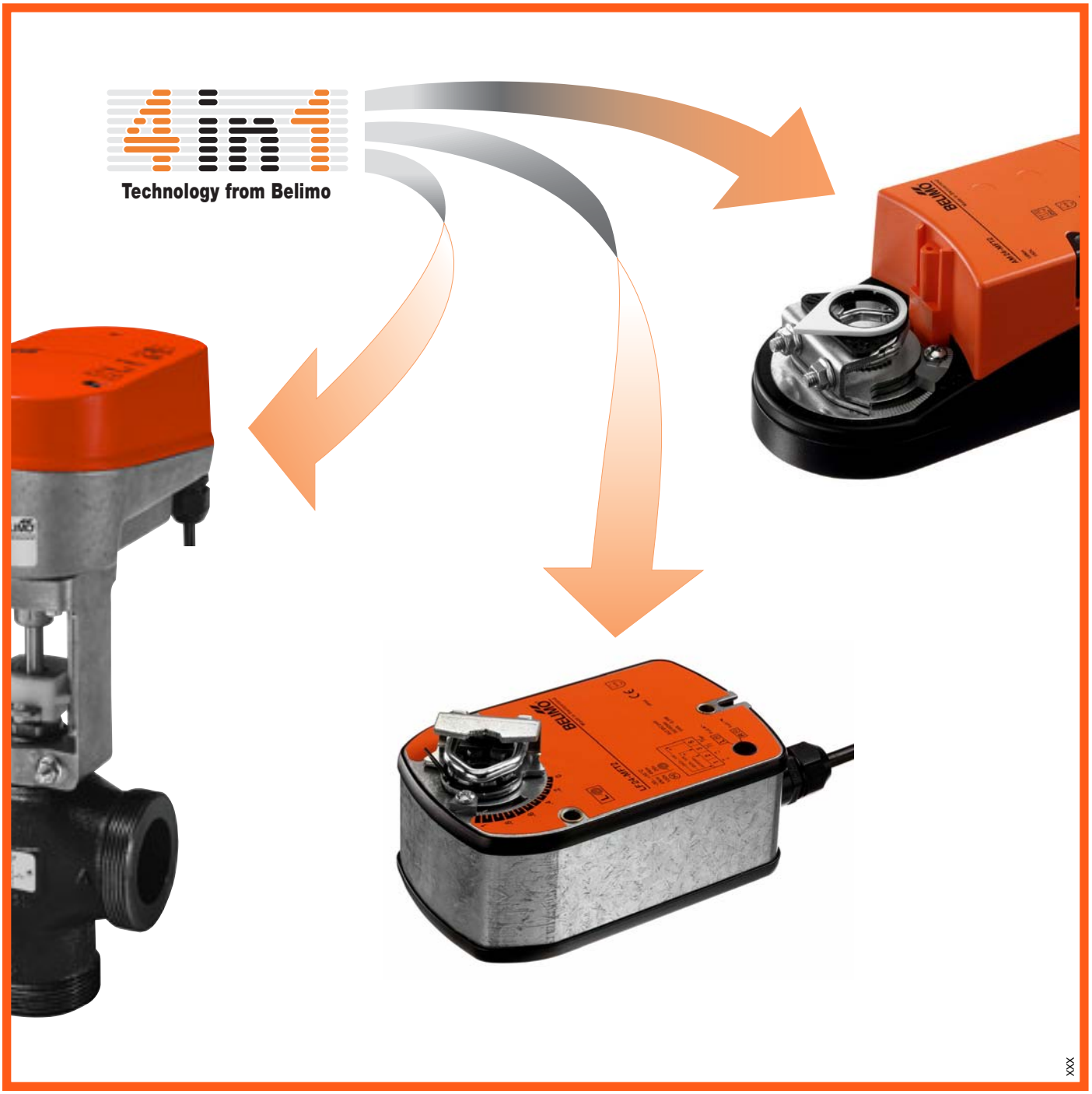
BELIMO

Actuators for heating,
ventilation, air-conditioning

2. + 6. MFT2-1

Product Information
Multi-Function-Technology

MFT2



xxx

MFT(2) actuators: Simple technology with greater benefits

As least as good as before

The new MFT(2) actuators with «4-in-1 Technology» are just as easy to install, connect up and use as conventional types. However, their digital control with an integrated Belimo MP-Bus also allows them to communicate with each other, which gives them much improved functionality. It makes integrating the final controlling elements into a bus system easier while at the same time affording much greater flexibility in the procurement and use of the actuators.

Distributed networks

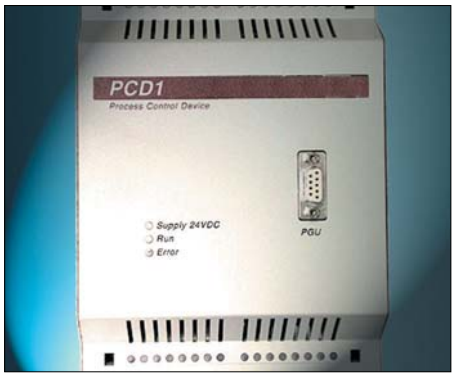
The MP-Bus developed by Belimo allows all kinds of MFT(2) actuators to be linked together. Power supply and digital communication are carried over a single 3-wire cable. This means that several final controlling elements can be linked together at minimum cost to form distributed, functional units, e.g. in order to organise networks of different air dampers and valves in a ventilation system plant room or several VAV controllers in a particular building zone.

Direct sensor connection

The direct connection of conventional sensors for humidity, temperature, etc., and also monitors and switches, to an MFT(2) actuator (see Table on Page 4) gives analogue sensors a bus capability. This simple solution avoids the use of expensive bus-capable sensors and greatly reduces the amount of wiring and cabling needed.

LON® bus integration

Up to 16 air dampers, valves and sensors connected to a Belimo MP-Bus can be linked to a LON® bus through a single interface:



• Via ordinary SPC/DDC controllers, provided they are equipped with an MP-Bus interface. The controller simply needs to have one input / output for all the actuators and sensors that are connected to the system.

• Via Belimo's UK24LON, LonMark®-certified universal interface unit. Using this unit makes all MFT(2) actuators LON®-compatible so that they can be connected to many different types of control system.

Individual parameterising and variable operation

MFT(2) actuators can be parameterised individually when necessary. This allows them to be matched precisely to the needs of the plant installation. Because, in addition, the mode of operation of each actuator can be freely chosen it is sufficient to have just a few different types to cover almost all the applications that arise in practice. This improves flexibility for planning purposes and also reduces the cost of procurement and warehousing. The bus-capable actuators can also be operated conventionally before being linked up to a bus system at low cost at some time in the future.

4 functions in 1 actuator

Technology from Belimo

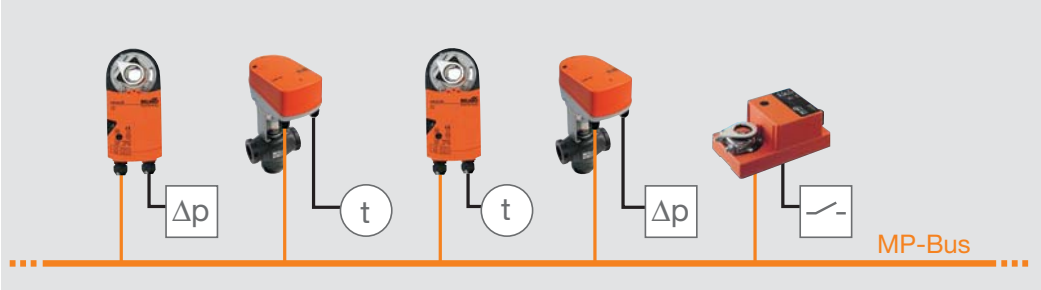
Simple bus capability

Up to eight MFT(2) actuators can be connected together over the MP-Bus and be linked to a DDC controller with an MP-Bus interface or to a LonWorks® system via the UK24-LON universal node unit.

LONMARK®

Cost-effective sensor interfacing

One conventional sensor can be connected to each MFT(2) actuator. The «4 in1» technology digitizes the sensor's analogue signals and transfers them to the Belimo MP-Bus over a common conductor.

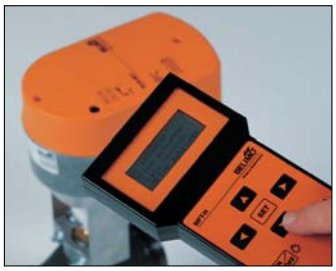


Individual parameter assignment

When necessary, the «4 in 1» technology allows parameters such as running time, position checkback, electric angle-of-rotation limiting, etc. to be set individually for any particular actuator. The actuators are also self-adapting during commissioning and self-monitoring during operation.

Delivered from the factory with either standard or customized parameter settings…

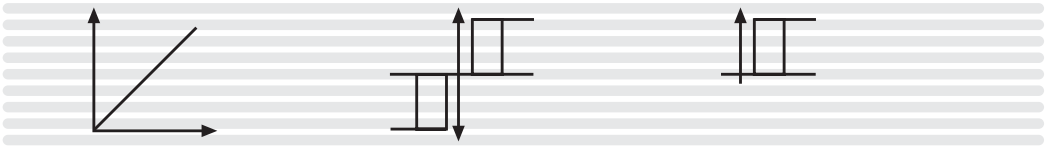
…alternatively enter your own settings with the Type H parameter assignment device or the PC-Tool…



…or enter your own settings on-site with the Type H parameter assignment device or the PC-Tool

Variable operating modes

The «4 in 1» technology can process different control signals such as modulating, 3-point or Open/Close. The MFT(2) actuators can be operated either conventionally or by bus system.



Modulating operation

3-point operation

Open/Close operation

Contents

General information 4
Symbols used in this document 5

Mode of operation 6
Safety 7

Parameterising tools / Modulating control 8
3-point control 9

Open / Close control 10
PWM control 11

MP-Bus / Connections / Lead lengths 12–13

MP-Bus: Sensors / Switches / Network topology 14–15

MP-Bus: Co-operation nodes / Other makes with MP interface 16
Linking to a LON-Bus / Cycle times 17

MP-Bus addressing 18–19

Basic positions 20
Angle-of-rotation / Stroke adaption 21

Working range / Feedback 22–23

Direction-of-rotation 24
Direction of stroke / Closing point selection 25

Running time 26
Effects of changing the running time 27

Force / Torque / Angle-of-rotation 28–29

Damper actuators: Override control / Angle-of-rotation limiting 30–31

Stroke / Response sensitivity 32
Reversal hysteresis 33

Sound power / Protection class 34
Degree of protection / Emergency positions / Maintenance / EMC 35

Damper actuators: Functional examples / diagrams 36–37

Valve actuators: Descriptions / Functional tables 38–39

Mounting / Position indication 40
Position limiting / Manual operation 41

Manual operation, valve actuators 42

General data / Technical data 43–45

Dimension drafts 46

Family / Type	• Damper actuators x Valve actuators
NM replaced by NM24A-MP NM24-MFT(2)	•
AM replaced by AM24A-MP AM24-MFT(2)	•
GM replaced by GM24A-MP GM24-MFT(2)	•
LF  LF24-MFT(2)	•
AF  AF24-MFT(2)	•
NV  NV24-MFT(2)	x
NVF  NVF24-MFT(2)(-E)	x
AV  AV24-MFT(2)*	x

*Delivery deadline on request, from 2002

Application
Traditional systems, Bus systems
Supplementary documentation

The following data is applicable to actuators for both dampers and valves

Application of ..24-MFT(2) damper and valve actuators
- Bus-capable ..24-MFT(2) damper actuators for operating air dampers
- Bus-capable ..24-MFT(2) valve actuators for operating globe valves

Traditional systems
Although they have a bus capability, the ..24-MFT(2) damper and valve actuators can also be used in traditional systems. They are parameterised with all the basic values for the usual applications before they leave the factory and are delivered in modulating-control form.

Customised versions with individually parameterised values can be ordered when needed.

For making service adjustments on-site MFT(2) actuators can be reprogrammed using an MFT-H Parameter Assignment Device or a Belimo PC-Tool.

Bus systems

		MFT actuator	MFT2 actuator
Bus linking and control	DDC controller with MP interface	•	•
	LonWorks®	via UK24LON	via UK24LON
	modulating	•	•
	3-point	•	•
	open/close	•	•
Sensor linking	active sensor On/Off switch	•	—
	active/passive sensor On/Off switch	—	•
Parameterisable with MFT parameterising tools	working range	•	•
	electronic angle-of-rotation limiting	•	•
	torque/force [1)]	•	•
	direction of rotation	•	•
	running time	•	•
	position feedback	•	•

1) Not possible for actuators with a safety function

Changeover from conventional to bus operation is automatic as soon as the actuator is assigned an MP address over the MP-Bus.

Supplementary documentation
Additional general product data, instructions for use, etc. will be found in the information brochures for the individual product families.

Product Range for air: **2.NM, 2.AM, 2.GM, 2.LF und 2.AF**
Product Range for water: **6.H**

Symbols	Meaning Supplementary documentation
	**General** The symbols described below are used throughout this document in order to provide greater clarity for the reader.
	**Factory setting** Factory settings (basic values).
	**Traditional systems** Functions that can be activated for use in traditional systems (as distinct from MP-Bus systems): Modulating, 3-point, Open/Close or PWM control.
	**Bus systems** Functions that can be activated for use in bus systems.
	**Parameterisable values** Values which, when necessary, can be re-parameterised with the MFT-H Parameter Assignment Device or a Belimo PC-Tool. **Supplementary documentation** Detailed information on the **MFT-H Parameter Assignment Device** will be found in the **MFT-H** operating instructions.
	**Ex-works parameterising** Parameter assignment can be performed outside the factory.
	**Fixed values** Values and functions that are fixed and cannot be changed (e.g. the mechanical / electronic design of the device).
	**Spring return** Actuators with spring return.

Mode of operation

BELIMO

Family / Type	Mode of operation for traditional systems	Mode of operation for bus systems
NM replaced by NM24A-MP NM24-MFT(2)	**Traditional systems** In traditional systems MFT(2) actuators are controlled by a DC 0...10 Volt standard control signal and move to the position specified by the control signal.	**Bus systems** In bus systems, MFT(2) actuators receive their digital control signal from the master controller over the MP-Bus and move to the position specified by the controller.
AM replaced by AM24A-MP AM24-MFT(2)		
GM replaced by GM24A-MP GM24-MFT(2)		
LF  LF24-MFT(2)		
AF  AF24-MFT(2)		
NV  NV24-MFT(2)		
NVF  NVF24-MFT(2)(-E)		
AV  AV24-MFT(2)*		

*Delivery deadline on request, from 2002

Functional safety

Functional safety for MFT(2) actuators
All the actuators are overload-proof, need no limit switches and halt automatically at the end-stops.

Safety and emergency control functions

LF24-MFT(2) and AF24-MFT(2)
The spring-return actuators move the damper to the required operating position while tensioning the return spring at the same time. Any interruption in the power supply causes the spring to move the damper back to the safe position.

NVF24-MFT(2)(-E)
Any interruption in the power supply causes the spring to move the spindle gearing in the **retract** direction in the case of NVF.. actuators or in the **extend** direction in the case of NVF..(-E) actuators (emergency control function).

BELIMO

Family

Type

NM

replaced by NM24A-MP

NM24-MFT(2)

AM

replaced by AM24A-MP

AM24-MFT(2)

GM

replaced by GM24A-MP

GM24-MFT(2)

LF

LF24-MFT(2)

AF

AF24-MFT(2)

NV

NV24-MFT(2)

NVF

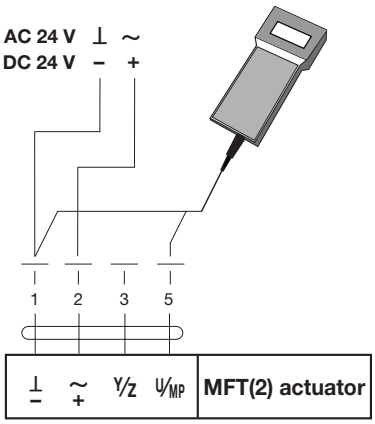
NVF24-MFT(2)(-E)

AV

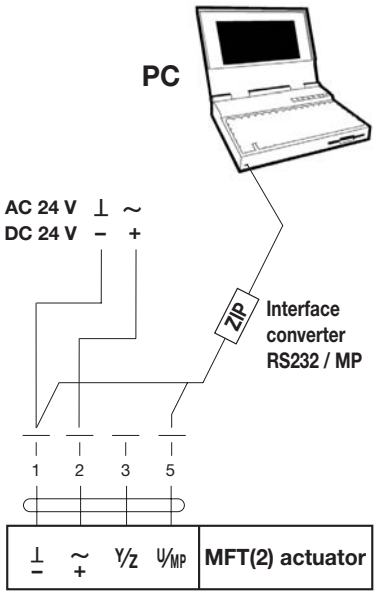
AV24-MFT(2)*

Connecting a parameterising tool

MFT-H Parameter Assignment Device



Belimo PC-Tool

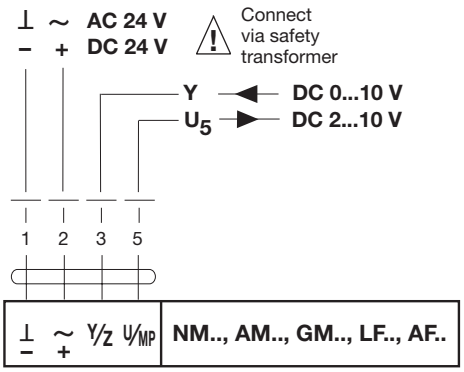


Note:
Further information on how to use the MFT-H hand-held device will be found in the «MFT-H Operating Instructions».

*Delivery deadline on request, from 2002

Wiring diagram
Modulating control DC 0…10 V

Connecting damper actuators

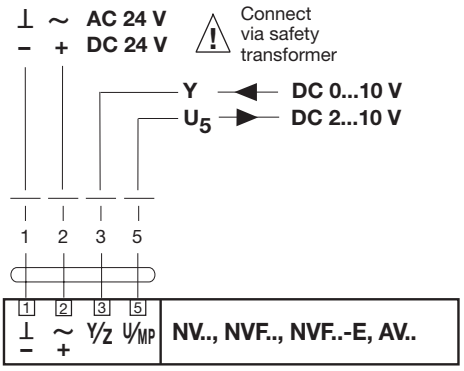


Y: Adjustable working range 0.5...32 V
U_5: Adjustable

Note:
Typical functions and functional diagrams for damper actuators with basic settings see Page 36.

Functional diagrams for damper actuators with custom-parameterised settings will be found directly adjacent to the functions.

Connecting valve actuators



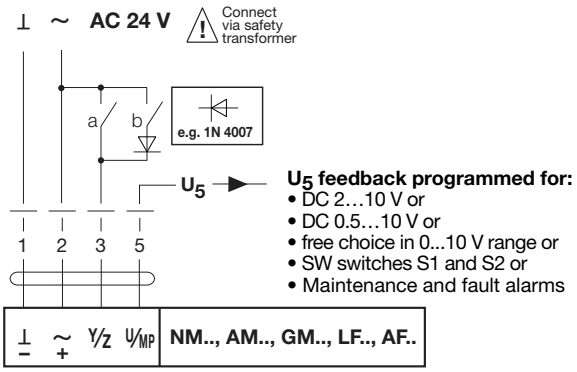
Y: Adjustable working range 0.5...32 V
U_5: Adjustable

Note:
For other functional diagrams for valve actuators NV... and NVF... see Page 39

Wiring diagrams and functions

Connecting damper actuators

3-point control (can be re-parameterised with the MFT-H Parameter Assignment Device)



U_5 feedback programmed for:
- DC 2…10 V or
- DC 0.5…10 V or
- free choice in 0...10 V range or
- SW switches S1 and S2 or
- Maintenance and fault alarms

More actuators can be connected in parallel.
Take note of the rating data.

Input impedance Ri @ Y, y2 = 1.5 kΩ

Function NM.., AM..

a	b	Direction-of-rotation switch R	L
		Stop	Stop

Function GM..

a	b	Direction-of-rotation switch A	B
		Stop	Stop

Function LF.., AF

a	b	Mounting side L	Mounting side R	Direction-of-rotation switch R	L	R	L
				Stop	Stop	Stop	Stop

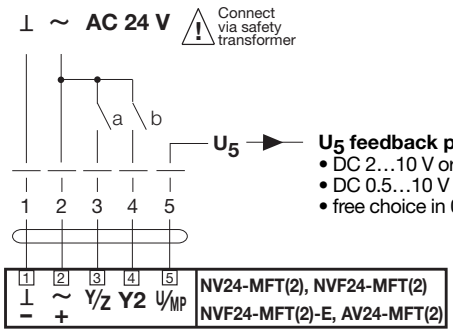
Connecting valve actuators

3-point control is easy to implement with a 4-wire circuit.

But remember that the actuator must be parameterised for 3-point control.

Input impedance Ri @ Y, y2 = 1.5 kΩ

Valve actuators with and without emergency control function *



U_5 feedback programmed for:
- DC 2…10 V or
- DC 0.5…10 V or
- free choice in 0...10 V range

Control contact**		Linear actuator
a	b	spindle
Open	Open	stopped
Close	Open	extends
Open	Close	retracts
Close	Close	retracts

* Single-wire connection via terminal 3 with diode possible (see Damper Actuator diagram above)

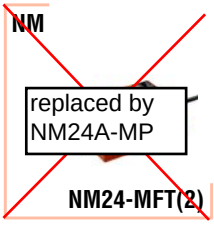
** Slide switch S3.1/S3.2 on linear actuator in OFF position

Family

Type

Wiring diagrams and functions

NM



NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

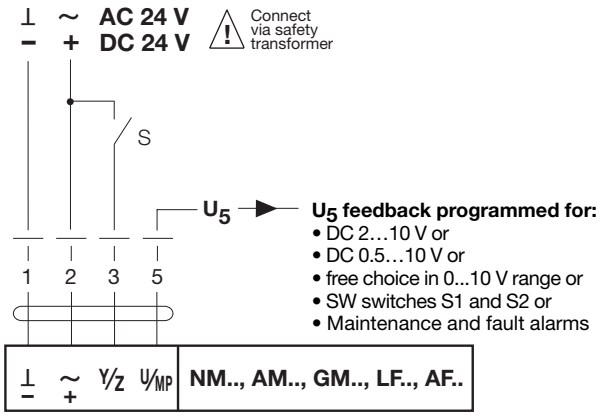
LF24-MFT(2)

AF

AF24-MFT(2)

Wiring diagram for damper actuators

(custom-parameterised with the MFT-H device)

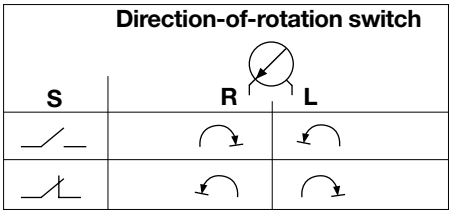


U_5 feedback programmed for:
- DC 2…10 V or
- DC 0.5…10 V or
- free choice in 0...10 V range or
- SW switches S1 and S2 or
- Maintenance and fault alarms

More actuators can be connected in parallel.
Take note of the rating data.

Input impedance Ri @ Y, y2 = 1.5 kΩ

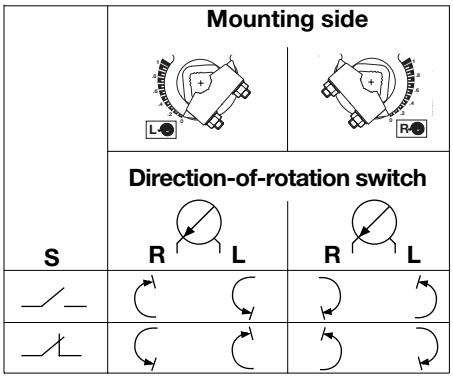
Function NM.., AM..



Function GM..

S	Direction-of-rotation-switch A	Direction-of-rotation-switch B

Function LF.., AF



NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

AV

AV24-MFT(2)*

Wiring diagrams for valve actuators

Override control on Page 39

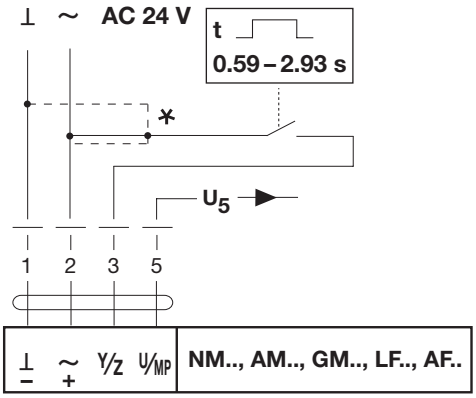
*Delivery deadline on request, from 2002

Wiring diagrams

Description of PWM control
Examples

The PWM method of control described here is most popular for the American market.

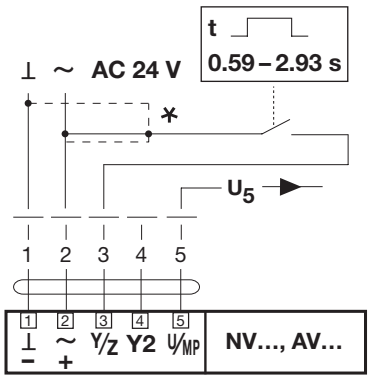
PWM wiring diagram for damper actuators



* Control by Triac (Source or Sink) also possible

Ri @ Y = 750 Ω

PWM wiring diagram for valve actuators



* Control by Triac (Source or Sink) also possible

Ri @ Y = 750 Ω

PWM control

In PWM control the actuator measures the length of the control pulse and then moves to the corresponding position.

Depending on the controller that is operating the MFT(2) actuator, various ranges of PWM can be selected at the actuator.

Selectable ranges for MFT(2) actuators for dampers and valves:

0.02 – 5 s
0.59 – 2.93 s
0.1 – 25.5 s
PWM variable from PWMmin. 0.02 s to PWMmax. 50.00 s

Examples of PWM control

(PWM range selected at the actuator: 0.59 – 2.93 s)

Example 1: 100 % angle of rotation or stroke

When a pulse of 2.93 seconds duration is sent to the actuator the latter moves to the 100 % angle-of-rotation position (if pulses of more than 2.93 seconds duration are sent to the actuator the latter will also move to the 100 % angle-of-rotation position).

Example 2: 50 % angle of rotation or stroke

When a pulse of 0.59 s + (2.93 s – 0.59 s) / 2 = 1.17 s + 0.59 s duration is sent to the actuator the latter moves to the 50 % angle-of-rotation position.

Example 3: 0 % angle of rotation or stroke

When a pulse of 0.59 s duration is sent to the actuator the latter moves to the 0 % angle-of-rotation position (if pulses of less than 0.59 s duration but more than 20 ms duration are sent to the actuator the latter will also move to the 0 % angle-of-rotation position; if the pulse is less than 20 ms the function will be undefined).

Family / Type

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

AF

AF24-MFT(2)

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

AV

AV24-MFT(2)*

*Delivery deadline on request, from 2002

The MP-Bus
Wiring diagram for control via the MP-Bus

The MP-Bus

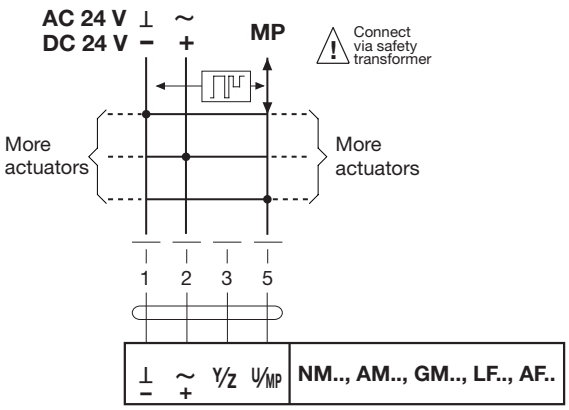
The actuators have an MP-Bus communications capability.

Up to 8 actuators can be linked together over an Belimo MP-Bus system.

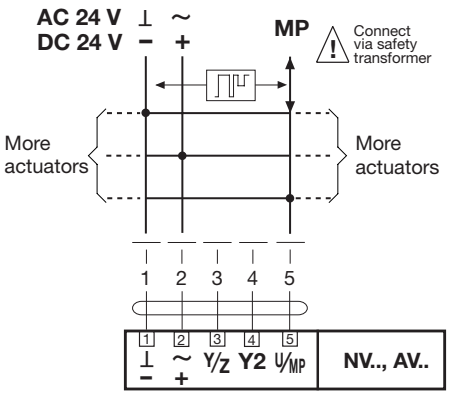
The MFT(2) actuators receive their digital control signals from a higher-level Bus-Master over the MP-Bus system and move to the specified position.

The changeover from conventional to bus operation takes place automatically as soon as an MP address (1...8) has been assigned to the MFT(2) actuator (see «MP addressing», pp. 18...19).

Wiring diagram for damper actuators



Wiring diagram for valve actuators

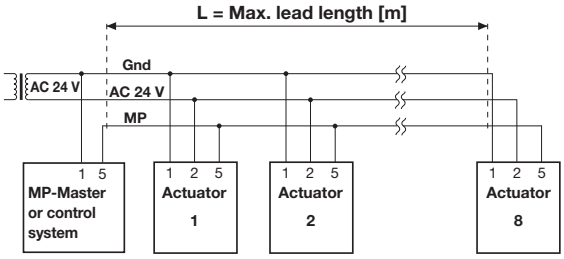


MP-Bus connection
Lead lengths for AC 24 V power via the MP-Bus

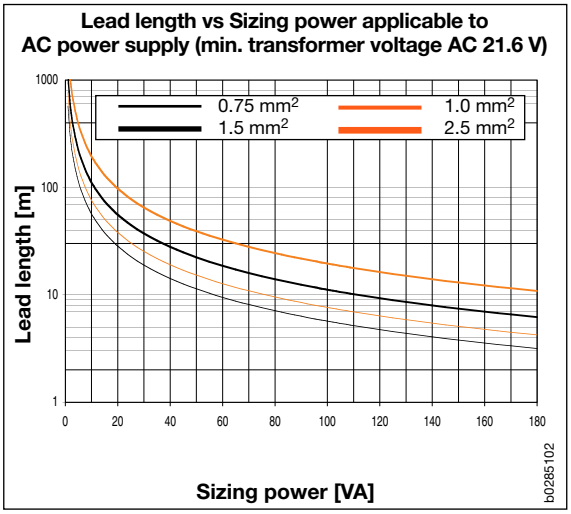
MP-Bus connection

- Facilities for connecting up to 8 MFT(2) actuators per network
- Bus linking
  – 3-core for bus power supply
  – 2-core for local power supply
- Neither special cable nor terminating resistors are needed
- The length of lead is limited (for calculation see below)
  – by the sum of the ratings of the connected MFT(2) actuators
  – by the type of power supply (AC via bus / DC via bus / AC local)

Max. lead lengths for an AC 24 V power supply (via bus system)



Total sizing power for MFT(2) actuators (VA)



With NVF24-MFT(2) actuators the sizing power must be multiplied by a factor of 2.

Calculating maximum lead lengths

The values of sizing power [VA] of the MFT(2) actuators being used must be added together so that the corresponding lead lengths can be read off from the diagram.

Example:
The following are connected to the MP-Bus: 1 in No. NM.., 1 in No. AM.., 1 in No. AF.. and 1 in No. NV..

Total sizing power:
3 VA + 5 VA + 10 VA + 5 VA = 23 VA

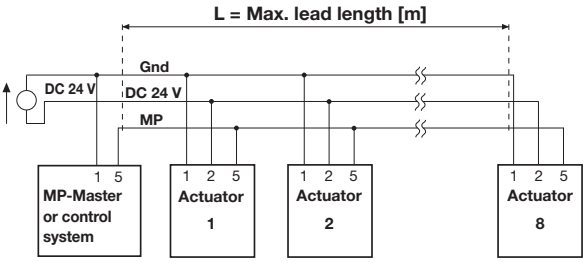
Read off the following from the family of curves:
- For cable with a core dia. 0.75 mm²: **Lead length 25 m**
- For cable with a core dia. 1.0 mm²: **Lead length 33 m**
- For cable with a core dia. 1.5 mm²: **Lead length 50 m**
- For cable with a core dia. 2.5 mm²: **Lead length 85 m**

MP-Bus connection
Lead lengths for DC 24 V power via the MP-Bus

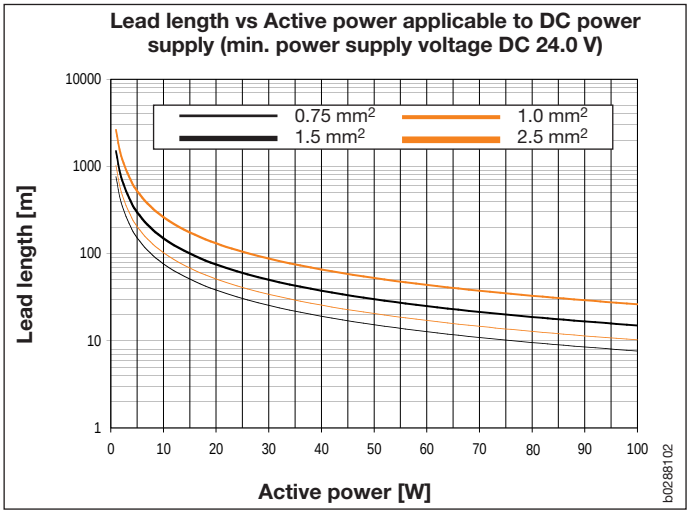
MP-Bus connection

- Facilities for connecting up to 8 MFT(2) actuators per network
- Bus linking
  – 3-core for bus power supply
  – 2-core for local power supply
- Neither special cable nor terminating resistors are needed
- The length of lead is limited (for calculation see below)
  – by the sum of the ratings of the connected MFT(2) actuators
  – by the cross sectional area of lead
  – by the type of power supply (AC via bus / DC via bus / AC local)

Maximum lead lengths for a DC 24 V power supply (via bus system)



Total sizing power for MFT(2) actuators (W)



Lead length vs Active power applicable to DC power supply (minimum voltage DC 24 V)

Calculating maximum lead lengths

The values of power consumption [W] of the MFT(2) actuators being used must be added together so that the corresponding lead lengths can be read off from the diagram.

Example:
The following are connected to the MP-Bus: 1 in No. NM.., 1 in No. AM.., 1 in No. AF.. and 1 in No. NV..

Total sizing power:
1.3 W + 2.5 W + 6.0 W + 3.0 W = 12.8 W

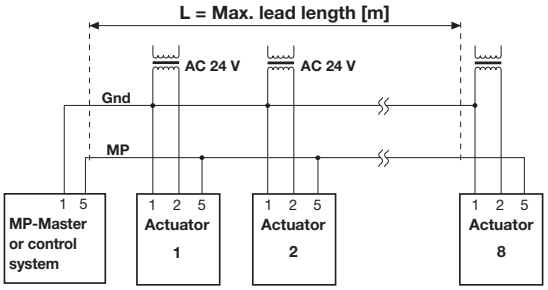
Read off the following from the family of curves:
- For cable with a core dia. 0.75 mm²: **Lead length 60 m**
- For cable with a core dia. 1.0 mm²: **Lead length 80 m**
- For cable with a core dia. 1.5 mm²: **Lead length 115 m**
- For cable with a core dia. 2.5 mm²: **Lead length 200 m**

MP-Bus connection
Lead lengths for an AC 24 V power supply (local)

MP-Bus connection

- Facilities for connecting up to 8 MFT(2) actuators per network
- Bus linking
  – 3-core for bus power supply
  – 2-core for local power supply
- Neither special cable nor terminating resistors are needed

Maximum lead lengths for an AC 24 V power supply (local)



When the actuators are being supplied locally at AC 24 V from a separate transformer the lead lengths can be increased very substantially. The lead lengths are as listed in the table regardless of the power ratings of the connected actuators.

Core dia. [mm²]	L = Max. lead length [m]
0.75	800
1.0	
1.5	
2.5	

Family

Type

MP-Bus: Connecting passive sensors

BUS

NM

NM24-MFT2

AM

AM24-MFT2

GM

GM24-MFT2

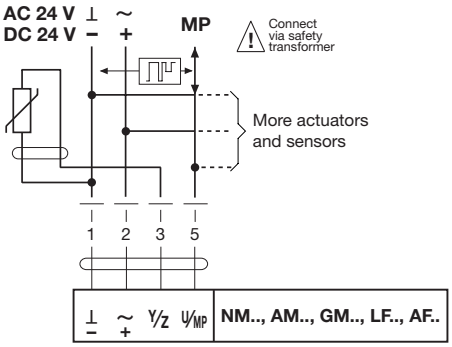
LF

LF24-MFT2

AF

AF24-MFT2

Wiring diagram for damper actuators



NV

NV24-MFT2

NVF

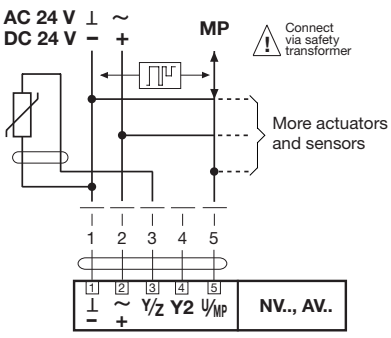
NVF24-MFT2(-E)

AV

AV24-MFT2*

*Delivery deadline on request, from 2002

Wiring diagram for valve actuators



Connecting sensors for MP-Bus operation

- Each MFT(2) actuator has a connection facility for 1 sensor (passive/active sensor or switching contact).
- The MFT(2) actuator serves as an analogue/digital converter for transferring the sensor signal to the higher-level system over the MP-Bus.
- The higher-level system must know the physical address (i.e. which sensor on which actuator) and also be able to interpret the corresponding sensor signal.
- Sensors should be connected by means of a separate wire whenever possible or at least the ground wire of the sensor should be run separately from the ground wire of the power supply for as great a distance as possible (in order to avoid equalising currents).
- In the case of passive sensors the cross sectional area of the connecting wire should be as large as possible (1 to 1.5 mm²) because the resistance of the wire affects the accuracy of measurement.

Passive sensors suitable for connection

Sensor type	Measurable temperature ranges
Ni1000	–28 °C…98 °C
Pt1000	–35 °C…155 °C
NTC (1 kΩ–10 kΩ @ 25 °C)	according to type –10 ° C…160 °C
Measuring ranges of the sensor input (3) when measuring resistance values	
Sensor type	**Measuring ranges**
Ni1000	850 Ω–1600 Ω
Pt1000	850 Ω–1600 Ω
NTC sensors	100 Ω–60 kΩ

Measuring ranges and accuracy of the measuring system when connecting passive sensors to the sensor input (3)

1. Pt1000 or Ni1000

Measuring range: 850–1600 Ω	
Measuring tolerance, abs. [%]	Resolution (whole number)
±0.3 %	1 Ω
Example: Pt1000 @ 0 °C = 1000 Ω Measuring tolerance = ±3 Ω or ±0.5 °K	

2. NTC

Measuring range: 100 Ω–60 kΩ			
Measuring tolerance, abs. [%] corresponding to Ω measuring range		Resolution	Example: NTC 2.2 kΩ measured temperature
200–300 Ω	±5	1 Ω	±2 °K @ 85 °C
301–600 Ω	±2		±0.6 °K @ 60 °C
601–1700 Ω	±1		±0.25 °K @ 32 °C
1701–5000 Ω	±2		±0.5 °K @ 5 °C
5001–10000 Ω	±5		±1 °K @ –10 °C
10001–20000 Ω	±10		±1.5 °K @ –25 °C
20001–50000 Ω	±25		±4 °K @ –40 °C

MP-Bus: Connecting active sensors

MP-Bus: Connecting external switches, e.g. pressure monitors

Network topology

Connecting sensors for MP-Bus operation (applicable to actuators for both dampers and valves)

- Each MFT(2) actuator has a connection facility for 1 sensor (passive/active sensor or switching contact).
- The MFT(2) actuator serves as an analogue/digital converter for transferring the sensor signal to the higher-level system over the MP-Bus.
- The higher-level system must know the physical address (i.e. which sensor on which actuator) and also be able to interpret the corresponding sensor signal.
- Sensors should be connected by means of a separate wire whenever possible or at least the ground wire of the sensor should be run separately from the ground wire of the power supply for as great a distance as possible (in order to avoid equalising currents).
- In the case of passive sensors the cross sectional area of the connecting wire should be as large as possible (1 to 1.5 mm2) because the resistance of the wire affects the accuracy of measurement.

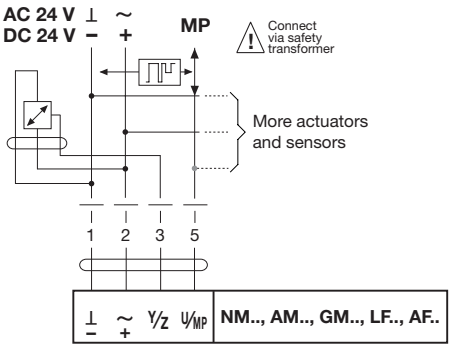
What are active sensors?
Sensors for temperature, humidity, etc. with an output of DC 0 to 32 V

Resolution
Typically 30 mV

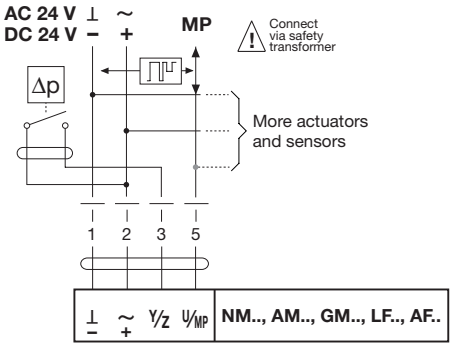
Requirements for switching contacts
A switching contact must be able to make and break a current of 16 mA @ 24 V.

Note:
The MFT(2) actuators must be parameterised with >= 0.6 V as the start point of the working range.

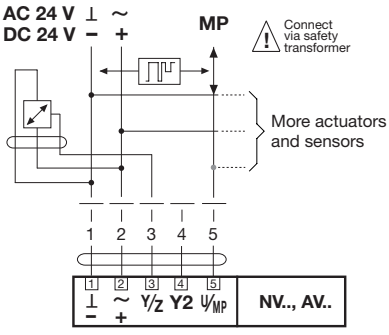
Wiring diagram for active sensors on damper actuators



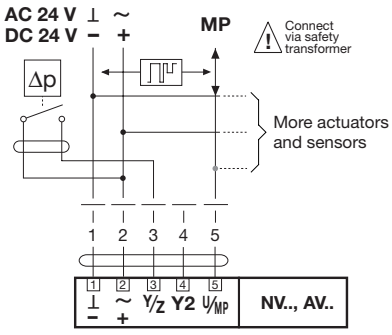
Wiring diagram for external switching contacts on damper actuators



Wiring diagram for active sensors on valve actuators

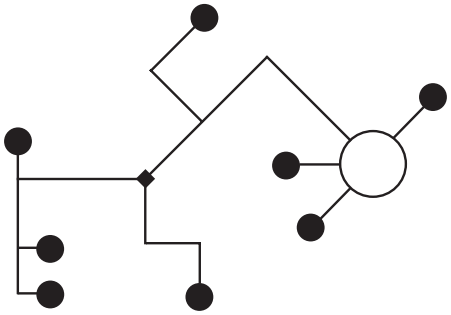


Wiring diagram for external switching contacts on valve actuators



Applicable to actuators for both dampers and valves

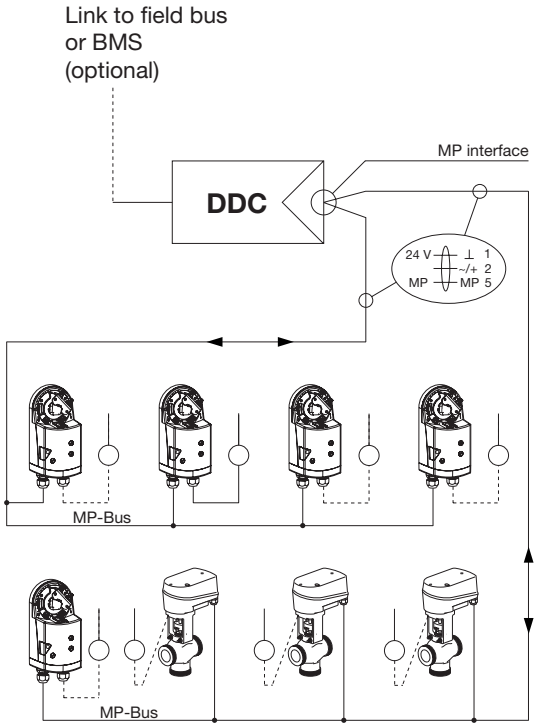
No restrictions
There are no restrictions on network topology (star, ring, tree or mixed formats are permissible).



(up to 8 actuators)

Family / Type	MP-Bus and co-operation nodes	Other makes with MP interface
NM replaced by NM24A-MP NM24-MFT(2)	Applicable to actuators for both dampers and valves	Applicable to actuators for both dampers and valves
AM replaced by AM24A-MP AM24-MFT(2)		
GM replaced by GM24A-MP GM24-MFT(2)		
LF LF24-MFT(2)		
AF AF24-MFT(2)		
NV NV24-MFT(2)		
NVF NVF24-MFT(2)(-E)		
AV AV24-MFT(2)*		

Co-operation nodes
Belimo will be happy to supply any manufacturers of digital controllers (DDC, SPC) who would like to integrate the MP-Bus protocol into their products with a technical specification of the system. The controllers will then be able to communicate directly with MFT(2) actuators.



Connecting sensors
Either an active sensor or a passive sensor can be connected to each actuator.

Linking to a field bus
The controller can be linked to a field bus (e.g. LON) provided it is equipped with a suitable interface.

DDC or SPC systems with an MP interface

Maker:	*SAIA-Burges*
Types:	PDC1, PDC2
MP-module:	PDC2.T500 for 2 x 8 MFT(2) actuators and sensors

*Delivery deadline on request, from 2002

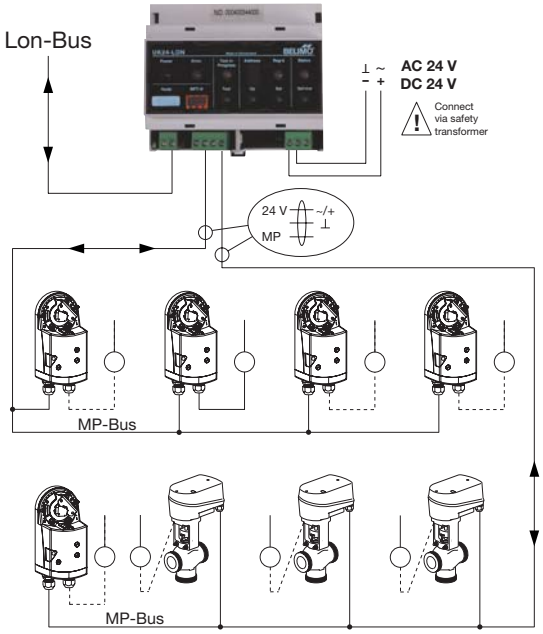
Linking to a LON-Bus through a UK24LON unit

Applicable to actuators for both dampers and valves

The UK24LON unit

The purpose of the Belimo UK24LON unit, which has been approved by LonMark, is to link a Belimo MP-Bus to a LON-Bus. The UK24LON unit incorporates an FTT-10A Transceiver.

Up to 8 actuators can be connected to the MP-Bus side.



Connecting sensors

Either an active sensor or a passive sensor can be connected to each actuator. This allows the analogue signal from the sensor to be digitised very simply by means of the Belimo actuator so that it can be passed on to the LON-Bus via the UK24LON unit.

Further information

Further information on integrating systems into a LON-Bus can be found in the UK24LON product documentation.

MP-Bus cycle times

Applicable to actuators for both dampers and valves

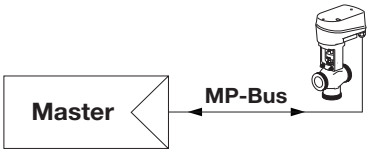
Communication time

Each command that is transmitted over the bus takes an average of ca. 150 milliseconds (a command always comprises an instruction and a response).

1. Example with one MFT(2) actuator

- The Master sends a set value to the MFT(2) actuator (1st command).
- The Master reads out the actual value from the MFT(2) actuator (2nd command).

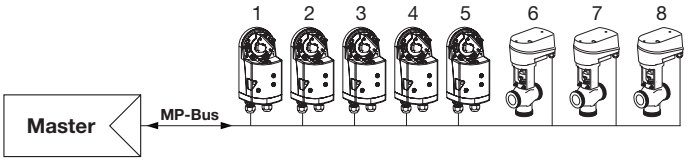
Therefore, the whole process of communication lasts for 2 commands of 150 ms each = **ca. 300 ms**.



2. Example with eight MFT(2) actuators

- The Master sends a set value to each of the 1 to 8 MFT(2) actuators (No. of commands: 8).
- The Master reads out the actual values from the eight MFT(2) actuators (No. of commands: 8).

Therefore, the whole process of communication lasts for 16 commands of 150 ms each = **ca. 2.4 s**.



Notes

Algorithm

The algorithm for the cycle must be specified by the maker of the digital controller (DDC).

UK24LON cycle times

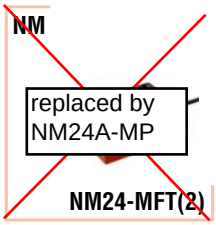
When MFT(2) actuators are used in conjunction with a Belimo UK24LON unit the corresponding cycle times will be found listed in the product data sheet.

Family / Type	MP-Bus addressing, semi-automatic

Applicable to actuators for both dampers and valves

One Bus-Master (e.g. DDC controller) can communicate with up to 8 Slaves (MFT(2) actuators) over an MP-Bus. Each node in the bus system must be clearly identifiable. Therefore, it is essential for each Slave to have its own address.

NM



NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

AF

AF24-MFT(2)

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

AV

AV24-MFT(2)*

*Delivery deadline on request, from 2002

MP-Bus addressing, semi-automatic with acknowledgement

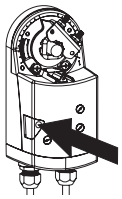
Procedure

1. Set the required MP address 1 to 8 at the Bus-Master (UK24LON).
2. Set the Bus-Master to the ready position by initiating the appropriate function (UK24LON 'Set' button).
3. Make the appropriate acknowledgement at the actuator (see diagrams). The MP address that was set at the Bus-Master has now been assigned to the MFT(2) actuator.

Acknowledgement with NM.., AM.., GM..

Procedure

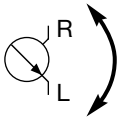
Press the manual button once.



Acknowledgement with LF.., AF..

Procedure

Move the L/R switch back and forth once (in less than 5 seconds)

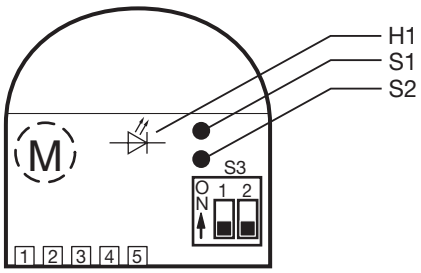


Acknowledgement with NV.., NVF..(-E), AV..

Procedure

Press the S2 button once.

Note:
If the H1 light flashes (alternately red/green) it means that you must acknowledge with the S2 button.



MP-Bus addressing by serial number

Applicable to actuators for both dampers and valves

One Bus-Master (e.g. DDC controller) can communicate with up to 8 Slaves (MFT(2) actuators) over an MP-Bus. Each node in the bus system must be clearly identifiable. Therefore, it is essential for each Slave to have its own address.

MP-Bus addressing by serial number

Individual serial numbers

Attached to each actuator when it is delivered is a label bearing its individual serial number.

Example: 09939-31234-064-008

Key

09939	Year and week
31234	Day of number
064	Family
008	Testing station

Archiving the serial number for addressing

A second detachable label bearing the identical serial number is also attached to the actuator for the following purpose:

When the actuator has been installed in a specific position in the system this second label can be detached from the actuator and stuck on to the system plan in the corresponding position. This allows each individual actuator to be traced when necessary.

When the system is being commissioned the PC-Tool can now be used to communicate with the MFT(2) actuator by means of its serial number; the MP address (1 to 8) can be assigned in this way.

Family / Type	Basic positions, factory setting	Basic positions, parameterisable
NM  **NM24-MFT(2)**	**Positions with NM.., AM.., GM..** At the first power-up, i.e. during initial commissioning or after the pushbutton has been pressed, the actuator moves to the basic position. After this, the actuator moves to the position specified by the control signal.	**Positions with NM.., AM.., GM..** Can be inverted from the factory setting.
AM  **AM24-MFT(2)**		
GM  **GM24-MFT(2)**		
LF  **LF24-MFT(2)**	**Positions with LF.., AF..** After power-up, the LF24-MFT(2) and the AF24-MFT(2) automatically acquire their safe positions (zero initialising). This process – while the actuator is stationary – takes ca. 15 seconds.	**Positions with LF.., AF..** See Basic positions
AF  **AF24-MFT(2)**		
NV  **NV24-MFT(2)**	**Positions with NV.., NVF..(-E), AV..** See Adaption (overleaf).	**Positions with NV.., NVF..(-E), AV..** See Adaption (overleaf).
NVF  **NVF24-MFT(2)(-E)**		
AV  **AV24-MFT(2)***		

Pos. D-of-R switch			Basic position	
L Ⓜ	Y = 0		ccw	End-stop left
R Ⓜ	Y = 0		cw	End-stop right

*Delivery deadline on request, from 2002

Angle-of-rotation or stroke adaption, factory setting

Angle-of-rotation adaption for damper actuators
Adaption is **not** automatic!

Stroke adaption for valve actuators (valves with 2 mechanical end-stops)
At the first power-up the stroke is adapted automatically. The available stroke (between the two mechanical end-stops of the valve) is acquired as the 100% value and stored in the micro-computer. The control signal and the running time are then adapted to suit this 100 % value.

The function can also be triggered by pressing the S2 button (under the lid of the housing).

Angle-of-rotation or stroke adaption, parameterisable

Angle-of-rotation adaption for damper actuators
Automatic adaption can be started with the PC-Tool or the MFT manual parameter assignment device. The mechanical angle-of-rotation (upper and lower end-stops) is acquired and stored in the microcomputer. The running time and the working range are adapted to the control range that is preset with MIN and MAX. The U5 measuring signal corresponds to the effective mechanical angle-of-rotation.

The function can also be triggered manually:

– NM, AM, GM: press the manual button twice

– LF, AF: move the switch from L to R and back again within 5 seconds

Stroke adaption for valve actuators (with 2 end-stops)
Adaption can be started with the PC-Tool or the MFT manual parameter assignment device.

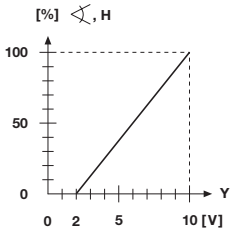
Fault alarms can only be reset with the S2 button.

Note:
In the case of valves without a second mechanical end-stop the effective value of stroke can be stored in the software; the S2 adaption button is inoperative.

(However, a test run with synchronisation is performed at the closing point).

Family / Type	Working range DC 2…10 V	Working range DC variable	Feedback U5 as modulating DC measuring signal U
NM ~~NM24-MFT(2)~~ replaced by NM24A-MP	Damper and valve actuators	Damper and valve actuators	Damper and valve actuators
AM ~~AM24-MFT(2)~~ replaced by AM24A-MP			
GM ~~GM24-MFT(2)~~ replaced by GM24A-MP			
LF LF24-MFT(2)			
AF AF24-MFT(2)			
NV NV24-MFT(2)			
NVF NVF24-MFT(2)(-E)			
AV AV24-MFT(2)*			

Diagram



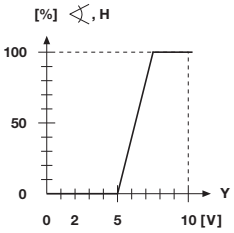
Legend:
∢, H = Angle-of-rotation or stroke

Adjustable values
Start point: DC 0.5…30 V
End point: DC 2.5…32 V

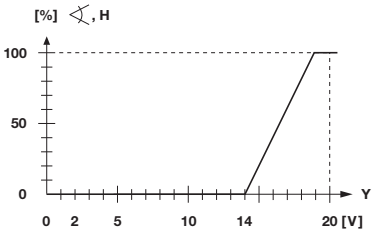
Note:

The end point must be at least 2 V above the start point.

Example 1
Preset working range DC 5...7.5 V

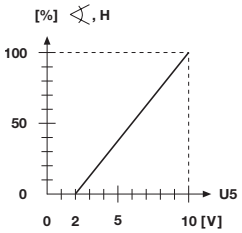


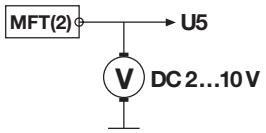
Example 2
Preset working range DC 14...19 V



Legend:
∢, H = Angle-of-rotation or stroke

Diagram
U5 = DC 2…10 V @ 0.5 mA





Legend:
∢ = Angle-of-rotation
H = Nominal stroke

*Delivery deadline on request, from 2002

U5 as modulating DC measuring signal U, variable

Damper and valve actuators

Adjustable values

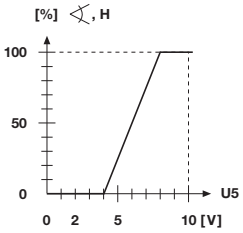
Start point: DC 0.5...8 V
End point: DC 2.5...10 V

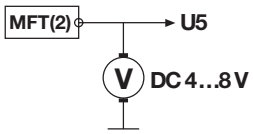
Note:

The end point must be at least 2 V above the start point.

Example

Preset working range
DC 4...8 V





Legend:

= Angle-of-rotation
H = Nominal stroke

U5 as maintenance / fault alarm

Applicable to actuators for both dampers and valves

Definable criteria

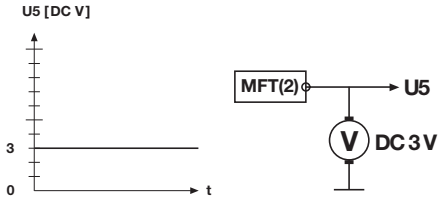
The following criteria providing an output at U5 for a maintenance or alarm signal can be defined:

- **Stop & Go-ratio**
  Actuator hunting (unstable system) can be selected for MFT(2) actuators NM, AM, GM, LF, AF
- **Mechanical overload** (set position not reached, actuator stationary) can be selected for all MFT(2) actuators
- **Actuating travel** (mechanical position changed 10%) can be selected for all MFT(2) actuators

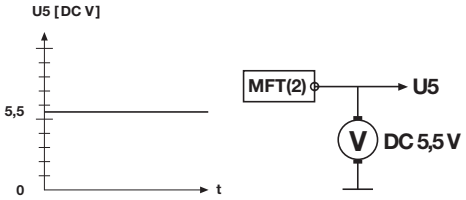
Signals:

According to whether **Maintenance** or **Fault** has been defined from the above criteria, U5 outputs the appropriate signal when the event occurs.

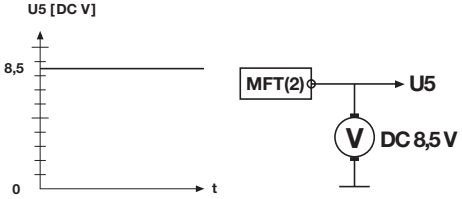
Output level for normal operation
(no maintenance or fault alarm signal)



Output level for maintenance alarm



Output level for fault alarm



⚠ **Note on damper actuators:**
For these functions, angle-of-rotation adaption must be implemented (see Page 21) when the angle-of-rotation is mechanically limited (< 95°).

⚠ **Note on valve actuators:**
When a fault alarm has been activated the red LED under the lid of the housing also lights up.

(Faults can only be reset by re-adapting with S2)

U5 as soft-switch

Damper and valve actuators

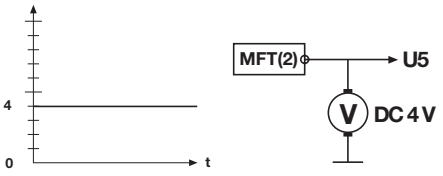
Assignment of softswitches

Softswitches can also be assigned to U5, in which case the U5 signal is converted to 3 different voltage levels; this signals the status of the 2 switches that can be selected (S1, S2).

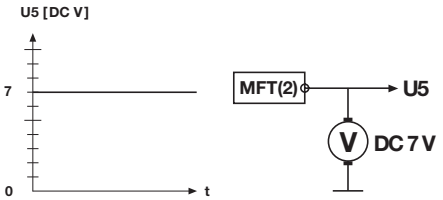
S1 and S2 can be adjusted between 1 % and 99 % angle-of-rotation (or stroke in the case of a linear actuator).

Switching levels: see following examples.

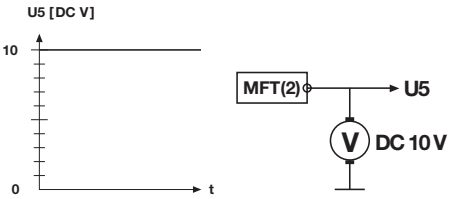
Example 1: Actuator position less than preset value of S1



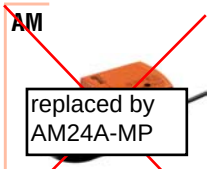
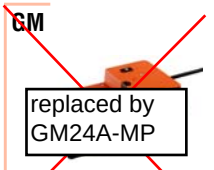
Example 2: Actuator position greater than preset value of S1 and less than value of S2



Example 3: Actuator position greater than preset value of S2



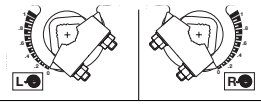
⚠ **The value of S1 must be at least 10 % less than that of S2**

Family / Type	Direction-of-rotation when Y = 0	Direction-of-rotation, reversible
NM  **NM24-MFT(2)**	Applicable to NM.., AM.., GM..	●
AM  **AM24-MFT(2)**		●
GM  **GM24-MFT(2)**		●
LF  **LF24-MFT(2)**	Applicable to LF.., AF..	●
AF  **AF24-MFT(2)**		●
NV  **NV24-MFT(2)**		
NVF  **NVF24-MFT(2)(-E)**		
AV  **AV24-MFT(2)***		

Pos. D-of-R switch

L Ⓜ	Y = 0 ↶
R Ⓜ	Y = 0 ↷

Mounting side



D-of-R switch

R L		R L	
when Y = 0	when Y = 0	when Y = 0	when Y = 0
↺	↻	↻	↺

*Delivery deadline on request, from 2002

Direction of stroke and closing point selection, factory settings

Direction of stroke and closing point selection, reversible

Applicable to NV.., NVF..(-E)

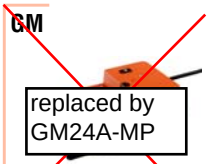
S3.1	Direction of stroke		The direction of stroke is reversed to the control signal
	Off position*		**Control signal 0% corresponds to 0 % stroke = 0 % U5**
	On position		Control signal 100 % corresponds to 0 % stroke = 0% U5
S3.2	Choice of closing point		Closing point with actuator spindle extended or retracted. The feedback signal U_5 will be set to 0% by the chosen closing point.
	Off position*	Δ	**Closing point with actuator spindle retracted**
	On position	∇	Closing point with actuator spindle extended
Only properly authorised and trained persons may change the settings of dip switches S3.			

* **Bold type** in the table means standard factory setting.

●

●

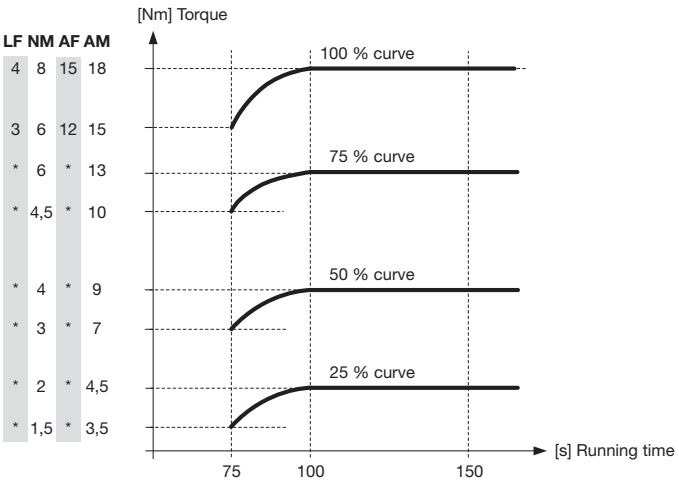
●

Family / Type	Running time, factory setting	Changing the running time
NM  **NM24-MFT(2)**	**Factory setting for NM.., AM.., GM..** 150 s	**Note: Applicable to all actuators** When the running time is changed the torque / actuating force and sound power level also change. Refer to the function curves on the next page. **Possible settings for:** NM.., AM.. 75…300 s GM.. 120…300 s
AM  **AM24-MFT(2)**		
GM  **GM24-MFT(2)**		
LF  **LF24-MFT(2)**	**Factory setting for LF..** Motor: 150 s Spring return: ≈20 s @ –20…50 °C max. 60 s @ –30 °C	**Possible settings for LF.., AF..** 75…300 s
AF  **AF24-MFT(2)**	**Factory setting for AF..** Motor: 150 s Spring return: ≈ 20 s	
NV  **NV24-MFT(2)**	**Factory setting for NV.., NVF..(-E)** 150 s	**Possible settings for NV.., NVF..(-E)** 55(95)…1200(2200) s for 10(20) mm stroke
NVF  **NVF24-MFT(2)(-E)**		
AV  **AV24-MFT(2)***	**Factory setting for AV..** 320 s *Delivery deadline on request, from 2002	**Possible settings for AV..** 170…800 s

Torque / actuating force function when changing the running time

Applicable to damper actuators

Torque function when changing the running time

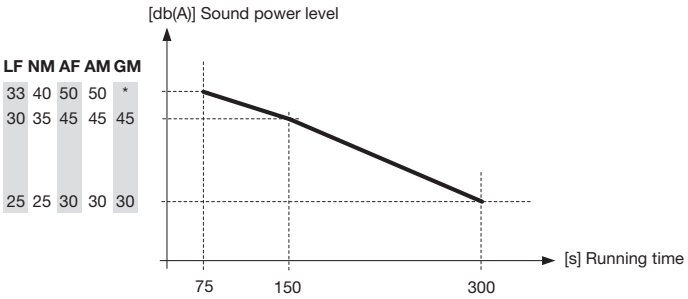


* AF and LF: Torque cannot be reduced

Sound power level function when changing the running time

Applicable to damper actuators

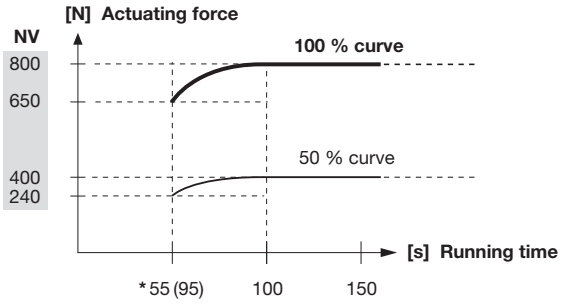
Sound power level function when changing the running time



* GM: Running time can be changed 120...300 s

Applicable to valve actuators

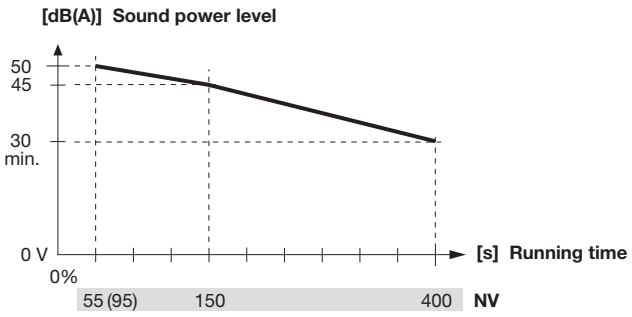
Actuating force function when changing the running time

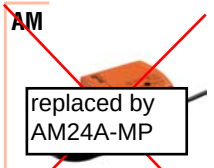
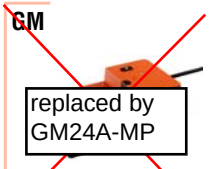


* for 10(20) mm stroke

Applicable to valve actuators

Sound power level function when changing the running time



Family / Type	Blocking torque	Torque, factory setting	Torque, adjustable	Blocking force
NM  **NM24-MFT(2)**	8 Nm	min. 8 Nm	Applicable to NM.., AM.., GM.. Torque can be reduced to 25 %, 50 %, 75 %	
AM  **AM24-MFT(2)**	15 Nm	min. 18 Nm		
GM  **GM24-MFT(2)**	30 Nm	min. 30 Nm		
LF  **LF24-MFT(2)**	4 Nm	Motor and spring return min. 4 Nm Ⓜ	Applicable to LF.., AF.. Torque **cannot** be reduced	
AF  **AF24-MFT(2)**	15 Nm	Motor and spring return min. 15 Nm Ⓜ		
NV  **NV24-MFT(2)**				
NVF  **NVF24-MFT(2)(-E)**				800 N
AV  **AV24-MFT(2)***				2000 N

*Delivery deadline on request, from 2002

Actuating force, factory setting	Actuating force, adjustable	Angle-of-rotation	Electronic angle-of-rotation limiting
		max. 95 ° mechanically limited 20…100 %	Applicable to damper actuators Electronic angle-of-rotation limiting see Page 31
		max. 95 ° mechanically limited 35…100 %	
		max. 95 ° angle-of-rotation limiting possible with accessory ZDB-GM	
		max. 95 ° mechanically limited 37…100 % or with accessory ZDB-LF	
		max. 95 ° angle-of-rotation limiting possible with accessory ZDB-AF	
Closing force 1000 N Blocking force 800 N	Can be reduced to 25 %, 50 %, 75 %		
Motor and spring return 800 N M	Actuating force and spring return **cannot** be reduced!		
2000 N	Can be reduced to 25 %, 50 %, 75 %		

Family	Override control and electronic angle-of-rotation limiting
Type	

NM

replaced by NM24A-MP

NM24-MFT(2)

AM

replaced by AM24A-MP

AM24-MFT(2)

GM

replaced by GM24A-MP

GM24-MFT(2)

LF

LF24-MFT(2)

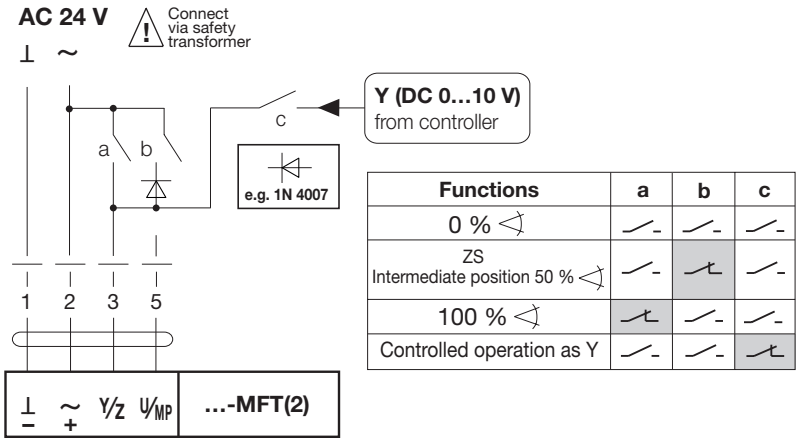
AF

AF24-MFT(2)

Override control
(referred to the full mechanical angle of rotation of 95°)

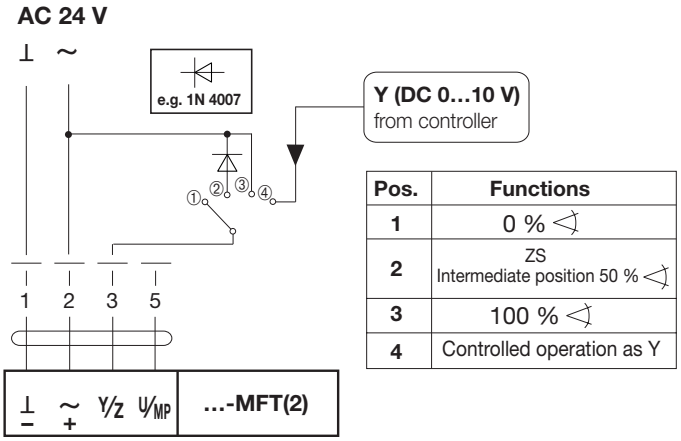
MAX (Max. position) = 100 %
MIN (Min. position) = 0 %
ZS (intermediate position) = 50 %

Diagram of override control AC 24 V (with relay contacts)



Functions	a	b	c
0 %			
ZS Intermediate position 50 %			
100 %			
Controlled operation as Y			

Diagram of override control AC 24 V (with rotary switch)



Pos.	Functions
1	0 %
2	ZS Intermediate position 50 %
3	100 %
4	Controlled operation as Y

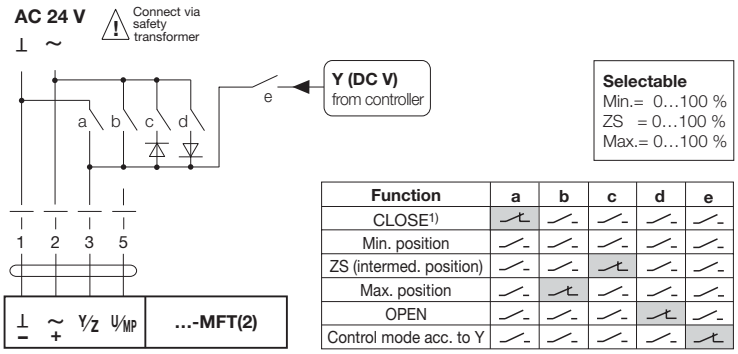
Override control and electronic angle-of-rotation limiting

Position
MAX (End of operating range)
MIN (Beginning of operating range)
ZS (Intermediate position, 0 % = MIN, 100 % = MAX)

Selectable
0…100 % from angle of rotation
0…100 % from MAX
0…100 % from control range (MIN…MAX)

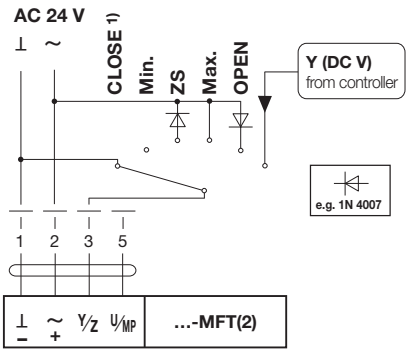
Wiring diagram for customised parameter override control with AC 24 V

With relay contacts



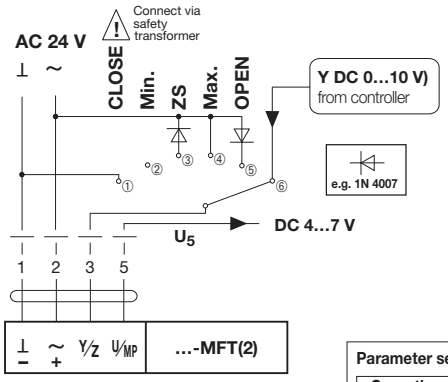
Function	a	b	c	d	e
CLOSE[1)]	t				
Min. position					
ZS (intermed. position)			t		
Max. position		t			
OPEN				t	
Control mode acc. to Y					t

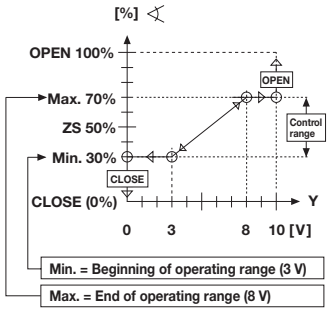
With rotary switch



1) Note! The function needs the beginning of the operating range to be set to a minimum of 0.6 V in order to be effective.

Example of override control and electronic angle of rotation limiting





Description

- In the control mode (rotary switch Pos. ⑥) the actuator runs with limiting through Min. and Max. (example: 30 %....70 %) in the control range. Note: When the Y-signal is < 0.2 V, the actuator runs in the override position CLOSE.
- When the rotary switch is set to positions ①–⑤, the actuator runs to the required position according to the appropriate override command.

Parameter settings:

Operating range	Feedback signal U5
Start = DC 3 V Finish = DC 8 V	Start = DC 4 V Finish = DC 7 V

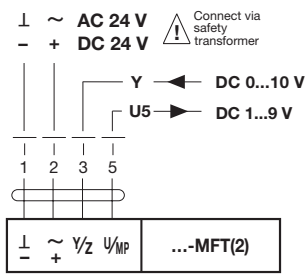
Min. (min. position)	Max. (max. position)	ZS (intermed. position)
43 % Max. (≙ 30 %-◁)	70 % ◁	50 %

Note:
The intermediate position ZS is referred to the control range set with Min. and Max.
(0 % ZS = Min. / 100 % ZS = Max.)

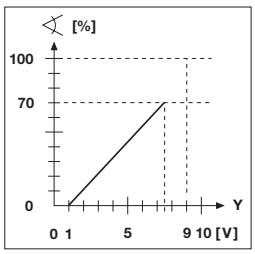
Example of feedback signal U5 with mechanically-limited angle of rotation (with and without angle of rotation setting)

Parameter settings:

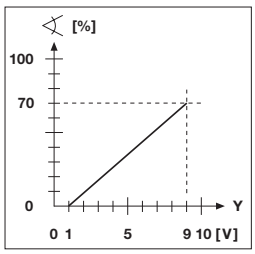
Control signal	Feedback signal U5	Angle of rotation mechanically limited by limit stops
DC 0…10 V	Start = DC 1 V Finish = DC 9 V	at 70 % ◁



a) Graph **without** angle of rotation setting

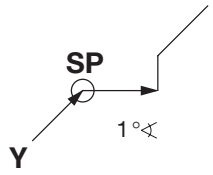
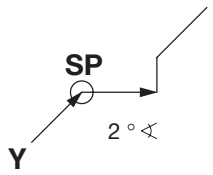
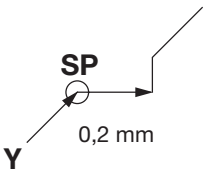
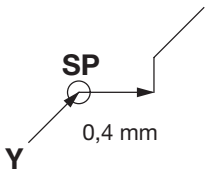


b) Graph **with** angle of rotation setting



Stroke / Response sensitivity

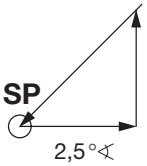
BELIMO

Family / Type	Nominal stroke	Stroke	Response sensitivity, factory setting	Response sensitivity, parameterisable
NM replaced by NM24A-MP NM24-MFT(2)			Applicable to damper actuators  normal	Applicable to damper actuators  damped
AM replaced by AM24A-MP AM24-MFT(2)				
GM replaced by GM24A-MP GM24-MFT(2)				
LF  LF24-MFT(2)				
AF  AF24-MFT(2)				
NV  NV24-MFT(2)	Applicable to NV.., NV..(-E) 20 mm	Applicable to NV.., NV..(-E) 10…20 mm	Applicable to valve actuators  normal	Applicable to valve actuators  damped
NVF  NVF24-MFT(2)(-E)				
AV  AV24-MFT(2)*	40 mm	20…40 mm		

*Delivery deadline on request, from 2002

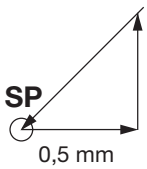
Reversal hysteresis, factory setting

Applicable to damper actuators



normal

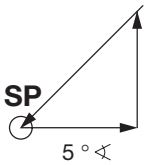
Applicable to valve actuators



normal

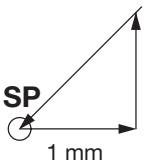
Reversal hysteresis, parameterisable

Applicable to damper actuators



damped

Applicable to valve actuators



damped

Sound power / Protection class

BELIMO

Family / Type	Sound power level, data	Sound power level, explanation	Protection class
NM  **NM24-MFT(2)**	max. 35 dB(A) @ 150 s	Applicable to actuators for both dampers and valves **Explanation** The sound power level varies with the speed or the running time (refer to the function curves on Page 27; only applicable to the sound power level from the motor). The values of sound power level emitted by spring-return actuators (LF, AF, and NVF) always remain constant.	Applicable to actuators for both dampers and valves Safety low voltage
AM  **AM24-MFT(2)**	max. 45 dB(A) @ 150 s		
GM  **GM24-MFT(2)**	max. 45 dB(A) @ 150 s		
LF  **LF24-MFT(2)**	Motor max. 30 dB(A) @ 150 s Spring ≈ 62 dB(A)		
AF  **AF24-MFT(2)**	Motor max. 45 dB(A) @ 150 s Spring ≈ 62 dB(A)		
NV  **NV24-MFT(2)**	max. 35 dB(A) @ 150 s		
NVF  **NVF24-MFT(2)(-E)**	Motor max. 35 dB(A) @ 150 s Spring ≈ 60 dB(A)		
AV  **AV24-MFT(2)***	max. 35 dB(A) @ 150 s *Delivery deadline on request, from 2002		

Degree of protection

Applicable to NM.., AM.., GM..

IP54

(bottom cable entry)

Applicable to LF.., AF.., NV.., NVF..(-E), AV

IP54

Guaranteed number of safe/emergency positions

Applicable to LF.., AF..

at least 60,000
safe positions

Applicable to NVF..(-E)

at least 60,000
emergency positions

Maintenance

Applicable to actuators for both dampers and valves

Maintenance-free

EMC

Applicable to actuators for both dampers and valves

Electromagnetic compatibility (EMC)

CE approval:

- 89/336/EEC
- 92/31/EEC
- 93/68/EEC

Family

Type

Damper actuators with basic values: Functional examples and diagrams

NM

replaced by NM24A-MP

NM24-MFT(2)

AM

replaced by AM24A-MP

AM24-MFT(2)

GM

replaced by GM24A-MP

GM24-MFT(2)

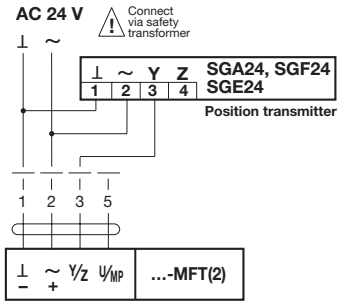
LF

LF24-MFT(2)

AF

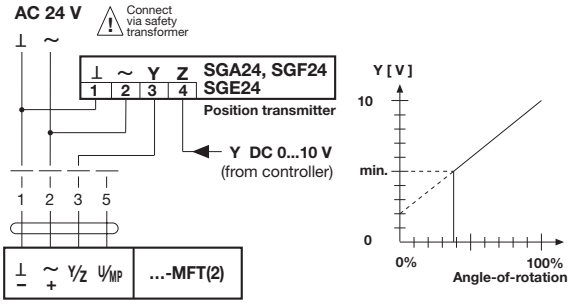
AF24-MFT(2)

Remote control 0 to 100%



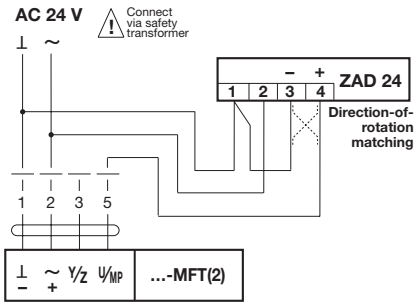
Up to 10 more actuators can be connected in parallel

Minimum limiting

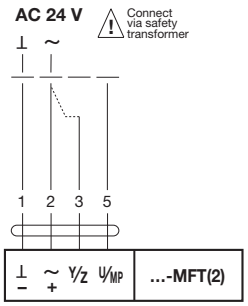


Up to 10 more actuators can be connected in parallel

Position indication



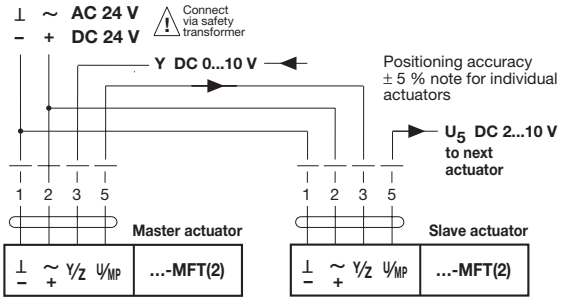
Functional check



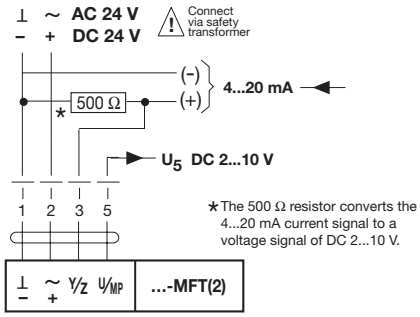
Procedure

- Apply AC 24 V to terminals 1 and 2
- Disconnect terminal 3:
  - direction-of-rotation "**L**": Aactuator rotates ccw
  - direction-of-rotation "**R**": actuator rotates cw
- Short-circuit terminals 2 and 3:
  - actuator runs ccw

Follow-up control (position-sensitive)



4 to 20 mA control via external resistance



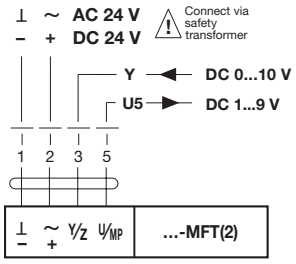
*The 500 Ω resistor converts the 4...20 mA current signal to a voltage signal of DC 2...10 V.

Custom-parameterised damper actuators: Functional examples and diagrams

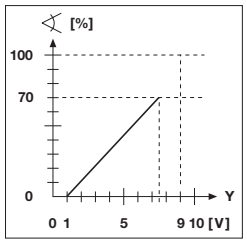
Feedback signal U5 with mechanically-limited angle of rotation (with and without angle of rotation setting)

Parameter settings:

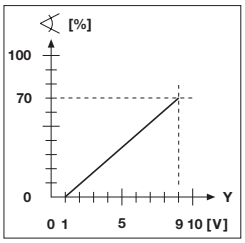
Control signal	Feedback signal U5	Angle of rotation mechanically limited by limit stops
DC 0…10 V	Start = DC 1 V Finish = DC 9 V	at 70 %



a) Graph **without** angle of rotation setting



b) Graph **with** angle of rotation setting

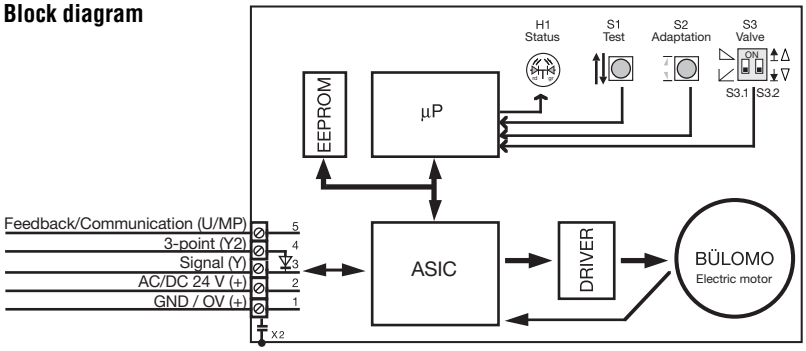


Family

Type

Descriptions and functional tables for valve actuators NV.., NV..(-E), AV..

Block diagram



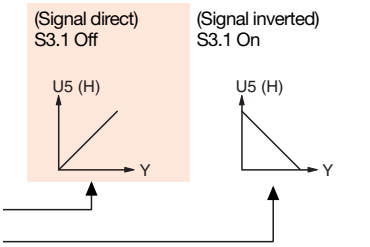
Under the cover of the actuator are the terminals for connecting the lead, the control devices S1, S2 and S3 and the LED indicator H1.The control signal is processed in the microprocessor and fed to the brushless electric motor (BÜLOMO) via the driver. By setting the dip switch S3 appropriately or by pressing push-buttons S1 and S2 it is possible to configure the actuator very simply on-site to suit actual requirements when changes from the factory settings are needed.

Functional description S

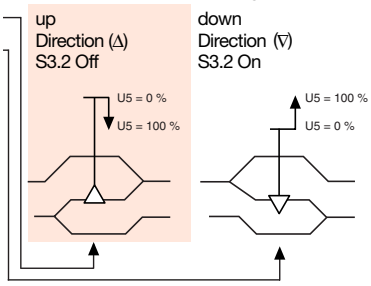
S1	Test switch	The valve performs full stroke at maximum running time and check the adapted stroke
S2	Adaptation	The stroke effected (between the two mechanical end-stops of the valve) is acquired as 100% stroke and stored in the microprocessor. The control signal and running time are then matched to this 100% stroke.
S3.1	Direction of stroke	The direction of stroke is reversed to the control signal
	Off position*	**Control signal 0% corresponds to 0% stroke = 0% U5**
	On position	Control signal 100% corresponds to 0% stroke = 0% U5
S3.2	Choice of closing point	Closing point with actuator spindle extended or retracted. The feedback signal U5 will be set to 0% by the chosen closing point.
	Off position*	**Closing point with actuator spindle retracted**
	On position	Closing point with actuator spindle extended
⚠	Only properly authorised and trained persons may change the settings of dip switch S3 and pushbutton S2.	

*Bold type in the table means standard factory setting.

Slide switch S3.1 direction-of-stroke



Slide switch S3.2 closing point



LED indicator H1

Green steady light	Actuator working properly
Green flashing light	Test run or adaptation with synchronisation in progress
Red steady light	Fault; repeat adaptation
Red flashing light	After power interruption (> 2 sec.). By the next closing movement the valve will be automatically synchronised in the chosen closing point. The LED indicator will change from a red flashing into a green steady light.
Alternate red/green flashing light	Addressing via control system and operation of adaptation pushbutton S2 in progress

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

AV

AV24-MFT(2)*

*Delivery deadline on request, from 2002

Descriptions and functional tables for valve actuators NV.., NV..(-E), AV..

Modulating

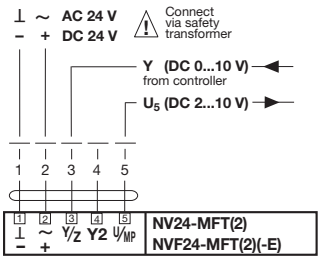


Diagram direct

inverted

Direction of valve plug	Direct signal	Inverted signal	Closing point «up»	Closing point «down»	Control signal min. (e.g. Y=2 V)	Control signal max. (e.g. Y=10 V)	Measuring signal min. (e.g. U=2V)	Measuring signal max.(e.g.U=10V)	Spindle travel:	
	S3.1		S3.2							
Δ**	Off		Off		x		x		retracts	
						x		x		extends
∇	Off			On	x		x			extends
						x		x	retracts	
	S3.1		S3.2							
Δ**		On 1)	Off		x			x		extends
						x	x		retracts	
∇		On 1)		On	x			x	retracts	
						x	x			extends

1) When the controller produces a negative signal (< 0.15 V) the slide switch S3.1 must not be set to the «On» position if the working range of the actuator has been parameterised for 2...10 V (except if the start point in the parameterised working range is 0.5 V).

Control signal Y parameterised for:
- DC 2…10 V or
- DC 0.5…10 V or
- free choice in 0.5...32 V range

U5 feedback programmed for:
- DC 2…10 V or
- DC 0.5…10 V or
- free choice in 0.5...10 V range

3-point parameterised MFT actuator

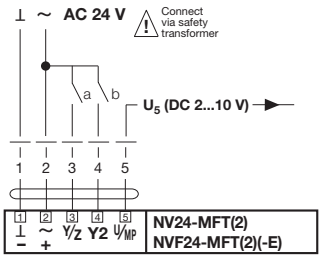


Diagram direct

inverted

Direction of valve plug	Direct signal	Inverted signal	Closing point «up»	Closing point «down»	Control contact a Y/Z	Control contact b Y2	Measuring signal min.(e.g.U=2V)	Measuring signal max.(e.g.U=10V)	Spindle travel:	
	S3.1		S3.2							
					0	0	*)	*)	stopped	stopped
Δ**	Off		Off		1	0		m		extends
					0	1	m		retracts	
∇	Off			On	1	0		m	retracts	
					0	1	m			extends
Δ**		On	Off		1	0	m		retracts	
					0	1		m		extends
∇		On		On	1	0	m			extends
					0	1		m	retracts	

***)** Measuring signal U5 according to position **m:** When control contact a or b in switch position 1 longer than running time (150 s)

3-point control is easy to implement with a 4-wire connection.
However, the linear actuator must be parameterized for 3-point control.

Override 100%

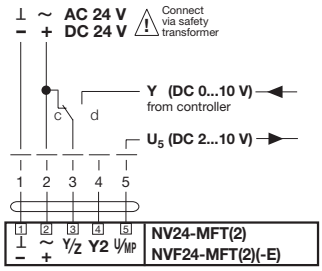


Diagram override

Direction of valve plug	Direct signal	Inverted signal	Closing point «up»	Closing point «down»	Control contact c	Control contact d	Measuring signal min.(e.g.U=2V)	Measuring signal max.(e.g.U=10V)	Spindle travel:	
	S3.1		S3.2							
Δ**	Off		Off		1	0		x		extends
		On			1	0	x		retracts	
∇	Off			On	1	0		x	retracts	
		On			1	0	x			extends

A typical use for «100 %» override control is in a frost protection circuit. Whether or not the frost thermostat has to interrupt the signal conductor to controller «d» depends on the make of controller being used (not necessary if the signal output at the controller is short-circuit-proof and protected against polarity reversal).

Emergency control function

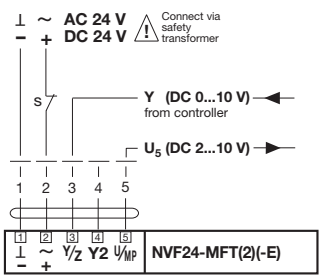


Diagram emergency control function

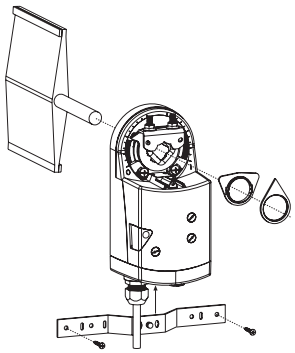
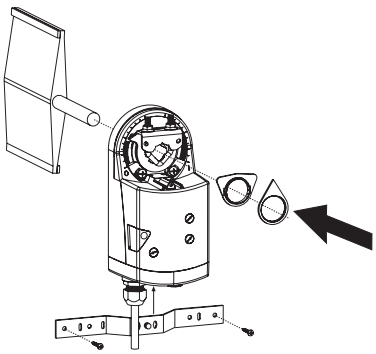
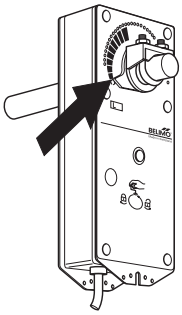
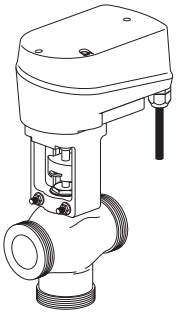
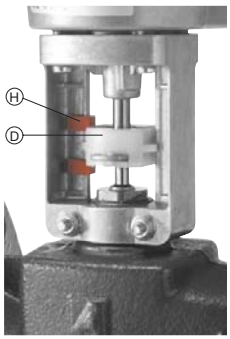
Direction of valve plug	Direct signal	Inverted signal	Closing point «up»	Closing point «down»	Control contact s		Measuring signal min.(e.g.U=2V)	Measuring signal max.(e.g.U=10V)	Spindle travel:	
	S3.1		S3.2						NVF24-MFT(2)	NVF24-MFT(2)-E
Δ**	1)		1)		0		k	k	retracts	
∇	1)		1)		0		k	k		extends

1) The position of the slide switch does not affect the direction of emergency travel
k) No measuring voltages can be acquired when de-energised

The actuator spindle runs to the end-stop when the power supply is interrupted. In the case of NVF24-MFT(2) actuators the actuator spindle retracts into the actuator housing and the *valve closes.
In the case of NVF24-MFT(2)-E actuators the actuator spindle extends from the actuator housing and the *valve opens.

* Belimo valve range H4, H5, H6, H7

****** With Belimo H4, H5, H6 and H7 valves the closing point is «up» direction of valve plug Δ).

Family / Type	Simple mounting	Mechanical position indication
NM replaced by NM24A-MP → **NM24-MFT(2)**	Applicable to damper actuators	Applicable to damper actuators
AM replaced by AM24A-MP → **AM24-MFT(2)**	**Direct mounting** Simple direct mounting on the damper spindle by means of a universal clamp. An anti-rotation device is included to prevent the unit from twisting.	**Position indication** From the spindle clamp.
GM replaced by GM24A-MP → **GM24-MFT(2)**	 Example: AM24-MFT(2)	 Example: AM24-MFT(2)
LF  **LF24-MFT(2)**		 Example: AF24-MFT(2)
AF  **AF24-MFT(2)**		
NV  **NV24-MFT(2)**	Applicable to valve actuators	Applicable to valve actuators
NVF  **NVF24-MFT(2)(-E)**	**Mounting** Simple mounting on the neck of the valve. Easy connection of valve stem and actuator spindle (no tools needed).	**Ascertaining the valve position** The position of the valve can be ascertained by means of the position indicator (D) and the two position followers (H). During commissioning, the position indicator positions the followers automatically according to the amount of valve stroke that has been executed.
AV  **AV24-MFT(2)***	 Example: NV24-MFT(2)	 Example: NV24-MFT(2)

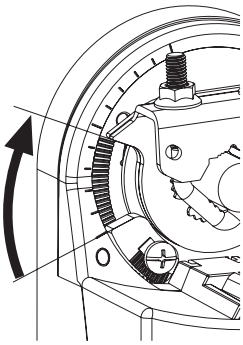
*Delivery deadline on request, from 2002

Mechanical position limiting

Applicable to damper actuators

Setting the angle-of-rotation
The angle-of-rotation can be set by means of the built-in mechanical end-stops.

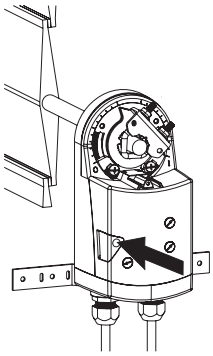
In the case of the GM24.. the ZDB-GM accessory will be needed for limiting the angle-of-rotation.



Example: AM24-MFT(2)

Manual operation

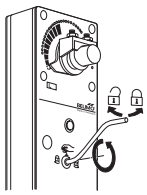
Manual operation NM.., AM.., GM..
Manual operation with self-resetting pushbutton (gearing disengaged while depressed).



Example:
AM24-MFT(2)

LF24-MFT(2): No manual operating facility

Manual operation AF24-MFT(2)
By hand crank; damper can be fixed in any position. Release is either manual or automatic by energising the power supply.



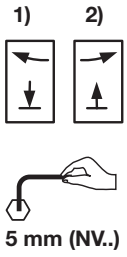
Manual operation NV.., NVF..(-E), AV..
See overleaf.

Family: Manual operation NV.., NVF..(-E)

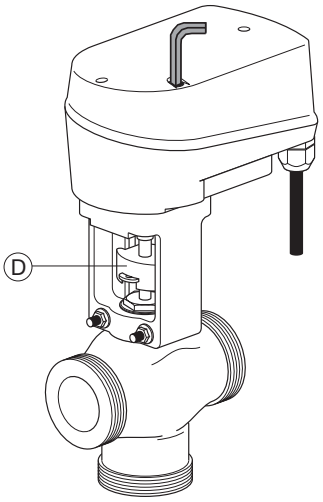
Type

When a linear actuator is supplied separately but together with a valve, the actuator spindle is extended to the ca. ¾ position. The spindle can be operated with a hexagonal key (the 5 mm [or 3/16"] hexagonal key is not included with the actuator).
The manual operating mechanism is overload-proof. The actuator spindle will remain at the manual setting until the power supply to the actuator is energised or, the next time the power supply is interrupted, it moves to whichever end stroke position has been selected.

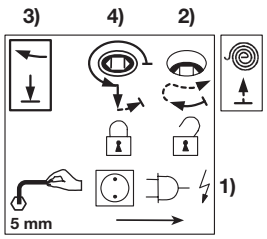
NV24-MFT(2)



Turning the hexagonal key clockwise 1) causes the actuator spindle to extend; turning it counter-clockwise 2) causes it to retract.



NVF24-MFT(2)



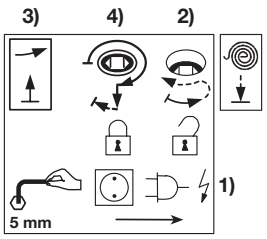
1) Isolate the actuator from the power supply

2) Disengaging manual operation of the NVF24-MFT(2)
Turn the hexagonal key clockwise through ca. 45° until resistance is encountered. Then lift the key (ca. 7 mm) until the black socket for the key is level with the top of the housing cover. The spring mechanism will now rotate the key counter-clockwise and the actuator spindle will retract.

3) Manual operation of the NVF24-MFT(2)
Turning the hexagonal key clockwise causes the actuator spindle to extend; it must be stopped at the required position of stroke.

4) Locking manual operation of the NVF24-MFT(2)
Turn the hexagonal key back ¾ turn counter-clockwise and then press it down into the cover of the housing (the black socket will move inwards ca. 7 mm). Slight counter-clockwise rotation of the key will then lock the manual operating mechanism in position.

NVF24-MFT(2)-E



1) Isolate the actuator from the power supply

2) Disengaging manual operation of the NVF24-MFT(2)-E
Turn the hexagonal key counter-clockwise through ca. 45° until resistance is encountered. Then lift the key (ca. 7 mm) until the black socket for the key is level with the top of the housing cover. The spring mechanism will now rotate the key clockwise, the actuator spindle will extend fully, the postion indicator (D) will move down and the valve can be coupled up.

3) Manual operation of the NVF24-MFT(2)-E
Turning the hexagonal key counterclockwise causes the actuator spindle to retract; it must be stopped at the required position of stroke.

4) Locking manual operation of the NVF24-MFT(2)-E
Turn the hexagonal key back ¾ turn clockwise and then press it down into the cover of the housing (the black socket will move inwards ca. 7 mm). Slight clockwise rotation of the key will then lock the manual operating mechanism in position.

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

Family / Type	Nominal voltage AC 24 V 50/60 Hz DC 24 V	Nominal voltage range AC 19,2…28,8 V DC 21,6…35,0 V	For wire sizing
NM replaced by NM24A-MP **NM24-MFT(2)**	●	●	3 VA Imax 5.8 A @ 5 ms
AM replaced by AM24A-MP **AM24-MFT(2)**	●	●	5 VA Imax 8.3 A @ 5 ms
GM replaced by GM24A-MP **GM24-MFT(2)**	●	●	8 VA Imax 8.3 A @ 5 ms
LF  **LF24-MFT(2)**	●	●	5 VA Imax 5.8 A @ 5 ms
AF  **AF24-MFT(2)**	●	●	10 VA Imax 8.3 A @ 5 ms
NV  **NV24-MFT(2)**	●	●	5 VA Imax 8.3 A @ 5 ms
NVF  **NVF24-MFT(2)(-E)**	●	●	10 VA Imax 8.3 A @ 5 ms
AV  **AV24-MFT(2)***	●	●	7 VA

*Delivery deadline on request, from 2002

Family / Type	Power consumption	Connection	Cable gland
NM  **NM24-MFT(2)**	Operating: 1.3 W Stationary: 0.5 W	Lead 1 m 4 x 0.75 mm²	not needed
AM  **AM24-MFT(2)**	Operating: 2.5 W Stationary: 1.2 W	Lead 1 m, 4 x 0.75 mm² (Direct connection via screw terminals for 2 x 1.5 mm² leads possible)	1 x Pg11 for 6...7 mm dia. leads included
GM  **GM24-MFT(2)**	Operating: 3.6 W Stationary: 2 W	Lead 1 m 4 x 0.75 mm²	not needed
LF  **LF24-MFT(2)**	Operating: 2.5 W Stationary: 1 W	Lead 1 m 4 x 0.75 mm²	not needed
AF  **AF24-MFT(2)**	Operating: 6 W Stationary: 2.5 W	Lead 1 m 4 x 0.75 mm²	not needed
NV  **NV24-MFT(2)**	Operating: 3 W	Lead 1 m, 5 x 0.75 mm² (Direct connection via screw terminals for 2 x 1.5 mm² leads possible)	1 x Pg11 for 6...7.9 mm dia. leads included
NVF  **NVF24-MFT(2)(-E)**	Operating: 5.5 W	Lead 1 m, 5 x 0.75 mm² (Direct connection via screw terminals for 2 x 1.5 mm² or 1 x 2.5 mm² leads possible)	1 x Pg11 for 6...7.9 mm dia. leads included
AV  **AV24-MFT(2)***	Operating: 5 W	Lead 1 m, 5 x 0.75 mm² (Direct connection via screw terminals for 2 x 1.5 mm² or 1 x 2.5 mm² leads possible)	1 x Pg11 for 6...7.9 mm dia. leads included

*Delivery deadline on request, from 2002

Weight	Ambient temp. range	Non-operating temp.	Humidity test
	Applicable to damper actuators	Applicable to all actuators	Applicable to damper actuators
900 g	−30…+50 °C	−40…+80 °C	to EN 60335-1
1300 g			
2000 g			
1400 g			
2800 g			
	Applicable to valve actuators		Applicable to valve actuators
1500 g (without globe valve)	0…+50 °C		to EN 60730-1
1800 g (without globe valve)			
2900 g (without globe valve)			

Family / Type	Dimensions

NM

replaced by NM24A-MP

NM24-MFT(2)

AM

replaced by AM24A-MP

AM24-MFT(2)

GM

replaced by GM24A-MP

GM24-MFT(2)

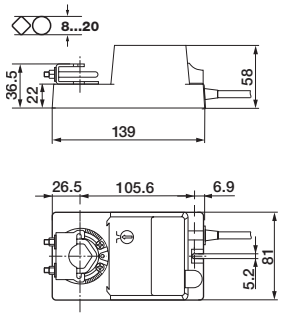
LF

LF24-MFT(2)

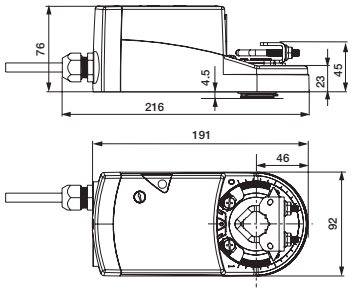
AF

AF24-MFT(2)

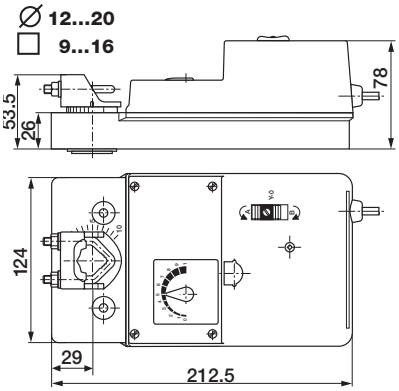
Dimensions damper actuators



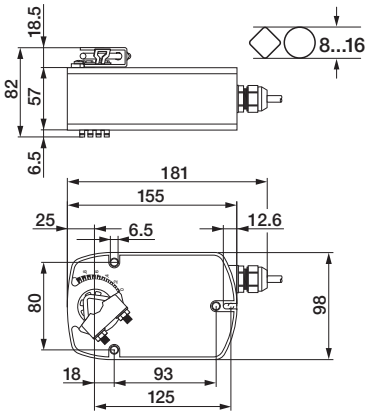
NM..



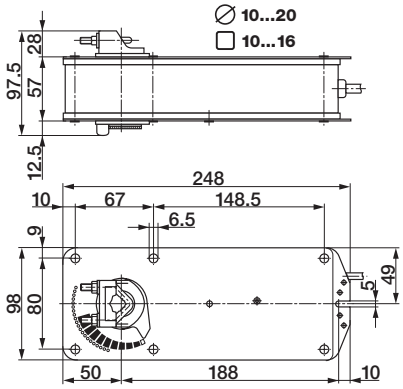
AM..



GM..



LF..



AF..

Dimensions valve actuators

NV

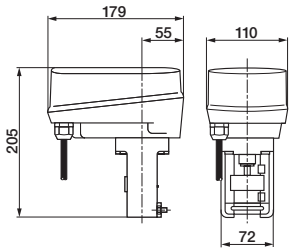
NV24-MFT(2)

NVF

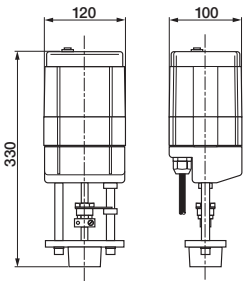
NVF24-MFT(2)(-E)

AV

AV24-MFT(2)*



NV., NVF..(-E) with UNV-002



AV..

*Delivery deadline on request, from 2002

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

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

Contact the following for further information:

Belimo Headquarters

CH BELIMO Holding AG
Brunnenbachstrasse 1
8340 Hinwil, Switzerland
Tel. +41 (0)43 843 61 11
Telefax +41 (0)43 843 62 68
E-Mail: info@belimo.ch
Internet: www.belimo.ch

Belimo Subsidiaries

AT/ HR/ HU/ SK/ SL BELIMO Automation
Handelsgesellschaft m.b.H.
Geiselbergstrasse 26–32
1110 Wien, Austria
Tel. +43 (0)1 749 03 61-0
Telefax +43 (0)1 749 03 61-99
E-Mail: info@belimo.at

AU BELIMO Actuators Pty. Ltd.
Unit 10, 266 Osborne Avenue
Clayton South, VIC 3169
Australia
Tel. +61 (0)3 9551 0201
Telefax +61 (0)3 9551 0215
E-Mail:
belimo@belimoactuators.com

CA BELIMO Aircontrols (CAN), Inc.
5716 Coopers Ave., Units 14&15
Mississauga, Ontario L4Z 2E8
Canada
Tel. +1 (1)905 712 31 18
Telefax +1 (1)905 712 31 24
E-Mail: webmaster@belimo.com

CH BELIMO Automation AG
Sales Switzerland
Brunnenbachstrasse 1
8340 Hinwil, Switzerland
Tel. +41 (0)43 843 62 12
Telefax +41 (0)43 843 62 66
E-Mail: info@belimo.ch
Internet: www.belimo.ch

DE BELIMO Stellantriebe
Vertriebs GmbH
Welfenstr. 27, Postfach 72 02 30
70599 Stuttgart, Germany
Tel. +49 (0)711 1 67 83-0
Telefax +49 (0)711 1 67 83-73
E-Mail: info@belimo.de
Internet: http://www.belimo.de

ES BELIMO Ibérica
de Servomotores, S.A.
C/San Romualdo, 12–14
28037 Madrid, Spain
Tel. +34 91 304 11 11
Telefax +34 91 327 25 39
E-Mail: info@belimo.es

FR BELIMO Servomoteurs
Z.A. de Courtry
33, Rue de la Régale
77181 Courtry, France
Tél. +33 (0)1 64 72 83 70
Téléfax +33 (0)1 64 72 94 09
E-Mail: mail@belimo.fr

GB BELIMO Automation UK Limited
The Lion Centre
Hampton Road West
Feltham, Middlesex, Great Britain
TW 13 6DS
Tel. +44 (0)20 8755 4411
Telefax +44 (0)20 8755 4042
E-Mail: belimo@belimo.co.uk

HK BELIMO Actuators Ltd.
Room 208, 2/F
New Commerce Centre
19 On Sum Street, Shatin, N.T.
Hong Kong
Tel. +852 26 87 17 16
Telefax +852 26 87 17 95
E-Mail: info@belimo.com.hk

PL BELIMO Silowniki S.A.
ul. Zagadki 21
02-227 Warszawa, Poland
Tel. +48 (0)22 886 53 05
Telefax +48 (0)22 886 53 08
E-Mail: info@belimo.pl

SG BELIMO Actuators Pte Ltd
2, Jurong East Street 21
#04-31F IMM Building
Singapore 609601
Tel. +65 6564 9828
Telefax +65 6564 9038
E-Mail: info@belimo.com.sg

US BELIMO Aircontrols (USA), Inc.
43 Old Ridgebury Road
P.O. Box 2928
Danbury, CT 06810 USA
Tel. +1 (1)203 791 99 15
Telefax +1 (1)203 792 29 67
E-Mail: webmaster@belimo.com
Internet: www.belimo.com

Belimo Representatives and Agencies

AE BELIMO Automation
Middle East Office
P.O. Box 55427
Dubai, U.A.E.
Tel. +971 (0)4 387 417
Telefax +971 (0)4 387 415
E-Mail:
belimome@emirates.net.ae

BG BELIMO Bulgaria Ltd.
j.k. Lagera, 3 Smolyanska Str.
bl. 56, entr. B, ap. 50
1612 Sofia, Bulgaria
Tel. +3592 952 3470/1
Telefax +3592 545 995
E-Mail: belimo@intech.bg

CN BELIMO Actuators Ltd.
18 FA3, 585 Longhua West-Road
200232 Shanghai, China
Tel. +86 21 6469 2895
Telefax +86 21 6469 2909
E-Mail: shanghai@belimo.com.hk

CN BELIMO Beijing
Rm 605, Beijing Hai Chang
Edifice, 44, Liang Ma Qiao Road
Chao Yang District
100016 Beijing, China
Tel. +86 10 6462 1382
Telefax +86 10 6462 1383
E-Mail: beijing@belimo.com.hk

CY R.E.S. Ltd.
P.O. Box 8297
Nicosia, Cyprus
Tel. +357 (0)2 51 10 07
Telefax +357 (0)2 49 65 47
E-Mail:
reliance@spidernet.com.cy

CZ BELIMO CZ (Ing. Ivar Mentzl)
Charkovská 16
10100 Praha 10, Czech Republic
Tel. +420 (0)2 717 4 0 311
Telefax +420 (0)2 717 43 057
E-Mail: info@belimo.cz

DK BELIMO A/S
Thomas Helstedsvej 7A
8660 Skanderborg, Denmark
Tel. +45 86 52 44 00
Telefax +45 86 52 44 88
E-Mail: info@belimo.dk

EE BELIMO Balticum AS
Töri 10 d
11313 Tallinn, Estonia
Tel. +372 6 140 811
Telefax +372 6 140 812
E-Mail: info@belimo.ee

FI Oy Suomen BELIMO Ab
Insinöörinkatu 2
00880 Helsinki, Finland
Tel. +358 (0)9 75 11 65 00
Telefax +358 (0)9 75 11 65 31
E-Mail: belimo@belimo.fi

GR BELIMO Air Controls
29, Tagm. Plessa, Kallithea
GR 17674 Athens, Greece
Tel. +30 (0)1 94 00 766
Telefax +30 (0)1 94 00 767
E-Mail: belimogr@tee.gr

IE Safegard Systems Ltd.
Systems House, Unit 34
Southern Cross Business Park
Bray, Co Wicklow, Ireland
Tel. +353 (0)1 2761600
Telefax +353 (0)1 2761611
E-Mail: info@safegard.ie

IL Shemer Representations
P.O. Box 296
56101 Yehud, Israel
Tel. +972 3 536 51 67
Telefax +972 3 536 05 81
E-Mail: shemer@shemerep.co.il

IN BELIMO Vitek Air Controls
C-114 Lancelot, First Floor
S.V. Road, Borivali (West)
Mumbai 400 092, India
Tel. +91 22 806 21 63
Telefax +91 22 806 21 63
E-Mail: bvac@bom2.vsnl.net.in

IS Hitatækni ehf.
Langholtsvegi 109
104 Reykjavik, Iceland
Tel. +354 5 88 60 70
Telefax +354 5 88 60 71
E-Mail: fridmar@hitataekni.is

IT BELIMO Servomotori S.r.l.
Via Stezzano, 5
24050 Zanica BG, Italy
Tel. +39 035 67 26 82
Telefax +39 035 67 02 00
E-Mail: info@belimo.it

KR HANMO Corporation
3rd Floor, Yeosam Bldg. 648-23
Gangnam-Ku, Seoul, Korea
Tel. +822 3453 8225
Telefax +822 3453 8228

LB Energy Center (EC)
Hamra, Leon Street, Shatilla,
Bldg. 4th Floor,
P.O. Box 113-6955
Beirut, Lebanon
Tel. +961 (0)1 35 38 23
Telefax +961 (0)1 35 38 23
E-Mail:
belimome@emirates.net.ae

NL/ BE/ LU BELIMO Servomotoren BV
BENELUX
Postbus 300, 8160 AH Epe
Radeweg 25, 8171 MD Vaassen
Netherlands
Tel. +31 5 78 57 68 36
Telefax +31 5 78 57 69 15
E-Mail: info@belimo.nl

NO BELIMO Spjeldmotorer A/S
Konowsgate 5
0192 Oslo 1, Norway
Tel. +47 22 70 71 71
Telefax +47 22 70 71 70
E-Mail: info@belimo.no

PH BELIMO Actuators Philippines
Rm.# 507 Anita Build., 5th Floor
1300 Quezon Ave.,Cor.South Ave.
1103 Quezon City, Philippines
Tel. +63 (2) 373 5440
Telefax +63 (2) 373 5424
E-Mail: philippines@belimo.com.hk

RO SC Mano Construct srl
Str. Cameliei nr 5, sector 1
Bucuresti, Romania
Tel. +40 212 126 993
Telefax +40 212 126 995
E-Mail: manoconstruct@fx.ro

RU BELIMO Servomotors
Russia Ltd.
Nizhnyaya Pervomaiskaya,
46 Bld.1, Office 303
105203 Moscow, Russia
Tel. +7 095 965 74 64
Telefax +7 095 965 74 73
E-Mail: belimo.russia@mtu-net.ru

SE BELIMO Spjällmotorer AB
Hägerstens Allé 88
129 37 Hägersten, Sweden
Tel. +46 (0)8 88 07 00
Telefax +46 (0)8 97 85 75
E-Mail: info@belimo.se

SY Philippe A. Jebran
P.O. Box 7791
Damascus, Syria
Tel. +963 11 231 6586
Telefax +963 11 231 4052
E-Mail:
belimome@emirates.net.ae

TR BELIMO Otomasyon A.S.
Keyap Sitesi No. 20
TR-81260 Y Dudullu
Istanbul, Turkey
Tel. +90 216 527 98 70
Telefax +90 216 527 98 71
E-Mail: info@belimo.com.tr

TW Chianseng Enterprise Co. Ltd.
2F, No. 21, Tong Fong Street
Taipei, Taiwan
Tel. +886 2 27 08 77 80
Telefax +886 2 27 02 90 90
E-Mail: taiwan@belimo.com.hk

UA BELIMO Ukraine S.A.R.
34-A, Ul. Yurkovskaya, Appt.№ 2
254080 Kiev, Ukraine
Tel./Telefax +380 44 463 7586
E-Mail: comaster@belimo.kiev.ua

ZA BELIMO Actuators Southern Africa cc
P. O. Box 2483
Alberton 1450, South Africa
Tel. +27 (0)11 868 5681
Telefax +27 (0)11 900 2673
E-Mail: belimo@mega.co.za

ENG – 11.02 • PDF KONKRET SUPPORT_rev.Belimo • Subject to technical changes