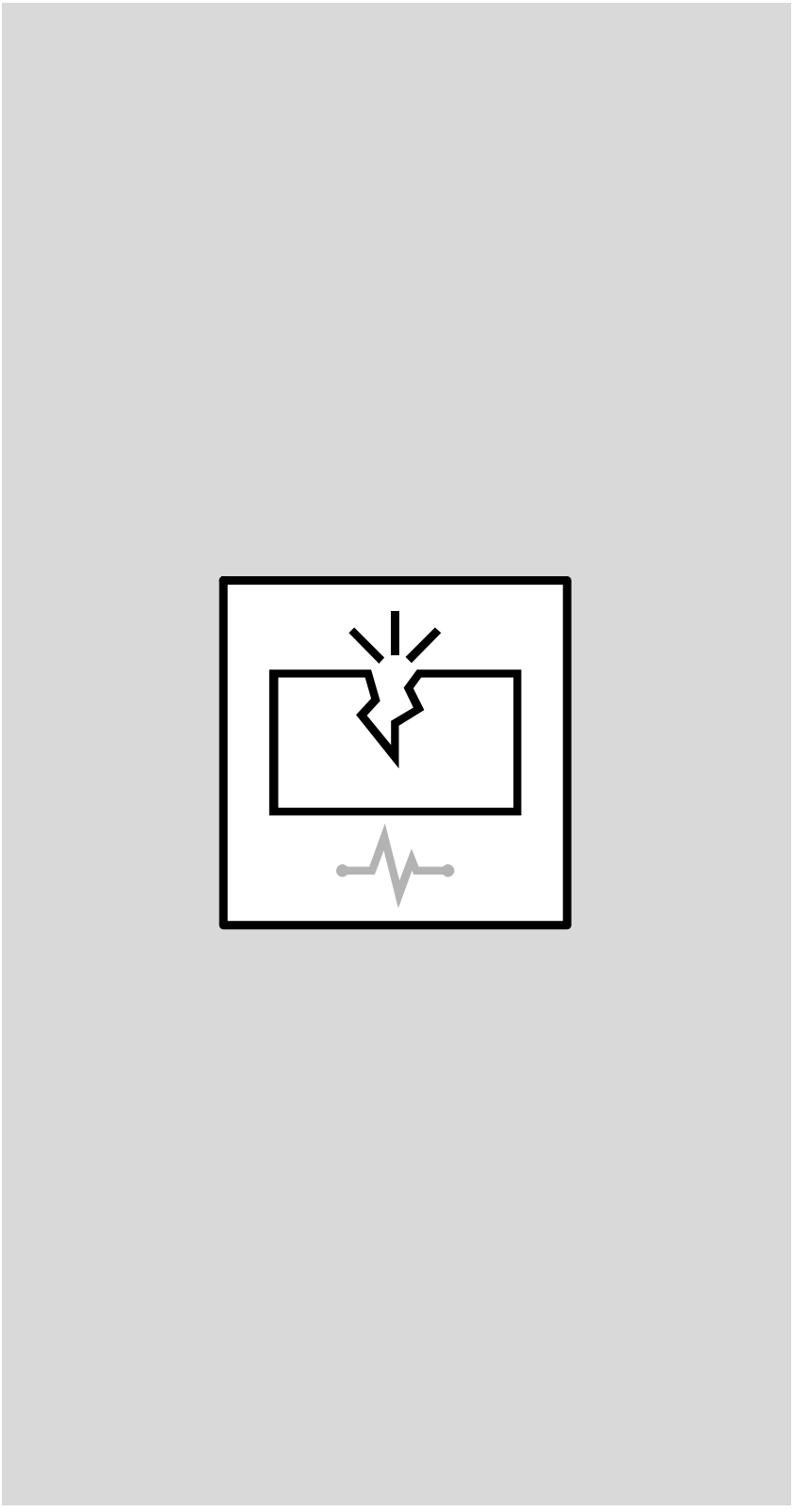
VTEM

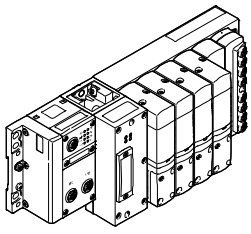
FESTO

Description

Motion App #12

Leakage diagnostics





8071865
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Translation of the original instructions
VTEM-MA12-EN

Table of contents

1 About this document

This document describes the function and parameterisation of the Motion app named on the title page. Information relevant for understanding the function as well as necessary steps and approaches for carrying out parameterisation are described in other documents (➔ 1.1 Further applicable documents).

1.1 Further applicable documents

Document	Table of contents
Instructions for mounting Motion Terminal CPX, VTEM (CPX_VTEM)	Instructions and important notes for mounting the Motion Terminal VTEM with attached CPX terminal
Instructions for use of Motion Terminal VTEM (VTEM)	Instructions and important notes on handling, installation, commissioning and maintenance of the Motion Terminal VTEM
Description of Motion Terminal VTEM, function and parameterisation (VTEM)	Detailed description of the Motion Terminal VTEM as well as its function and parameterisation
CPX system description (P.BE-CPX-SYS-...)	Information on the complete system of the CPX terminal

Tab. 1.1

For all available product documentation ➔ www.festo.com/pk

1.2 Target group

This document is intended for qualified personnel. Experience with electrical and pneumatic control systems is required in order to understand this documentation.

1.3 Product version

This document refers to the following product versions:

Product	Version
VTEM-...	Motion Terminal VTEM from Revision 01
CTMM-S1-C	Controller of the VTEM Motion Terminal from Revision 01
Firmware	Firmware of the CTMM controller from Version 4.0.2
VEVM-S1-27-...	Valve for VTEM Motion Terminal from Revision 01
CTMM-S1-D-8E-M8-3	Digital input module for VTEM Motion Terminal from Revision 01
CTMM-S1-A-8E-A-M8-4	Analogue input module for VTEM Motion Terminal from Revision 01
Browser	Firefox version 38 or later

Tab. 1.2

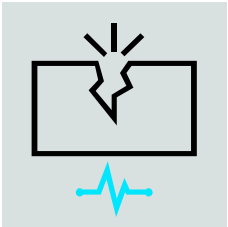
The product version can be determined using the [System] [Information] page in the WebConfig user interface of the Motion Terminal.

Note

There may be an updated version of this document for these or later product versions.

- Check whether a corresponding version of this document is available (➔ www.festo.com/sp).

2 Function

ID of the Motion app	Designation of the Motion app	Pictogram of the Motion app
12	Leakage diagnostics	

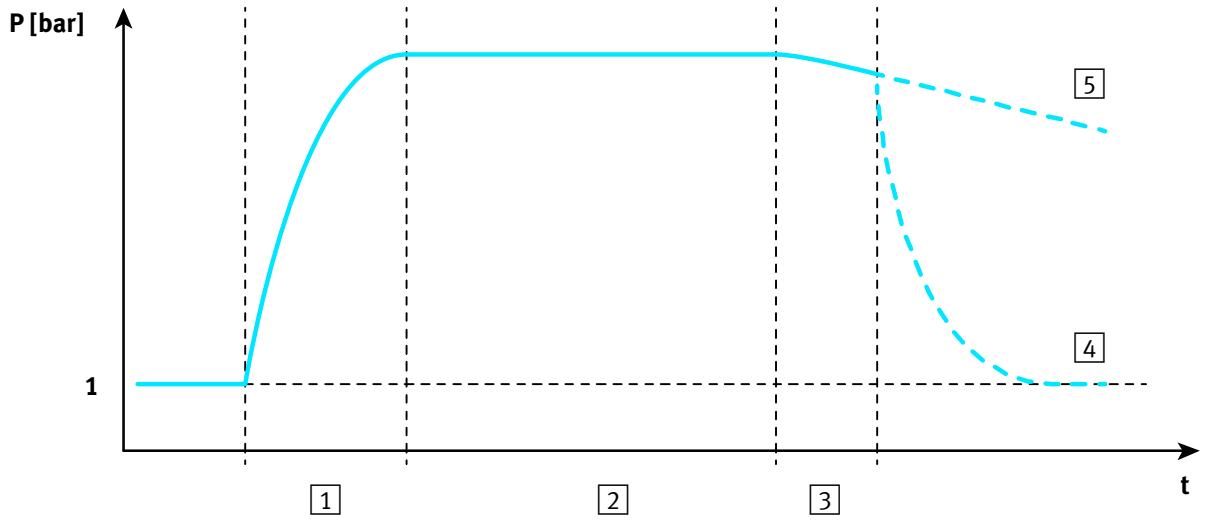
Tab. 2.1

The ID of the Motion app must be transferred through the area “operating mode of the valve (valve mode)” of the process data (bits 5 ... 0 in byte 0 (PDO)) to operate the Motion app on a valve (➔ Description of Motion Terminal VTEM, function and parameterisation).

2.1 Functional description

The “Leakage diagnostics” Motion app can be used to detect any leakage of the application. The Motion app is not intended for process monitoring, but rather preventive maintenance.
A teach-in run must be carried out beforehand when the system is in a good condition, during which the leakage reference value will be determined (e.g. when the system is installed). The reference value is saved in a persistent manner.
If there is a valid reference value for the leakage, the leakage volumetric flow rate currently determined is compared with the reference value and output as a leakage change (delta to the reference value) in l/h.

During the diagnostics of the drives, the Motion app independently advances and retracts the drive again.



1 Pressurisation with defined valve cross-section
2 Slow-down and abatement of the thermodynamic processes (pressurised, total 30 s)
3 Pressure change measurement (blocked)
4 Volume: Exhaust (valve cross-section 100 %)
5 Drives: End of the process, pressure remains locked in

Fig. 2.1

The leakage volumetric flow rate is calculated based on the drive volume or the volume and tube volume, as well as the measured pressure change 3 (➔ Fig. 2.1). The pressure change during the teach-in run serves as a comparison value. In addition to the calculated leakage volumetric flow rate, the leakage status for the valve connection is also provided. Using the previously defined limit values for the leakage change, the status will be output additionally as a numerical value (0, 1, 2, 3) or as a traffic light (red, orange, yellow, green).

The Motion app cannot be used for a vacuum. The supply pressure of the valve terminal must be within a range of 0.5 ... 8 bar. External pilot air supply is required for supply pressures below 3 bar. The temperature of the compressed air must be within a range of 10 ... 30 °C.

The Motion app only provides reliable results for volumes and drives that are listed in the drive list. In addition, it must also be ensured that the drive can reach both end positions.
If the drive is not installed horizontally (mounting position not equal to 0°), the effective weight force must be less than 75 % of the pneumatic force.

2.1.1 Status of the system upon completion and termination of the diagnostics

Completion of the diagnostics	
Volume	**Drives**
When leakage determination has been completed, the volumes will be exhausted so that the pressure head of the exhaust air is set. The valve is set to the “blocked” position.	When leakage determination has been completed, the valve is set to the “blocked” position. This means that the pressure applied at the time will remain locked-in (normally the supply pressure in chamber 2 and the exhaust air pressure in chamber 4).

Tab. 2.2

Termination of the diagnostics	
Volume	**Drives**
When leakage determination has been terminated, the valve is set to the “blocked” position. This means that the pressure applied at the time will remain locked-in.	

Tab. 2.3

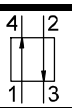
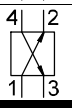
2.1.2 Teach-in run

The Motion app requires a leakage reference value for operation. This leakage reference value must be determined by executing a teach-in run when the system is in a good condition (e.g. when the system is installed). The reference value is automatically saved in a persistent manner.

For information about executing the teach-in run ➔ Description of function and parameterisation for Motion Terminal VTEM

2.1.3 Definition of the direction of movement / position of the drive

In this document and on the WebConfig user interface, the direction of movement or position of drives that are controlled through the Motion Terminal are normally described with the terms “advance” or “advanced” and “retract” or “retracted”, which refer to piston rod cylinders with a piston rod at one end. Based on the pneumatic function, the meaning of the terms can be transferred to other drives.

Term	**Port (4)**	**Port (2)**	**Switching position of the valve**	
Advance/advanced	Pressurised	Exhausted	14	
Retract/retracted	Exhausted	Pressurised	12	

Tab. 2.4

2.1.4 Supply air and exhaust air

The terms “supply air” and “exhaust air” are not permanently assigned to the service air ports, but refer to the respectively active motion.

Motion	Supply air through port	Exhaust air through port
Advancing	(4)	(2)
Retracting	(2)	(4)

Tab. 2.5

2.2 Required sensors

The Motion app does not require any external sensors.

2.3 Diagnostic messages and error elimination

For information on VTEM diagnostic messages and error elimination
➔ Description of function and parameterisation for Motion Terminal VTEM

2.4 System parameters used

ID	System parameters	Range of values	Default value
12	Tube length, outlet (2)	0 mm ... 5000 mm	1000 mm
13	Tube length outlet (4)	0 mm ... 5000 mm	1000 mm
14	Tube internal diameter, outlet (2)	4 mm ... 10 mm	5.7 mm
15	Tube internal diameter, outlet (4)	4 mm ... 10 mm	5.7 mm
20	Drive type	1)	0 2)
21	Drive stroke	0 mm ... 1000 mm	100 mm
40	Volume at outlet (2)	0 l ... 32 l	0.4 l
41	Volume at outlet (4)	0 l ... 32 l	0.4 l
60	Mounting position of drive	–90° ... +90°	0°

1) List of supported drives from Festo and the corresponding values for the parameter
➔ Description of function and parameterisation for Motion Terminal VTEM
2) The value must be changed to a valid value before the Motion app is started.

Tab. 2.6

2.4.1 Tube length at (2)

ID	Range of values	Value of digit	Range of digit
12	0 ... 5000 mm	1 mm	0 ... 5000 × 1 mm

Tab. 2.7

2.4.2 Tube length at (4)

ID	Range of values	Value of digit	Range of digit
13	0 ... 5000 mm	1 mm	0 ... 5000 × 1 mm

Tab. 2.8

2.4.3 Tube internal diameter at (2)

ID	Range of values	Value of digit	Range of digit
14	4 ... 10 mm	0.01 mm	400 ... 1000 × 0.01 mm

Tab. 2.9

Internal diameter for tubes from Festo				
External Ø [mm]	**4**	**6**	**8**	**10**
PUN	2.6	4.0	5.7	7.0
PUN-CM	2.5	4.0	5.5	7.0
PUN-H	2.6	4.0	5.7	7.0
PUN-V0	–	4.0	5.7	7.0
PUN-V0-C	2.0	2.0	4.0	6.0
PLN	2.9	4.0	5.9	7.0
PEN	2.7	4.0	5.7	7.0
PAN	2.9	4.0	5.9	7.0
PAN-MF	2.5	4.0	6.0	7.5
PAN-R	2.5	3.8	5.0	6.2
PFAN	2.9	4.0	5.9	7.0

Tab. 2.10

2.4.4 Tube internal diameter at (4)

ID	Range of values	Value of digit	Range of digit
15	4 ... 10 mm	0.01 mm	400 ... 1000 × 0.01 mm

Tab. 2.11

Internal diameter for tubes from Festo				
External Ø [mm]	**4**	**6**	**8**	**10**
PUN	2.6	4.0	5.7	7.0
PUN-CM	2.5	4.0	5.5	7.0
PUN-H	2.6	4.0	5.7	7.0
PUN-V0	–	4.0	5.7	7.0
PUN-V0-C	2.0	2.0	4.0	6.0
PLN	2.9	4.0	5.9	7.0
PEN	2.7	4.0	5.7	7.0
PAN	2.9	4.0	5.9	7.0
PAN-MF	2.5	4.0	6.0	7.5
PAN-R	2.5	3.8	5.0	6.2
PFAN	2.9	4.0	5.9	7.0

Tab. 2.12

2.4.5 Drive type

ID	Range of values	Value of digit	Range of digit
20	–32768 ... +32767	1	–32768 ... +32767

Tab. 2.13

List of supported drives from Festo and the corresponding values for the parameter
➔ Description of function and parameterisation for Motion Terminal VTEM

2.4.6 Drive stroke

The drive stroke describes the maximum stroke of the drive without taking into account the mechanical stops within the total stroke.

ID	Range of values	Value of digit	Range of digit
21	0 ... 1000 mm	1 mm	0 ... 1000 × 1 mm

Tab. 2.14

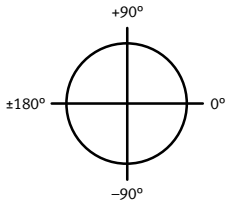
When selecting a semi-rotary drive as the drive type, the parameter is automatically described with the value for the swivel angle of the semi-rotary drive in the unit “degrees”.

2.4.7 Mounting position of drive

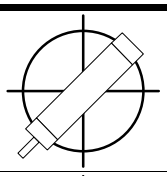
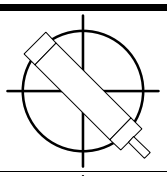
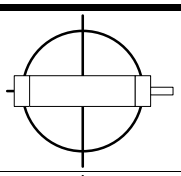
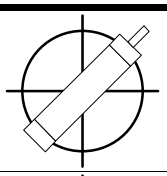
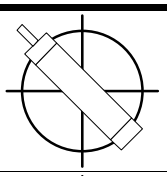
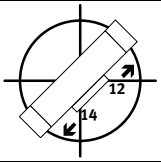
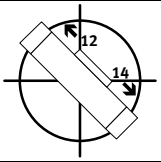
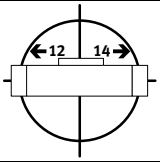
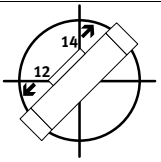
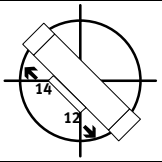
ID	Range of values	Value of digit	Range of digit
60	–90 ... +90°	0.01°	–9000 ... +9000 × 0.01°

Tab. 2.15

A positive value means that, when advancing (port (4) pressurised, port (2) exhausted), the load is moved upwards (away from the ground).



The specified value for the mounting position relates to the position of the plane on which the load is moved, and therefore differs depending on the selected drive (➔ System parameter 20 “Drive type”).

Drive system	-135°	-45°	0°	45°	135°
Cylinder with piston rod					
Linear drive (12 = “retract”) (14 = “advance”)					
Semi-rotary drive	Semi-rotary drives may only be used in the following installation situations, in which the gravitational force does not have any influence on the movement behaviour of the semi-rotary drive due to the mounting position. – Centre of mass within the axis of rotation: Any mounting position permitted. – Centre of mass outside the axis of rotation (not recommended): Only vertical mounting position permitted, axis points vertically upward or downward. In these cases, the parameter “Drive mounting position” must not be parameterised. Any use outside the installation situations described above can result in unpredictable movements of the semi-rotary drive and is therefore not permissible.				

Tab. 2.16

2.5 Application parameters used

ID	Application parameters	Range of values	Default value
100	Retract load[1)]	0 ... 100 kg	0 kg
101	Advance load[2)]	0 ... 100 kg	0 kg
200	Max. permissible leakage for “Good” status	2 ... perm. leakage for “Warning” l/h	10 l/h
201	Max. permissible leakage for “Warning” status	Perm. leakage for “Good” + 1 digit ... perm. leakage for “Critical” l/h	30 l/h
202	Max. permissible leakage for “Critical” status	Perm. leakage for “Warning”+ 1 digit ... 600 l/h - 1 digit	60 l/h

1) (2) pressurised, (4) exhausted

2) (4) pressurised, (2) exhausted

Tab. 2.17

2.5.1 Advance load ((4) pressurised, (2) exhausted)

ID	Range of values	Value of digit	Range of digit
101	0 … 100 kg	0.01 kg	0 … 10000 × 0.01 kg

Tab. 2.18

2.5.2 Advance load ((4) pressurised, (2) exhausted)

ID	Range of values	Value of digit	Range of digit
101	0 … 100 kg	0.01 kg	0 … 10000 × 0.1 kg

Tab. 2.19

2.5.3 Max. permissible leakage for “Good” status

ID	Range of values	Value of digit	Range of digit
200	2 … perm. leakage for “Warning” l/h	0.1 l/h	20 … perm. leakage for “Warning” × 0.1 l/s

Tab. 2.20

2.5.4 Max. permissible leakage for “Warning” status

ID	Range of values	Value of digit	Range of digit
201	Perm. leakage for “Good” +1 digit … perm. leakage for “Critical” l/h	0.1 l/h	Perm. leakage for “Good” +1 digit … perm. leakage for “Critical” × 0.1 l/s

Tab. 2.21

2.5.5 Max. permissible leakage for “Critical” status

ID	Range of values	Value of digit	Range of digit
202	Perm. leakage for “Warning” +1 digit … 600 l/h	0.1 l/h	Perm. leakage for “Warning” +1 digit … 6000 × 0.1 l/s

Tab. 2.22

2.6 Defaults

The structure of the process data is described in the description “Function and parameterisation of Motion Terminal VTEM”.

2.6.1 Setting of the Motion app (app option)

Not used.

2.6.2 Control of the Motion app (app control)

Diagnostics

During the diagnostics procedure, the Motion app independently moves the drive between the end positions.

The leakage volumetric flow rate is essentially calculated based on the volume, as well as the measured pressure change.
The diagnostics is controlled via bits 7 … 6 in byte 0 (PDO).

PDO byte 0							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Status	Bit 7	Bit 6	Dec.
Deactivate diagnostics	0	0	0
Activate diagnostics	0	1	1
Exhausting	1	0	2
Reserved	1	1	3

Tab. 2.23

2.6.3 Reference value

Not used.

2.7 Return values

2.7.1 Status of the Motion app (app state)

Warning

The presence of warnings in the diagnostic memory of the Motion Terminal is depicted through bit 7 in byte 1 (PDI).

PDI byte 1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Value	Description
0	No warnings are present.
1	Warning is present in the diagnostic memory of the Motion Terminal.

Tab. 2.24

For information regarding handling warnings and errors
➔ Description “Function and parameterisation of Motion Terminal VTEM”

The status of the Motion app is depicted in byte 1 (PDI).

Status of leakage, port (2)

PDI byte 1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Status	Bit 1	Bit 0	Dec.
“Fault” (red)	0	0	0
“Critical” (orange)	0	1	1
“Warning” (yellow)	1	0	2
“Good” (green)	1	1	3

Tab. 2.25

Status of leakage, port (4)

PDI byte 1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Status	Bit 3	Bit 2	Dec.
“Fault” (red)	0	0	0
“Critical” (orange)	0	1	1
“Warning” (yellow)	1	0	2
“Good” (green)	1	1	3

Tab. 2.26

Diagnostics status

PDI byte 1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Status	Bit 6	Bit 5	Bit 4	Dec.
Diagnostics inactive	0	0	0	0
Diagnostics active	0	0	1	1
Diagnostics cancelled	0	1	0	2
Diagnostics partially completed ((2) valid)	0	1	1	3
Diagnostics partially completed ((4) valid)	1	1	0	6
Diagnostics completed	1	1	1	7

Tab. 2.27

2.7.2 Actual value 1, actual value 2

Leakage change at port (2) and port (4)

The leakage change is depicted through bytes 5 ... 4 and 3 ... 2 (PDI).

PDI byte 5	PDI byte 4	PDI byte 3	PDI byte 2
Port (4)		Port (2)	

Connection	Range of values	Value of digit	Range of digit	Data type	Byte (PDI)
(2)	–32768 ... +32767 l/h	0.1 l/h	–32768 ... +32767 × 1 l/h	16 bit signed integer	3 ... 2
(4)	–32768 ... +32767 l/h	0.1 l/h	–32768 ... +32767 × 1 l/h	16 bit signed integer	5 ... 4

Tab. 2.28

A Technical appendix

A.1 Technical data

The following technical data applies for a compressed air temperature of 10 ... 30 °C and in a leakage range of 0 ... 50 l/h.

Characteristic values		
Absolute accuracy		
Small volume: 0.01 l	[l/h]	±10
Large volume: 5 l	[l/h]	±15
Small cylinder: ADN-25-50-A-P-A	[l/h]	±10
Large cylinder: DSBC-63-500-PPVA-N3	[l/h]	±10
Repetition accuracy	[l/h]	±10

Tab. A.1

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