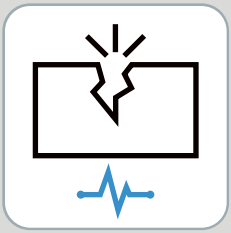
GAMM-A12
Motion App



FESTO

Description | Leakage diagnostics

8104027

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2019-04a
[8104029]

Translation of the original instructions

Table of contents

1 About this document

This document describes the function and parameterisation of the Motion App shown on the title page. Information relevant for understanding the function as well as the necessary steps and approaches for parameterisation are described in other documents ➔ 1.1 Applicable documents.

1.1 Applicable documents

User documentation	Name, type	Contents
Instruction manual	Motion Terminal, CPX, VTEM	Mounting the Motion Terminal VTEM together with the CPX terminal
Instruction manual	Motion Terminal, VTEM	Operating the Motion Terminal VTEM
Description	Motion Terminal, VTEM	Description of the Motion Terminal VTEM, function and parameterisation
Description	CPX terminal, P.BE-CPX-SYS-...	Information on the complete system of the CPX terminal
Application note	Malfunction codes VTEM	Tables with all application-relevant malfunction codes ➔ www.festo.com/sp ➔ VTEM ➔ Expert knowledge
Application note	Supported drives VTEM	List of all drives released for the Festo Motion Terminal (VTEM) ➔ www.festo.com/sp ➔ VTEM ➔ Expert knowledge

Tab. 1 Documentation on the product

All available documents for the product ➔ 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 Motion Terminal VTEM from revision 01
Firmware	Firmware of the controller CTMM from version 4.12.0
VEVM-S1-27-...	Valve for Motion Terminal VTEM from revision 01
CTMM-S1-D-8E-M8-3	Digital input module for Motion Terminal VTEM from revision 02
CTMM-S1-A-8E-A-M8-4	Analogue input module for Motion Terminal VTEM from revision 02
Browser	– Firefox from version 38 (recommended) – Chrome from version 64 – Internet Explorer from version 11 – Microsoft Edge from version 38

Tab. 2 Product version

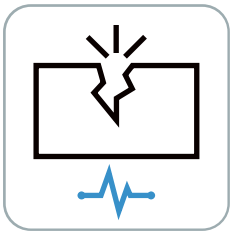
The product version can be found using the [System] [Information] page in the WebConfig user interface of the Motion Terminal.

NOTICE!

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

- Check whether there is an updated version of this document ➔ www.festo.com/sp.

2 Function

ID of the Motion App	Name of the Motion App	Pictogram of the Motion App
12	Leakage diagnostics	

Tab. 3

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The ID of the Motion App must be transmitted via the "operating mode of the valve (valve mode)" of the process data (bits 5 ... 0 in Byte 0 (PDO)) to be able to operate the Motion App on a valve ➔ Description of the Motion Terminal VTEM, function and parameterisation.

2.1 Function description

The 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. First, a teach-in run must be carried out when the system is in a good status (➔ 2.1.2 Teach-in run) in order to determine the leakage reference value (e. g. when the system is installed). The reference value is automatically and permanently saved. If there is a valid reference value for the leakage, the current leakage of the application can be determined at a later point. This is used to calculate and output the leakage change from the reference value.

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The use of only one valve output (connection (2) or connection (4)) is not possible. The leakage of the two valve outputs is always detected.

- If required, seal a valve output.

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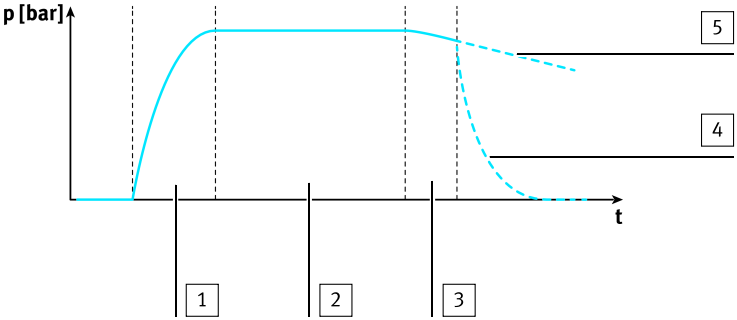
During the diagnostics of the drives, the Motion App independently advances and retracts the drive again.



1 Pressurisation with defined valve cross-section
2 Slow-down and easing off 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. 1 Pressure profile

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.1.
The calculated leakage volumetric flow rate 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 critical 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).

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The Motion App cannot be used for a vacuum. The supply pressure of the valve terminal must be between 0.5 ... 8 bar. External pilot air supply is required for supply pressures below 3 bar. The negative pressure monitoring must also be deactivated via the corresponding CPX module parameters ➔ Description of the function and parameterisation of the Motion Terminal VTEM. The temperature of the compressed air must be between 10 ... 30 °C.

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The Motion App only provides reliable results for volumes and drives that are listed in the drive list. In addition, the drive must be able to 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 identification has been completed, the volumes will be exhausted so that the pressure level of the exhaust air is set. Finally, the valve is set to the “blocked” position.	When leakage identification 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. 4 Completion of the diagnostics

Termination of the diagnostics	
Volume	Drives
When leakage identification has been terminated, the valve is set to the “blocked” position. This means that the pressure applied at the time will remain locked in. The locked in pressure can be removed via the controller for the Motion App (app control) "Exhaust".	

Tab. 5 Termination of the diagnostics

2.1.2 Teach-in run

The Motion App requires a leakage reference value for operation. This leakage reference value must be determined by carrying out a teach-in run when the system is in a good status (e. g. when the system is installed). The reference value is automatically and permanently saved.

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For information on carrying out the teach-in run ➔ Description of the function and parameterisation of the Motion Terminal VTEM

Reading and writing teach-in data

Teach-in data can be read out and overwritten if required. In this way, for example, a backup of the teach-in data can be generated or the teach-in data can be transferred to identically constructed systems. The reading and writing of the teach-in data takes place through an own channel in transfer mode ➔ Description of the Function and Parameterisation of Motion Terminal VTEM.

NOTICE!

- Before transferring the teach-in data, check whether the teach-in data match the system parameters and application parameters for the system.

ID	Teach-in data	Access
1	Reference value for (2)	Reading/writing
2	Reference value for (4)	Reading/writing

Tab. 6 Teach-in data

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

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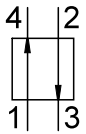
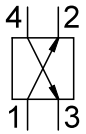
In this document and on the WebConfig interface, the direction of movement and the position of drives that are controlled by the Motion Terminal are generally described using the terms ‘advancing’ or ‘advanced’ and ‘retracting’ or ‘retracted’, respectively, which relate to piston rod cylinders with a piston rod at one end. Depending on the pneumatic function, the meaning of the terms can be used for other drives.

Term	Connection (4)	Connection (2)	Switching position of the valve	
Advancing/advanced	Pressurised	Exhausted	14	
Retracting/retracted	Exhausted	Pressurised	12	

Tab. 7 Direction of motion

2.1.4 Supply air and exhaust air

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

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

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

Tab. 8 Supply air and exhaust air

2.2 Required sensors

The Motion App does not require any external sensors.

2.3 Diagnostic messages and error elimination

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For information on the VTEM diagnostic messages and error elimination ➔ Description of the Function and Parameterisation of the Motion Terminal VTEM and ➔ www.festo.com/sp ➔ Expert knowledge

2.4 System parameters used

ID	System parameters	Value range
12	Tube length output (2)	0 … 5000 mm
13	Tube length output (4)	0 … 5000 mm
14	Tube internal diameter, output (2)	4 … 10 mm
15	Tube internal diameter, output (4)	4 … 10 mm
20	Drive type	➔ List of supported drives
21	Drive stroke	10 … 1000 mm
40	Volume at output (2)	0 … 32 l
41	Volume at output (4)	0 … 32 l
60	Mounting position of drive	–90 … +90°

Tab. 9 System parameters

2.4.1 Tube length at (2)

ID	Value range	Digit value	Digit range
12	0 … 5000 mm	1 mm	0 … 5000 × 1 mm

Tab. 10 Tubing length

2.4.2 Tube length at (4)

ID	Value range	Digit value	Digit range
13	0 … 5000 mm	1 mm	0 … 5000 × 1 mm

Tab. 11 Tubing length

2.4.3 Tube internal diameter at (2)

ID	Value range	Digit value	Digit range
14	4 … 10 mm	0.01 mm	400 … 1000 × 0.01 mm

Tab. 12 Tube internal diameter

2.4.4 Tube internal diameter at (4)

ID	Value range	Digit value	Digit range
15	4 … 10 mm	0.01 mm	400 … 1000 × 0.01 mm

Tab. 13 Tube internal diameter

Internal diameter for Festo tubing			
External Ø [mm]	6	8	10
PUN	4.0	5.7	7.0
PUN-CM	4.0	5.5	7.0
PUN-H	4.0	5.7	7.0
PUN-V0	4.0	5.7	7.0
PUN-V0-C	2.0	4.0	6.0
PLN	4.0	5.9	7.0
PEN	4.0	5.7	7.0
PAN	4.0	5.9	7.0
PAN-MF	4.0	6.0	7.5
PAN-R	3.8	5.0	6.2
PFAN	4.0	5.9	7.0

Tab. 14 Internal diameter for Festo tubing

2.4.5 Drive type

ID	Value range	Digit value	Digit range
20	➔ List of supported drives	1	➔ List of supported drives

Tab. 15 Drive type

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List of the supported drives of Festo and the corresponding values for the parameter on the WebConfig interface or at ➔ www.festo.com/sp ➔ Expert knowledge

2.4.6 Drive stroke

The drive stroke describes the maximum stroke of the drive.

ID	Value range	Digit value	Digit range
21	10 … 1000 mm	1 mm	10 … 1000 × 1 mm

Tab. 16 Drive stroke

2.4.7 Mounting position of drive

ID	Value range	Digit value	Digit range
60	–90 … +90°	0.01°	–9000 … +9000 × 0.01°

Tab. 17 Mounting position of drive

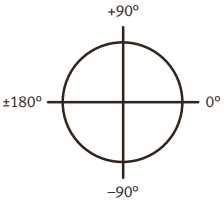

Fig. 2 Mounting position of drive

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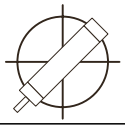
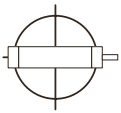
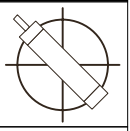
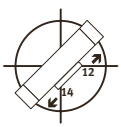
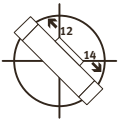
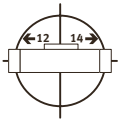
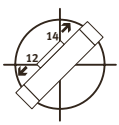
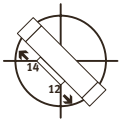
A positive value for the mounting position means that the mass is moved when advancing upward (away from the ground) (port (4) pressurised, port (2) exhausted, switching position 14).

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°
Piston rod cylinder					
Linear drive (12 = "retracted") (14 = "advanced")					
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 gravity within the axis of rotation: any mounting position permitted. – Centre of gravity 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. 18 Drive system and mounting position

2.5 Application parameters used

ID	Application parameters	Value range
100	Retract load [1] (only for linear drives)	0 … 100 kg
101	Advance load[2] (only for linear drives)	0 … 100 kg
102	Mass moment of inertia, retracting[1] (only for semi-rotary drives)	0 … 32767 kg cm^2
103	Mass moment of inertia, advancing[2] (only for semi-rotary drives)	0 … 32767 kg cm^2
200	Max. permissible leakage for “Good” status	2 … 600 l/h
201	Max. permissible leakage for “Warning” status	2 … 600 l/h
202	Max. permissible leakage for “Critical” status	2 … 600 l/h

1) (2) pressurised, (4) exhausted
2) (4) pressurised, (2) exhausted

Tab. 19 Application parameters

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For the maximum permitted leakages, the following applies: [max. leakage for status "Good"] < [max. leakage for status "Warning"] < [max. leakage for status "Critical"]

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When using a volume, the parameters 100 to 103 can be ignored.

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

The parameter must only be used for linear drives.

ID	Value range	Digit value	Digit range
100	0 … 100 kg	0.01 kg	0 … 10000 × 0.01 kg

Tab. 20 Retract load

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

The parameter must only be used for linear drives.

ID	Value range	Digit value	Digit range
101	0 … 100 kg	0.01 kg	0 … 10000 × 0.01 kg

Tab. 21 Advance load

2.5.3 Mass moment of inertia, retracting ((2) pressurised, (4) exhausted)

The parameter must only be used for semi-rotary drives.

ID	Value range	Digit value	Digit range
102	0 … 32767 kg cm^2	1 kg cm^2	0 … 32767 × 1 kg cm^2

Tab. 22 Mass moment of inertia, retracting

2.5.4 Mass moment of inertia, advancing ((4) pressurised, (2) exhausted)

The parameter must only be used for semi-rotary drives.

ID	Value range	Digit value	Digit range
103	0 … 32767 kg cm^2	1 kg cm^2	0 … 32767 × 1 kg cm^2

Tab. 23 Mass moment of inertia, advancing

2.5.5 Max. permissible leakage for “Good” status

ID	Value range	Digit value	Digit range
200	2 … 600 l/h[1)]	0.1 l/h	20 … 6000 × 0.1 l/h

1) For the maximum permitted leakages, the following applies: [max. leakage for status "Good"] < [max. leakage for status "Warning"] < [max. leakage for status "Critical"]

Tab. 24 Max. permissible leakage for “Good” status

2.5.6 Max. permissible leakage for “Warning” status

ID	Value range	Digit value	Digit range
201	2 … 600 l/h[1)]	0.1 l/h	20 … 6000 × 0.1 l/h

1) For the maximum permitted leakages, the following applies: [max. leakage for status "Good"] < [max. leakage for status "Warning"] < [max. leakage for status "Critical"]

Tab. 25 Max. permissible leakage for “Warning” status

2.5.7 Max. permissible leakage for “Critical” status

ID	Value range	Digit value	Digit range
202	2 … 600 l/h[1)]	0.1 l/h	20 … 6000 × 0.1 l/h

1) For the maximum permitted leakages, the following applies: [max. leakage for status "Good"] < [max. leakage for status "Warning"] < [max. leakage for status "Critical"]

Tab. 26 Max. permissible leakage for “Critical” status

2.6 Default values

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The structure of the process data is described in "Function and parameterisation of the 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)

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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).

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

Tab. 27 Control of the Motion App

2.7 Return values

2.7.1 Status of the Motion App (app state)

Warning

Bit 7 in byte 1 (PDI) will indicate if there are any warnings in the diagnostic memory of the Motion Terminal.

Value	Description
0	There are no warnings.
1	There is a warning in the diagnostic memory of the Motion Terminal.

Tab. 28 Warning

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For dealing with warnings and errors ➔ Description of function and parameterisation of Motion Terminal VTEM

Status of leakage change, port (2)

The status of the leakage change at port (2) is given via bits 0 ... 1 in byte 1 (PDI).

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. 29 Status of leakage change

Status of leakage change, port (4)

The status of the leakage change at port (4) is given via bits 2 ... 3 in byte 1 (PDI).

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. 30 Status of leakage change

Diagnostics status

The diagnostics status is given via bits 4 ... 6 in byte 1 (PDI).

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	0	0	4
Diagnostics completed	1	0	1	5

Tab. 31 Diagnostics status

2.7.2 Actual value 1 and 2 (actual value 1, actual value 2)

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

The leakage change is indicated using bytes 5 … 4 and 3 … 2 (PDI).

Connection	Value range	Digit value	Digit range	Data type	Byte PDI
(2)	–3276.8 … 3276.7 l/h	0.1 l/h	–32768 … 32767 × 0.1 l/h	16 Bit Signed Integer	3 … 2
(4)	–3276.8 … 3276.7 l/h	0.1 l/h	–32768 … 32767 × 0.1 l/h	16 Bit Signed Integer	5 … 4

Tab. 32 Leakage change

3 Technical data

The following data is valid for the nominal conditions and for the following parameters:

– Total volume (tubing + pneum. consumer): 0.08 … 5 l
– Temperature of compressed air 10 … 30 °C
– Supply pressure 0.5 … 8 bar
– A weight force acting on the connected drive may be a maximum of 75 % of the pneumatic force.

The accuracy specifications apply for a leakage of 0 … 50 l/h.

Characteristic values	
Absolute accuracy	± (10 l/h + 0.15 × actual leakage)
Repetition accuracy	± (2 l/h + 0.15 × actual leakage)

Tab. 33 Characteristic values

Example:

Real leakage (actual leakage): 40 l/h

➔ Absolute accuracy of estimated leakage: ± 16 l/h

➔ Repetition accuracy of estimated leakage: ± 8 l/h

Copyright:
Festo AG & Co. KG
Ruiter Straße 82
73734 Esslingen
Germany

Phone:
+49 711 347-0

Fax:
+49 711 347-2144

e-mail:
service_international@festo.com

Internet:
www.festo.com