

Online Help – choice of topic

Module

MFT-PC



Damper actuators



Valve actuators

VAV-Module

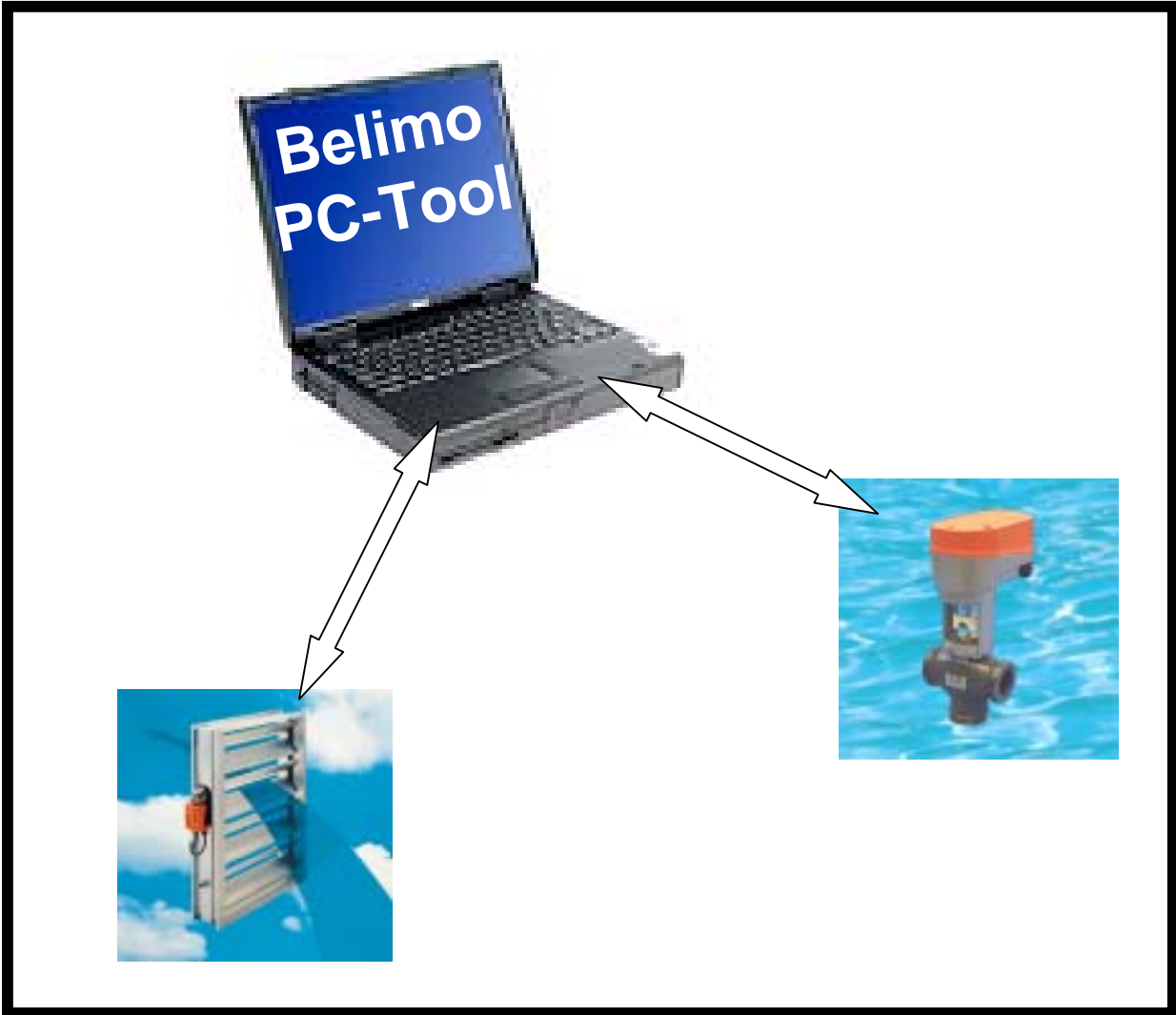
NMV-D2M



VAV-Compact

Please contact your local Belimo agent or representative for more information and the latest documentation.
All Belimo product documentation (in pdf format) can be downloaded from <http://www.belimo.ch/CH/EN/PDF>

Description PC-Tool Module MFT-PC



Belimo PC-Tool Module MFT-PC

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A Application

A1 Using the Belimo PC-Tool

A1.1 The MFT-PC and NMV-D2M modules

The two software modules MFT-PC and NMV-D2M are implemented in the Belimo PC-Tool. The MFT-PC module is used for adapting the individual parameters of multi-functional MFT(2) actuators installed in a system for application or servicing purposes, typically the control signal, the operating range, the feedback function and the running time. At the factory MFT(2) actuators are parameterized with basic values that are suitable for normal applications.

The NMV-D2M Module is used for the commissioning and servicing of VAV air boxes employing Belimo VAV-Control.

A1.2 Service testing with the PC-Tool

The PC-Tool allows the functions of MFT(2) actuators to be tested. The parameterized values can be read out and/or an MFT(2) actuator can be operated by the PC-Tool in order to check it for correct functioning.

A1.3 Adjustable functions depending on the actuator

Depending on the application a specific **configuration table** containing preset values is stored in each actuator. This data configuration determines which menu items in the PC-Tool are selected and which values can be changed. As soon as the PC-Tool is connected to an actuator it reads out the relevant data configuration from it.

A1.4 Inactive display

Parameters and menu items which cannot be accessed in a particular actuator are displayed in grey on the PC-Tool (inactive display).

A2 Parameterizable MFT(2) actuators

A2.1 Parameterizable damper actuators

Actuators without safety function			Actuators with safety function		
Type	Torque	Rated voltage	Type	Torque	Rated voltage
NM24-MFT(2)	8 Nm	AC/DC 24V	LF24-MFT(2)	4 Nm	AC/DC 24V
AM24-MFT(2)	18 Nm	AC/DC 24V	AF24-MFT(2)	15 Nm	AC/DC 24V
GM24-MFT(2)	36 Nm	AC/DC 24V			

Actuators for direct connection to LONWORKS®

AM24LON (US) without safety function	AF24LON (US) with safety function	GM24LON (US) without safety function
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A2.2 Parameterizable valve actuators

Actuators without an emergency control function			Actuators without an emergency control function		
Type	Force	Rated voltage	Type	Force	Rated voltage
NV24-MFT(2)	800 N	AC/DC 24V	NVF24-MFT(2)	800N	AC/DC 24V
			NVF24-MFT(2)-E	800N	AC/DC 24V

Actuators for direct connection to LONWORKS®

Actuators without an emergency control function	Actuators without an emergency control function
NV24LON, AV24LON, NVS24LON, AVS24LON	NVF24LON NVF24LON-E

A3 Connecting and wiring

The PC-Tool can be integrated into applications in different ways depending on how it is to be used.

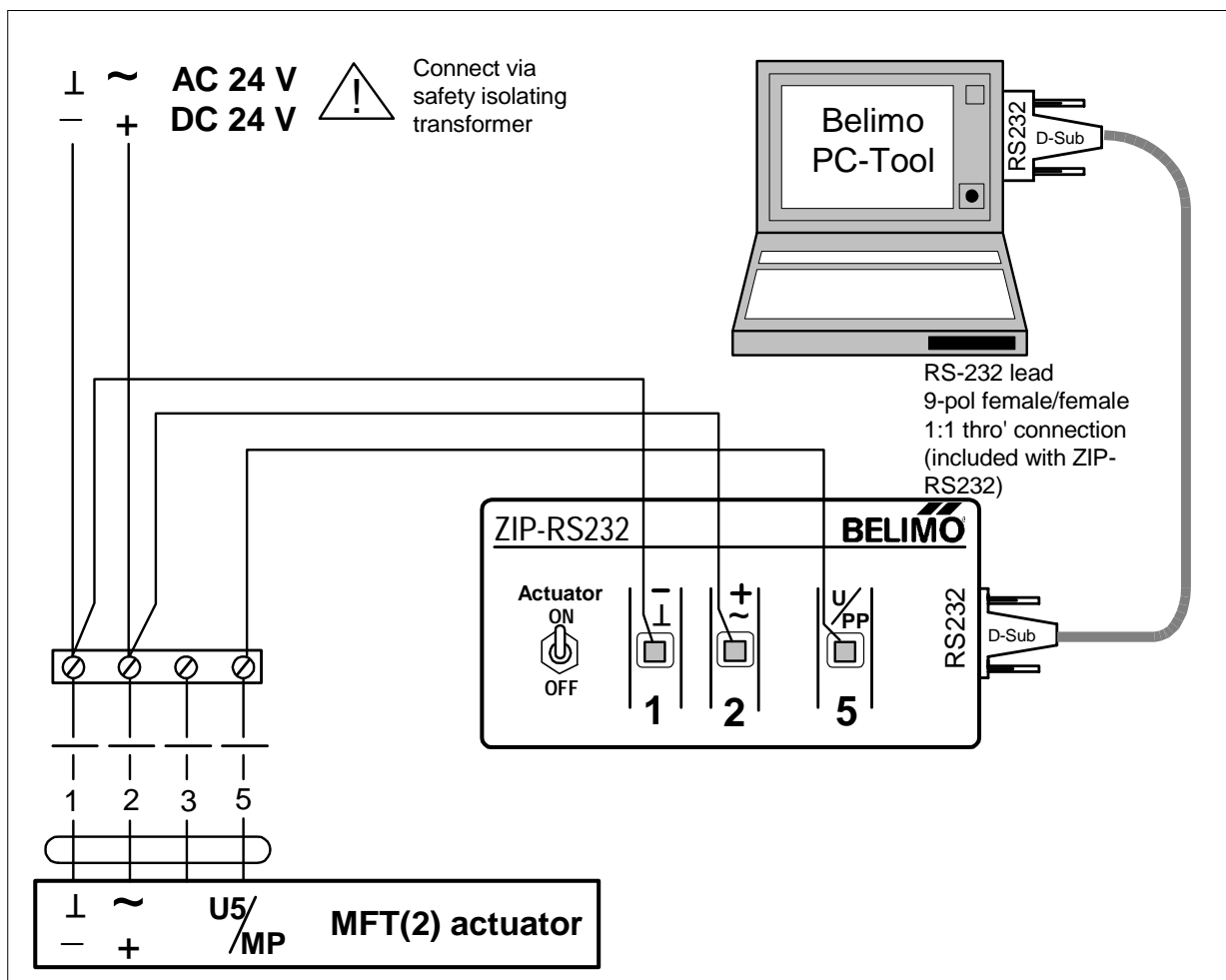
A3.1 Diagram 1

Typical use Diagram 1:

Parameterizing an MFT(2) actuator when it has already been incorporated into the installed system.

Wiring notes for Diagram 1:

- ▶ The power supply for the MFT(2) actuator is taken from the power supply to the whole installation
- ▶ The power supply for ZIP-RS232 is taken from the power supply to the whole installation
- ▶ For as long as the U5/MP connection of the MFT(2) actuator is connected to the PC-Tool via ZIP-RS232 the U5 feedback signal does not correspond to the instantaneous actual value.



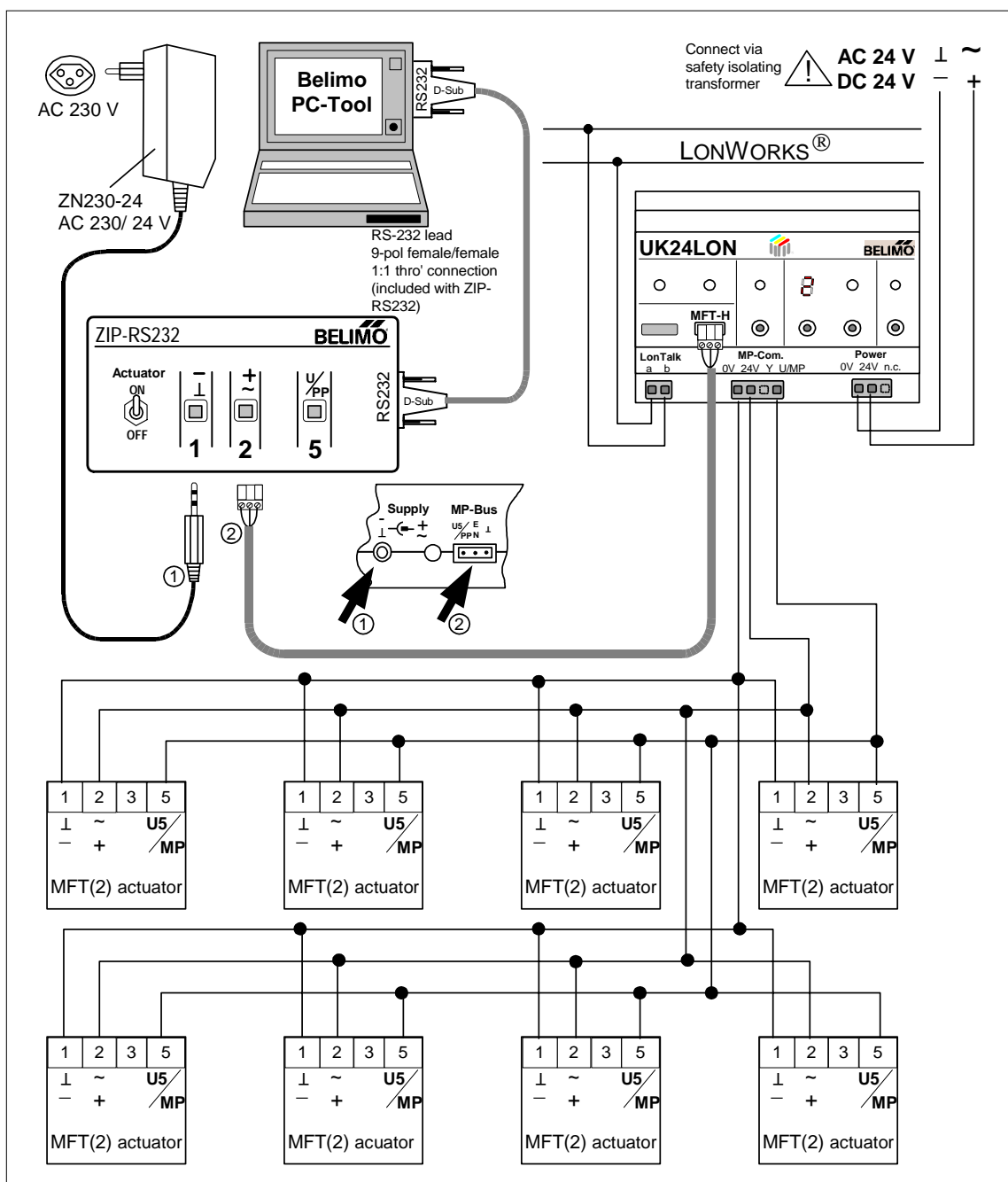
A3.3 Diagram 3

Typical use Diagram 3:

Parameterizing MFT(2) actuators when they have already been integrated into a bus system (e.g. LONWORKS®).

Wiring notes for Diagram 3:

- ▶ The power supply for the MFT(2) actuator is taken from the UK24LON
- ▶ The power supply for ZIP-RS232 is taken from ZN230-24
- ▶ ZIP-RS232 is connected directly to the UK24LON by means of a 3-core lead. In this case the UK24LON displays an "H" in the address field. No data can be exchanged between LonWorks and the MFT(2) actuators in this situation. During this time the data is buffer-stored in the UK24LON.



A3.4 Diagram 4

Typical use Diagram 4:

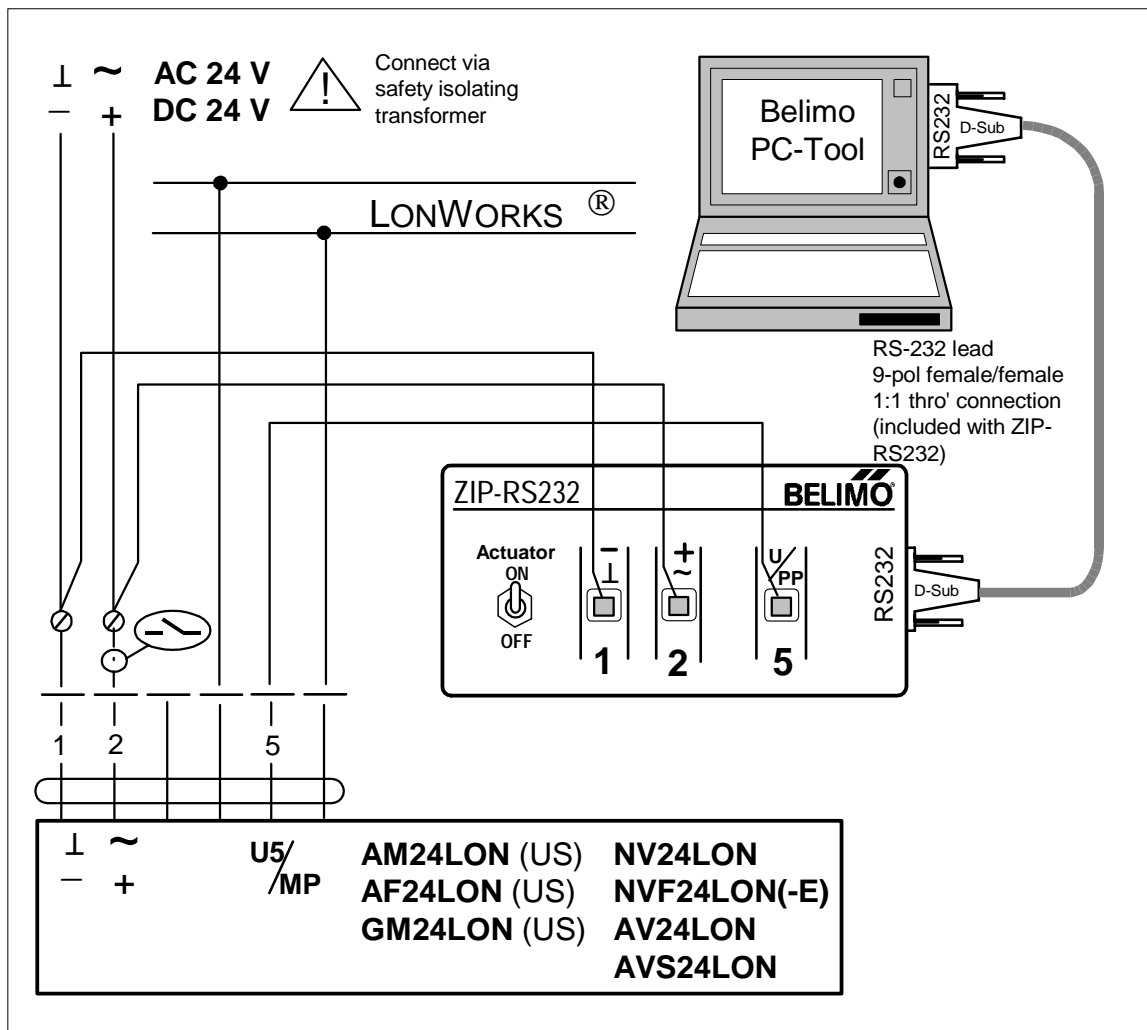
Parameterizing a LON actuator (for direct connection to LONWORKS®) when it has already been incorporated into the installed system.

Wiring notes for Diagram 4:

After the LON actuator has been connected to the power supply the PC-Tool has only 30 seconds to establish communication with the actuator. After the 30 seconds has elapsed the actuator automatically isolates itself from the LONWORKS® network. However, if the PC-Tool has established communication with the actuator during this time it will remain on-line for as long as necessary.

Consequently, proceed as follows:

1. Wire-up as shown in the diagram. Do not connect core 2 of the LON actuator to the AC or DC 24 V power supply yet (connection is indicated by a switch symbol).
2. Power-up the PC-Tool and select toolbar PP (see [G5.2](#)) in the address field.
3. Power-up the LON actuator, i.e. core 2, indicated by a switch symbol, with AC or DC 24 V.
4. Communication between the PC-Tool and the LON actuator is now established. No data can be exchanged between LonWorks and the actuator while the PC-Tool is actually communicating with the actuator.



A3.5 Diagram 5

Typical use Diagram 5:

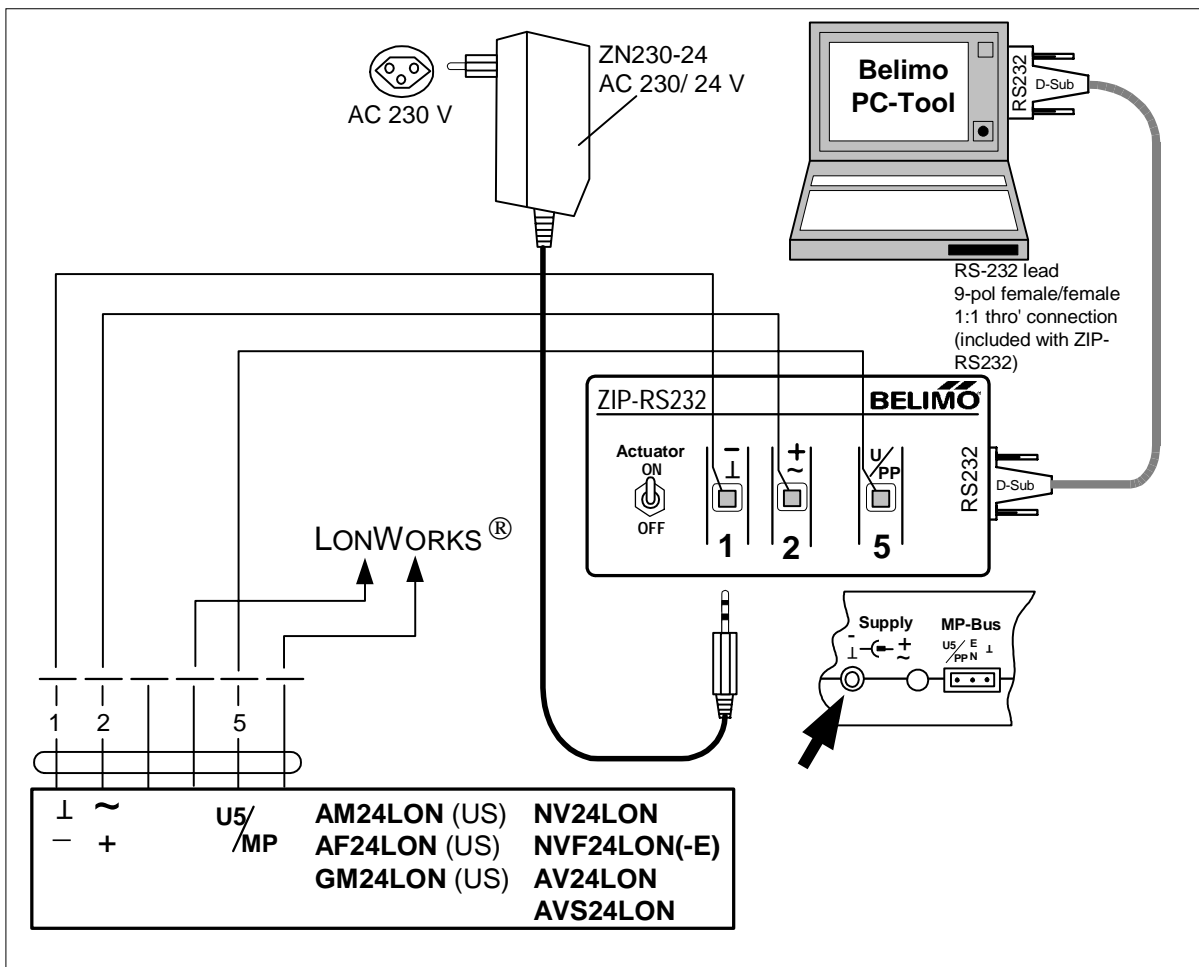
Parameterizing a LON actuator (for direct connection to LONWORKS®) before it has been incorporated into the installed system.

Wiring notes for Diagram 5:

After the LON actuator has been connected to the power supply the PC-Tool has only 30 seconds to establish communication with the actuator. After the 30 seconds has elapsed the actuator automatically isolates itself from the LONWORKS® network. However, if the PC-Tool has established communication with the LON actuator during this time it will remain on-line for as long as necessary.

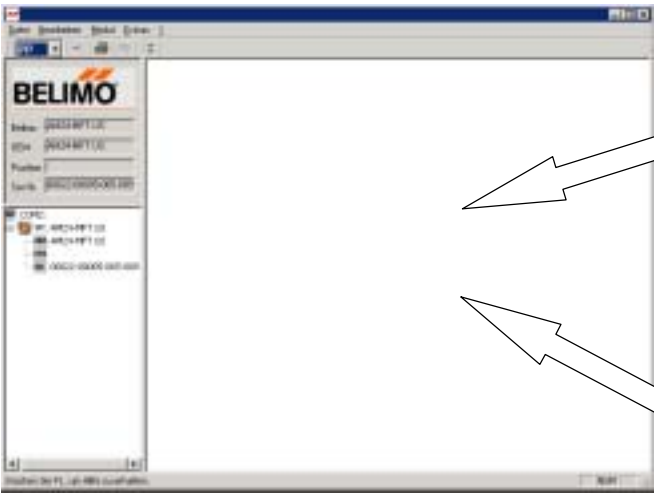
Consequently, proceed as follows:

1. Set the "Actuator" switch on ZIP-RS232 to the OFF position and wire up as shown in the diagram.
2. Power-up the PC-Tool and select toolbar PP (see [G5.2](#)) in the address field.
3. Power-up the LON actuator, i.e. set the "Actuator" switch on ZIP-RS232 to the ON position.
4. Communication between the PC-Tool and the LON actuator is now established.



A4 Structure of the PC-Tool

The PC-Tool comprises basic software with the MFT-PC and NMV-D2M modules implemented in it. The basic software provides general functions for use by the modules.



Basic software



Module MFT-PC



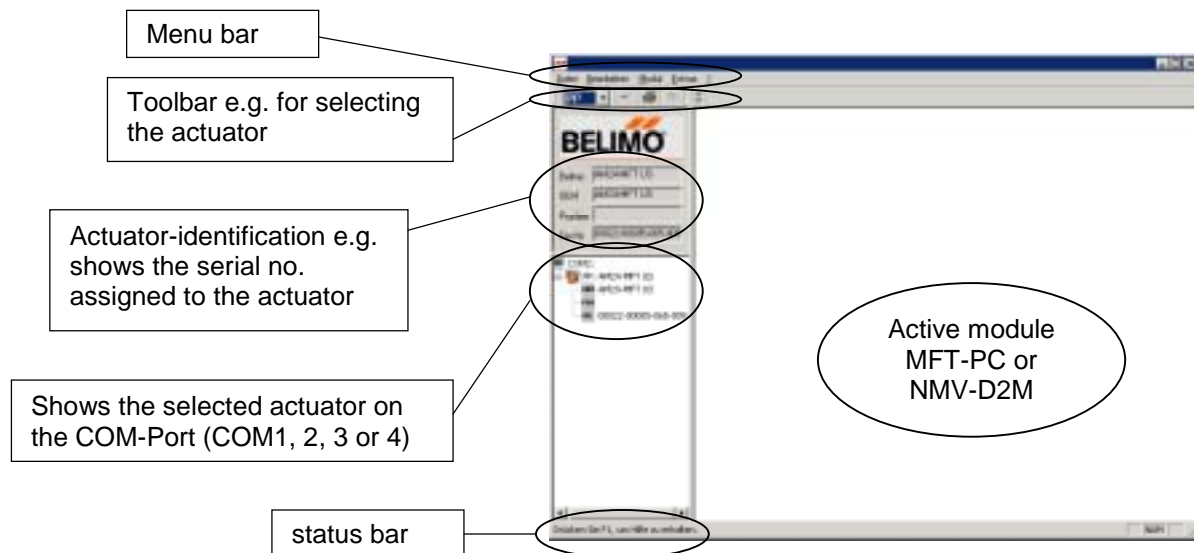
Module NMV-D2M

G Basic software

G1 Purpose

The Basic Software is the software framework within which the individual software modules operate (the modules MFT-PC and NMV-D2M are currently available). It provides the user with general functions that can be used by all modules. Typical general functions are addressing the actuators, printing out the set values, selecting modules, etc.

G2 Description of the elements



G3 Description of the menu bar



G3.1 Module

Menu item	Short description
Module\ MFT-PC	Selecting the MFT-PC module for assigning general actuator parameters.
Module\ NMV-D2M	Selecting the NMV-D2M Module. For parameterizing and commissioning the VAV-Compact NMV-D2M. Note: If an attempt is made to parameterize an unsuitable actuator (not a NMV-D2M) with the NMV-D2M module the PC-Tool will trigger an alarm.

G3.2 Extras

Menu item	Short description
Extras\ Address actuators ...F2	Selecting the address of an actuator (For procedure see G5.1)
Extras\ Options...	The following choice appears when Options is selected: <ul style="list-style-type: none"> • General <ul style="list-style-type: none"> > Language and COM 1, 2, 3 or 4 can be selected > Module release code for manufacturer • MFT-PC <ul style="list-style-type: none"> > The password function can be activated or deactivated. • NMV-D2M <ul style="list-style-type: none"> > Options for the NMV-D2M module can be selected

G3.3 MFT-PC

Menu item	Short description
MFT-PC\ Undo all entries	All values that have been parameterized since the last time the actuator was read by the PC-Tool are reset.
MFT-PC\ Load basic configuration...	For parameterizing MFT(2) actuators with standard or basic functions. A data record containing the normal parameters for the application is stored for each basic function. Note: The available basic functions depend on the selected module (MFT-PC or NMV-D2M) and the MFT(2) actuator connected. (For procedure see G5.3)
MFT-PC\ Copy device	For copying a data record from one MFT(2) actuator to another. Typical application: <ul style="list-style-type: none"> • For substituting a new actuator for an MFT(2) actuator with a special data record that has suffered a mechanical defect. • For parameterizing small numbers of actuators (For copying procedure see G5.4)

G3.4 File

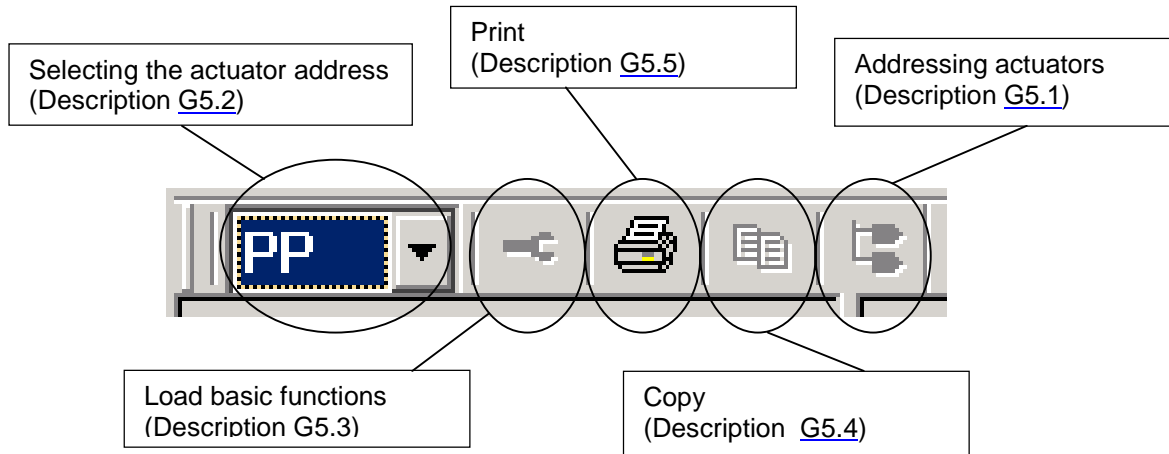
Menu item	Short description
File\ Print... Strg+P	For printing out the settings of the MFT(2) actuator that is currently being accessed (for procedure see G5.5)
File\ Printer settings...	Printer setup menu. (Standard Windows)
File\ Exit	Leave PC-Tool

G3.5 ?

Menu item	Short description
?\ Help	Calling for help.
?\ Info on Belimo PC-Tool	Belimo PC-Tool Version No.

G4 Description of the toolbar

The toolbar provides a very simple means of calling the most frequently used functions.



G5 Working with the basic software

This section tells you how to perform the following tasks:

Address an actuator <F2> ([G5.1](#))

Select the address of the actuator for communication ([G5.2](#))

Load basic functions ([G5.3](#))

Copy ([G5.4](#))


Print ([G5.5](#))

G5.1 Address an actuator

G5.1.1 General notes

- Either PP or MP1...MP8 can be selected as an actuator address.
- Address PP (PP = Point-to-Point) is selected when only one MFT(2) actuator is connected to the PC-Tool (see [A3.1 Diagram 1](#) or [A3.2 Diagram 2](#)). When an actuator is addressed for PP it is automatically parameterized for the conventional mode of operation (without the MP-Bus). In this case control is either modulating with DC, 3-point, Open-Close or PWM. Addressing for PP is also used in order to return an actuator that has previously been set up for bus operation to conventional operation.
- In order to use the U5 feedback signal the actuator must first be addressed for PP because U5 is only enabled in the conventional mode (not MP-Bus) (in the MP-Bus mode of operation the U5 terminal is used for communication).
- Address MP1...MP8 is selected when several MFT(2) actuators are connected to the PC-Tool via the MP-Bus (see [A3.3 Diagram 3](#)). This is because when several MFT(2) actuators are communicating via the MP-Bus they must be clearly identifiable. When an MFT(2) actuator is given an MP address MP1...MP8 it is automatically parameterized for the MP-Bus mode of operation. In this case digital control is exercised over the MP-Bus. Since several MFT(2) actuators are communicating over the MP-Bus it is important that each can be clearly identified.
- If a selected address has already been assigned the PC-Tool first opens a dialogue box and asks for confirmation that the existing address can be used again.

G5.1.2 Start addressing

Access the menu [Extras\Addressing actuators] via the menu bar or via the addressing symbol  on the toolbar [Addressing actuators].

G5.1.3 Two types of addressing

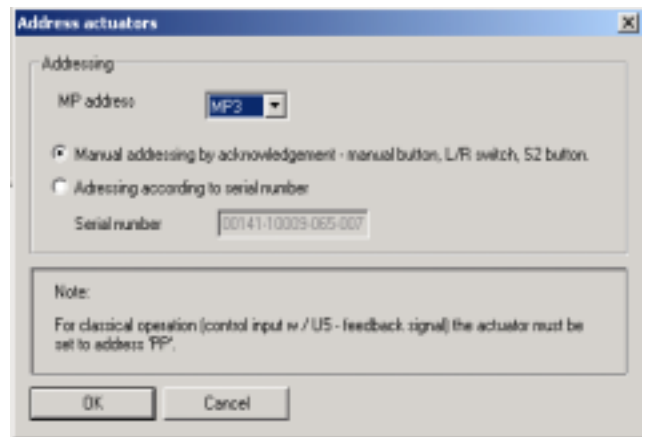
There are two types of addressing available:
Manual addressing with acknowledgement and addressing with known Serial No.

G5.1.3.1 Manual addressing with acknowledgement

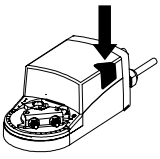
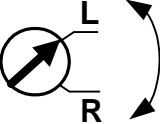
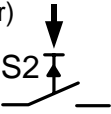
Procedure for addressing with acknowledgement:

- Select the required address (PP or MP1...MP8) in the MP-Address field of the dialogue box (here: MP3).
- Select the type of addressing from the dialogue box.
- Press the OK key. The PC-Tool will then make the following request:

Please move depending on involved type of actuator:
Disengage button / L/R switch / S2 button



- Respond to the request by triggering the appropriate acknowledgement function indicated in the table below:

Actuator family	Actuator type	Acknowledgement function
Actuators without spring return	NM24-MFT(2) AM24-MFT(2) GM24-MFT(2)	Press the manual pushbutton once 
Actuators with Spring return	LF24-MFT(2) AF24-MFT(2)	Operate the L/R switch back and forth once (within 4 seconds) 
Linear actuators for valves	NV24-MFT(2) NVF24-MFT(2) NVF24-MFT(2)-E	Press key S2 once (under the housing cover) 

- As soon as the MP address has been assigned to the actuator the PC-Tool will display the following message:

Successful addressed

G5.1.3.2 Addressing with known Serial No.

A label bearing an individual Serial No. is attached to each MFT(2) actuator when it is delivered. Using this Serial No. it is possible to assign an address to the actuator, either PP or MP1...MP8. An additional detachable label bearing an identical Serial No. is packed with the actuator. When the actuator has been installed in a specific position in the system this additional label can be stuck on the drawing of the system in the appropriate position. This provides a record of where in a building specific actuators have been installed. The appropriate address PP or MP1...MP8 can be assigned to an actuator via this Serial No.

Procedure for addressing with known Serial No.:

- Select the required address (PP or MP1...MP8) in the MP-Address field of the dialogue box (here: MP3).
- Select the type of addressing according to the dialogue box and enter the Serial No. of the actuator in the field (a bar code reader can also be used).
- Press the OK key.
- As soon as the MP-Address has been assigned to the MFT(2) actuator the PC-Tool will provide the following display:

Successful addressed



G5.2 Selecting the address of the actuator for communication

G5.2.1 General notes

- The actuator that is to be accessed via PP or MP1...MP8 must have been properly connected (see Diagram A3....).
- Regardless of the actuator address each MFT(2) actuator can be accessed via PP. However, PP input may only be selected when only one actuator is connected to the PC-Tool.
- LON actuators (actuators for direct connection to LONWORKS®) can only be accessed via PP or MP1.

Communication error on the MP-Bus

If the PC-Tool detects a communication error on the MP-Bus, a dialogue box opens and lists the possible causes:

Communication error on the MP-Bus !

Possible causes:

- Several actuators have the same MP address
- PC-Tool is communicating by PP but several actuators are connected to the MP-Bus
- The actuators have not been addressed

On the status bar (bottom left) the “**Communication error on MP-Bus**” message remains on-screen even after the OK button has been pressed until the problem with the MP-Bus has been rectified.

Procedure for selecting the actuator address:

- The sequence is started by selecting the appropriate address on the toolbar B4 (PP or MP1...MP8) (here: MP3).
- The PC-Tool will now check the bus automatically for the presence of an MFT(2) actuator with the selected address (MP3). If the PC-Tool recognizes the appropriate actuator it automatically reads out all the actuator-specific values from it. The actuator identification and the actuator detected on Ports COM 1, 2, 3 or 4 are shown on the left-hand side of the screen.



G5.3 Load basic functions


G5.3.1 General notes

- Loading the basic functions allows an MFT(2) actuator to be parameterized with standard or basic functions. For each basic function a data record is stored containing the usual basic values for the function. It contains the type of control and the associated basic values such as running time 150 s, torque 100%, etc.
- If an actuator has been given an MP-Address MP1...MP8 it is ready for the bus mode of operation. In the bus mode the actuator is controlled digitally over the MP-Bus and the conventional control modes (control signals DCV, PWM, 3-point, etc.) are disabled. In the bus mode, however, loading a basic function can still be very useful in order to parameterize an actuator with the basic values suitable for a particular type of control (running time 150 s, torque 100 %, etc.).

G5.3.2 Basic functions and associated basic values

Basic function	Basic values
SR (DC 2-10 V)	Operating range DC 2...10V, U5 feedback DC 2...10V, Torque/Force 100%, Running time 150s, Manual adaption, Minimum = 0%, Intermediate = 50%, Maximum = 100% (Wiring diagram M1.1.2)
PWM (0,59-2,93s)	Operating range 0.59-2.93s, U5 feedback DC 2...10V, Torque/Force 100%, Running time 150s, Manual adaption, Minimum = 0%, Intermediate = 50%, Maximum = 100% (Wiring diagram M1.2.4)
3-point	U5 feedback DC 2...10V, Torque/Force 100%, Running time 150s, Manual adaption, Minimum = 0%, Intermediate = 50%, Maximum = 100 % (Wiring diagram M1.3.1)
Open-Close	U5 feedback DC 2...10V, Torque/Force 100%, Running time 150s, Manual adaption, Minimum = 0%, Intermediate = 50%, Maximum = 100% (Wiring diagram M1.4.1)
VAV (6 ± 4 V)	Operating range DC 6 +/- 4V, U5 feedback DC 2...10V, Torque/Force 100%, Running time 150s, Manual adaption, Minimum = 0%, Intermediate = 50%, Maximum = 100% (Wiring diagram M1.5.1)

G5.3.3 Procedure for loading a basic function

- From the menu bar [MFT-PC\Load basic configuration...] or from the symbol  on the Toolbar, go to “Basic configuration” where all the available basic functions are listed.
- When the required basic function has been selected by clicking on the “Load configuration” button the appropriate function is loaded into the graphic interface of the PC-Tool.
- Clicking on the “Programming” button then loads the function into the MFT(2) actuator.

G5.4 Copying


G5.4.1 Typical application

- For substituting a new actuator for one with a special data record that has suffered a mechanical defect.
- For parameterizing small numbers of actuators.

G5.4.2 General notes

- With the “Copy” function it is possible to read out the values from an actuator and duplicate them in other MFT(2) actuators of the same type.
- The MFT(2) actuator to which the data is copied must have the same address (PP or MP1...MP8) as the original actuator from which the copy was taken. Therefore, before the copying is actually effected the future copied actuator must have been given the same address as the original actuator (see [G5.1](#) for the addressing procedure).

G5.4.3 Copying procedure

1. Establish an electrical connection between the PC-Tool and the MFT(2) actuator (see [A3.2 Diagram 2](#)) from which the data is to be obtained.
2. Start copying, i.e. reading out the data from the original actuator, via the menu bar [MFT-PC\Copy device] or via the symbol  on the Toolbar.
3. PC-Tool opens the “PC-Tool, copy” dialogue field with the following request:

Actual data read out.
Please connect an actuator of the same type and MP address, then press OK.

4. In accordance with the PC-Tool request, connect the new actuator and then press OK. The new actuator will be registered by PC-Tool and the values will be loaded into it.
5. PC-Tool then opens the following dialogue box::

Copying successful !
Do you wish to copy the same settings to another actuator ?

6. - Selecting 'No' ends the copying.
- Selecting 'Yes' opens the following dialogue box:

Please connect an actuator of the same type and MP address, then press OK.


7. In accordance with the PC-Tool request, connect the new actuator and then press OK. The new actuator will be registered by PC-Tool and the values will be loaded into it.

8. PC-Tool then opens the following dialogue box:

Copying successful !
Do you wish to copy the same settings to another actuator ?

Continue repeating steps 6 to 8 until the required number of actuator copies have been made.

G5.5 Printing

Printing can be started via the menu bar [File\Print] or via the symbol  on the Toolbar. A list of the values with which the connected actuator has been parameterized will be printed out.

Note:

The whole of the Help document can be printed out directly from the Help file (pdf format).

M MFT-PC module

The MFT-PC module is used for assigning general parameters to actuators. It contains four main parameter assignment pages, namely “Control”, “Feedback signal U5”, “Motion” and “Service”.

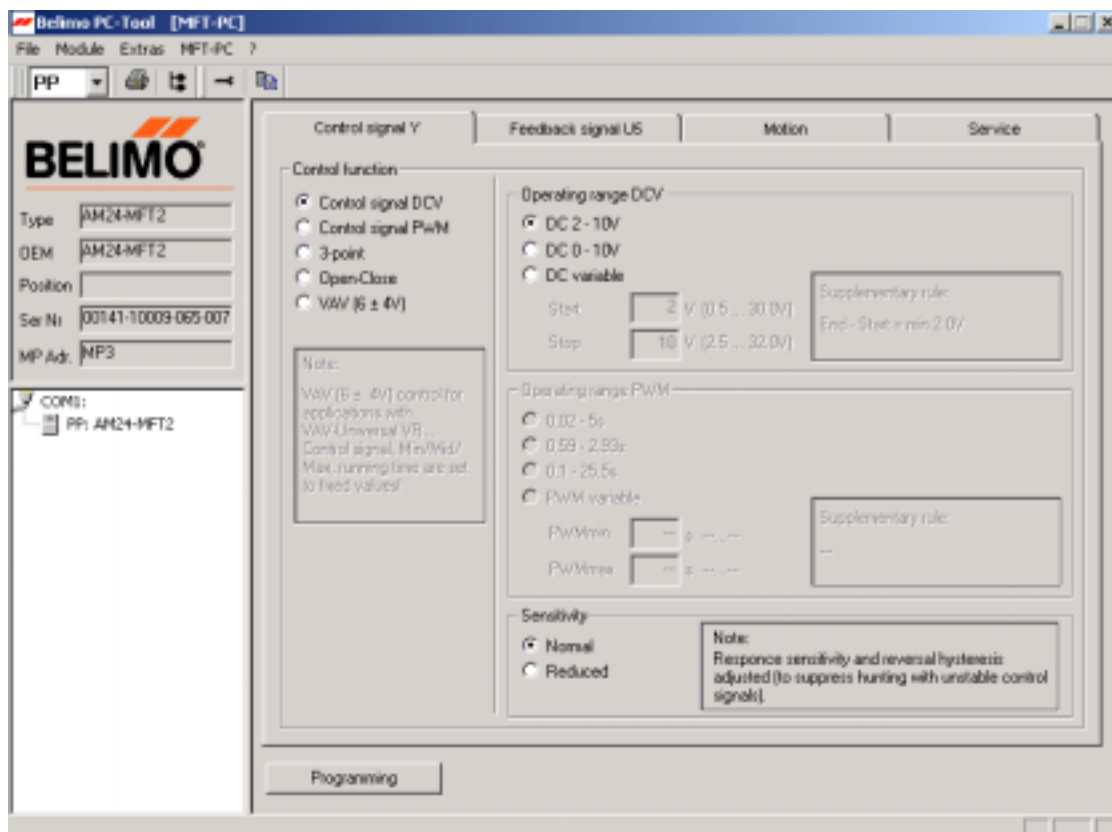
The MFT-PC module can be selected on the menu bar under “Module”. The appropriate MFT(2) actuator can then be accessed by selecting the corresponding address on the Toolbar (see [G5.2](#)).

If the particular actuator is recognized by the PC-Tool it will automatically read out all the specific values from it. The PC-Tool will then always display those values that the MFT(2) actuator received the last time it was parameterized. Menus and values that are not valid for the particular actuator in question are shown in grey (inactive) on the PC-Tool and cannot be changed.

If, when making a modification for a particular basic function (see [G5.3](#)), only individual values need to be changed it is advisable to load the MFT(2) actuator with the appropriate basic function (see [G5.3](#)) before making the modification.

M1 Parameter assignment page “Control“

The “Control” parameter assignment page allows types of control and associated operating ranges to be defined. The types of control are applicable to the conventional mode of operation (in this case the actuator must be addressed for PP). As soon as the actuator has been given an MP-Address MP1...MP8 it is ready for the bus mode of operation. In the bus mode the actuator is controlled digitally over the bus and the conventional modes of operation are disabled (Bus operation [A3.3 Diagram 3](#)).



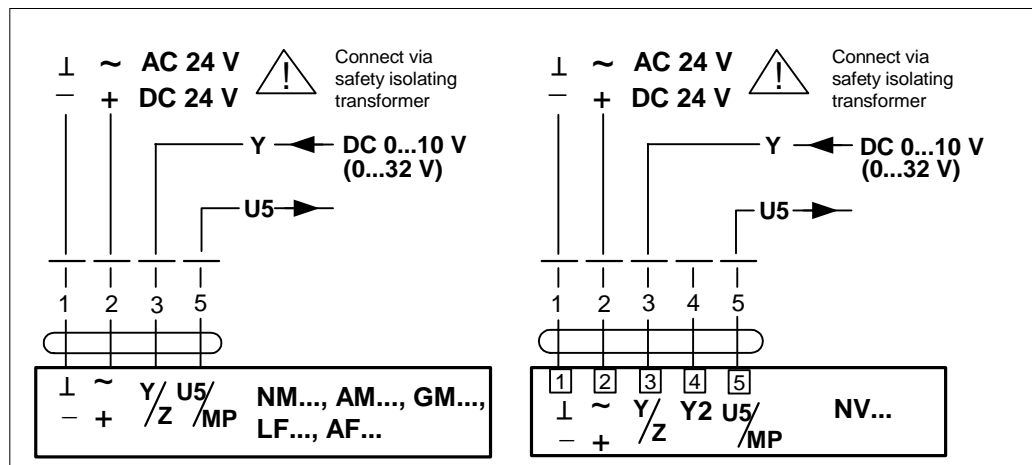
M1.1 Control signal DCV

Selecting this function parameterizes an MFT(2) actuator for modulating control with a DC voltage. Three different operating ranges can be selected in the DCV operating range field:

M1.1.1 DCV operating ranges

DC 2 - 10V	Selecting a fixed operating range of DC 2.0...10.0V
DC 0.5 - 10V	Selecting a fixed operating range of DC 0.5...10.0V
DC variabel	Selecting a variable operating range with: Start point DC 0.5...30.0 V, finish point DC 2.5...32.0V Note: The finish point must be at least 2V above the start points.

M1.1.2 Wiring diagram for the DCV control signal



M1.2 Control signal PWM

Selecting this function parameterizes an MFT(2) actuator for PWM control.

M1.2.1 Explanation of PWM

The PWM control described here is mainly used in America. With PWM control the MFT(2) actuator measures the length of the control pulse and then moves to the position that corresponds to it. Referring to the controller that operates the MFT(2) actuator, various PWM ranges can be selected at the actuator.

M1.2.2 Examples of PWM control (select PWM range on actuator: 0.59-2.93s)

Example 1: 100% angle of rotation or stroke/lift

When a pulse of 2.93 seconds is sent to the actuator it causes it to move to 100% angle of rotation or stroke/lift. (If the pulses sent to the actuator are of longer duration than 2.93 s the actuator will also move to the 100 % position).

Example 2: 50% angle of rotation or stroke/lift

When a pulse of $0.59s + (2.93s - 0.59) / 2 = 1.76s$ is sent to the actuator it causes it to move to 50% angle of rotation or stroke/lift.

Example 3: 0% angle of rotation or stroke/lift

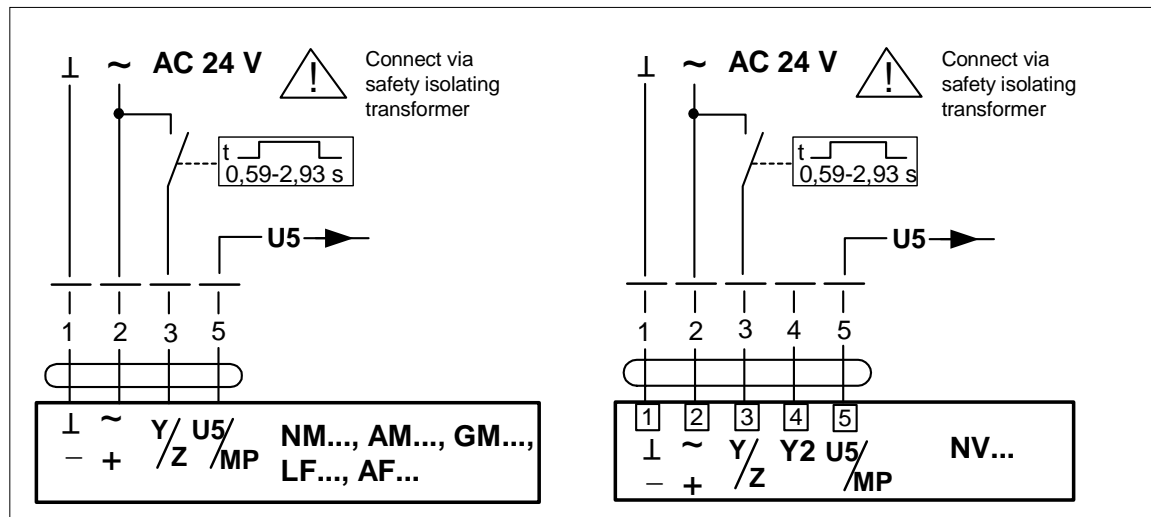
When a pulse of 0.59 s duration is sent to the actuator it causes it to move to the 0% angle-of-rotation position. (If the pulses sent to the actuator are of shorter duration than 0.59s but longer duration than 20 ms the actuator will also move to the 0% angle-of-rotation position; at less than 20 ms there is no defined function).

Four different operating ranges can be selected in the “PWM operating range” field:

M1.2.3 PWM operating ranges

0,02 – 5 s	Fixed PWM operating range 1
0,59 - 2,93 s	Fixed PWM operating range 2
0,1 .- 25,5 s	Fixed PWM operating range 3
PWM variable	Variable operating range with PWM min. 0.02 s...PWM max. 50.0s

M1.2.4 Wiring diagram for the PWM control signal



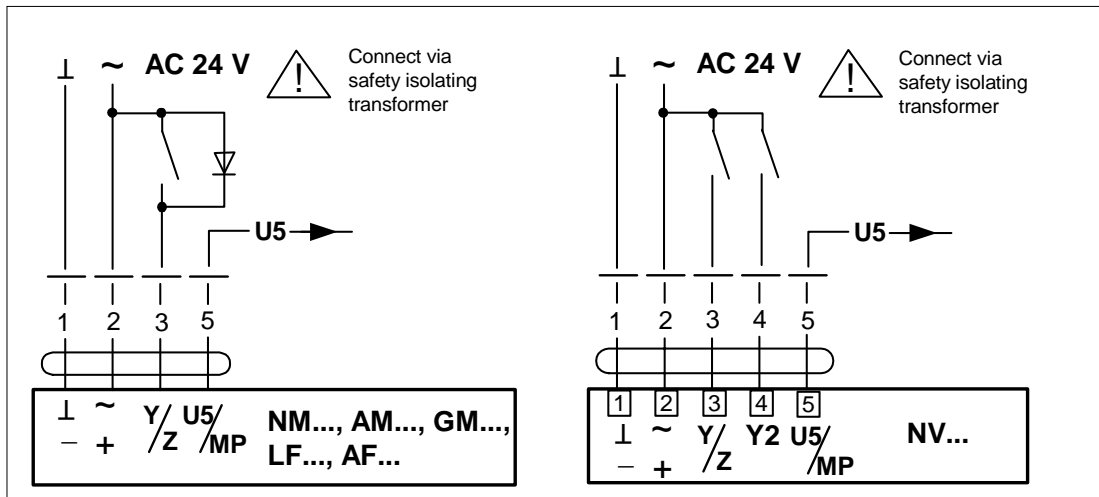
Note: Control by triac possible (source or sink).

M1.3 3-point control

Selecting this function parameterizes an MFT(2) actuator for 3-point control.

Note: This type of control **cannot** be used with a DC 24V power supply!

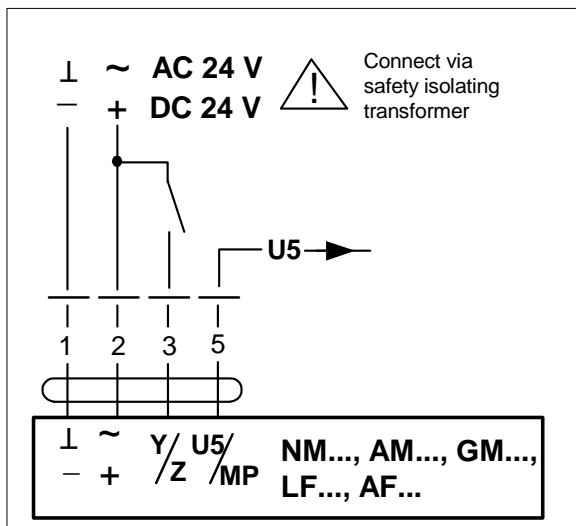
M1.3.1 Wiring diagram for 3-point control



M1.4 Open-Close control

Selecting this function parameterizes an MFT(2) actuator for Open-Close control (sometimes also known as 2-point control).

M1.4.1 Wiring diagram for Open-Close control

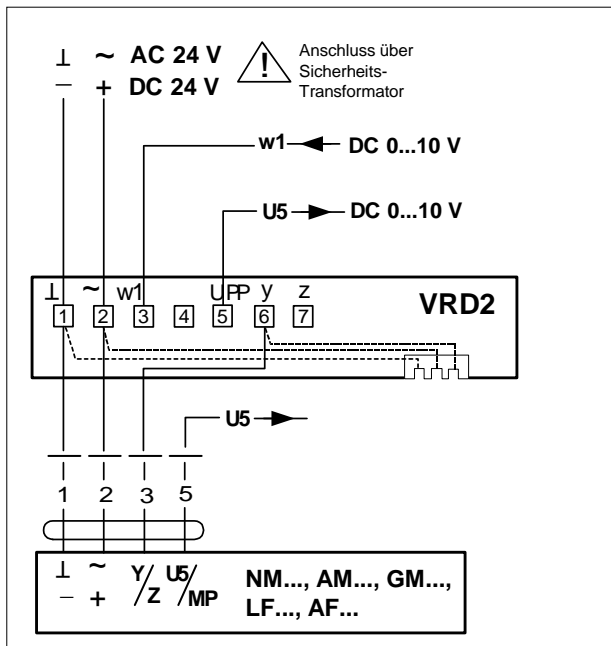


M1.5 VAV control (6 ± 4 V)

Selecting this function parameterizes an MFT(2) actuator as a VAV actuating device which allows it to be controlled by VAV controllers VR..

Note: When VAV is selected (6 +/- 4 V) the values for Minimum, Maximum, Intermediate, running time and angle of rotation are reset to the default values.

M1.5.1 Wiring diagram for VR.. control



M1.6 Control sensitivity

“Sensitivity” refers to effects on the response sensitivity and the reversal hysteresis. It can be very helpful in suppressing oscillations caused by an unstable control signal.

M1.6.1 Meaning of “Normal“

	Response sensitivity	Reversal hysteresis
Rotary actuators	1°	2,5°
Linear actuators	0,2 mm	0,5 mm

M1.6.2 Meaning of “Reduced“

	Response sensitivity	Reversal hysteresis
Rotary actuators	2°	5°
Linear actuators	0,4 mm	1 mm

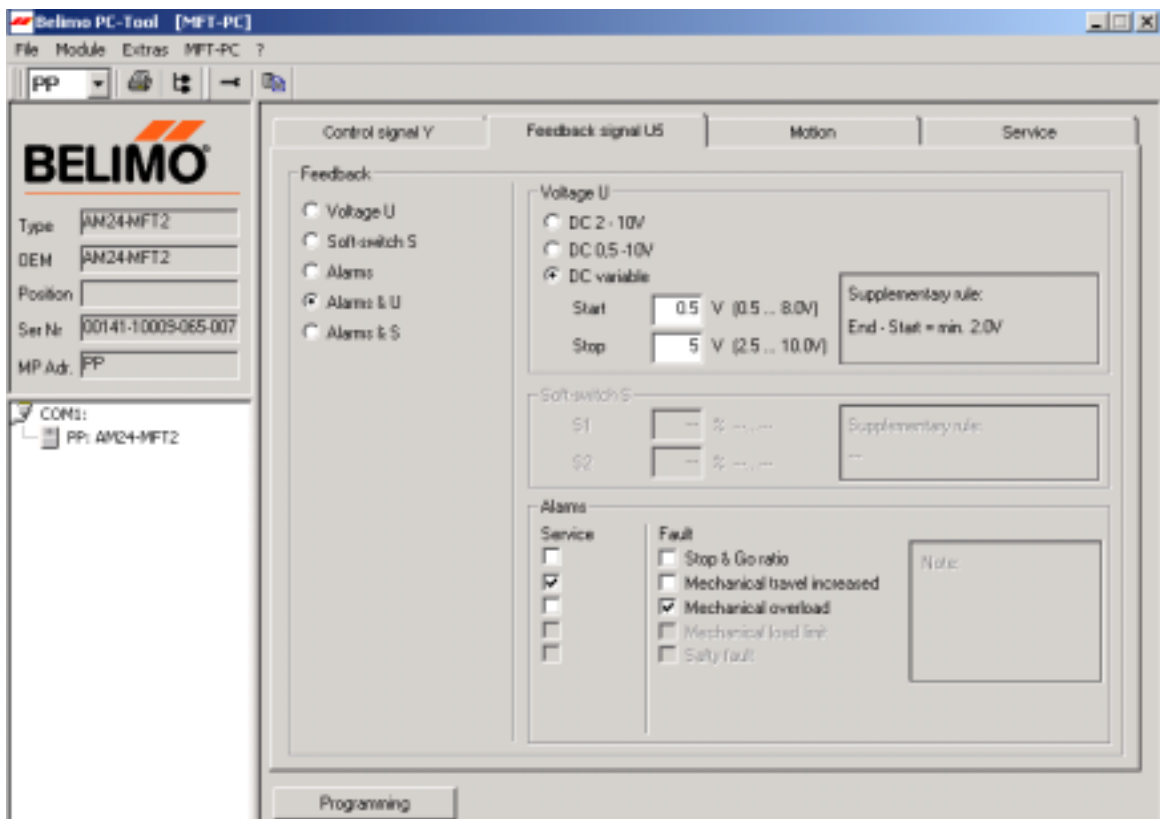
M1.7 Programming on the “Control” parameter assignment page

As soon as the “Programming” button has been pressed all the data that has been defined on the “Control”, Feedback signal "U5", “Motion” and “Service” parameter assignment pages are loaded into the MFT(2) actuator. If data has been entered that is outside the valid range for the function the programming will be discontinued and the incorrect items will be listed in a dialogue box. When the entries have been corrected the programming can be restarted by pressing the “Programming” button again.

M2 Parameter assignment page “Feedback signal U5”

The function of the feedback signal U5 signal is defined on the “Feedback signal U5” parameter assignment page. **In order for these functions to be defined the actuator must have been addressed for PP (conventional mode of operation).** If the actuator has been given an MP-Address (MP1...MP8) it will be controlled digitally over the MP Bus. In this case the U5 connection is used as a bus communication conductor and the functions of U5 feedback cannot be used in this case. If the MFT(2) actuator has been given an MP-Address MP1...MP8 the “Feedback signal U5” parameter assignment page will have been deactivated automatically (grey background).

Note: When the angle of rotation has been limited mechanically to < 95° the angle must also be adapted electronically in order for the functions to be correct (see [M4.7](#)).



M2.1 Measuring signal U

Selecting U5 feedback as a modulating, linear DC measuring voltage. The defined signals correspond to 0...100% angle of rotation or stroke/lift.

M2.1.1 Range of measuring signal U

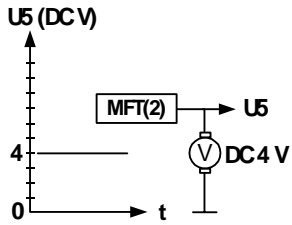
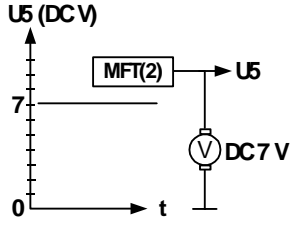
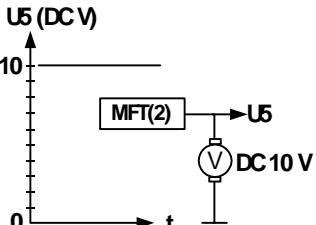
Three different ranges can be selected in the “Range of measuring signal U” field:

DC 2 - 10V	Select a fixed DC measuring signal of DC 2.0...10.0V
DC 0.5 - 10V	Select a fixed DC measuring signal of DC 0,5...10.0V
DC variable	Variable definition of a DC measuring signal with: Start point DC 0.5...8.0V and finish point DC 2.5...10.0V Note: The finish point must be at least 2V above the start points.

M2.2 Softswitches S

Selecting U5 feedback as softswitches S1 and S2. Referring to the effective mechanical angle of rotation or stroke/lift of the MFT(2) actuator, two soft switching points (S1 and S2) can be defined (adjustable 1...99%, whereby the value of S2 must always be at least 10% higher than the value of S1). The level of the U5 DC voltage changes depending on the angle of rotation or stroke/lift executed and whether switching point S1 or S2 is reached.

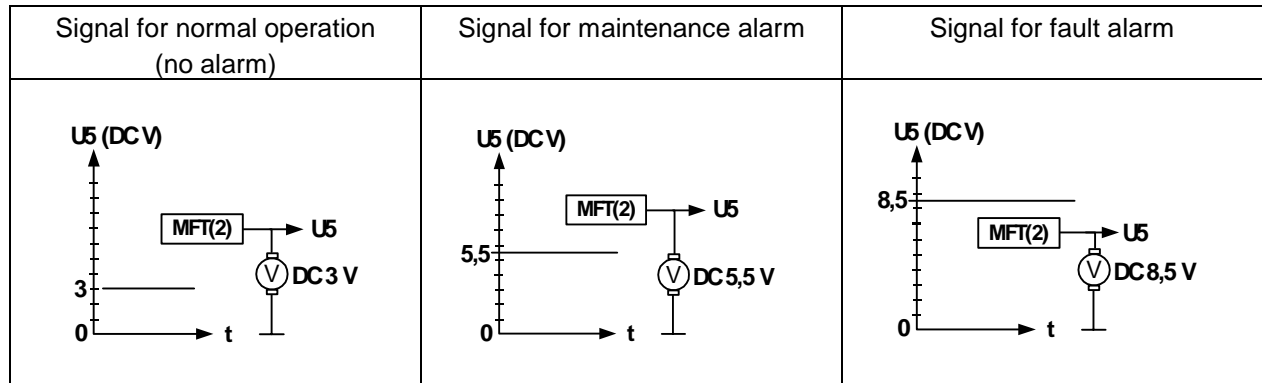
M2.2.1 Levels for softswitches S1 & S2

Actuator position	Level U5
Position less than the set value of S1	
Position greater than the set value of S1 and less than the value of S2	
Position greater than the set value of S2	

M2.3 Alarms

Assigning maintenance alarms or fault alarms to the U5 feedback. Various criteria can be defined so that a maintenance alarm or fault alarm is output from U5. Depending on whether maintenance or fault has been defined by the criteria, U5 will output a specific signal when the criterion occurs.

U5 signals for corresponding alarms:



M2.3.1 Selecting the criteria

The following criteria can be assigned as maintenance alarms or fault alarms:

The ✓ symbol indicates when an alarm is set.

M2.3.2 Stop & Go-Ratio

Selectable criterion of an oscillating actuator (due to unstable control, for example) as a maintenance alarm or fault alarm. The "Stop & Go Ratio" is the ratio between active time and operating time (Operating time = No. of hours when the actuator was powered up. Active time = No. of hours when the MFT(2) actuator was powered up and in mechanical motion). A maintenance alarm or fault alarm is generated when the "Stop & Go Ratio" exceeds a value of 20% (see also [M4.2](#) Parameter assignment page "Service").

M2.3.3 Mechanical travel increased

Selectable criterion for a 10% increase in mechanical actuator travel as a maintenance alarm or fault alarm.

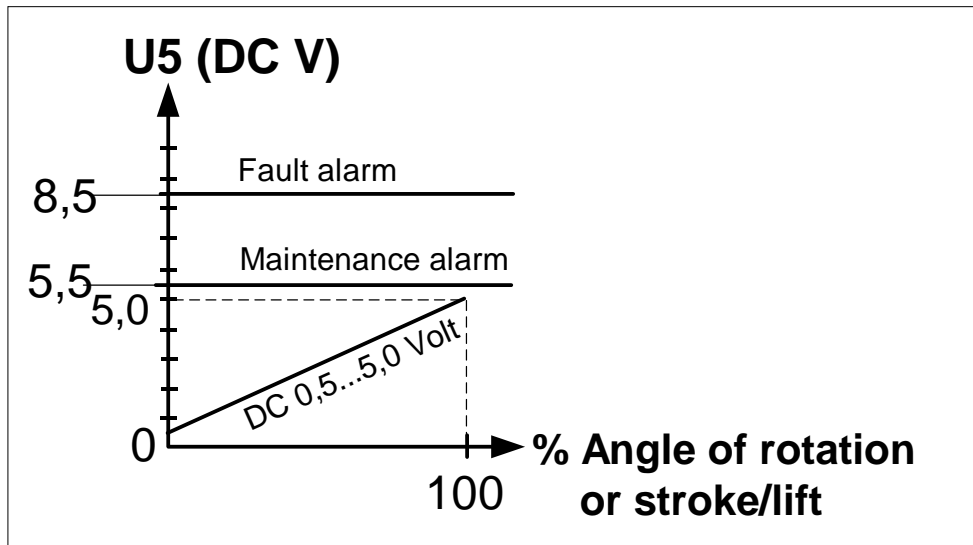
M2.3.4 Mechanical overload

Selectable criterion for mechanical overload (actuator stationary) as a maintenance alarm or fault alarm.

M2.4 Alarms & U

Selectable combination of maintenance alarms and fault alarms and modulating DC measuring voltages. When a maintenance or fault criterion occurs the maintenance alarm or fault alarm signal overrides the modulating measuring voltage signal.

Note: When using this combined function it is advisable to fix the modulating DC output voltage signal at 0.5...5.0 V. Otherwise it will not be possible to interpret the appropriate signal (see diagram).



M2.5 Alarms & S

Selectable combination of maintenance alarms or fault alarms and softswitches S1 and S2. When a maintenance or fault criterion occurs the softswitch signals (see M2.2) are overridden by the maintenance alarm or fault alarm signal.

M2.6 Programming on the “Feedback signal U5” parameter assignment page

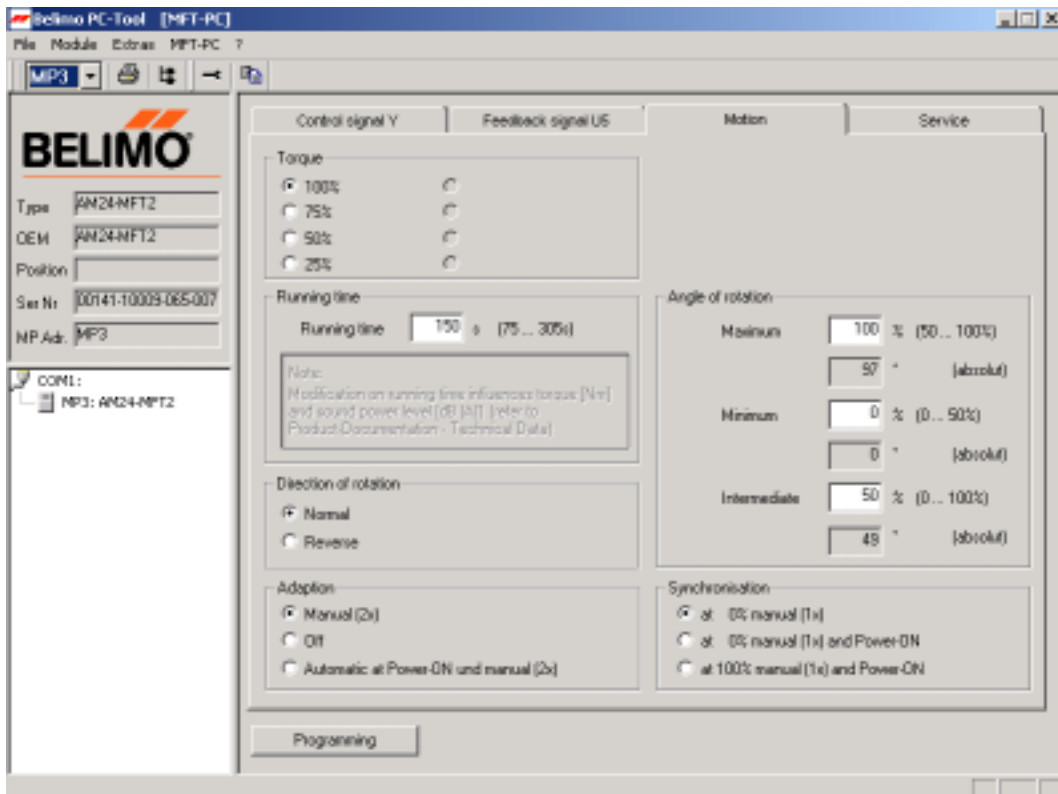
As soon as the “Programming” button is pressed all data that has been defined on the four parameter assignment pages “Control”, “Feedback signal U5”, “Motion” and “Service” are loaded into the MFT(2) actuator. If data that lies outside the valid range for the function has been entered, the programming will be discontinued and the incorrect items listed in a dialogue box. When the entries have been corrected programming can be restarted by pressing the “Programming” button again.

Notes:

- Maintenance alarms are cancelled when an MFT(2) actuator is powered down. The maintenance alarms can also be cancelled with the PC-Tool, on the “Service” parameter assignment page (see M4) for active alarms (see [M4.4.2](#)).
- Fault alarms can only be cancelled with the PC-Tool (see [M4.4.2](#)).

M3 Parameter assignment page “Motion“

Motion, running time, stroke/lift and angle of rotation functions for MFT(2) actuators can be defined on the “Motion” parameter assignment page.



M3.1 Torque / Force

M3.1.1 Steps

Torque / force for MFT(2) actuators can be selected as follows:

Step	Function	Examples
100 %	This setting is the nominal value of torque or force.	AM24-MFT2 = 18 Nm NV24-MFT = 800 N
75 %	Set the torque / force to 75% of the nominal value.	AM24-MFT2 = 13,5 Nm NV24-MFT = 600 N
50 %	Set the torque / force to 50 % of the nominal value.	AM24-MFT2 = 9 Nm NV24-MFT = 400 N
25 %	Set the torque / force to 25% of the nominal value.	AM24-MFT2 = 4,5 Nm NV24-MFT = 200 N

M3.2 Running time

M3.2.1 Relationships to running time

The adjustable running time depends on the particular MFT(2) actuator that is connected (see [A1.3](#)).

In addition, the adjustable running time also depends on the following parameters or functions:

- Magnitude of the mechanically adapted angle of rotation (see Adaption [M3.4](#))
- Set values for maximum and minimum (see [M3.5.1](#) & [M3.5.2](#))

The adjustable range of running time is shown in brackets to the right of the “Running time” field.

Note: If the running time is less than the basic value it is possible for the values of torque [Nm] or force [N] and sound power level [dB] for an MFT(2) actuator to change. It is essential to note the corresponding function curves in the product information documentation for MFT(2) actuators.

M3.3 Direction of operation

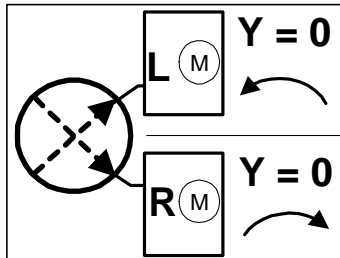
The direction of operation can be selected as either “Normal” or “Reverse”.

M3.3.1 Meaning of “Normal”

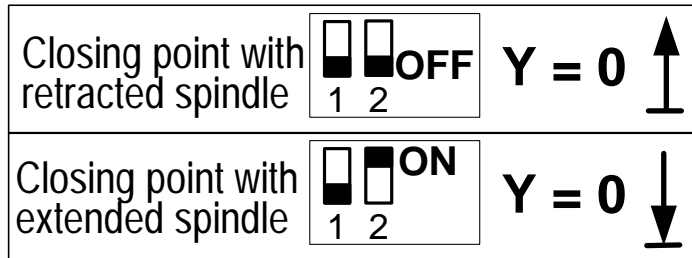
The direction of operation corresponds to the position of the L/R switch on the housing of an MFT(2) damper actuator or the setting of DIL switch S3.2 (closing point) of a linear actuator.

Normal = according to the switch positions

L/R switch for MFT(2) damper actuators



Switch S3.2 for NV... linear actuators

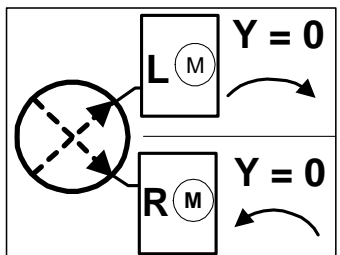


M3.3.2 Meaning of “Reverse”

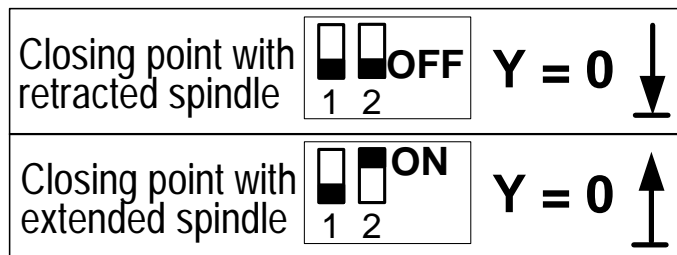
The preset direction of operation of the actuator is reversed.

Reverse = Opposite to the switch positions

L/R switch for MFT(2) damper actuators



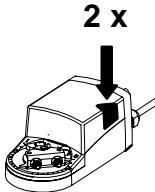
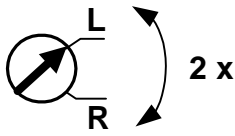
Switch S3.2 for NV... linear actuators



M3.4 Adaption

Here it is possible to select the criteria that trigger the adaption of an MFT(2) damper actuator. During the adaption the U5 feedback (e.g. measuring signal U) is automatically adapted to the effective mechanical angle of rotation. The operating range and running time are adapted to the control range that is preset with Minimum and Maximum (see [M3.5.1](#) & [M3.5.2](#)).

M3.4.1 Criteria for triggering an adaption

Criteria	Meaning	
Manual (2x) Trigger by pressing the manual pushbutton twice:  <ul style="list-style-type: none"> • AM24-MFT(2) • GM24-MFT(2) • AM24LON (US) • GM24LON (US) 	Trigger by operating the L/R switch back and forth twice (within 4 seconds).  <ul style="list-style-type: none"> • LF24-MFT(2) • AF24-MFT(2) • AF24LON (US) 	
Off	No adaption	
Automatic at Power-ON and manual (2x)	The adaption is triggered at each power-up or by operating the switch or pushbutton twice.	

M3.5 Angle of rotation / Valve lift

With damper actuators and valve actuators it is possible to select override positions and/or angle of rotation or stroke/lift limits (for detailed functional descriptions see Product Information 2 + 6. MFT2).

Note: In the case of actuators with a mechanically limited angle of rotation (< 95°) the angle must be adapted electronically in order to ensure that the functions can be enabled.

M3.5.1 Maximum

The maximum is adjustable as a percentage of the angle of rotation or the lift/stroke. The absolute angle of rotation [°] or the absolute value of lift/stroke [mm] is shown in the field below, which corresponds to the specific value of percentage entered (Maximum).

Note: The control range of the angle of rotation or the lift/stroke preset with Maximum (M3.5.1) and Minimum (M3.5.2) and the running time set under (M3.2.1) are mutually interactive, i.e. the preset range of running time (M3.2.1) is affected by the preset control range and the possible settings of control range (Minimum and Maximum) are affected by the preset range of running time.

M3.5.2 Minimum

The Minimum is adjustable as a percentage of the angle of rotation or the lift/stroke referred to the above setting of "Maximum". The absolute angle of rotation [°] or the absolute lift/stroke [mm] is shown in the field below, which corresponds to the specific value of percentage entered (Minimum).

Note: The control range of the angle of rotation or the lift/stroke preset with Maximum (M3.5.1) and Minimum (M3.5.2) and the running time set under (M3.2.1) are mutually interactive, i.e. the preset range of running time (M3.2.1) is affected by the preset control range and the possible settings of control range (Minimum and Maximum) are affected by the preset range of running time.

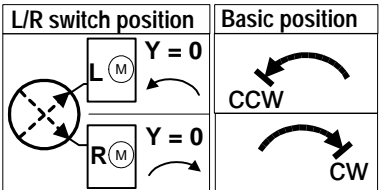
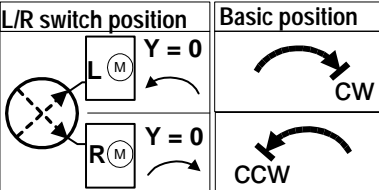
M3.5.3 Intermediate

Adjustable from 0 to 100% referred to the control range defined above by the “Minimum” and “Maximum” settings (see [M3.5.1](#) and [M3.5.2](#)). The absolute angle of rotation [°] or the absolute value of lift/stroke [mm] are shown in the field below, which corresponds to the specific value of percentage entered (Intermediate value).

M3.6 Synchronisation

In the case of MFT(2) actuators without a safety function (no spring) the criteria for triggering and the synchronising position can be defined.

M3.6.1 Criteria for triggering synchronisation

Select	Triggering criterion	Basic position according to L/R switch setting
at 0 % manual (1x)	<ul style="list-style-type: none"> At initial commissioning When manual pushbutton is pressed 	
at 0 % manual (1x) and Power-ON	<ul style="list-style-type: none"> At each power-up On power failure When manual pushbutton is pressed 	
bei 100 % manual (1x) and at Power-ON	<ul style="list-style-type: none"> At each power-up On power failure When manual pushbutton is pressed 	

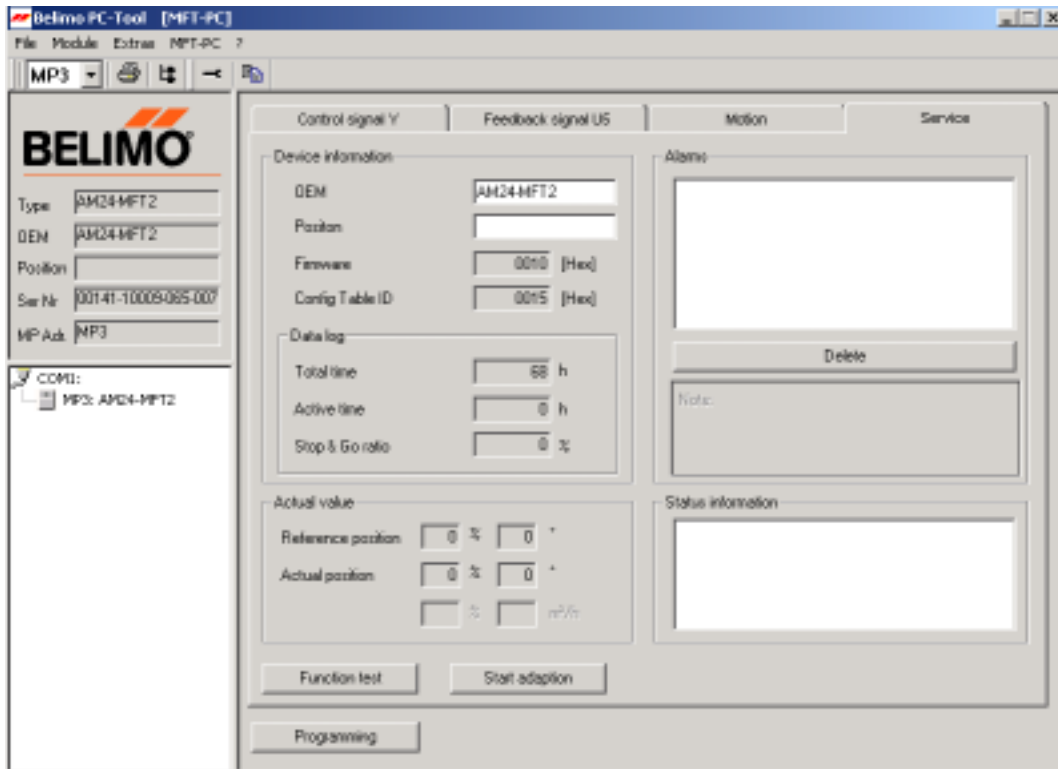
Note: With a reversed direction of action (see [M3.3](#)) the basic positions are inverted.

M3.7 Programming on the “Motion” parameter assignment page

As soon as the “Programming” button has been pressed all data that has been defined on the four parameter assignment pages “Control”, “Feedback signal U5”, “Motion” and “Service” are loaded into the MFT(2) actuator. If any data that lies outside the valid range for a function has been entered, programming will be discontinued and the incorrect items will be listed in a dialogue box. When the entries have been corrected the programming can be restarted by pressing “Programming” button again.

M4 Parameter assignment page “Service“

The “Service“ parameter assignment page offers facilities for triggering and parameterizing service functions. It also offers access to specific information on items of hardware.



M4.1 Device information

OEM

A specific OEM designation can be defined here.

Position

A specific Item No. (e.g. actuator location in the plant) can be defined here.

Firmware

The current version of the actuator software (in Hex Code) is shown here.

Config Table iD

Identification of the Configuration Table in Hex-Code.
(For a description of the Configuration Table see [A1.3](#))

M4.2 Data log

Displays operating time [h], active time [h] and Stop & Go Ratio

Operating time	No. of hours during which the actuator was powered up.
Active time	No. of hours during which the MFT(2) actuator was powered-up and in mechanical motion.
Stop&Go-Ratio	Ratio Active time / Operating time (to calculate = Active time [h] / Operating time [h] x 100) If the Stop & Go Ratio is relatively high it may be due to instability in the MFT(2) actuator control system. On the "Feedback signal U5" parameter assignment page (see M2) the Stop & Go Ratio can be defined as a criterion for maintenance alarms or fault alarms (see M2.3.1).

M4.3 Actual value

In this field the actual position of the MFT(2) actuator can be compared with the reference value.

- In the case of MFT(2) damper actuators the values are indicated as relative values in % and as absolute values in [°] corresponding to the full angle of rotation.
- In the case of MFT(2) valve actuators the values are indicated as relative values in % and as absolute values in [mm] corresponding to the full stroke/lift.

M4.4 Alarms

All active alarms are indicated in this field. All alarms are indicated regardless of whether the alarm (in M2.3) has been defined as a maintenance alarm or a fault alarm. Therefore, an alarm can only be evaluated as a maintenance alarm or a fault alarm from the level of the U5 measuring signal. This means that it is possible for the actuator to be addressed for PP (conventional mode).

M4.4.1 Possible alarms

- Stop & Go Ratio too high (>20%)
- Increased actuator travel (10%)
- Mechanical overload

M4.4.2 Delete selected alarms

- Maintenance alarms are deleted when the MFT(2) is disconnected from the power supply. The individual maintenance alarms can also be deleted by pressing the "Delete" button after first selecting the appropriate alarm.
- Fault alarms can only be deleted with the PC-Tool by pressing the "Delete" button after first selecting the appropriate alarm.
- In the case of valve actuators any existing alarms can only be cancelled with the S2 key.

M4.5 Status information

All status alarms are shown in this field.

M4.5.1 Possible status alarms

- Adaption in progress
- Synchronisation in progress
- Test run in progress

M4.6 Function test

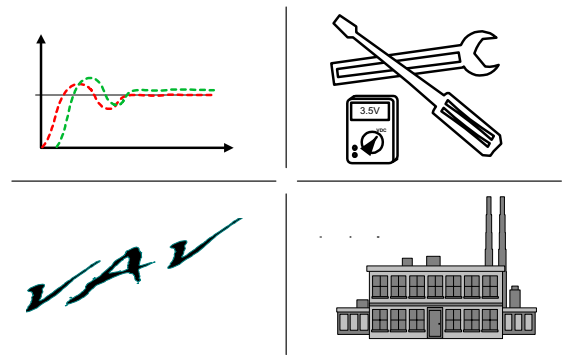
Pressing the “Function test“ button triggers a functional run of the actuator. After triggering, the actuator runs automatically first to the 0% position (Minimum setting see M3.5.2) and then to the 100% position (Maximum setting see M3.5.1). When the run has been completed the actuator moves to the position specified by the control signal. If, say, the maximum actuating range is not achieved, a status alarm will be indicated (see M4.4.1). The run proceeds independently of any preset parameters.

M4.7 Start adaption

An adaption can be triggered by pressing the “Start adaption“ button. During the adaption process the MFT(2) actuator runs automatically to both end positions of its actuating range and, in the process, automatically adapts the U5 feedback signal (e.g. the measuring signal U) to the effective mechanical angle of rotation. The operating range and the running time are adapted to the control range defined with the Minimum and Maximum values (see [M3.5.1](#) & [M3.5.2](#)).

M4.8 Programming on the “Service“ parameter assignment page

As soon as the “Programming“ button has been pressed all data that has been defined on the four parameter assignment pages “Control“, “Feedback signal U5“, “Motion“ and “Service“ are loaded into the MFT(2) actuator. If any data that lies outside the valid range for a function has been entered, programming will be discontinued and the incorrect items will be listed in a dialogue box. When the entries have been corrected the programming can be restarted by pressing “Programming“ button again.



4. A1-PC-T V2 NMV-D2M/EN
PC-Tool Module NMV-D2M

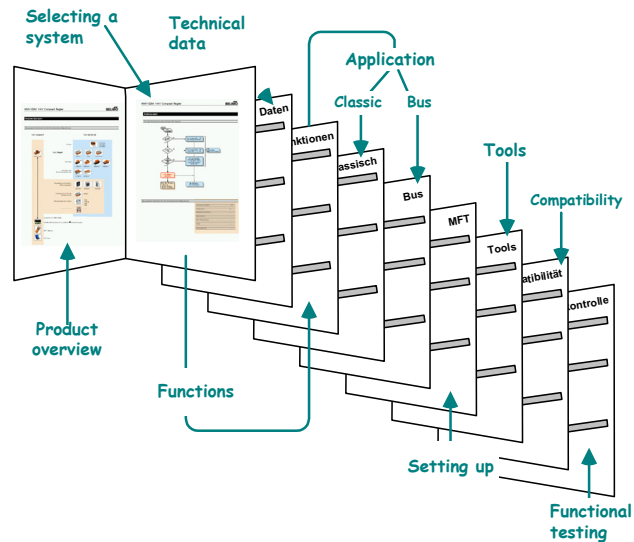


VAV-Compact - Product Information

Full technical information on VAV-Compact products will be found in the following documentation:

- 4. NMV-D2M
- Product Information
- Air Volume Control VAV-Compact

The documentation is structured by subject and provides the following detail information:



Please contact your local Belimo agent or representative for more information and the latest VAV documentation.
 All Belimo product documentation (in pdf format) can be downloaded from <http://www.belimo.ch/CH/EN/PDF>

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Applications	N-A
VAV-Compact NMV-D2M	N-A1
Customised versions.....	N-A1.1
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Direct connection to control cabinet or connection box.....	N-A2.2
Connection in a bus system.....	N-A2.3
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N-A Applications

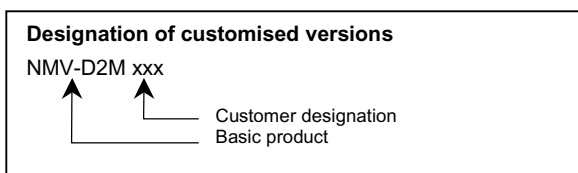
N-A 1 VAV-Compact NMV-D2M

The PC-Tool Module NMV-D2M has been designed specifically for the VAV-Compact NMV-D2M and its use in connection with CAV and VAV air boxes.

N-A1.1 Customised versions

Belimo VAV-Compact controllers are control devices that have been manufactured for specific customers and are produced individually for various air box manufacturers (OEMs). Therefore, each version is an optimum match for the components used by particular manufacturers, such as measuring transducers, damper spindles and mounting systems.

Some customised versions have different operating step control systems than the standard NMV-D2M. The technical documentation provided by the manufacturers of the air boxes should be given close attention.



N-A 1.2 Support for ...

... VAV-Compact NMV-D2 / NMV-24V / NMV-24D

These devices are not sold any more and are not supported by PC-Tool V2.

... VAV-Universal VRD2 / VRD2-L / VRP / VRP-STP

are not supported by PC-Tool V2.

... VAV ...24-MFT2 actuators

These actuator types need the MFT-PC Module of PC-Tool. Therefore, please change over to the appropriate module.

... VAV ...24 V actuators

These types are pure VAV actuators from the VAV-Universal range and are not supported by PC-Tool V2.

Changing old Belimo VAV controllers

When planning to change old Belimo VAV controllers such as VR1, VR2, NMV24-D and NMV24-V first get in touch with your local Belimo agent or representative !

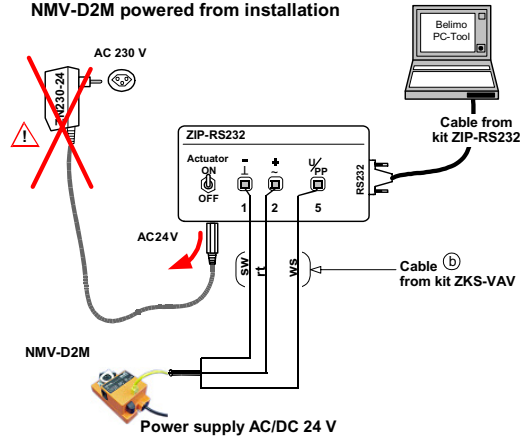
N-A2 Communication links to the NMV-D2M

The NMV-D2M can be connected to a PC through a ZIP-RS232 interface unit.

There are various alternative types of cable (b and c) available from the ZKS-VAV cable sets for making on-site connections.

N-A2.1 Local connection via diagnostic socket

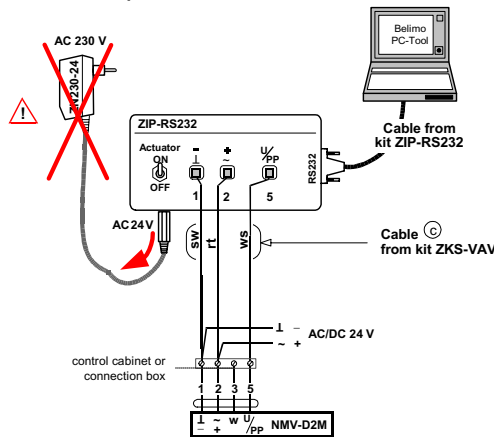
NMV-D2M powered from installation



Duplicated NMV-D2M power supply !
 The NMV-D2M must not have a duplicated power supply! When using this method of connection remove the AC 24 V plug from the ZIP-RS232 unit.

N-A2.2 Direct connection to control cabinet or connection box

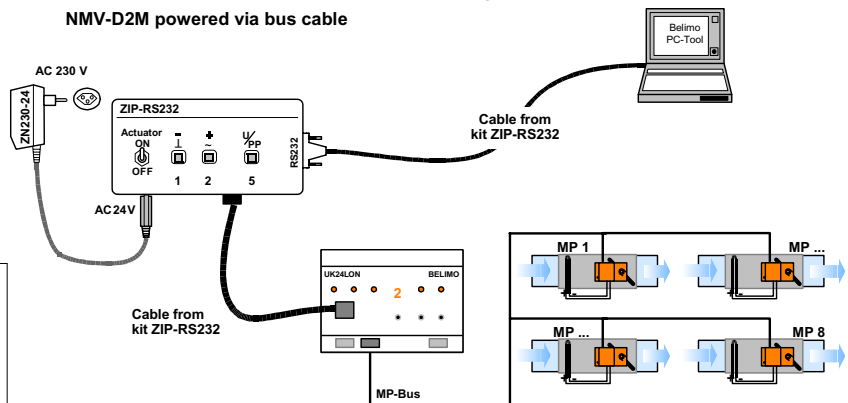
NMV-D2M powered from installation



Duplicated NMV-D2M power supply !
 The NMV-D2M must not have a duplicated power supply! When using this method of connection remove the AC 24 V plug from the ZIP-RS232 unit.

N-A2.3 Connection in a bus system

NMV-D2M powered via bus cable



Connecting PC-Tool to the bus system !
 In bus mode no tools may be operated through the communications socket of the NMV-D2M. For this application the connection is made directly to the UK24LON unit or the DDC system.

N-A3 Module NMV-D2M: General

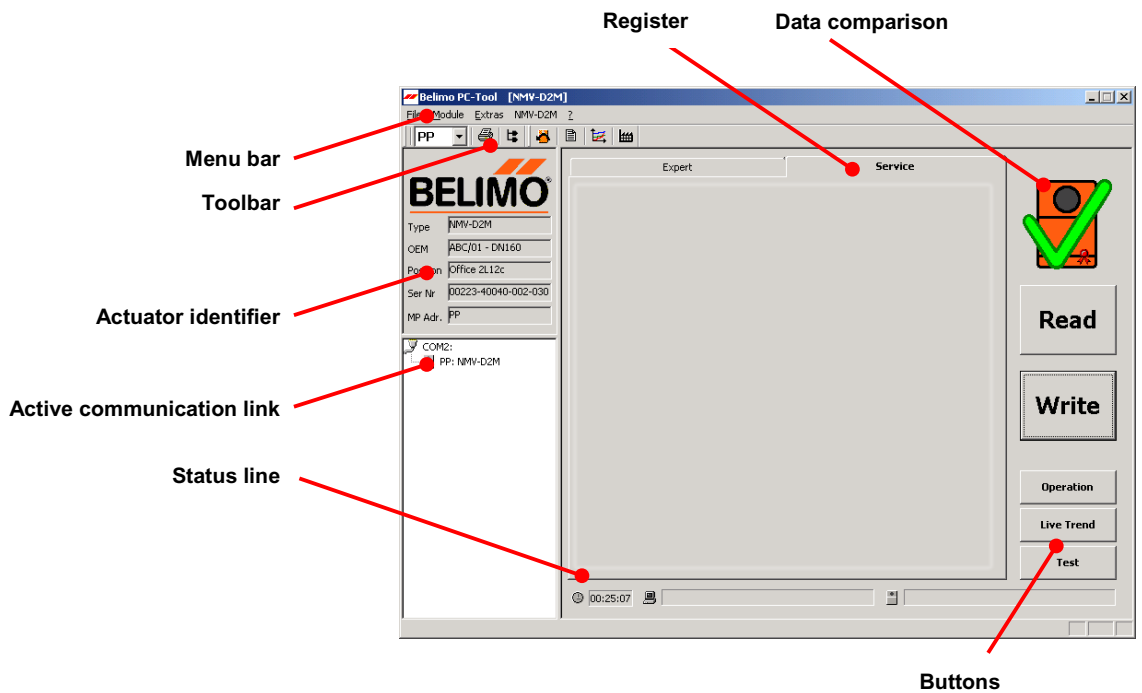
N-A3.1 Purpose

Module NMV-D2M is used specifically for VAV air boxes to operate and assign parameters to the Belimo VAV-Compact NMV-D2M controller. The functions are shared between the two 'Service' and 'Expert' registers depending on the particular application.

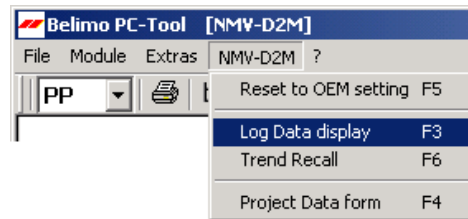
In addition to these two registers the module also offers users a variety of basic functions. This chapter describes each of those functions in detail.

N-A3.2 Description of the elements

N-A3.2.1 Operator interface



N-A3.2.2 Description of the menu bar



N-A3.2.3 Menu functions / Function keys

Menu entry	Brief description	Function key
File		
Print...	Controller settings of active NMV-D2M are printed out	<CTRL> <P>
Printer setting...	Printer option	
End	Close program	<ALT> <F4>

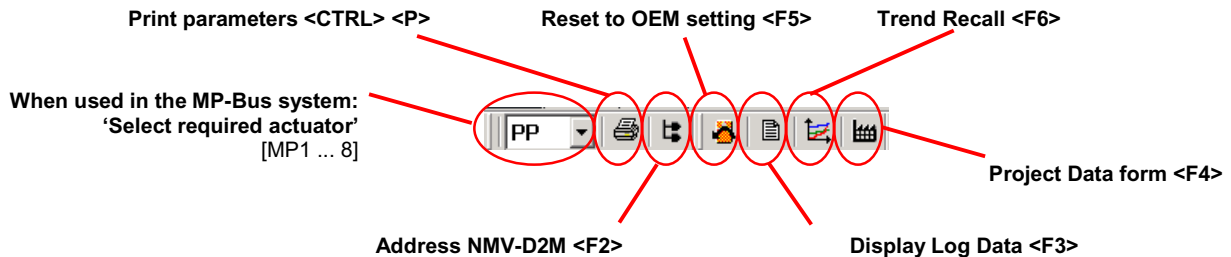
Menu functions / Function keys (continued)

Menu entry	Brief description	Function key
Module		
MFT-PC	Module for assigning parameters to Belimo MFT actuators, such as AM24-MFT, AF24-MFT, etc.	
NMV-D2M	VAV module for VAV-Compact NMV-D2M controllers	

Menu entry	Brief description	Function key
Extras		
Address actuators... F2	Change address assigned to NMV-D2M	<F2>
Options...		
General		
- Language	Select program language	
- Com Port	Set communication Port 1...4	
- Module release	Activate special functions (only for manufacturers)	
MFT-PC		
- Actuator password	Activate password function	
NMV-D2M		
- NMV-D2M password	Activate password function	
- Flow unit	Display volumetric flow in m ³ /h / l/s / cfm	
- Label printer	Activate label printer (only for manufacturers)	
- Box-Type	Select Box-Type file (only for manufacturers)	
- Log data	Select storage directory	
- Trend data	Select storage directory	
- Test-Sequence	Select Test-Sequence file	

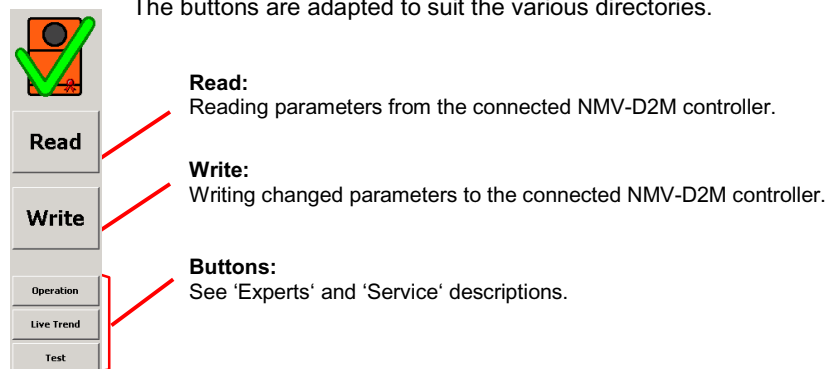
Menu entry	Brief description	Function key
NMV-D2M		
Reset to OEM setting	Reset operating flow settings to OEM default values	<F5>
Log Data display	Show log file	<F3>
Trend Recall	Display stored trend data	<F6>
Project Data form	Open input screen mask for project data for trend, log, test and print functions	<F4>

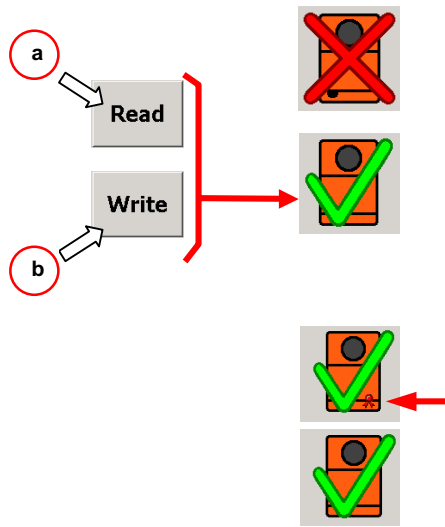
N-A3.2.4 Description of the toolbar



N-A2.3.5 Description of the buttons

The buttons are adapted to suit the various directories.





N-A3.2.6 ‘Actuator symbol’ (data comparison)

The large NMV-D2M symbol, above the buttons, shows the consistency of data between the connected NMV-D2M and the screen display.

Screen data and NMV-D2M data do not agree:

- a) Read data not executed
- b) Screen data changed but Write data not executed

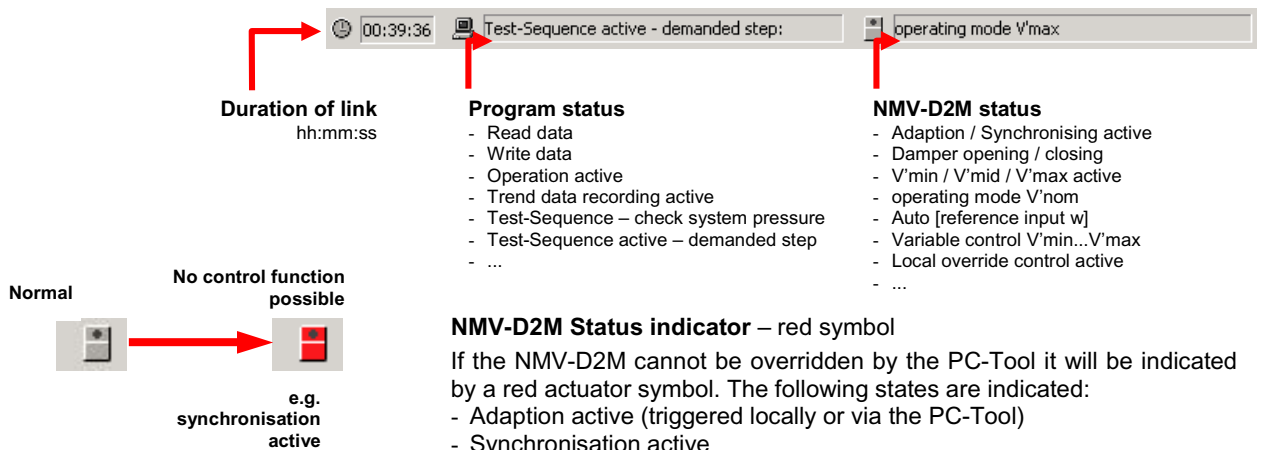
Screen data and NMV-D2M data agree.

N-A3.2.7 Seal-bit function

The settings of operating flow rate programmed by the manufacturer V'min, V'mid and V'max are flagged by the so-called 'seal bit'. If any of these values are adjusted on-site it will be indicated by the 'broken seal bit' symbol. The manufacturer's value (OEM defaults) can be reset at any time with the <F5> function, OEM defaults'. However, the seal bit cannot be reset by the user.

N-A3.2.8 Status line

The active program and the status of the NMV-D2M are indicated on this line.

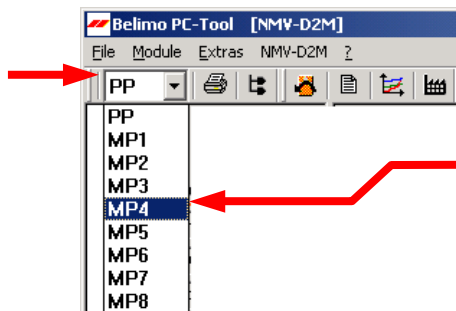


NMV-D2M Status indicator – red symbol

If the NMV-D2M cannot be overridden by the PC-Tool it will be indicated by a red actuator symbol. The following states are indicated:

- Adaption active (triggered locally or via the PC-Tool)
- Synchronisation active
- Local override control active, e.g. CAV 'Close' step

N-A3.2.9 Select required actuator (bus mode)



Open address window

Select required address, e.g. MP4

The selected active communication link is shown in the actuator identifier.

N-A4 Basic functions

The basic functions described below are available in all directories.

N-A4.1 Print <CTRL> <P>

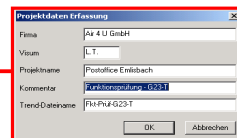
The following data and settings of the active NMV-D2M are printed:

Print <CNTRI> <P>



- Project information <F4>

Project-specific information: this is not NMV-D2M data but entries from the 'Acquire project data' input screen mask.



Note: The data of the this screen mask remains valid until the relevant fields are deleted or overwritten.

- Equipment information

Type / OEM info / Position / Serial number / MP address / Version designation

- NMV-D2M controller settings

Mode / Operating flow rate setting (calibration value / V'nom / V'max, V'mid, V'min) / Direction of rotation / Torque / Adaption and synchronisation

Belimo VAV 13.08.2002 / 08:43:36

VAV-Compact NMV-D2M: Controller setting

Project Information	
Company	Air 4 U GmbH
Project	Swiss Tower - Milano
Short mark	L.T.
Comment	Maintenance HVAC 2L
Device information	
BELIMO type	NMV-D2M
OEM	ABC/01 - DN160
Position	Office L2 21A
Serial number	00223-40040-002-030
MP address	PP
Firmware	0021
Config. Table-ID	003C
NMV-D2M - Controller Setting	
Mode	0...10 V
Volumetric flow	
Calib. Value	2277
V'nom	730 l/s
V'max	554 l/s / 80 %
V'mid	356 l/s / 50 %
V'min	128 l/s / 22 %
Direction of rotation (damper open)	cw
Torque	2 Nm
Adaption	Manual [2x]
Synchronisation	at 0%, manual [1x]

Addressing <F2>



N-A4.2 Addressing <F2>

Conventional mode address: PP

When several NMV-D2M's or MFT(2) actuators communicate over the MP-Bus they must be clearly identifiable.

Bus mode address: MP1...MP8

N-A4.2.1 Address setting PP / MP

- Conventional mode setting 'PP' (Point-to-Point)

The 'PP' address is selected when an NMV-D2M under conventional control is connected to the PC-Tool.

See *Connection diagram N-A2.1 and N-A2.2.*

When an NMV-D2M is addressed 'PP' it is automatically assigned parameters for conventional mode.

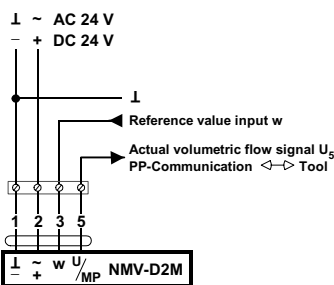
For VAV, modulating control is effected with 0/2...10 V DC or, for CAV, by means of step control. The signal for the actual value of volumetric flow U5 is available at Terminal 5.

An NMV-D2M set for bus mode (MP) can be reset for conventional control by addressing for 'PP'.

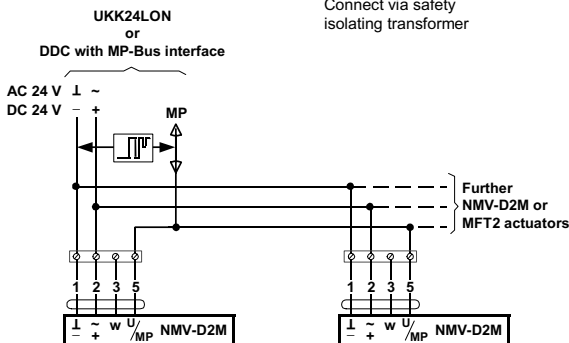
- Bus mode setting 'MP' (Multi-Point)

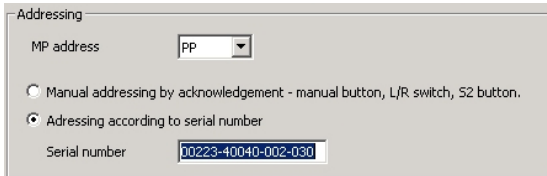
Address 'MP1...MP8' is selected when several NMV-D2M's or other Belimo MFT(2) actuators are incorporated into a higher level system via the MP-Bus. In this case the connection is always made at the bus interface, e.g. UK24LON and never directly to the communication socket of the NMV-D2M. See *Connection diagram N-A2.3.*

If an NMV-D2M is given an MP address 'MP1...MP8' it will automatically be assigned parameters for MP-Bus operation. In this case control is effected digitally over the MP-Bus.



Connect via safety isolating transformer





N-A4.2.2 Methods of addressing

The screen mask for addressing the NMV-D2M is called from the menu, the toolbar or the <F2> function key.

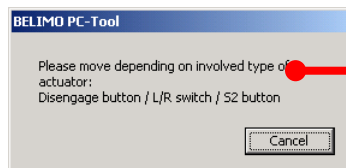
There are two methods available:

- Addressing by manual disengagement push-button
- Addressing according to serial number

N-A4.2.3 Addressing by manual disengagement push-button

Procedure:

- Set the required address in the 'MP address' field.
- Activate 'Manual addressing by acknowledgement'
- Press 'OK'



Press the manual disengagement push-button on the NMV-D2M. An appropriate signal is given if the setting of the address is successful. Repeat the procedure if a fault alarm is given.

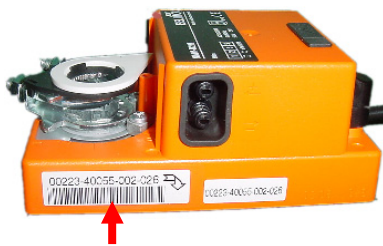
N-A4.2.4 Addressing according to serial number

Procedure:

- Set the required address in the 'MP address' field.
- Activate 'Addressing according to serial number'
- Enter the serial number (by hand or bar code reader)

When there is a direct link to the actuator the serial number read from the NMV-D2M appears as the default value.

- Press 'OK'
- An appropriate signal is given if the setting of the address is successful. Repeat the procedure if a fault alarm is given.



Practical tip – Address sticker

Detach the large sticker and paste it on to the appropriate installation plan.

This will allow addressing to be carried out later with no need for direct access to the controller. It also forms part of the installation's documentation.

Reset to OEM setting <F5>



N-A4.3 Reset to OEM setting <F5>

This function allows changed settings of operating volumetric flow to be reset to the unit manufacturer's default values.

The following values are reset:

- V'max
- V'mid
- V'min

N-A5.2 Log file

The log data is stored in a month file (text format) on the hard disk.

NA5.2.1 Procedure

Data records are selected with the 'Up' and 'Down' arrow keys or the cursor. The '<-' and '->' arrow keys or the cursor give access to any columns that are outside the visible area of the screen.

Date	Time	Serial number	OEM [Box-Type]	Position	Action	Cal...	onfi...	S...	Project	Comment
02.08.2002	10:15:56	00223-40040-002-029	ABC/01 - DN125	Office L2 21A	Read data	1200	x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	10:15:53	00223-40040-002-029	ABC/01 - DN125	Office L2 21A	Read data	1200	x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	09:28:47	00223-40040-002-043	ABC/01 - DN160	Office L2 21A	Write data		x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	09:28:36	00223-40040-002-043	ABC/01 - DN160	Office L2 21A	Write data		x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	09:26:22	00223-40040-002-042	ABC/01 - DN160	Office L2 13C	Read data	2200	x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	09:22:18	00223-40040-002-041	ABC/01 - DN160	Office L2 13B	Read data	2200	x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	09:18:15	00223-40040-002-035	ABC/01 - DN125	Office L2 13A	Read data	1200	x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	09:18:11	00223-40040-002-035	ABC/01 - DN125	Office L2 13A	Write data		x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	09:14:57	00223-40040-002-030	ABC/01 - DN160	Office L2 14B	Write data		x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L
02.08.2002	09:14:45	00223-40040-002-030	ABC/01 - DN160	Office L2 14B	Read data	2200	x003C	L.T.	Swiss Tower - Milano	Maintenance HVAC 2L

Entries highlighted by clicking with the mouse or with the arrow keys can be loaded into a display screen mask (zoom function) by clicking on or by pressing the <Space> key.

Belimo VAV Log Data

Date: 02.08.2002
 Time: 09:18:11
 Serial number: 00223-40040-002-035
 OEM [Box-Type]: ABC/01 - DN125
 Position: Office L2 13A
 Action: Write data
 Calibration Value: ...
 Calibration flow [%]: ...
 V'nom [l/s]: 55
 V'max [l/s]: 55
 V'max [%]: 100
 V'min [l/s]: 15
 V'min [%]: 27
 V'mid [l/s]: 35
 V'mid [%]: 50
 Direction of rotation [open]: CW
 MP-Address: ...
 Mode: 2...10 V
 Setpoint [w]: ...
 Volumetric flow signal [U5]: ...
 Active alarms: ...
 Operating time: ...
 Active time: ...
 Stop & Go ratio: ...
 Type: NMV-D2M
 Firmware: 0x0021
 Config. Table-ID: 0x003C
 Short mark: L.T.
 Project: Swiss Tower - Milano
 Comment: Maintenance HVAC 2L

< Print Close >

Print: The data of a VAV-box equipped with an NMV-D2M can be printed out directly from the display screen mask for documentation purposes.

Display screen mask (zoom function) - change entry:

- Mouse: Click on '<' or '>'
- Keyboard: Use <TAB> to focus on '<' and '>' and then use the <Space> key to page through the entries.

N-A5.2.2 Access to previous months

The data of previous months can be called directly from the Log Data window. The function is selected with the 'Log Data' button.

Display old log file

Suchen in: VAV\Logfiles

Dateiname: NMV-D2M_200205.txt Größe: 34 KB

Dateiname: NMV-D2M_200204.txt Größe: 34 KB

Dateiname: NMV-D2M_200203.txt Größe: 34 KB

Dateiname: NMV-D2M_200202.txt Größe: 34 KB

Dateiname: NMV-D2M_200201.txt Größe: 2 KB

Dateiname: NMV-D2M_200205.txt Öffnen

Dateityp: Text Files (*.txt) Abbrechen

Schiebgeschützt öffnen

N-A5.3 File structure

The log file contains the following columns:

Column headings for log data window

The preset programming language governs the language used for the column headings - they are also used for the displays in the log data window. Therefore, a new language setting will only become effective for the log data display when the next month file is generated.

Column	Description	Explanation
Date	Date log entry	Time / Date, when ?
Time	Time log entry	"
Serial number	Serial Number of NMV-D2M	Identification, which ?
OEM [Box-Type]	OEM information	"
Position	Plant designation	"
Action	Read / Write / Reset to OEM defaults	User action, what ?
Calibration Value	Calibration data	For manufacturer only
Calibration flow [%]	Calibration data	For manufacturer only
V'nom [m³/h]	Nominal flow	Operating flow
V'max [m³/h]	V'max setting	"
V'max [%]	"	"
V'min [m³/h]	V'min setting	"
V'min [%]	"	"
V'mid [m³/h]	V'mid setting	"
V'mid [%]	"	"
Direction of rotation [open]	Direction of damper rotation	Actuator setting
MP-Address	NMV-D2M address setting	"
Mode	Mode setting: 0...10 / 2...10 V	"
Setpoint [w]	" variable setting, setpoint signal w	"
Volumetric flow signal [U5]	" variable setting, actual value signal U5	"
Active alarms	Active alarms	Alarm / Operating data
Operating time	Operating time	"
Active time	Active time	"
Stop && Go ratio	Stop & Go ratio	"
Result1	Parameter field	Internal parameters
Result2	"	"
Result3	"	"
Result4	"	"
Result5	"	"
Type	NMV-D2M xxx [customised version]	Controller type
Firmware	SW version	"
Config. Table-ID	Configuration table	"
Short mark	User's initials	Project data <F4>
Project	Project designation	"
Comment	Remarks	"

N

-A5.3.1 File name

When a log file is generated it is given a unique name as follows:

- Structure: *NMVD2M_JJJJMM.txt*

e.g.: *NMV-D2M_200206.txt* for year 2002, month June

The structure of the name is fixed and cannot be changed by the user.

N-A5.3.2 Storage directory (path)

Default:

The subdirectory in the PC-Tool program directory:

... \VAVLogfiles

User-defined path:

The user can select the destination directory in the 'EXTRAS ; OPTIONS... ; NMVD2M' menu. All log files are then stored in that directory.

Trend Recall <F6>



N-A6 Trend Recall <F6>

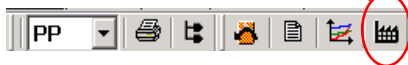
The Trend function is provided so that the control parameters of a VAV- / CAV-box equipped with a Belimo VAV-Compact NMV-D2M can be checked.

An overall analysis of these values will show the system supply pressure, the dynamic behaviour of the air box and the control system (e.g.: room temperature controller, DDC, step control).

Using 'Trend Recall' in the 'Live Trend' function it is possible to read out previously stored data from the data carrier and display it on the screen.

These functions are described in detail in Part N-S Service:
See N-S4.2 'Live Trend' and N-S4.3 'Trend Recall'

Project Data form <F4>



N-A7 Project Data form <F4>

This screen mask is used for entering project-specific and trend-specific data such as file names. The data is used by the log, print, trend and test functions.

N-A7.1 Data fields

- **Company** Company name, e.g. 'Air 4 U GmbH'
Entered once.
- **Initials** User's initials
these are only changed if there is more than one person using the same PC.
- **Project name** Usually entered once per visit to an installation, at the start of work.
- **Comment** Entered when necessary before each trend and test recording or jointly for a series of tests, for example.
- **Trend file name** When this function is being used an entry is made in this field for each trend and test recording. If this function is not being used a default name is used instead.

N-A7.2 Procedure

- Project data must be entered before execution of printout, trend recording, etc.
- The data given remains valid until it is changed or deleted.
- When the entry screen mask is called the 'Comment' field is highlighted, i.e. an entry can be made directly without having to select the field. This is very helpful when carrying out series of tests.
- Blank fields are permitted.



Practical tip – Project data for servicing

Start work: Press <F4>:

- Company / Initials / Enter project name

Step 1:

Connect PC to NMV-D2M

Step 2:

a) Press <F4>, open input screen form

b) Enter remarks, e.g.:

'Function test with new fan setting'

c) Close screen mask with 'OK'

Step 3:

Start Live Trend or Test

Steps 2 and 3 must be repeated to repeat a test or for the next VAV-box.

N-A8 Extras ; Options ; NMV-D2M

The 'NMV-D2M' options dialogue is used for defining specific parameters for a VAV-Compact NMV-D2M controller.

N-A8.1 NMV-D2M password

NMV-D2M password function – only for manufacturers.

N-A8.1 Flow unit

Volumetric flow data is stored in the NMV-D2M in m³/h. The 'Flow unit' option allows the PC-Tool NMV-D2M Module display to be in m³/h, l/s, cfm.

N-A8.2 Label printer

Label print option – only for manufacturers.

N-A8.3 Box-Type – File selection

Select Box-Type file – for manufacturer only.

N-A8.4 Log data - path selection

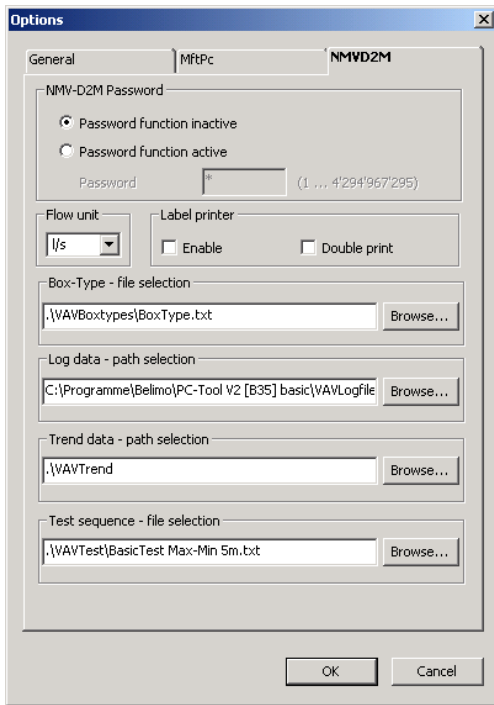
Destination directory for NMV-D2M log data. The NMV-D2M log files are stored in the selected directory.

N-A8.5 Trend data - path selection

Destination directory for NMV-D2M 'Trend' and 'Test' data. All NMV-D2M *.tnd files are stored in the selected directory.

N-A8.6 Test-Sequence – File selection

Defining the Test-Sequences activated in the 'Service' register with the 'Test' function.



N-A9 Help

Specific parameters for use with VAV-Compact NMV-D2M controllers are defined in the 'NMV-D2M' options dialogue.

N-A9.1 Help entries (BelimoPcToolHelp_English.pdf)

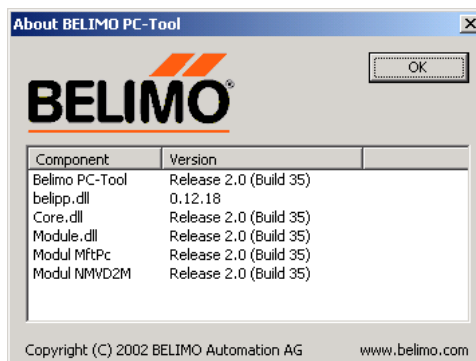
Call this user documentation in pdf format.

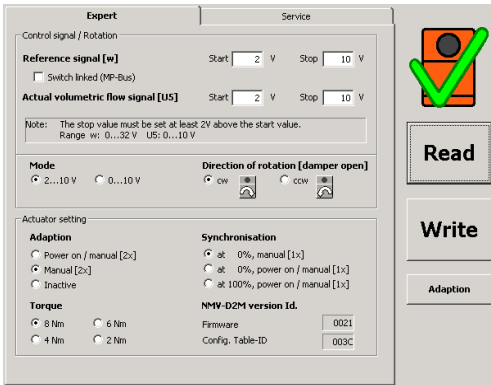
In order to display this file the Adobe Acrobat® Reader program must be installed first.

The help entries cover all the PC-Tool Modules that are currently available.

N-A8.1 About Belimo PC-Tool

This option provides information on what PC-Tool components are installed and their versions.





N-E Expert

The 'Expert' register allows the manufacturer and experienced service engineers to make changes to specific NMV-D2M settings such as:

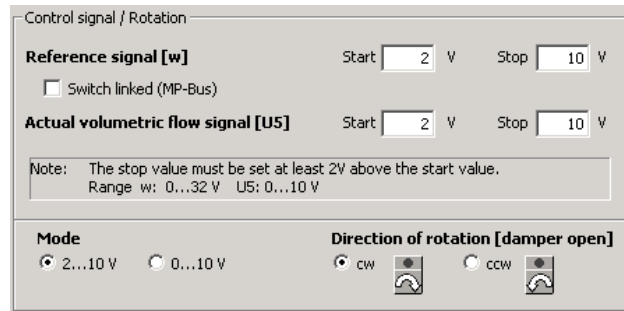
- Control signal
- Mode / Direction of rotation
- Adaption and synchronisation characteristics
- Display of NMV-D2M version data

N-E1 Using the 'Expert' register

The parameters contained in the 'Expert' register are the ones originally set during installation of the equipment. These settings are made by the manufacturer of the air boxes who also bears overall responsibility for their proper functioning. Any incorrect changes made to these parameters might cause the equipment to malfunction!

For this reason an appropriate message appears when changing from 'Service' to 'Expert'.

N-E2 Control Signal / Direction of rotation



Practical tip – Mode setting

Make the 0 ... 10 / 2 ... 10 V setting directly from the 'Mode' field.

N-E2.1 Control signal

Variable settings for reference signal [w] and actual volumetric flow signal [U5].

See 4. NMV-D2M Product Information for more information on connections.

N-E2.1.1 Reference signal [w], Working range V'min ... V'max

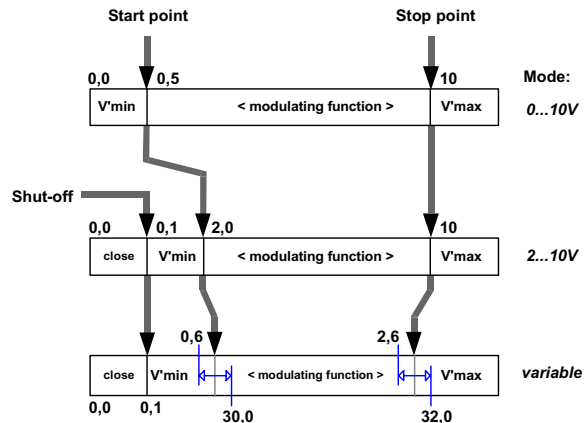
Start point: DC 0.6 ... 30 V
 Stop point: DC 2.6 ... 32 V

Range:

Reference signal function [w]

in the V'min ... V'max control range

- for controlling the NMV-D2M in CAV and VAV applications
- its signal form can be adapted by the mode or variable setting



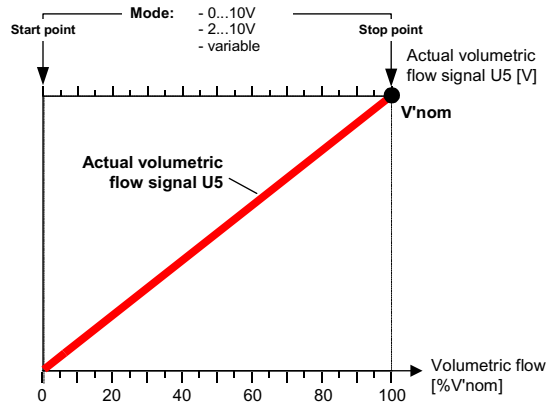
N-E2.1.2 Actual volumetric flow signal [U5]

Actual volumetric flow signal [U5], Working range 0...100% V'nom

Start point: DC 0.0 ... 8 V

Stop point: DC 2.0 ... 10 V

Range:



N-E2.1.3 Sensor connection

In bus mode ('MP' address 1...8) an active sensor or a switch can be connected to the NMV-D2M reference input [w]. This input value can be used in the higher level control system for VAV control, e.g. room temperature or other applications. See 4. NMV-D2M Product Information for further information.

- Connecting switches

In order to allow the NMV-D2M to evaluate the status of a connected switch reliably the start point of the working range must be properly set first:

Start point: DC 0.6 V *It is essential for the Start Point to be set to 0.6 V*

Stop point: DC 10 V

- Connecting active sensors

Start point: DC 0.0 V *The range of adjustment corresponding to the working range of the sensor.*

Stop point: DC 10...32 V

N-E2.2 Mode

2 ... 10 / 0 ... 10 V / variable

Mode
 2...10 V 0...10 V
 w 1.5...6V U5 0...10V

Variable settings are displayed in this field or can be reset by 2 ... 10 / 0 ... 10 V settings. Variable settings are made in the field above.

See 4. NMV-D2M Product Information for further information.

N-E2.3 Direction of rotation, damper opening

Depending on the design of the air box the manufacturer sets the direction of rotation of the damper accordingly. The direction of rotation depends on the open position of the damper.

Setting:

- cw clockwise (looking on the damper spindle)
- ccw counterclockwise (looking on the damper spindle)

Direction of rotation [damper open]

cw ccw

Actual volumetric flow signal [U5]

- corresponds to 0...100% V'nom
- indicates the current actual value of volumetric flow
- is not affected by the V'min and V'max settings
- its signal form can be adapted by the mode or variable setting

Practical tip – Quick setting

Reference signal [w] Start V Stop V

Switch linked (MP-Bus)

Direction of rotation

An incorrect direction of rotation setting will cause the air box to malfunction.

Practical tip – Damper open

Shortage of air due, for example, to excessively low supply pressure / fan fault: The VAV unit damper is 100% open and stays so while Setpoint > Actual value

Actuator setting
 An incorrect actuator setting can cause the air box to malfunction or even to be damaged.
 For this reason the settings should only be changed after prior consultation with the manufacturer.



N-E3 Actuator settings

Actuator setting

Adaption <input type="radio"/> Power on / manual [2x] <input checked="" type="radio"/> Manual [2x] <input type="radio"/> Inactive	Synchronisation <input checked="" type="radio"/> at 0%, manual [1x] <input type="radio"/> at 0%, power on / manual [1x] <input type="radio"/> at 100%, power on / manual [1x]
Torque <input checked="" type="radio"/> 8 Nm <input type="radio"/> 6 Nm <input type="radio"/> 4 Nm <input type="radio"/> 2 Nm	NMV-D2M version Id. Firmware: <input type="text" value="0021"/> Config. Table-ID: <input type="text" value="003C"/>

N-E3.1 Adaption

For adapting the control characteristics to the available range of control.

Setting	Function	Remarks
Manual (2x)	Adaption is initiated by 2x press manual disengagement button	Recommended setting
Off	Adaption deactivated	
Automatic (Power ON and manual (2x))	Adaption initiated: - after each power off - 2x press manual disengagement button	

N-E3.2 Synchronisation

Initiation criteria for synchronising the position calculation.

Setting	Function	Remarks
at 0% manual (1x)	Synchronising at Closed position - at first commissioning - when manual disengagement button	Recommended setting
at 0% manual (1x) and Power ON	Synchronising at Closed position - at each power-up - at power fail - when manual disengagement button	
at 100% manual (1x) and Power ON	Synchronising at Open position - at each power-up - at power fail - when manual disengagement button is pressed	

N-E3.4 Torque

Adapting the maximum value of torque to suit the type of air box being used.

Step	Function	Torque
100%	Rated active torque	min. 8 Nm
75%	75% of active torque	ca. 6 Nm
50%	50% of active torque	ca. 4 Nm
25%	25% of active torque	ca. 2 Nm

N-E3.5 NMV-D2M versions data

Indication of the version of software and the configuration table currently being used in the controller.

NMV-D2M Versions-Information

Firmware	<input type="text" value="0021"/>
Config. Table-ID	<input type="text" value="003C"/>

- Firmware : Software version (Hex-Code)
- Config. Table ID : Configuration table (Hex-Code)

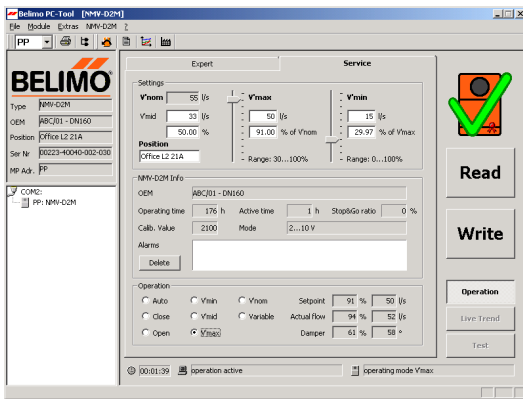
Support enquiries – Versions information
 The versions data is stored in the log file by the log function each time information is read. It can be displayed with the 'Read log data' function <F3>. This information should always be given in response to an enquiry.

Adaption behaviour
 The adaption behaviour can be adjusted to suit particular applications, see N-E3.1



N-E4 Adaption

With this function it is possible to acquire the positions of the upper and lower damper end-stops and store them in the NMV-D2M. Running time and working range are then adapted to the available angle of rotation. Ascertaining the positions of the mechanical end-stops allows a smooth approach to the end-stops so preventing any unnecessary overloading of the actuator and damper mechanisms.



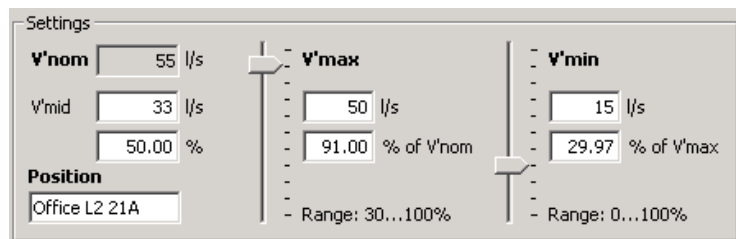
N-S Service

The 'Service' register is provided for:

- Adjusting the operating value of volumetric flow
- Reading the NMV-D2M operating data
- Testing the control and operating functions

All relevant parameters of a VAV- / CAV-box equipped with a Belimo VAV-Compact NMV-D2M are displayed on a screen. The 'Operation' field and the operating options associated with it allow a wide range of test and monitoring functions to be employed.

N-S1 Settings



Reset to OEM setting <F5>

This function allows changed settings of operating flow V'max / V'mid / V'min to be restored to the manufacturer's basic settings.

Nominal value of volumetric flow [V'nom]

Energy and noise considerations lead to the setting of an utmost permitted value of specific volumetric flow for each diameter of duct. The binding value of nominal volumetric flow is defined by the manufacturer of the air box who also bears responsibility for the proper functioning of his VAV boxes.

Operating value of volumetric flow

The linear characteristic of the NMV-D2M volumetric flow controller allows easy setting of the operating values of volumetric flow rate for installations. The V'max / V'min setting procedure is normally carried out by the manufacturer of the air box or alternatively during commissioning.

N-S1.1 V'nom

The nominal setting of volumetric flow allows the NMV-D2M to be adapted to the particular VAV- / CAV-box being used. The size, nominal flow rate and operating parameters are taken into account and preset. V'nom is the highest possible volumetric flow that the air box is capable of when the pressure drop and noise level are within the maximum permitted operating conditions.

N-S1.2 Adjusting the operating value of volumetric flow

- V'max

V'max is the upper limit value depending on the nominal value of volumetric flow. Range of adjustment 30...100% V'nom.

- V'min

V'min is the lower limit value depending on the maximum value of volumetric flow. Range of adjustment 0*...100% V'max

* Note:

The minimum setting of volumetric flow V'min depends on the particular VAV air box used. See 4. NMV-D2M Product Information for further information and the technical data provided by the manufacturer of the air box.

- V'mid

For constant-volume applications (CAV) there is an intermediate position available (V'mid) for finer grading of the settings. Range of adjustment 0...100% of V'min...V'max range.

N-S1.3 Position [16-character text field]
 Input field for a specific plant designation string:
 e.g. field address, plant designation, diagram position.

N-S2 NMV-D2M information

N-S2.1 OEM
 OEM-specific information string:
 e.g. firm’s name, air box type, installation, order

N-S2.2 Operating time
 Number of hours that the NMV-D2M has been powered up.

N-S2.3 Active time
 Number of hours that the NMV-D2M has been powered up and performing mechanical movements.

N-S2.4 Stop&Go ratio
 Ratio of active time to operating time
 (calculation = active time [h] / operating time [h] x 100)
 If the Stop&Go ratio is relatively high an unstable reference signal is a possible cause.


N-S2.5 Calibration value
 A setting for a specific air box that the manufacturer of the unit has ascertained during his calibration run on the test rig. The calibration value is an internal controller variable that represents the differential pressure at V’nom.


Calibration value
 The nominal value of volumetric flow and the corresponding calibration value are determined and set solely by the manufacturer of the air box (OEM). The manufacturer bears responsibility for the proper functioning of his VAV boxes.


N-S2.6 Alarms
 This field displays the alarm signals generated by the NMV-D2M:

- Stop&Go ratio too high
- Excessive travel (10%)
- Mechanical overload

The alarms can be cancelled by clicking on a particular alarm and pressing the ‘Delete’ key.

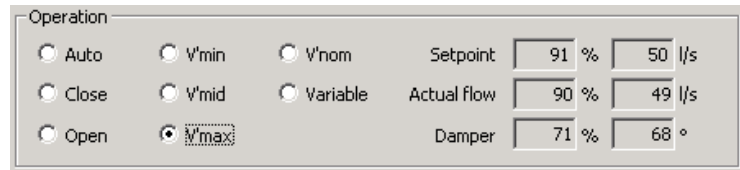
Auto – in control mode 
 Under normal circumstances the 'Auto' mode is active. In this situation the VAV / CAV controller is controlled via the reference input [w] or, in bus mode, via setpoint issue.

Auto – with the Tool connected 
 - Conventional mode: In this situation the VAV / CAV controller is controlled via the reference input [w].
 - Bus mode: When there is active communication with an operating device, setpoint issue from the higher level system (e.g. UK24LON) is interrupted. Without direct setpoint issue from the Tool the NMV-D2M is controlled from the reference input [w] (0 V = V'min or, with a sensor connection, according to the sensor value, 0...10 V).

Note – Disable operation 
 Before communication with the NMV-D2M is interrupted the active mode of operation must be discontinued by disabling the 'OPERATION' function !

Override control / Operating steps
 By appropriate connection of the reference input [w] of the NMV-D2M it is possible to select different modes of operation.
 See 4. NMV-D2M Product Information

N-S3 Operation



The 'Operation' field is for checking the control functions either on-site or on the manufacturer's test rig.

N-S3.1 Enable 'OPERATION'

Pressing this button enables or disables operating step control of the NMV-D2M.

The 'OPERATION' button is disabled when 'LIVE TREND' or 'TEST' are active.

N-S3.2 Disable 'OPERATION'

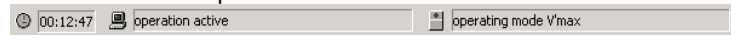
The preset operating step must be disabled after the 'Operation' function has been used!

If – during active operating step control – the communication conductor between the PC-Tool and the VAV controller suffers open-circuit, the preset operating step will remain stored in the NMV-D2M.

Reset (power-down) will return the NMV-D2M to Auto mode.

N-S3.3 Status information

Status line when 'Operation' is active:



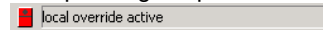
- PC status: 'Operation' active
- NMV-D2M status: the preset operating step

N-S3.4 Local override control

In order to ensure active local override control these local commands are given a higher priority.

e.g.: CAV air box with 'Close' override control.

Active local override control – when the NMV-D2M module is also issuing an operating step – is indicated by means of a red square symbol:



N-S3.5 Operating steps

- **Auto** – Status: 'Auto [reference signal w]'

Classic application: the NMV-D2M regulates to the applied 0/2...10 V reference signal

Bus mode: NMV-D2M controls the adjusted V'min value. Note: In case an additional sensor is connected (Bus mode only), the NMV-D2M follows to the 0...10 V voltage value of the sensor input [w].

- **Close** – Status: 'Damper closing'

Damper moving to the Closed position.

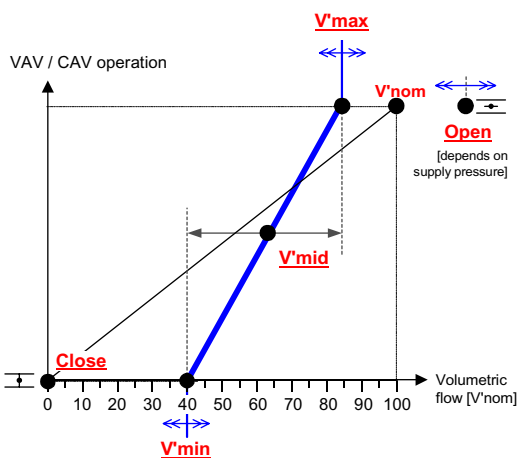
Setpoint display: --

- **Open** – Status: 'Damper opening'

Damper moving to the Open position.

Setpoint display: ---

Actual value display: range 0...110% V'nom



N-S Operating steps (continued)

- **V'min** – Status: 'Operating step V'min active'
The NMV-D2M regulates the volume to the preset V'min value.
- **V'mid** – Status: 'Operating step V'mid active'
The NMV-D2M regulates the volume to the preset V'mid value.
- **V'max** – Status: 'Operating step V'max active'
The NMV-D2M regulates the volume to the preset V'max value.
- **V'nom** – Status: 'NMV-D2M regulating to V'nom'
The NMV-D2M regulates the volume to the preset V'nom value.
- **Variable** – Status: 'Variable operation V'min...V'max'
Issue of the setpoint for volumetric flow, as an absolute value (e.g. in m³/h) or as a relative value (in %).
Range: operating volumetric flow setting V'min...V'max.

N-S3.6 Reference / Actual value of damper position

Reference value: preset setpoint for volumetric flow
Setpoint display as [%] value and as absolute value in [e.g.: m³/h] *)
The two fields serve as the input field when the 'Variable' mode of operation is active.

Actual value: current actual value of volumetric flow
Actual value display as [%] value and as absolute value in [e.g.: m³/h] *)
Range: 0...110% V'nom

Damper position: actual position of the damper
Damper position display as [%] value and as absolute value in [°] **)

*)
For absolute value display the V'nom value must be entered. The value is entered by the manufacturer of the air box during the calibration procedure.

**)
After a successful adaption run the 0...100% display is replaced by the available damper control range.
Absolute display in degrees of angle (0...95°)

N-S4 Trend

The Trend function has been provided so that the control parameters of VAV / CAV-boxes equipped with a Belimo VAV-Compact NMV-D2M can be checked. A full analysis of these values provides information on the system supply pressure and the dynamic behaviour of the air box and its control system (e.g.: room temperature controller, DDC, step control).

There are two methods available: 'Live Trend' and 'Trend Recall'. In the case of the former the data is recorded 'live' and presented as a diagram on the screen in real time. With the latter, data that has been recorded previously is read from the data carrier and displayed on the screen.

N-S4.1 Trend – Description of the elements

Project Data form <F4>

This allows the project-specific and trend-specific data, such as file names, to be entered.

The data is used by the log, print, trend and test functions. The data entries remain valid until they are changed or deleted.

-> Blank fields are allowed

Project Data form / <F4> /



Project & controller data → Project: Swiss Tower - Milano, Position: Office L2 21A, OEM [BoxType]: ABC/01 - DN160, Type: NMV-D2M, Serial number: 00223-40040-002-030, MP-Address: PP

Start-Stop Data source → Trend start: 12.08.2002 08:48:34, Trend stop: [empty], Data source: Live Data, Trend file: 00223-40040-002-030_12.08.2002_a.tnd, Comment: Maintenance HVAC 2L

Operating values of volumetric flow rate → V'nom [l/s]: 730, V'max [l/s]: 584 (80% of V'nom), V'min [l/s]: 128 (17% of V'nom, 22% of V'max)

Trend data → Graph showing Setpoint NMV-D2M [V], Actual volumetric flow [l/s], and Damper position [%] over time.

Legend with voltmeter function → Setpoint NMV-D2M 3.9 [V], Actual volumetric flow 5.1 [V], Damper

Buttons: Trend Recall (Recall data), Print option (Print), Abort (Exit)

Project data → Project, File name, Comments

Fwd / Back display +/- → Navigation arrows for the graph

N-S4.2 Live trend

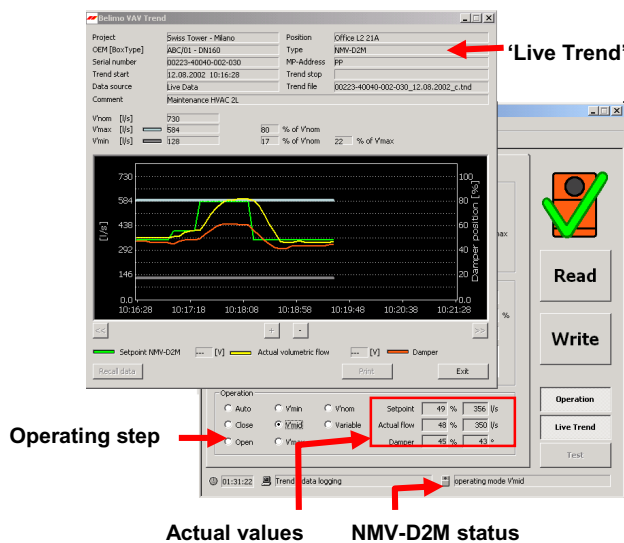
The 'LIVE TREND' function requires an active communication link to the NMV-D2M controller. This function allows a VAV controller to be checked under real operating conditions or a setpoint of volumetric flow to be issued, both options showing the active control behaviour of the VAV / CAV-box to which it is connected.

N-S4.2.1 Start/Stop

Start: with the 'LIVE TREND' button
 Stop: - with the 'LIVE TREND' or 'STOP' buttons
 - with the <ESC> key
 - by leaving the 'Service' register
 - by interrupting communication
 - by local initiation of synchronising or adaption
 'Live Trend' cannot be started when 'OPERATION' is activated.

N-S4.2.2 Selecting the operating step

Simultaneous display of the two windows allows the volumetric flow rate to be changed while a trend is being recorded so that the resulting system response can be observed.



N-S4.2.3 Voltage readings in 'Live Trend'

The voltage readings for 'Setpoint NMV-D2M' and 'Actual value of volumetric flow' are only available when the 'Auto' mode is active and the NMV-D2M address setting is 'PP'.
 The solution:
 - Reference value NMV-D2M V'min...V'max
 - Actual volumetric flow 0...100% V'nom

Note – Voltage display:
 The voltage readings shown are values determined by calculation. When dealing with faults the readings should be verified with a suitable measuring instrument.
 While the NMV-D2M is communicating with the PC-Tool the actual value signal U5 measured with a voltmeter at the NMV-D2M does not correspond to the actual value of volumetric flow !

N-S4.2.4 Trend file

For each new action the 'Live Trend' function generates a text file with a unique name.

- File name

Default:
 - structure: *serial number_date_index.tnd*
 e.g.: 00151-10002-002-029_11.06.2002_e.tnd

User-defined file name:

Enter the trend file name in the 'Project Data form' dialogue box.
 - structure: *15characters_date_index.tnd*
 e.g.: Fkt-Prüf-G23-T_04.11.2001_g.tnd

- Storage directory (path)

Default:
 As a subdirectory of the PC-Tool program directory:
 ...\\VAVTrend

User-defined path:

The user can select the destination directory in the 'EXTRAS ; OPTIONS... ; NMV-D2M' menu. All trend files are then stored in that directory.

N-S4.3 Trend Recall <F6>

Previously stored data is read from the hard disk and displayed on the screen.

Project Data form <F4>
 This allows the project-specific and trend-specific data, such as file names, to be entered.
 The data is used by the log, print, trend and test functions. The data entries remain valid until they are changed or deleted.
 -> Blank fields are allowed



Practical tip – File clearing

If the trend function is used often a large number of trend files will be accumulated. Therefore, after plotting, it is advisable to:
 - transfer the data to a project directory
 - delete the data if it is no longer needed



'Trend Recall'
start from toolbar:



N-S4.3.1 Read trend file

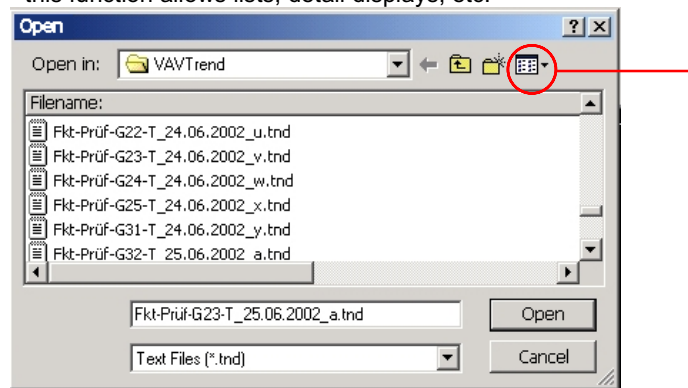
The trend window is opened from the 'NMV-D2M ; Trend Recall' menu <F6> or the toolbar. The 'READ DATA' button opens a browse window with access to all available drives.

Default path:
as set under 'EXTRAS ; OPTIONS ; NMV-D2M'.

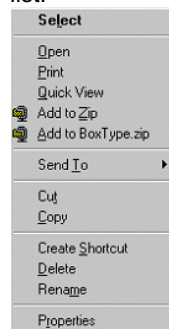
The browser window is used in the same way as the Explorer application of the PC operating system.

Hints:

- this function allows lists, detail displays, etc.



- highlight the required trend file and right clicking on it will open a choose list:



The appropriate file might now be deleted, renamed, etc. as required. Direct copying to floppy disk or transmission by e-mail are very simple procedures.



Practical tip – File clearing

If the trend function is used often a large number of trend files will be accumulated.

Therefore, after plotting, it is advisable to:

- transfer the data to a project directory
- delete the data if it is no longer needed

N-S5 Test

The 'TEST' function allows structured testing of the VAV- / CAV-box to be carried out.

When the function is started it first checks the system supply pressure and then runs to a defined typical value of volumetric flow with the help of a preselected Test-Sequence. The Trend window is opened so that the test results can be checked and stored.

For the purpose of carrying out reviews, the Test-Sequence recorded from the installation can be read from the hard disk, displayed on the screen and printed out.

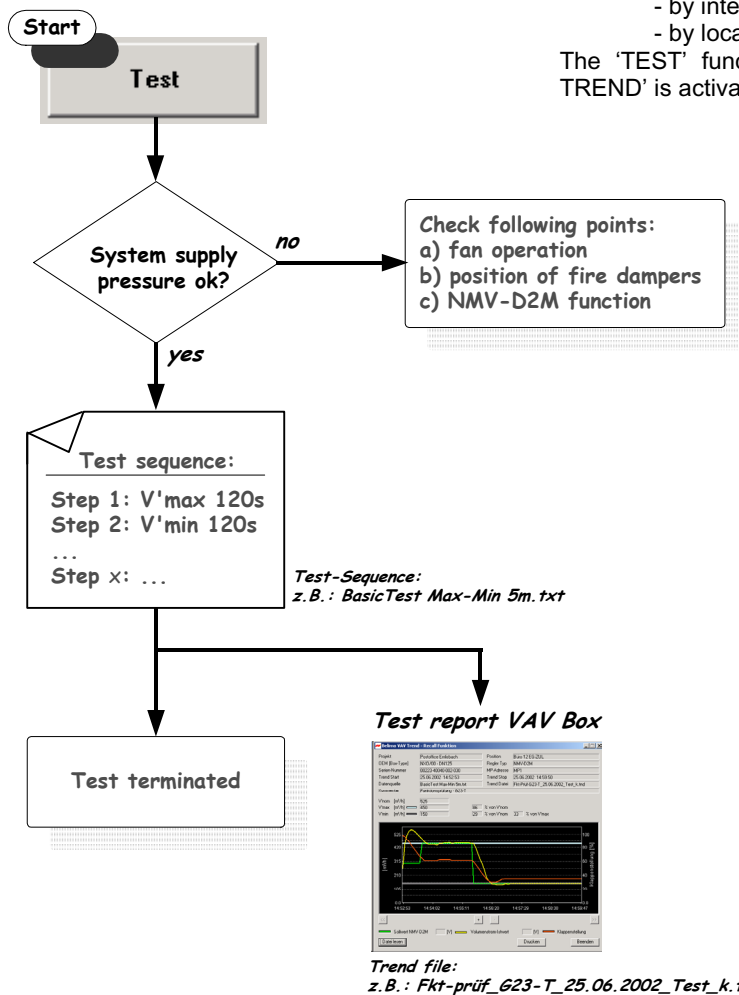
N-S5.1 Test-Sequence

The sequence of the 'Test' function is as shown in the diagram below.

N-S5.1.1 Start/Stop

- Start: with the 'TEST' button
 Stop: - with the <ESC> button
 - with the 'STOP' button
 - by interrupting communication
 - by local initiation of synchronising or adaption

The 'TEST' function cannot be started when 'OPERATION' or 'LIVE TREND' is activated.



N-S5.1 'Test' Diagnosis

That subject is explained in detail in a separate part. Several examples of CAV- / VAV-boxes that are functioning either correctly or incorrectly are described in detail.

See N-P Diagnosis.

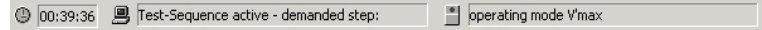
N-S5.3 Status display – Step control

The status display provides information on the Test-Sequence and set-point issue (Step):

- Check system pressure:



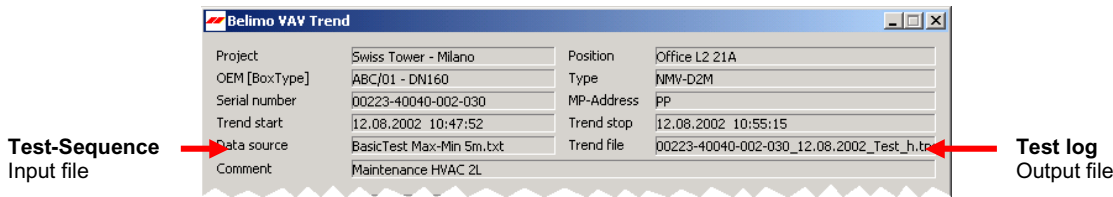
- Display current test step:



N-S5.4 Description of the elements

The 'Test' trend display will normally be the same as that from 'Live Trend'. See N-S4.1 Trend – Description of the elements.

The input file (defined Test-Sequence) and output file (Test log) are important for the test application.



N-S5.5 Selecting the operating step

Operating steps cannot be changed manually while 'TEST' is active.

N-S5.6 Display of actual values

The display of actual values ('Operation' field) is not available during the Test-Sequence.

N-S5.6.1 Voltage display in 'Live Trend'

The voltage display for 'Setpoint NMV-D2M' and 'Actual volumetric flow' is only available on the 'Auto' step during testing.

The NMV-D2M must always be set for conventional applications: Address setting 'PP'.

N-S5.7 Selecting the Test-Sequence

In addition to the preset standard Basic Test-Sequence, a different sequence can be selected if necessary. Depending on the functions to be tested there are Test-Sequences available with different steps and values of duration.

The Test-Sequence settings are made from the 'EXTRAS... | Options | NMV-D2M' menu.

N-S5.7.1 Available Test-Sequences:

BasicTest Max-Min 5m.txt

- Function : System check / V'max 120 s / V'min 120 s
- Duration : Check + (2 x 120 s) = ca. 5 minutes

Test-0 CAV (Open-Max-Min-Close) 8m.txt

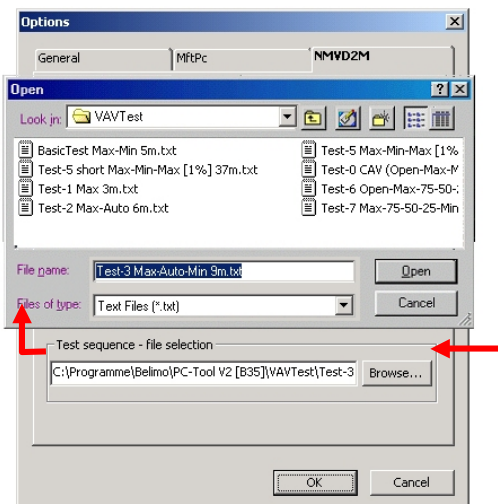
- Function : System check / Open / V'max / V'min / Close
- Open 90 s / V'max & V'min 180 s / Close 90 s
- Duration : Check + 90 s + (2 x 180 s) + 90 s = ca. 9 minutes

Test-1 Max 3m.txt

- Function : System check / V'max 180 s
- Duration : Check + (1 x 180 s) = ca. 3...4 minutes

Test-2 Max-Auto 6m.txt

- Function : System check / V'max 180 s / Auto (reference input w active) 180 s
- Duration : Check + (2 x 180 s) = ca. 6...7 minutes



- Available Test-Sequences (continued):

Test-3 Max-Auto-Min 9m.txt

- Function : System check / V'max 180 s / Auto (reference input w active) 180 s / V'min 180 s
- Duration : Check + (3 x 180 s) = ca. 9...10 minutes

Test-4 Max-Mid-Min 9m.txt

- Function : System check / V'max 180 s / V'mid 180 s / V'min 180 s
- Duration : Check + (3 x 180 s) = ca. 9...10 minutes

Test-5 Max-Min-Max [1%] 37m.txt

- Function : System check / V'max 120 s -> (V'max...V'min...V'max) 'V' sample with 1% increment: 10 s/step
- Duration : Check + 120 + (199 x 10 s) = ca. 36 minutes

Test-6 Open-Max-75-50-25-Min-Close 22m.txt

- Function : System check / Open / V'max / 75% / 50% / 25% / V'min / Close 180 s/step
- Duration : Check + (7 x 180 s) = ca. 22 minutes

Test-7 Max-75-50-25-Min 3h.txt

- Function : System check / Open / V'max / 75% / 50% / 25% / V'min Open 120 s / 1800 s/step
- Duration : Check + 120 s + (5 x 30 m) = ca. 3 hours

N-S5.8 Test log (Trend file)

As in the case of 'Live Trend', the 'Test' function also generates a xxx.tnd file. The stored data can be displayed on the screen afterwards and be printed out if necessary.

See: N-S4.3 'Trend Recall' for further information.

Each Test (Trend) file is stored under a unique name.

- File name

Default:

- structure: *serial_number_date_test_index.tnd*
- e.g.: 00151-10002-002-032_15.04.2002_Test_f.tnd

User-defined name:

Enter the Trend file name in the 'Project Data form' dialogue box.

- structure: *15characters_date__test_index.tnd*
- e.g.: Office12-1-OG ZUL_12.04.2002_Test_a.tnd

- Storage directory (path)

Default:

As a subdirectory of the PC-Tool program directory:
 ...\\VAVTrend

User-defined path:

The user can select the destination directory in the 'EXTRAS ; OPTIONS... ; NMV-D2M' menu. All trend files are then stored in that directory.

Project Data form <F4>
 This allows the project-specific and trend-specific data, such as file names, to be entered.
 The data is used by the log, print, trend and test functions. The data entries remain valid until they are changed or deleted.
 -> Blank fields are allowed



Practical tip – File clearing

If the trend function is used often a large number of trend files will be accumulated. Therefore, after plotting, it is advisable to:

- transfer the data to a project directory
- delete the data if it is no longer needed

N-S5.9 Read Test log (Trend Recall <F6>)

See N-S4.3 Trend Recall / <F6>



System test

The following points should be checked before any faults in the installation or faults in operation of the VAV/CAV-boxes are recorded and analysed:

- Installation: anti-rotation device / spindle attachment / sensor connection
- Connection: power / wiring / polarity
- Control: conventional or bus system

See 4. NMV-D2M Product Information for more information on function testing and NMV-D2M analysis options.

N-P Diagnosis

The 'Test' function in the 'Service' register allows VAV-/CAV-boxes to be diagnosed in easy and efficient fashion.

An active check of system supply pressure provides an indication of the function and efficiency of the pressurising device and its control system. Test reports produced with this function serve as test logs, as plant documentation and, the event of a fault, as an aid for the control and ventilation technicians involved.

By means of 10 examples the results of the diagnosis function are explained and the most suitable Test-Sequences for similar situations suggested. Due to the great variety of

- Plant concepts, appropriate for particular types of buildings
- Plant sizing and rating
- Control strategies
- Design-related differences between different makes of air box

the examples shown here may differ from the records obtained from your plant.

Below are descriptions and explanations of 10 examples of VAV- / CAV - boxes that are functioning either correctly or incorrectly.

N-P1 Index of recorded Test-Sequences

#	Air unit type.....	Function / Fault
1.	VAV	correct function
2.	CAV	correct function
3.	VAV / CAV.....	no system supply pressure
4.	VAV / CAV.....	insufficient system supply pressure
5.	VAV / CAV.....	excessive system supply pressure
6.	VAV / CAV.....	oversized air box
7.	VAV / CAV.....	wrong direction of rotation
8.	VAV / CAV.....	leakage air with VAV controller closed
9.	VAV.....	unstable reference signal
10.	VAV.....	unsuitable reference signal <-> Mode

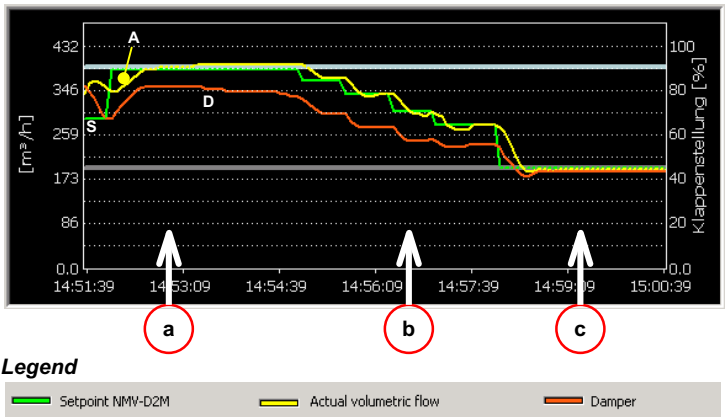
Planning and installation faults

and malfunctions resulting from them can only be corrected to a limited extent and sometimes not at all. Therefore, it is essential to adhere to the sizing and installation instructions provided by the manufacturer of the air box.

System supply pressure

A functioning VAV-/CAV-installation needs a correctly designed and adjusted pressurizing device. The air volume controller adjusts the control damper of the VAV-/CAV-box according to the value of supply pressure available. If there is no supply pressure, or insufficient pressure, the control damper will remain in the open position. This does not mean that the air volume controller is malfunctioning but simply the result of the lack of air. The pressure conditions in the ducting system must be correct in order for control to be effective.

N-P1.1 VAV-Box.....correct function



- Sequence**
- a) - Step 1: V'max
 - Volumetric flow at setpoint
 - Damper in control range
 - b) - Step 2: Auto [external control signal]
 - Actual value following setpoint
 - Damper in control range
 - c) - Step 3: V'min
 - Volumetric flow at setpoint
 - Damper in control range

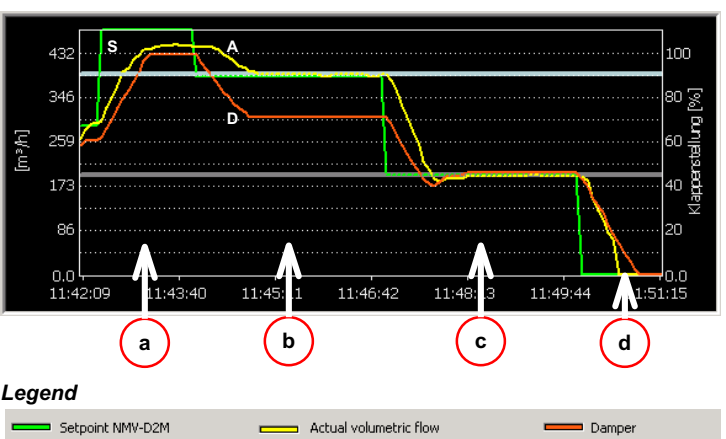
Legend
 - Setpoint NMV-D2M (green line)
 - Actual volumetric flow (yellow line)
 - Damper (orange line)

Suitable Test-Sequences

- Test 3 Max-Auto-Min 9m.txt
- or BasicTest Max-Min 5m.txt (without Auto Step)

Conclusion
 The correctly set up VAV air box is functioning correctly over the whole preset working range V'min ... V'max.

N-P1.2 CAV-Box.....correct function



- Sequence**
- a) - Step 1: Damper open (uncontrolled)
 - Volumetric flow depends on supply pressure
 - Damper 100% open
 - b) - Step 2: V'max
 - Volumetric flow at setpoint
 - Damper in control range
 - c) - Step 3: V'min
 - Volumetric flow at setpoint
 - Damper in control range
 - d) - Step 4: Damper closed (uncontrolled)
 - Volumetric flow zero [m³/h] / [l/s]
 - Damper closed

Legend
 - Setpoint NMV-D2M (green line)
 - Actual volumetric flow (yellow line)
 - Damper (orange line)

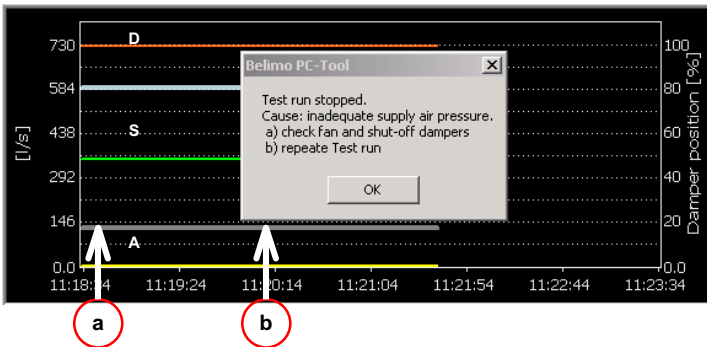
Suitable Test-Sequences

- Test 0 CAV (Open-Max-Min-Close) 8m.txt
- Test 4 Max-Mid-Min 9m.txt
- BasicTest Max-Min 5m.txt

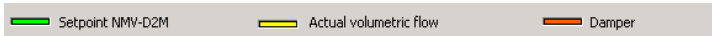
Conclusion
 The correctly set up VAV air box is functioning correctly over the whole preset working range V'min ... V'max.

4-A1PC-T V2 NMV-D2M-EN 14-08-02.doc PM VAV - Subject to technical changes

N-P1.3 VAV- / CAV-Boxno system supply pressure



Legend



Suitable Test-Sequences

- BasicTest Max-Min 5m.txt

Note:

The Test-Sequence is discontinued because of the lack of system supply pressure. Fault alarm: 'Inadequate supply air pressure'

Sequence

- Test start 'Check system supply pressure'
 - System test: setpoint V'mid
 - Volumetric flow zero [m³/h] / [l/s]
 - Damper 100% open
- Test-Sequence discontinued

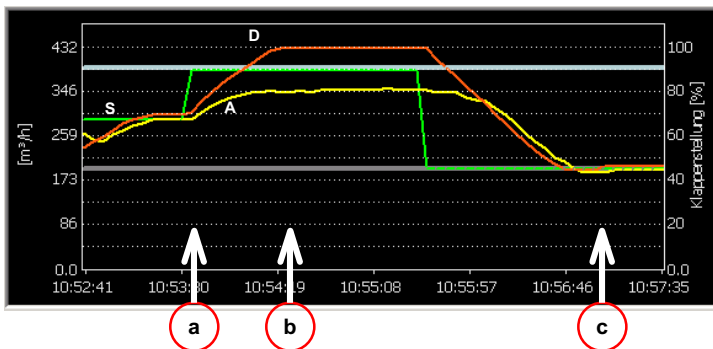
Possible faults

- Fan pressure control defective or inoperative
- Protective device triggered (fuse, thermal trip)
- Upstream fire damper closed
- Damper rotation incorrectly set

Suggestion for a remedy

- Check fan and pressure control, including the protective devices
- Check the function of the upstream dampers (control and fire dampers)
- Check damper direction of rotation
- Rectify fault and repeat test

N-P1.4 VAV- / CAV-Boxinsufficient system supply pressure



Legend



Suitable Test-Sequences

- BasicTest Max-Min 5m.txt
- Test 4 Max-Mid-Min 9m.txt

Note:

If the system does not attain the required supply pressure – during the test start – the Test-Sequence is discontinued and the fault alarm 'Inadequate supply air pressure' is given.

During the installation and commissioning phases of plants they are often set up for manual operation, i.e. maximum volumetric flow. Result: Insufficient system supply air pressure.

Sequence

- Step 1: V'max
 - Setpoint [V'max]
 - Volumetric flow does not reach setpoint
 - Damper 100% open
- Step 2: V'min
 - Volumetric flow at setpoint
 - Damper in control range

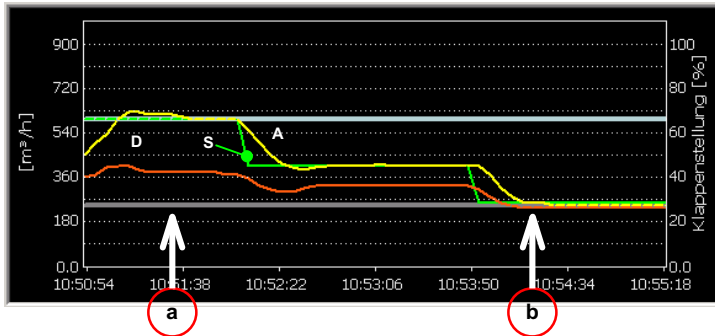
Possible faults

- Fan or pressure control defective
- Pressure control setpoint incorrectly set
- Plant not set up or set up incorrectly
- All VAV- / CAV air boxes being operated at max. volumetric flow (commissioning)

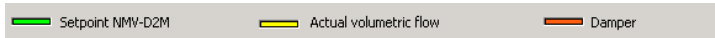
Suggestion for a remedy

- Increase supply pressure (increase pressure control setpoint), if this is impossible temporarily isolate several air units on the same section at the same time
- Repeat test
- Check fan and pressure control and set correctly.

N-P1.5 VAV- / CAV-Box excessive system supply pressure



Legend



Suitable Test-Sequences

- BasicTest Max-Min 5m.txt

Sequence

- a) Step 1: V'max
 - Volumetric flow at setpoint
 - Damper control range ~42%
- b) Step 3: V'min
 - Volumetric flow at setpoint
 - Damper control range ~28%

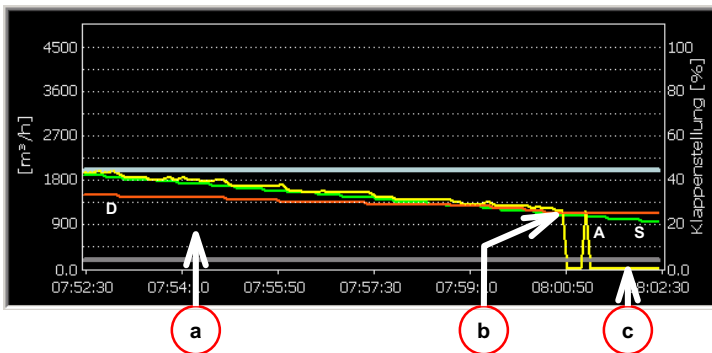
Cause

Fan or pressure control rated too high or set up too high.

Suggestion for optimising

Set the fan and pressure control so that the damper position of the VA-V/ CAV-boxes in V'max operation is approximately 80%

N-P1.6 VAV- / CAV-Box oversized air unit



Legend



Suitable Test-Sequences

- Test 5 Max-Min-Max [1%] 37m.txt
- Test 4 Max-Mid-Min 9m.txt

Note:

If the system does not attain the required supply pressure – during the Test start – the Test-Sequence is discontinued and the fault alarm 'Inadequate supply air pressure' is given.

Sequence

- a) The setpoint is reduced in 1% steps
- b) - Setpoint less than active differential pressure 2 Pa
 - NMV-D2M function
 - Leakage-flow suppression activated
- c) - Setpoint less than active differential pressure 2 Pa
 - Actual volumetric flow rate = 0

Causes and consequences

- VAV-/CAV-box oversized for the required value of volumetric flow
- Oversized air boxes are being operated in a difficult-to-control, sometimes uncontrollable, range
- The function range of the VAV-/CAV-box must not exceed 2 Pa. Otherwise the air box will be operated near leakage-flow suppression, i.e. in the uncontrollable range.

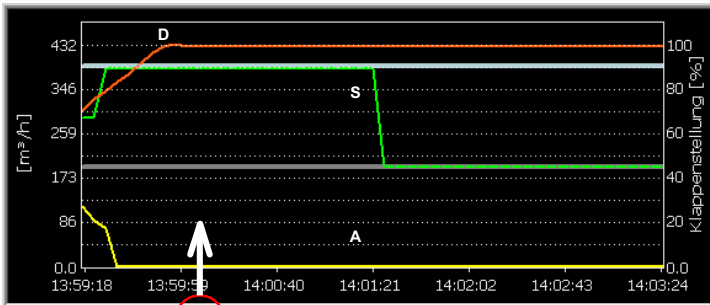
See:

- Air box manufacturer's documentation on minimum air flow for the VAV-/CAV-box
- 4. NMV-D2M Product Information on the leakage-flow suppression function

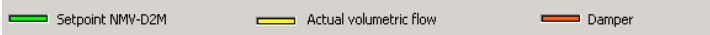
Suggestion for a remedy

- Increase the operating flow rate setting so that the V'min volumetric flow setting corresponds to an active differential pressure setting of more than 2 Pa.
- Investigate changing the air box (smaller nominal diameter).

N-P1.7 VAV- / CAV-Boxwrong direction of rotation



Legend



Suitable Test-Sequences

- BasicTest Max-Min 5m.txt

Note:

The Test-Sequence is discontinued because of the lack of system supply pressure. Fault alarm: 'Inadequate supply air pressure' is given.

Sequence

- a) Test start 'Check system supply pressure'
 - [System test: Setpoint V'mid]
 - Actual value zero [m³/h] / [l/s]
 - Damper 100% open

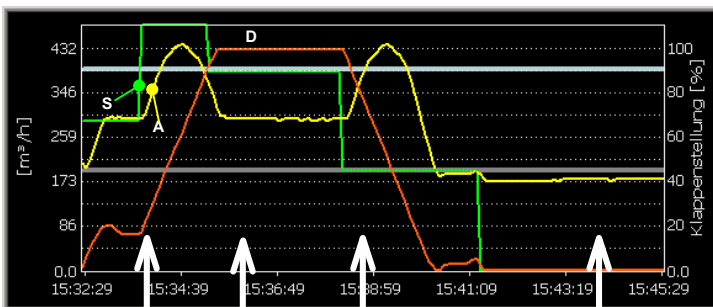
Possible faults

- Incorrect direction of rotation
- NMV-D2M shaft connector and damper spindle installed with offset (90°)

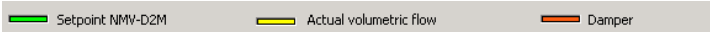
Suggestion for a remedy

- a) Check direction of rotation ('Service' register 'OPEN' or 'CLOSE' operation)
- b) Correct direction of rotation or mount the actuator correctly (note the mark on the damper blade)

N-P1.8 VAV- / CAV-Boxleakage air with VAV controller closed



Legend



Suitable Test-Sequences

- Test 0 CAV (Open-Max-Min-Close) 8m.txt

Note:

If the system does not attain the required supply pressure – during the Test start – the Test-Sequence is discontinued and the fault alarm 'Inadequate supply air pressure' is given.

The spindle is fitted with clear offset in order to record this symptom. As a result different values of offset can occur on-site in this situation.

Sequence

- a) Step 1: Damper open (uncontrolled)
 - Volumetric flow already very high when the damper is only slightly open !
 - Damper 20...100% open
- b) Step 2: V'max
 - Actual value not reaching setpoint
 - Damper apparently 100% open
- c) Step 3: V'min
 - Volume increases despite the damper closing and being clearly above the setpoint !
 - Damper in control range
- d) Step 4: Damper closed
 - Actual value: Volumetric flow present despite the damper apparently being closed !
 - Damper appears to be closed

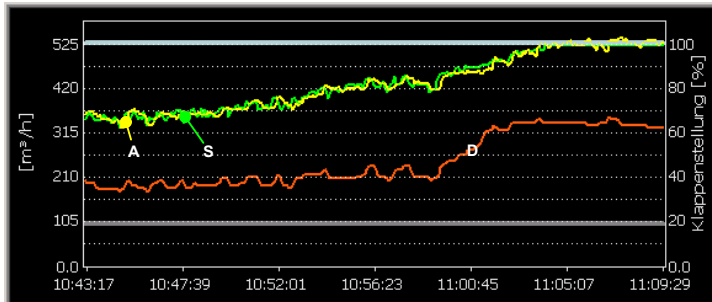
Possible fault

0° position of the actuator does not correspond to that of the closed damper blade. This produces offset, i.e. the damper remains open although the actuator is closed. When the actuator is 100% open the damper is already moving back in the 'Close' direction (90°).

Suggestion for a remedy

Remove the NMV-D2M and match the closed position correctly to that of the closed damper blade.

N-P1.9 VAV-Box.....unstable reference signal



Legend



Suitable Test-Sequences

- Test 2 Max-Auto 6m.txt
- Test 3 Max-Auto-Min 9m.txt

- Record the symptom with 'Live Trend' over an extended period of time, e.g. overnight. This allows intermittent faults to be located more easily.

Note:
The Test-Sequence is discontinued because of the lack of system supply pressure. Fault alarm: 'Inadequate supply air pressure' is given.

Sequence

- Reference signal hunting
- Volumetric flow following the setpoint
- Damper hunting in the control range

Cause and consequence

Room temperature control circuits are usually slow-response control loops: A tendency to hunt is an indication of either a lack of settings or incorrect settings.

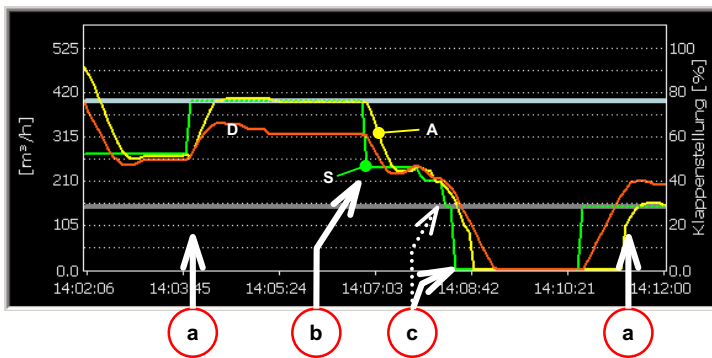
The VAV controller follows the reference signal, which is its task. Therefore, when a system is hunting it means that the damper actuator is in constant motion. So an adverse effect on service life is an inevitable consequence.

Pressure control is affected and, as a result, also the remaining VAV-boxes in the same section.

Suggestions for improvements

Match the reference control circuit correctly and adapt the controller parameters (P-band, etc.) to suit the complexity of the plant.
Investigate the positioning of the room temperature sensor. Mounting (e.g. tension from the conduit), draughts, sun, etc. can have a direct effect on the quality of control.

N-P1.10 VAV-Box.....unsuitable reference signal <-> Mode



Legend



Suitable Test-Sequences

- Test 2 Max-Auto 6m.txt
- Test 3 Max-Auto-Min 9m.txt

Note:
If the system does not attain the required supply pressure – during the test start – the Test-Sequence is discontinued and the fault alarm 'Inadequate supply air pressure' is given.

Naturally, the opposite situation can also arise: 'DDC 2...10 V, NMV-D2M 0...10 V'.
In this case the result is a worse deviation in the V'min range.

Sequence

- a) Step 1 + 3: V'max / V'min
Function correct
- b) Step 2: Auto (reference input active)
 - DDC output, room controller: 5.0 V
 - NMV-D2M regulates to 245 instead of 275 m³/h
- c) Step 2: Auto (reference input active)
 - DDC output, room controller: 0.0 V
 - Damper closes completely instead of to V'min

Cause

- The external reference signal (DDC, room temperature controller) has a working range of 0...10 V
- The NMV-D2M is set to 2...10 V mode
Function: 0 V = Close
2...10 V = V'min...V'max
The NMV-D2M is closed completely by the 0 V signal instead of to the required V'min (see c).

Suggestions for improvements

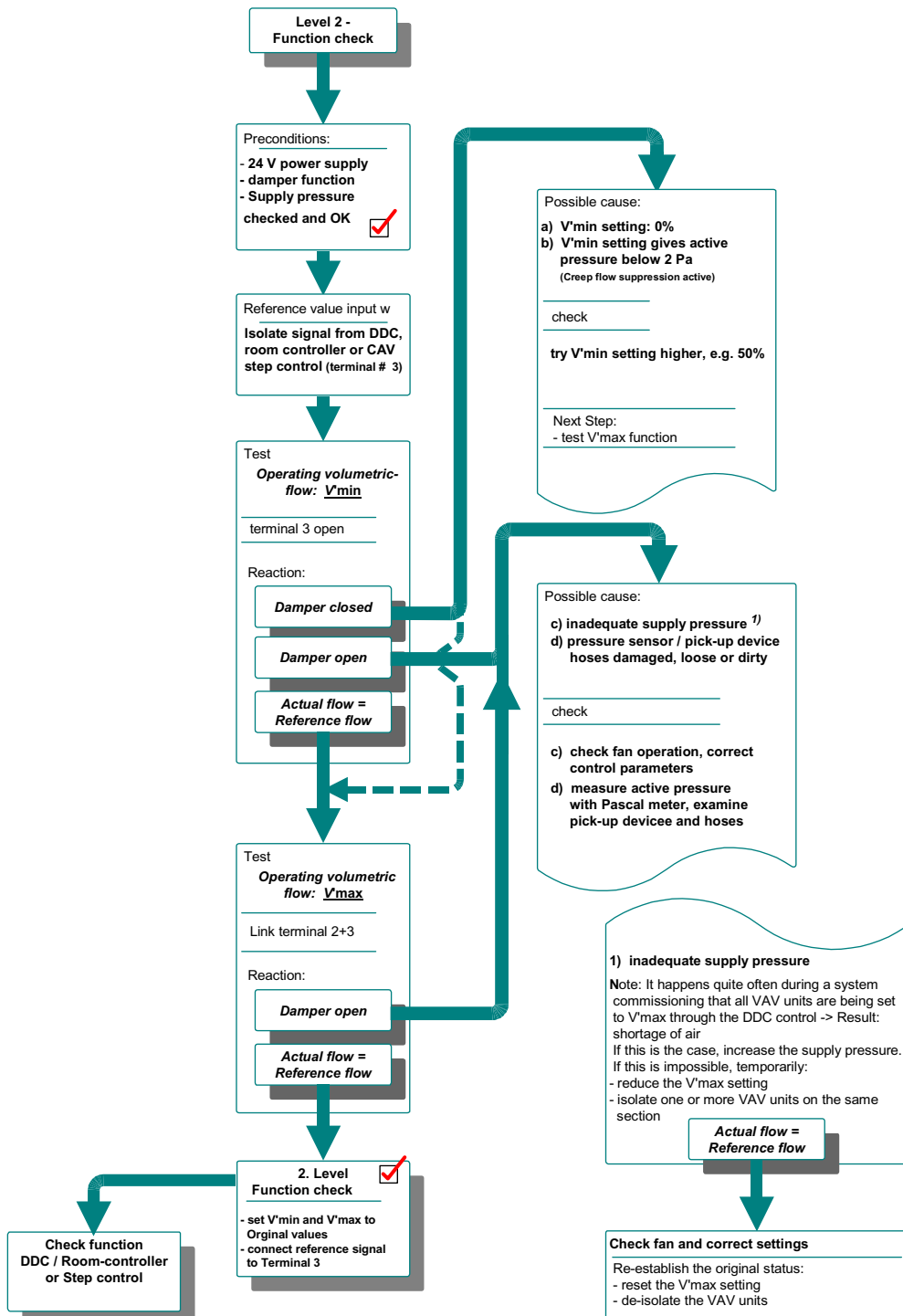
- a) Change over the NMV-D2M to the 0...10 V mode, or
- b) Change over the DDC output, room controller to working range 2...10 V (if this is possible).

N-D Miscellaneous

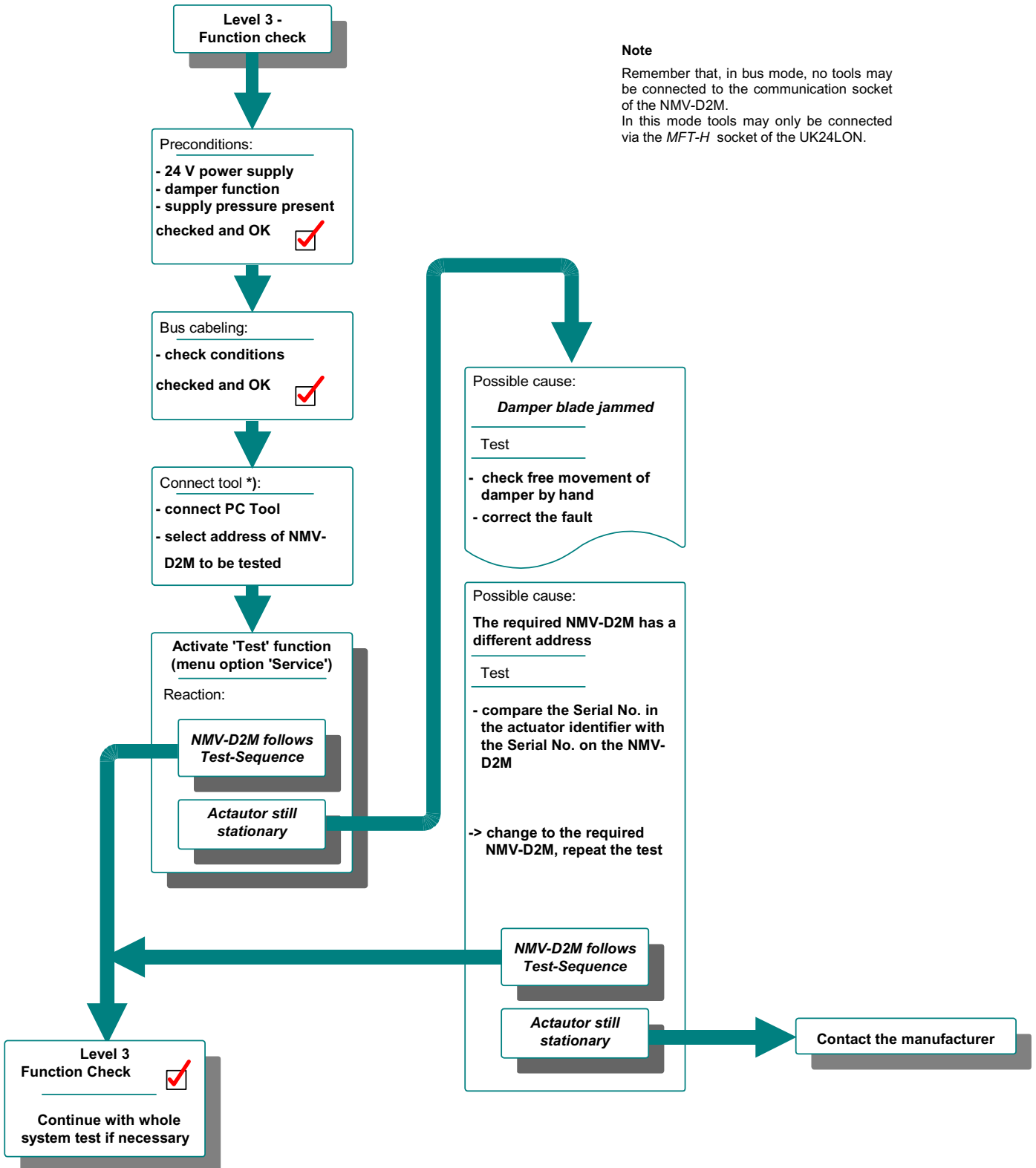
N-D1 Function checks of the NMV-D2M

Detailed information on function checks for the NMV-D2M will be found in 4. *NMV-D2M Product Information*. Some extracts are described on the two following pages, the Level 2 and 3 function checks.

N-D1.1 'Level 2' function check



N-D1.2 'Level 3' function check



Note

Remember that, in bus mode, no tools may be connected to the communication socket of the NMV-D2M. In this mode tools may only be connected via the *MFT-H* socket of the UK24LON.

N-D2 Formulae

- Formulae for converting units

m ³ /h -> l/s	Volumetric flow [m ³ /h]	/	3.6
m ³ /h -> cfm	Volumetric flow [m ³ /h]	/	1.6990107955
l/s -> m ³ /h	Volumetric flow [l/s]	*	3.6
l/s -> cfm	Volumetric flow [l/s]	*	2.1188800033
cfm -> m ³ /h	Volumetric flow [cfm]	*	1.6990107955
cfm -> l/s	Volumetric flow [cfm]	/	2.1188800033

- Formulae for calculating area

Area, circle	$A = 0.785 \times d^2$
Area, rectangle	$A = l \times b$

- Formulae for calculating volumetric flow

$$\text{Volumetric flow [m}^3/\text{h]} = (A [\text{m}^2] \times V [\text{m}^3]) \times 3600$$

- Formulae for calculating velocity

$$\text{Velocity [m/s]} = \text{Volumetric flow [m}^3/\text{h]} / \text{Area [m}^2]$$

- Formulae for volumetric flow and differential pressure

$$\dot{V} = c * \sqrt{\frac{\Delta p}{\rho}}$$

$$\Delta p = \rho * \left(\frac{\dot{V}}{c}\right)^2$$

- \dot{V} - Volumetric flow [m³/h]
- c - Constant differential pressure sensor, manufacturer's value, *see manufacturer's data*
- Δp - Differential pressure from measuring orifice (cross, bar) [Pa]
- ρ - Density [kg/m³]; 1.2 kg/m³ at 1013 hPa and 20°C

Innovation, Quality and Consultancy: A partnership for motorizing HVAC actuators

Air applications



Standard actuators and spring-return actuators for air control dampers in HVAC systems

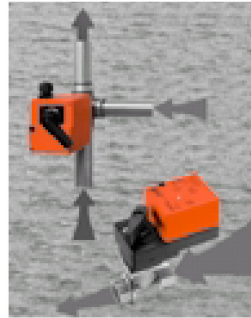


Safety actuators for motorizing fire and smoke extraction dampers

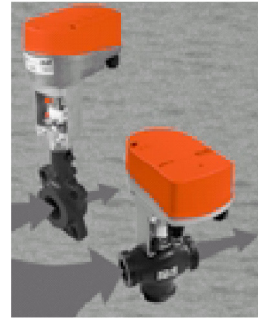


VAV systems for individual room air control

Water applications



Mixing actuators and motorized ball valves for HVAC water circuits



Globe valves and intelligent linear actuators – also for leading makes of valve

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