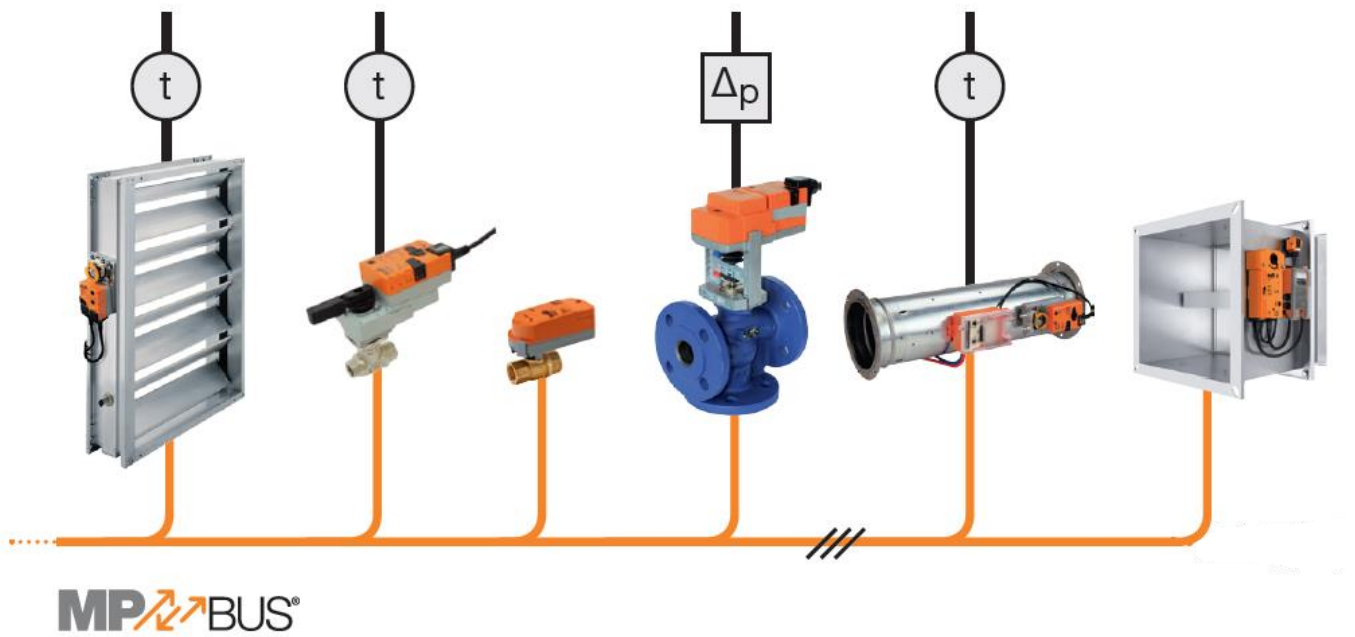


Introduction to MP-Bus Technology



Content

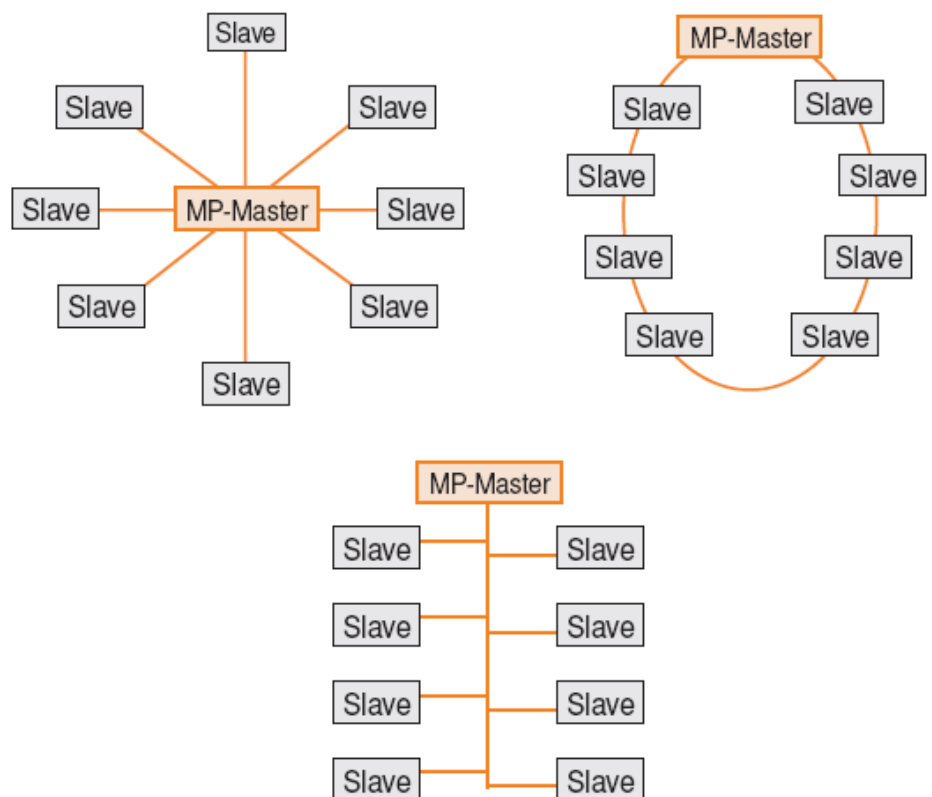
1. Introduction to MP-Bus Technology	3
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1. Introduction to MP-Bus Technology

- MP-Bus** The MP-Bus is the BELIMO master/slave bus. Up to 8 slaves can be connected to a MP-Master unit. By using exclusively actuators with the latest technology (e.g. ...MPL) up to 16 devices can be connected. The specifications of the respective MP partner apply.
- MP node** Umbrella term for MP capable actuators, sensors and sensor/actuator combinations (e.g. EnergyValve™, 6-Way-EPIV).

2. Network topologies

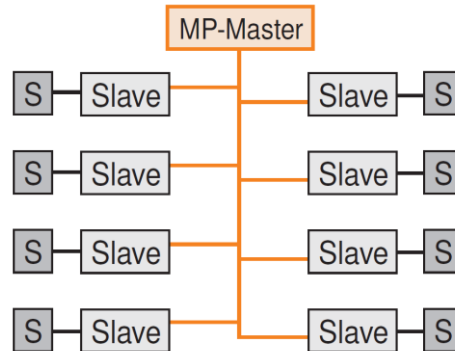
There are no restrictions with respect to network topology. Allowed topologies include star, ring, tree and mixed configurations.



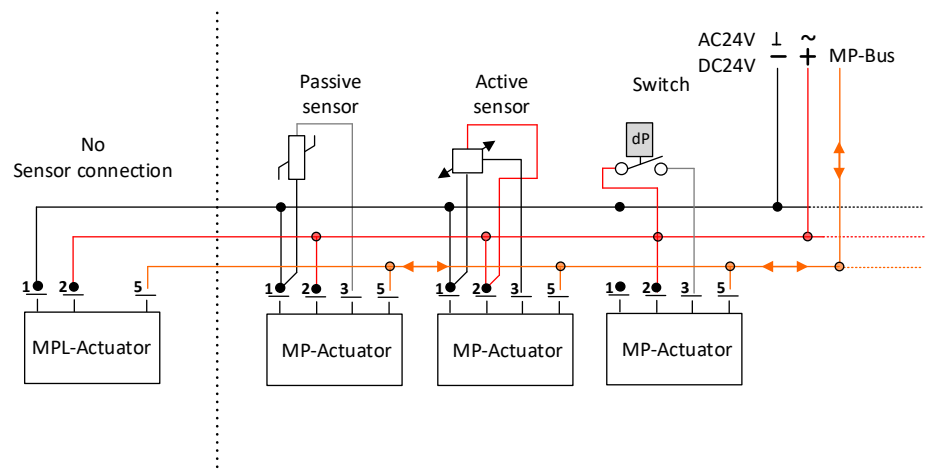
3. Sensor connection

One sensor can be connected per MP node in MP-Bus operation. The sensor value is measured with its raw value (Ω , mA, 0/1) digitised by the MP-node and transferred to the MP-Bus. The scaling and evaluation of the sensor value takes place in the MP-Master respectively DDC-controller.

Active sensors (outputs 0 ... 10 V DC) and switches (0/1) can be connected to the MP nodes. In addition, passive resistance sensors (e.g. Pt1000, NTC10K) can be connected. The respective product information / data sheet of the MP node must be observed.



Sensor connection



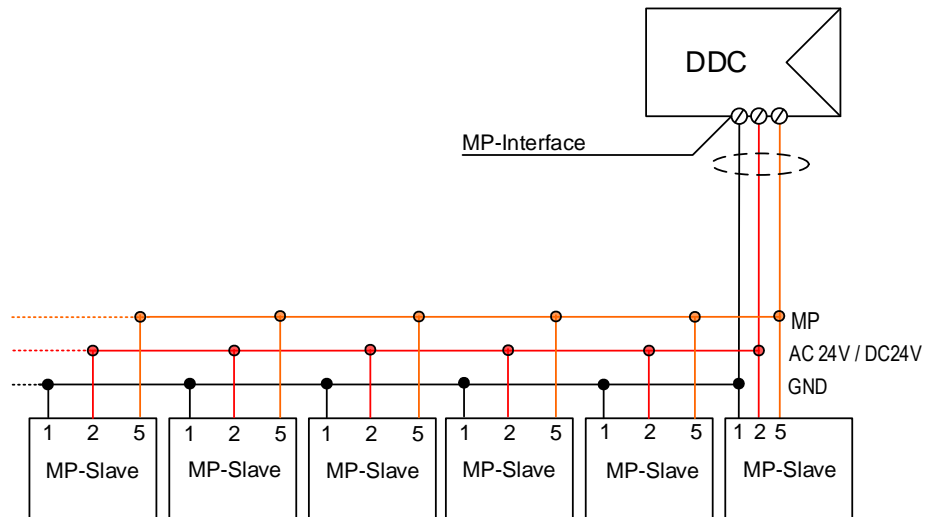
Restrictions

- MPL actuators** These actuator types do not have any options for a sensor connection
- 2-Way-EPIV** On actuator types with the designation EP..R + MP / EP..R-KMP as well P6..W ..- MP / P6..W ..- KMP, no passive sensors can be connected.

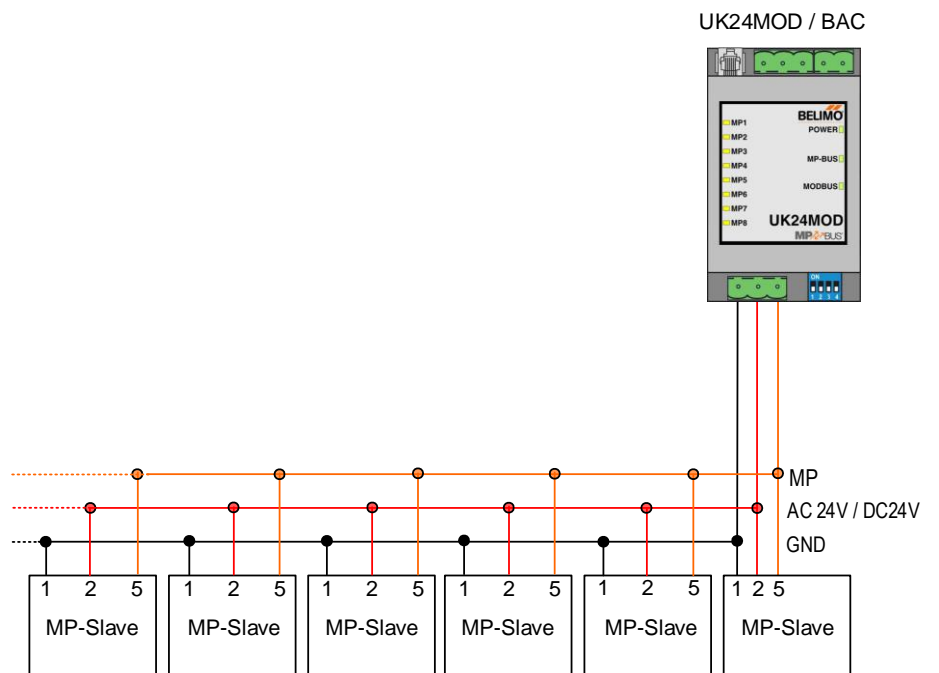
4. Connection to MP-Master

Definition MP-Master are MP co-operation nodes (PLC or DDC controller with MP interface), e.g. Wago, Saia-Burgess, etc., or MP gateways (for connection to a field bus system) e.g. UK24MOD, UK24BAC etc. The Belimo PC-Tool MFT-P is also an MP-Master.

MP-Partner solution



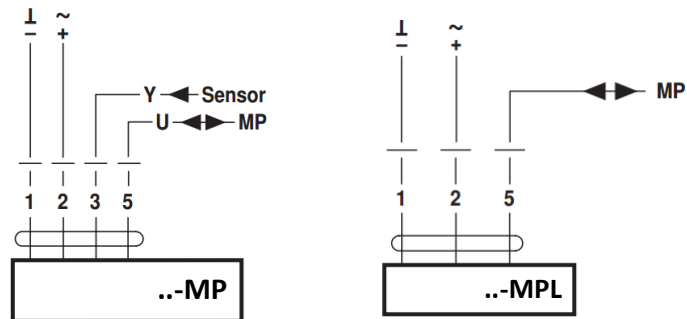
Belimo MP gateway



4.1 Connection MP nodes

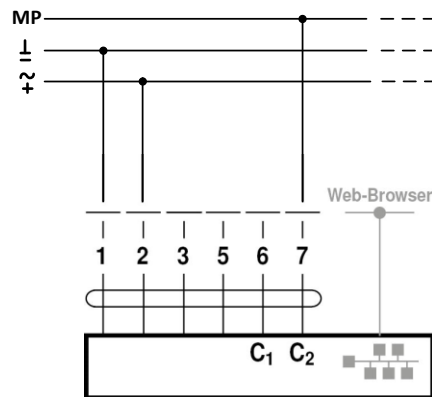
Standard The connection of MP nodes usually takes place on the basis of the connections
 Wire 1 GND / black
 Wire 2 24V / red
 Wire 5 MP / orange

MP(L) actuators

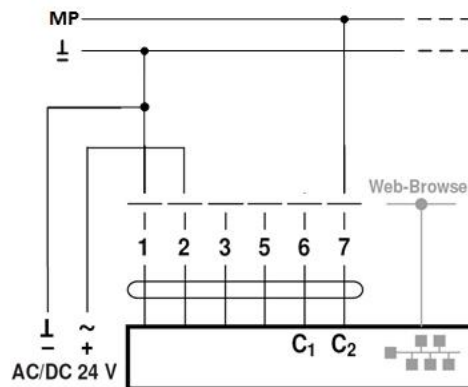


Exceptions The connection of some actuator types differs from the standard MP nodes. Therefore, please refer to the product-specific data sheet. Below are some examples.

EnergyValve™

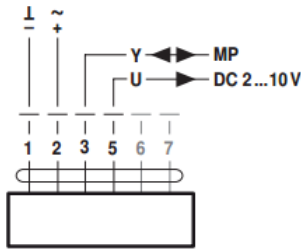


EnergyValve™
with local power supply

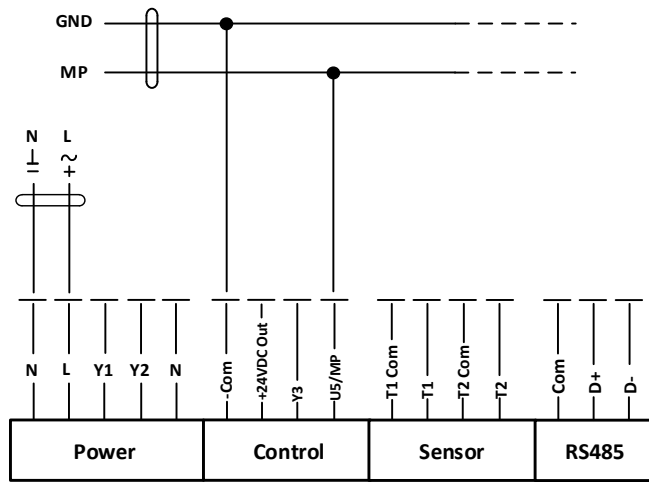


4.1 Connection MP nodes (Continuation)

6-Way EPIV

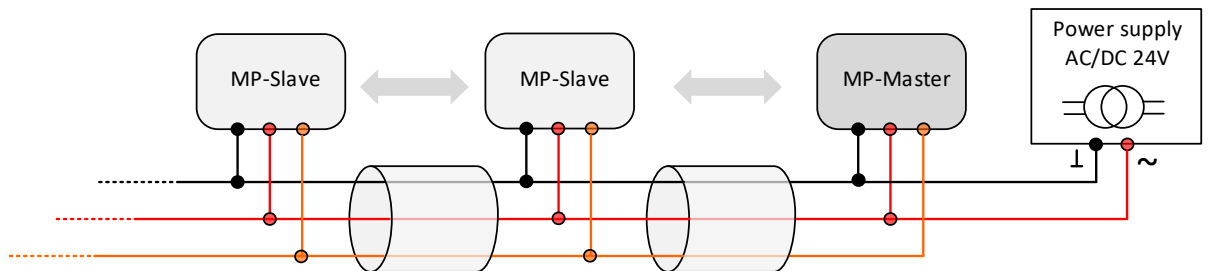


PR..A-S2-BAC



5. Cable

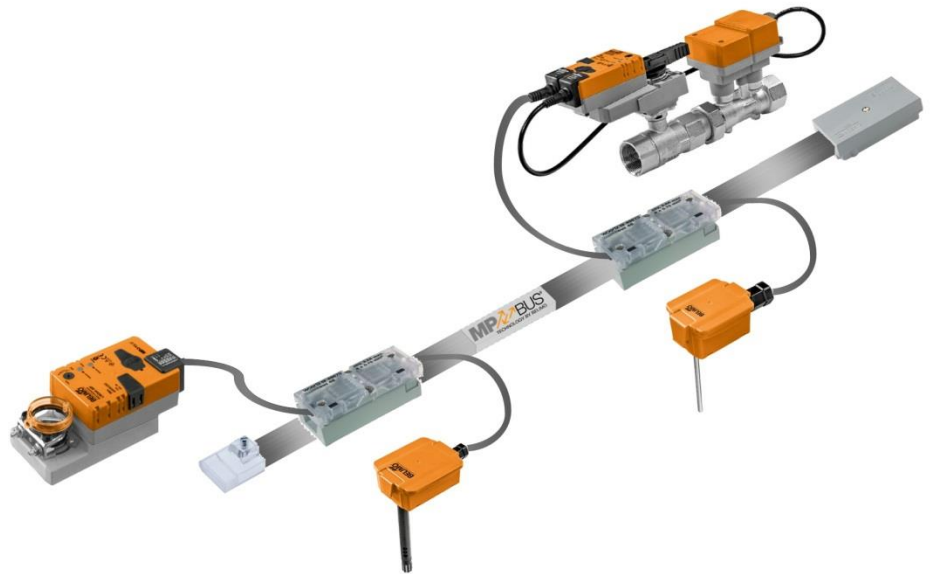
Communication and supply for the MP-Bus can be carried in the same cable. The power supply of the MP nodes is secured with GND and 24V AC or DC. The MP Master communicates with the connected nodes via the MP communication wire, which is referenced to the same GND as the voltage supply.



Neither special cables nor terminating resistors are required. An MP-Bus connection can be set up with commercially available installation cables. However, special bus cables are available for simplified installation.

Example Flat ribbon cable

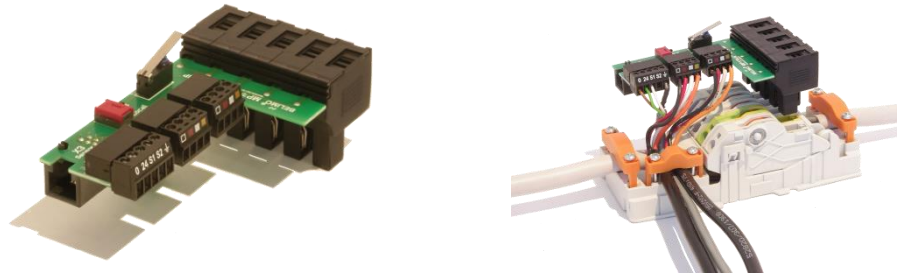
Flat ribbon cable from the company Woertz with adapter for the MP-bus connection of MP nodes and sensors.



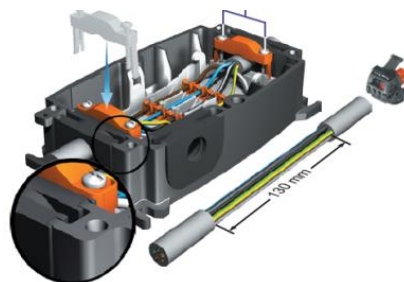
Contact www.woertz.ch

5. Cable (Continuation)**Example connection board**

With the connection board ZFP2-MP, it is possible to connect 2 MP nodes, including 2 sensors, to the MP-Bus by using connectors. Prefabricated and color-coded connectors on the MP nodes prevent wiring errors and ensure faster installation and commissioning. Via the RJ12 diagnostic connector, it is possible to parameterize or check the MP nodes independently of the MP-Bus.



The connection board is optionally installed together with the wiring box EXT-WR-FP20-MP (IP20) or EXT-WR-FP65-MP (IP65).



For further information on the connection board and wiring box, see www.belimo.eu

6. Cable lengths

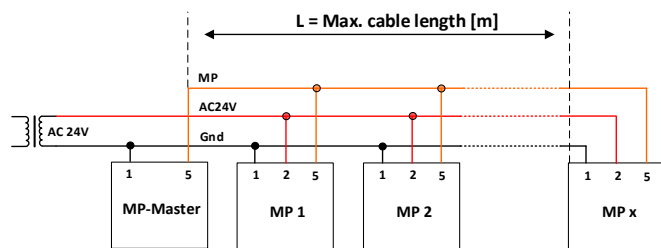
Definition cable length

The cable length of an MP network is limited by:

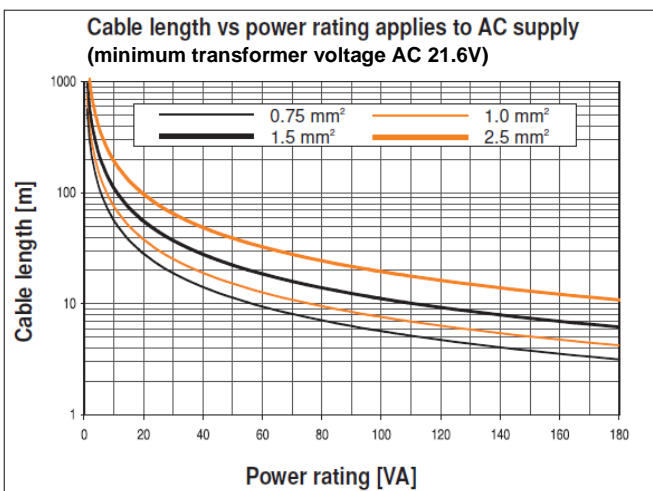
- the sum of the power consumption of each connected MP node
- the type of power supply (24V AC or DC over the Bus)
- the selection of the cable diameter

For the calculation of the maximum cable length, the Belimo [MP wiring calculator](#) is available on the Belimo website for the complete MP-Bus range.

Maximum cable length for AC 24 V supply



Total power rating MP nodes [VA]



Calculation of the maximum cable lengths

The power rating [VA] of each MP node has to be added, and the corresponding cable lengths are to be read from the diagram.

Example:

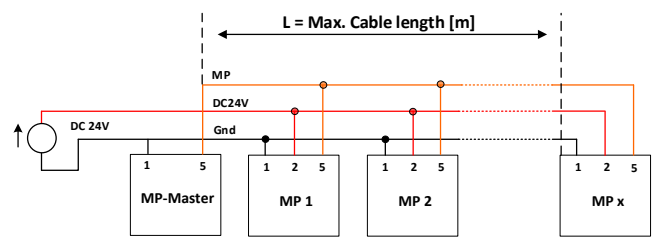
The following is connected to the MP-Bus: 1 x NM24A-MP, 1 x SM24A-MP, 1 x LMV-D3-MP... and 1 x NV24-MP-TPC

Total power rating:
 $5,5VA+6VA+4VA+4,5VA = 20VA$

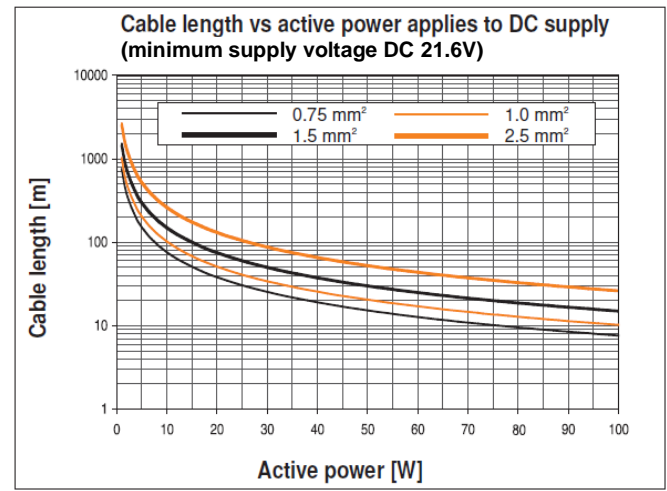
To be read out from the mass of curves:

- Cables with wire $\varnothing 0.75mm^2$: **Cable length 30 m**
- Cables with wire $\varnothing 1,0mm^2$: **Cable length 40 m**
- Cables with wire $\varnothing 1,5mm^2$: **Cable length 60 m**
- Cables with wire $\varnothing 2.5mm^2$: **Cable length 100 m**

Maximum cable length for DC 24 V supply



Total power consumption MP nodes [W]



Calculation of the maximum cable lengths

The power consumption [W] of each MP node has to be added, and the corresponding cable lengths are to be read from the diagram.

Example:

The following is connected to the MP-Bus: 1 x NM24A-MP, 1 x SM24A-MP, 1 x LMV-D3-MP... and 1 x NV24-MP-TPC

Total power rating:
 $3,5W+4W+2W+3W = 12,5W$

To be read out from the mass of curves::

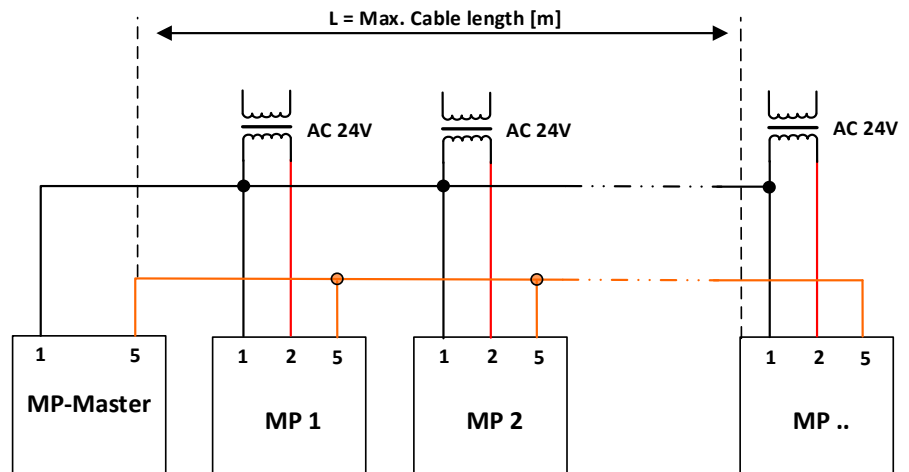
- Cables with wire $\varnothing 0.75mm^2$: **Cable length 60 m**
- Cables with wire $\varnothing 1,0mm^2$: **Cable length 80 m**
- Cables with wire $\varnothing 1,5mm^2$: **Cable length 120 m**
- Cables with wire $\varnothing 2.5mm^2$: **Cable length 180 m**

6. Cable lengths (Continuation)

On-site supply

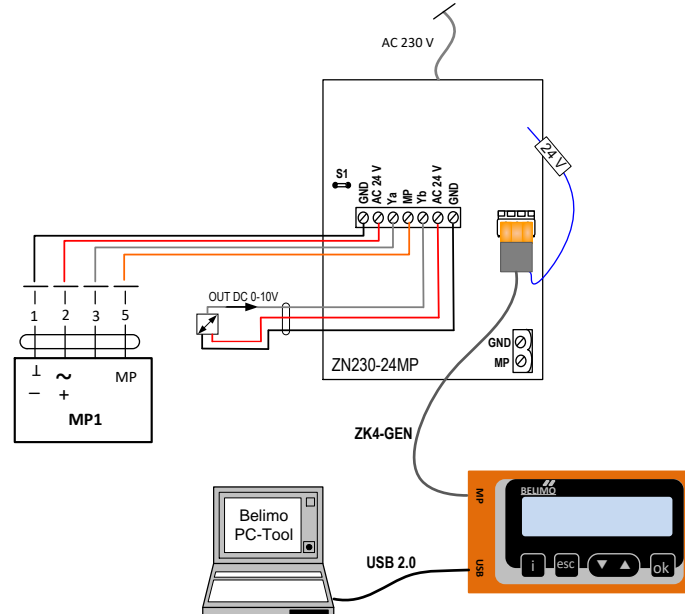
If the MP nodes are supplied with 24V AC or DC locally via a individual transformer, the cable lengths can be significantly increased. Cable lengths remain in accordance with the table, independent of the power rating of the actuators connected and independent of the wire \varnothing of the MP wiring.

Wire- \varnothing [mm ²]	L = Max. cable length [m]
0.75	800
1.0	
1.5	
2.5	



Example Plug-in power unit ZN230-24MP

The on-site supply can be accomplished with any commercially available transformer. BELIMO offers a device which is especially suited for on-site supply. The MP nodes are supplied locally with AC 24V by the ZN230-24MP. This permits the implementation of long MP-Bus lines. Via ZN230-24MP sensors can be connected to the MP nodes. The ZTH EU or PC tool MFT-P can also be connected to the MP node via ZN230-24MP. Communications with the MP network are disconnected as soon as an MFT parameterizing device is plugged in at the "Tool" socket. This ensures that data collisions will be prevented.



7. Override functions

It is possible to have override functions locally on the MP node while it is running on the MP-Bus, i.e. while it is being digitally controlled by the gateway - or by a DDC cooperation controller via the MP-Bus.

Restrictions

- Some analog overrides only work if the actuator is supplied with AC 24V.
- The overrides can only be used if the sensor integration on the same MP node is not used at the same time.
- The overrides are not or only partially available for individual MP-bus-capable actuator types (e.g. EnergyValve™, 6-Way-EPIV).

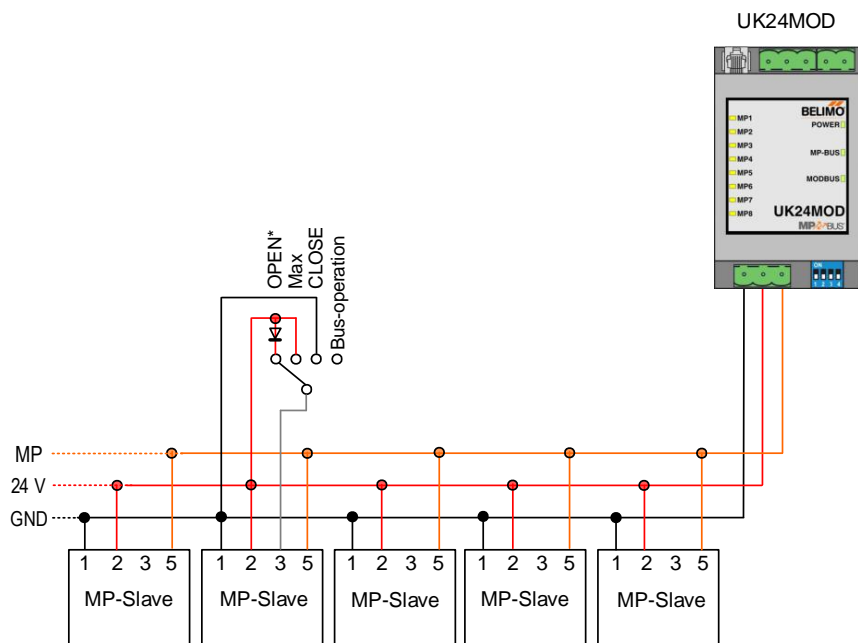
Example override operation on MP-Master

Analog override operation in connection with an application with the UK24MOD gateway.

NOTE

For volume and flow controllers, Max corresponds to the set maximum volume flow V'Max. In order to move the volume or flow controller into the forced-open position, a diode is mandatory.

* Not available with 24V DC supply.



8. Tools and accessories

For the operation of the MP-bus various additional devices for the installation, parameterization, as well as for operation and maintenance of the MP network are available.

ZTH-EU



Service-Tool for parametrizable and communicative Belimo actuators / VAV controller and HVAC performance devices.
The ZTH EU is powered from the service socket of the MP node when it is connected.

The ZTH EU can be used:

- for parameterizing MP nodes
- as level converter USB / MP-Bus (ZIP function)

See also document "Tool-Connections" at www.belimo.eu

NFC Belimo Assistent App



Belimo Assistent App for the parameterization of designated MP nodes via NFC.
For example, VAV-Compact .MV-D3-MP, PR actuators and 6-way EPIV

- Efficient commissioning by read and write data in powerless state
- Simple, wireless connection via integrated NFC interface

[Google Playstore](https://play.google.com/store/apps/details?id=com.belimo.belimoassistent)

ZIP-BT-NFC



BT / NFC converter for Parameterization via Bluetooth
Supply via integrated battery, including USB charge cable

The ZIP-BT-NFC converter enables Belimo devices (NFC-capable actuators, ...) to be operated with an iPhone or Android device.
The data transmission Smartphone <-> Belimo is wireless via a Bluetooth® BLE and/or NFC connection.

MFT-C



Adapter to Service-Tool ZTH EU
Easy connection via pressure clamps, configuration and parameterization of actuators with ZTH EU or PC tool

The actuator is connected to the MFT-C adapter using the pressure clamps.
The BELIMO plug-in power supply ZN230-24, plugged into the jack socket, supplies the connected actuator with voltage.

See also document "Tool-Connections" at www.belimo.eu

ZN230-24

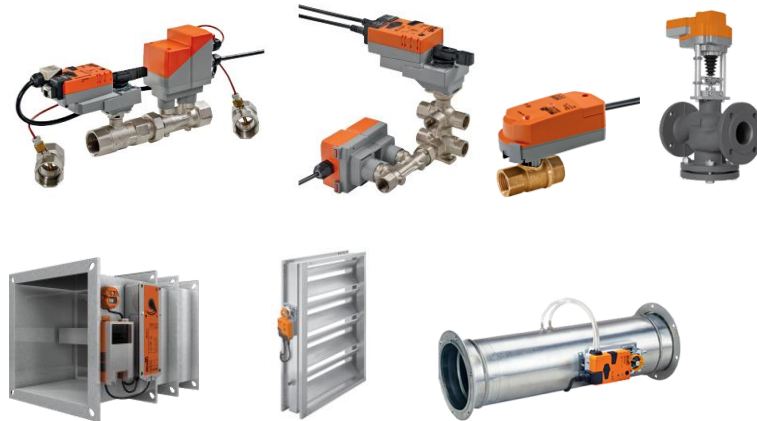
Plug-in power supply for the MFT-C



9. Overview of MP-Bus capable devices

MP nodes from Belimo

An up-to-date overview of all MP-Bus-capable devices can be found at www.belimo.eu/busactuators.



MP-nodes from 3rd party

MP nodes of third parties are devices which were not developed by Belimo, but which can be used together with the MP-Bus. The devices are not supported by all MP partners. Therefore, the respective documentation of the MP partners must be checked.

Modules and sensors from Walter Müller AG

These MP I/O modules and sensors are manufactured and distributed by Walter Müller AG (Switzerland)

UST-5 I/O



The module is used where analoge or digital signals from / to field devices such as sensors, switches, frequency converters, circuit breakers, etc. are to be connected to the MP-Bus.

AST-4



The analoge signal transmitter is used for measuring and outputting analoge variables via the MP-Bus.

Multi sensor PTH



Multi sensor for pressure, temperature and humidity, which can be connected as an independent MP-Bus device to an MP network.

To read the measured values for pressure, temperature and humidity, the necessary MP commands must be implemented in the MP-Master. Walter Müller AG provides a corresponding MP data profile.

More MP-Bus capable modules and sensors at www.wmag.ch

Contact

wmag@wmag.ch

10. MP-Bus functional profiles

Overview MP function profiles define the interface and its scope (data points, parameters, functions) of an MP node. A distinction is made between the following MP-Bus data profiles:

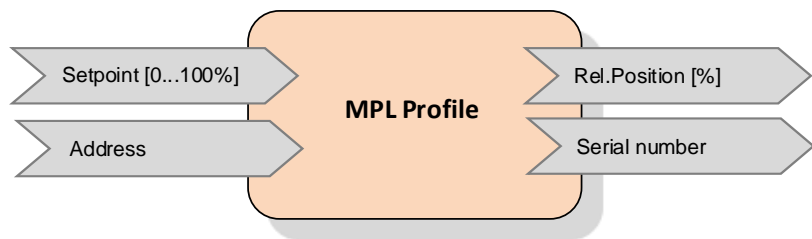
- MP profile
 - Air/ Water module
 - VAV / 2-Way EPIV
 - Fire safety
- MPL profile
- Data Pool device

MP function profile The MP function profiles include required commands, optional commands, and comments. The available MP profiles are explained in detail below.

Implementation data pool values Depending on the MP partner, the data pool profiles are not fully integrated. Therefore the function block description of the respective MP partners or the product description of the used Belimo gateway must be checked.

MPL profile The MPL profile is the simplest variant of an MP profile.

Profile overview

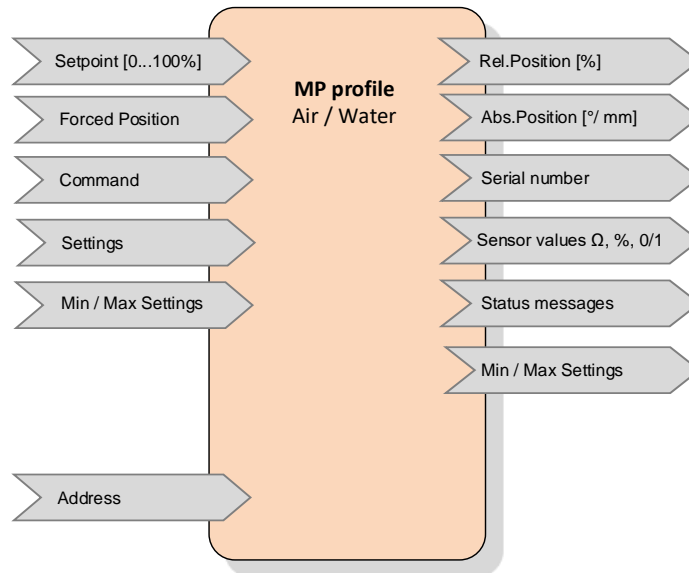


Typical actuator variants

Valve actuators	CQ24A-MPL (-T), KR24-MPL
Damper actuator	CM24-MPL-(L) or (R)

10. MP-Bus functional profiles (Continuation)

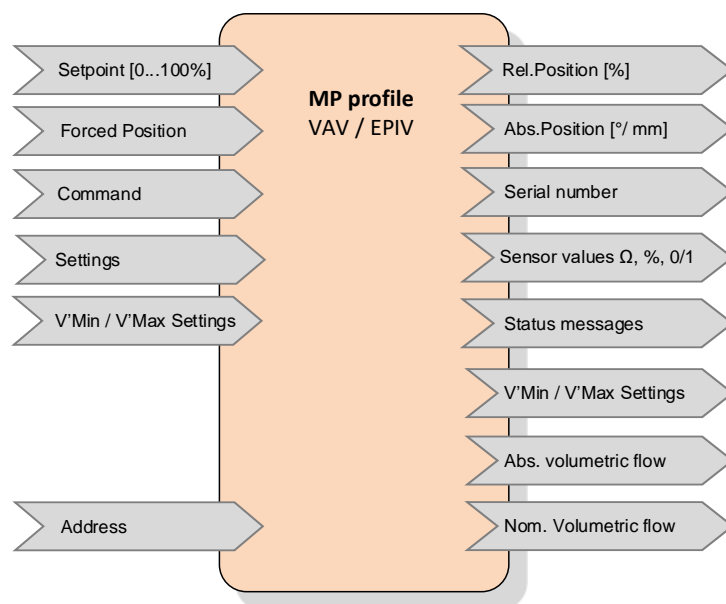
Air/ Water actuators Control of Air damper and valve actuators



Examples

Air damper actuators	..M24A-MP, ..H24A-MPx00, ..K24A-MP, ..HK24A-MPx00, ..F24A-MP, LU24A-MP
Valve actuators	..R24A-MP, ..V24A-MP, ..VK24A-MP, ..RF24A-MP / MFT,

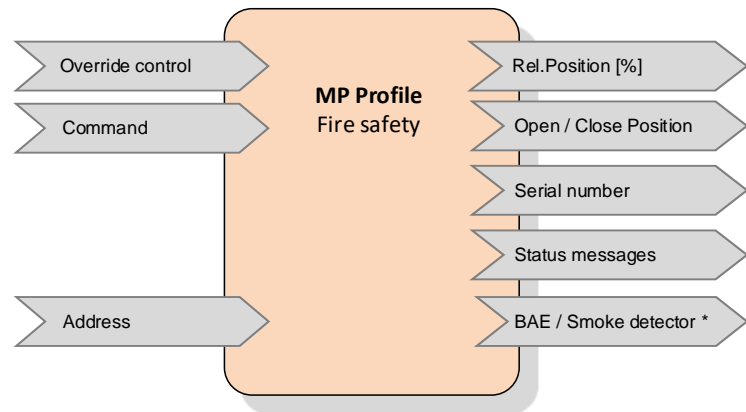
VAV/ 2-Way EPIV Control of VAV-controllers and electronic pressure-independent characterised control valves (2-way EPIV)



Examples	VAV-controller	..MV-D3-MP, VRP-M, ..HV-D3-MP
	2-Way EPIV	EP0..R+MP, EP0..R+KMP, P6..W..E-MP, P6..W..E-KMP

10. MP-Bus functional profiles (Continuation)

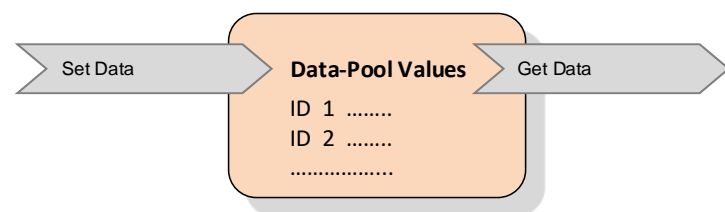
Fire safety Control of fire dampers



Examples	Fire protection & smoke extraction	BKN230-24MP & BF(G)24TL-T-ST *, BKN230-24-C-MP & actuator
-----------------	------------------------------------	---

* **Note** Depending on the device type individual status messages and commands are available or are interpreted logically. The product-specific data must be consulted.

Data pool devices Data pool devices are MP nodes which have no specific commands compared to previous profiles.



Functions The device-specific data pool values for each MP node can be obtained from the Belimo website.

Examples	EnergyValve®	EV0..R+BAC / P6..W..EV-BAC
	6-Way -EPIV	EP0..R-R+BAC
	Room combination sensor	MS24A-R0x-MPX

10. MP-Bus functional profiles (Continuation)

MP profile support MP-Master

	UK24EIB	UK24LON	UK24MOD	UK24BAC	MP cooperation partner
Air/ Water actuators	• 2)	•	•	•	• 1)
VAV/ 2-Way EPIV	• 2)	•	•	•	• 1)
Fire safety	X	X	•	•	• 1)
MPL profile	X	•	•	•	• 1)
Data pool device	X	X	X	X	• 1)

- 1) Check the functional scope directly with the respective MP partner
- 2) Restricted functionality, see product information

Note Which MP profiles are supported by which MP cooperation partner can be viewed in the "[MP cooperation partner list](#)" on the Belimo website.

MP BUS **BELIMO**

Belimo MP Partners

Data-pool Devices supported

- Room Sensor MS24-R0x-MPX
- EPIV 6-way EP...R-R6+BAC
- Energy Valve EV...R+BAC, P6...W...EV-BAC

Functional Profiles supported

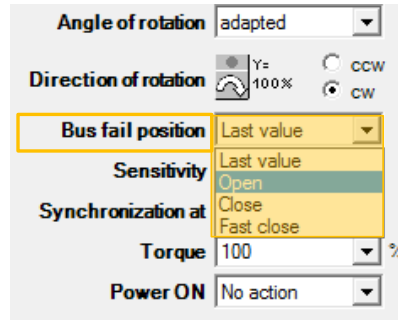
- MPL Actuator
- Fire & Smoke Damper Actuator
- VAV Controller / EPIV 2-way
- MP General Damper / Valve Actuator

A-M-Systeme	<p>A-M-Systeme GmbH Rechterfelder Straße 42a D-49429 Visbek www.a-m-systeme.de Ingo Hermes Phone: +49 4431-9415-09 info@a-m-systeme.de</p>	•	•	•	•	•
BECKHOFF	<p>BECKHOFF Automation GmbH Eiserstrasse 5 D-33415 Verl www.beckhoff.com Ralf Vienken Phone: +49 5246-963-169 r.vienken@beckhoff.com</p>	•	•	•	•	•
CAREL	<p>Carel Industries S.r.l. Via dell'Industria, 11 I-35029 Montebelluna (PD)</p>	•	•	•	•	•

11. Bus fail position

Definition For MP actuators, so called bus fail positions can be set using the PC tool. This makes it possible to define how the actuator should behave in the event that it detects that its communication to the MP-Master is missing (if communication is interrupted, then the actuator will detect this within 60 seconds.).

Example A valve actuator of a heating register, will get completely opened (frost protection function) in the event of a bus communication failure.



Possible settings bus fail position

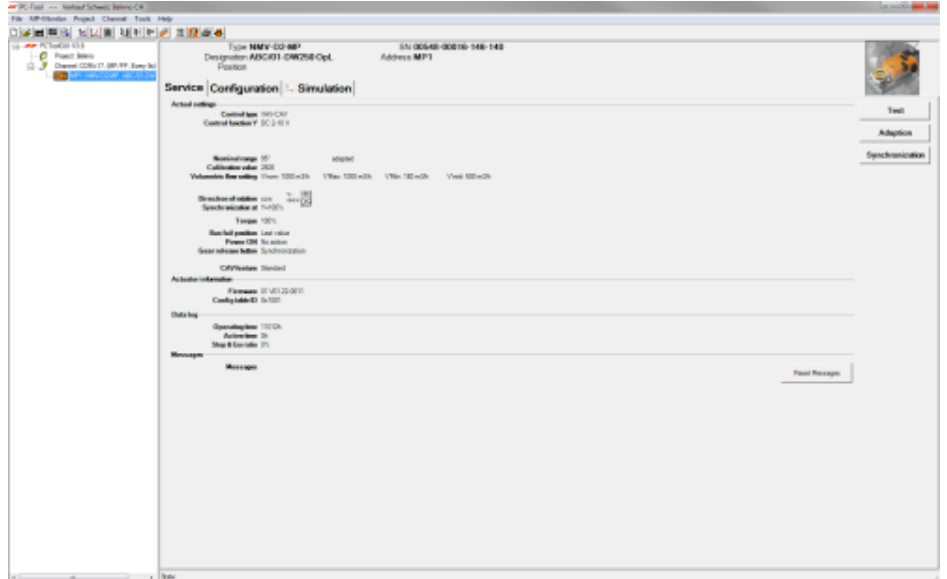
Device type	Possible bus fail position, adjustable with PC tool	Default Setting (factory setting)
..24A-MP	<ul style="list-style-type: none"> • Last value (actuator stops) • Open (actuator opens up entirely) • Close (actuator closes entirely) • Fast close (actuator closes entirely) 	<ul style="list-style-type: none"> • Last value (actuator stops)
...MV-Dx-MP	<ul style="list-style-type: none"> • Last value (control operation) • Open (actuator opens up entirely) • Close (actuator closes entirely) • Min / Vmin • Max / Vmax 	<ul style="list-style-type: none"> • Last value (control operation)

12. PC-Tool MFT-P parameterization

The PC tool offers the following features.
For detailed instructions on the MFT-P PC tool, see specific documentation in the PC tool itself.

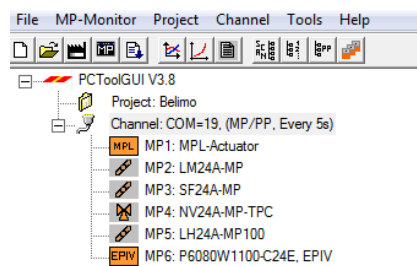
MP-Master operation

- Parameterizing the devices via MP-Bus
- Specification of set points for simulating the devices via MP-Bus
- Read in the sensors connected to the MP devices
- Recording of graphical trends



MP-Bus Scan

After start up, the PC tool checks the MP network with the bus scan function and displays all MP nodes that are integrated on the MP-Bus line.

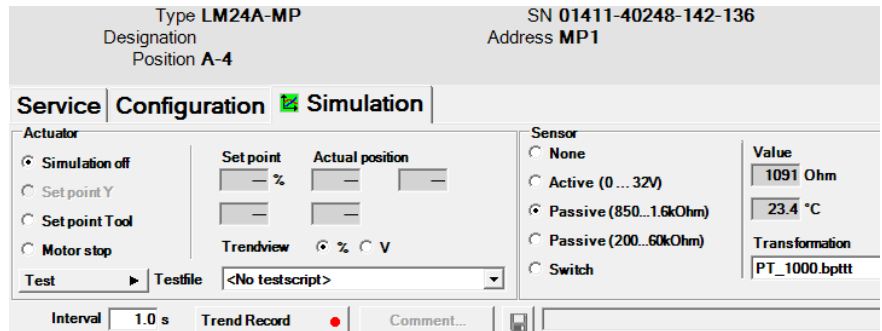


12. PC-Tool MFT-P parameterization (Continuation)

MP-Master Simulation

In the section "Simulation" of the PC tool, the following possibilities exist

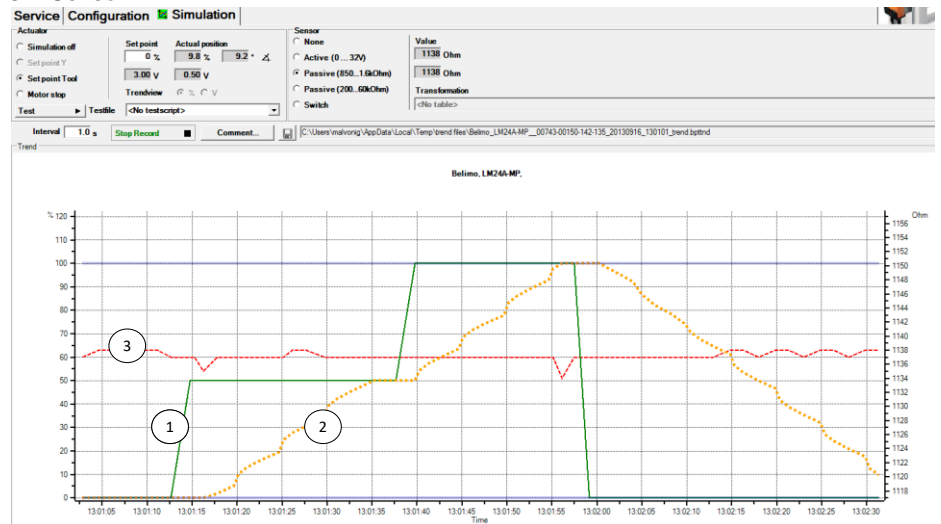
- Activate connected MP nodes independently of an MP-Master and read sensor values. (Setpoint tool)
- Read out the setpoint signal of the MP-Master and display the behaviour of the connected MP nodes (setpoint Y).



Recording a trend

Example using an LM24A-MP with connected passive sensor.

- 1 = setpoint drive
- 2 = actual value of actuator
- 3 = Sensor value in Ω

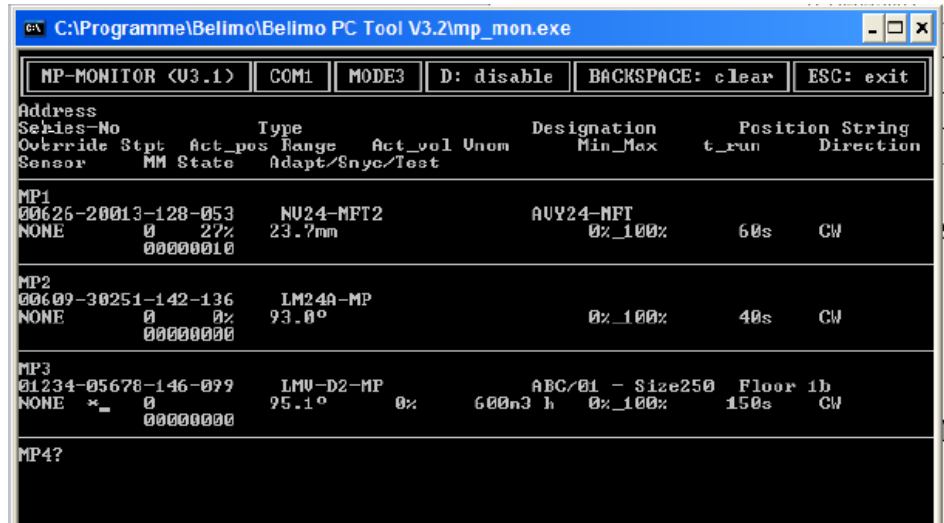


Note sensor values

Sensor values are recorded in raw values (Ω , mA, 0/1) and sent accordingly to the connected MP-Master.

Monitor function

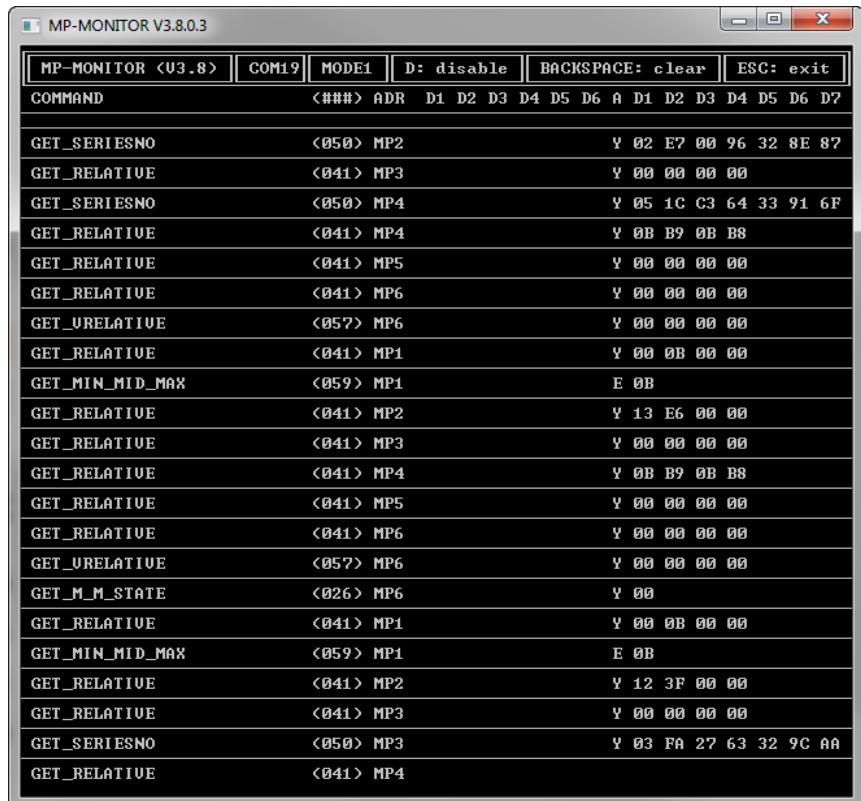
Check the MP communication with the MP monitor tool (module of PC-Tool V3.x)



The MP-Bus communication can be monitored and analysed using the monitor function. The following two functions are available

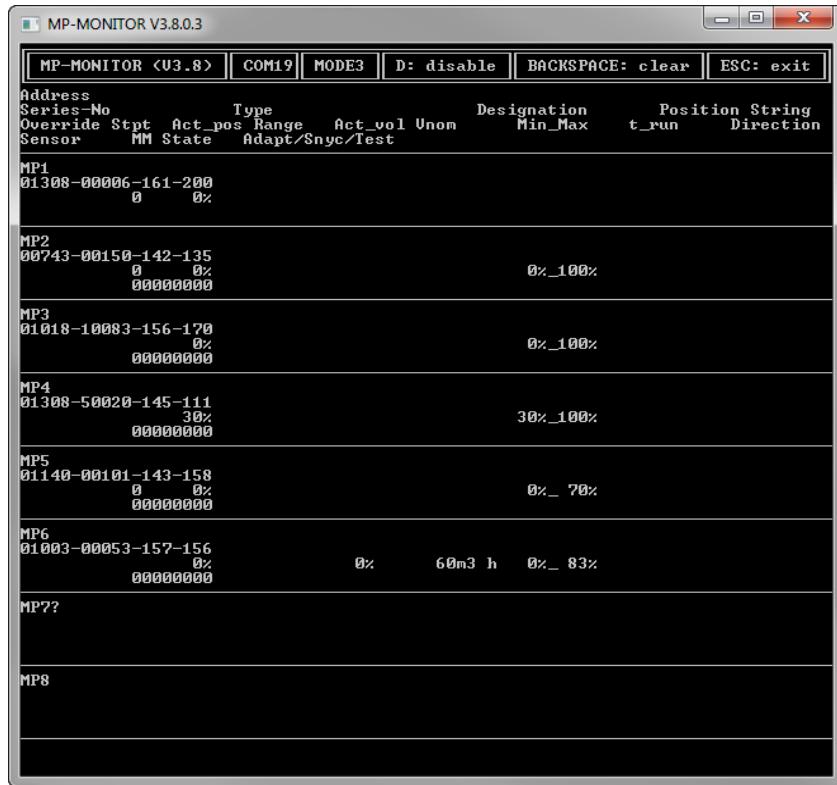
F1: MP logging on command level

Monitoring the MP commands sent from the MP-Master to the MP nodes.



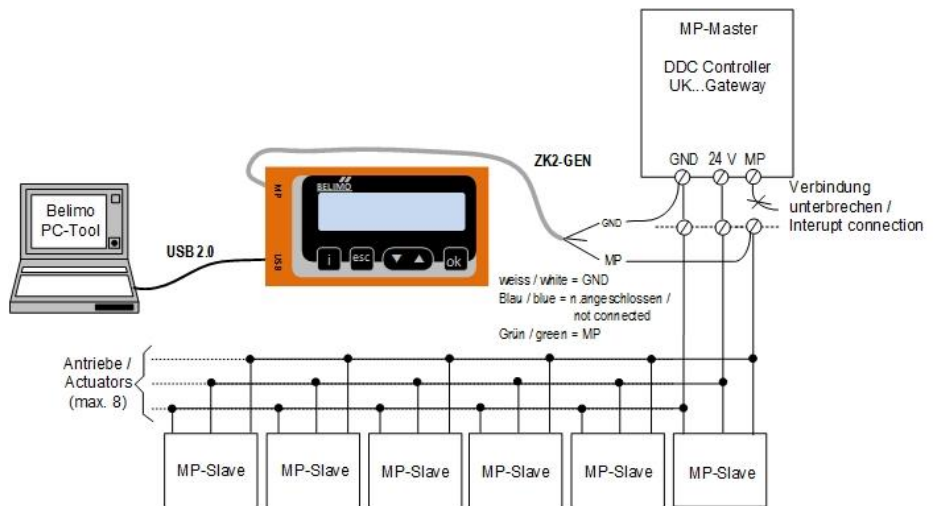
F3: MP logging on application level

Monitoring the connected MP nodes and their current parameters and process values.



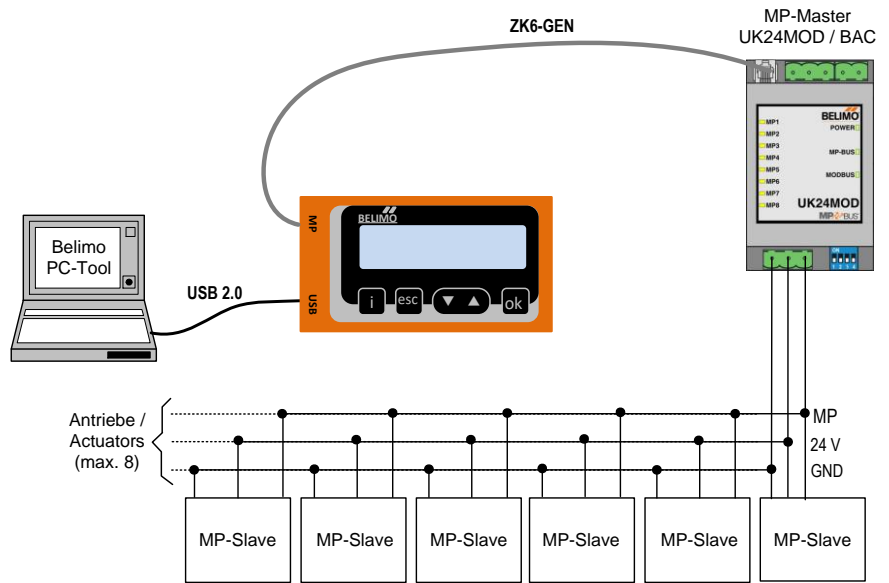
12.2 PC-Tool MFT-P Connection possibilities

PC-Tool (MP-Master)
to DDC controller
without specific tool connection



12.2 PC-Tool MFT-P Connection possibilities (Continuation)

**PC-Tool (MP-Master)
at gateways
with tool connection socket**



Behaviour

If the PC tool is connected to the tool connection socket, the MP-Master is automatically deactivated (Disabled) and the PC tool is recognized as an MP-Master. The higher-level bus system (e.g. BACnet, Modbus) becomes inactive.

As soon as the cable is removed from the tool connector, the gateway again operates as an MP-Master (Enabled), the higher-level bus system controls becomes active again.

Further connection possibilities

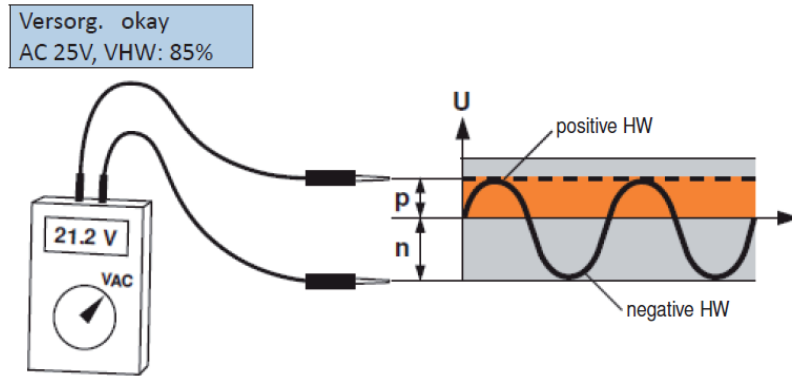
For further connection possibilities see document "Tool connections" at www.belimo.eu

The following diagnostics options are available with the ZTH EU

- Check the power supply
- MP-Tester
 - Check the MP-Bus levels
 - Frame counter

Check the power supply

The ZTH EU allows to check the "AC 24 V" power supply (III safety extra-low voltage) including the half wave ration of the Belimo MP-Bus nodes.

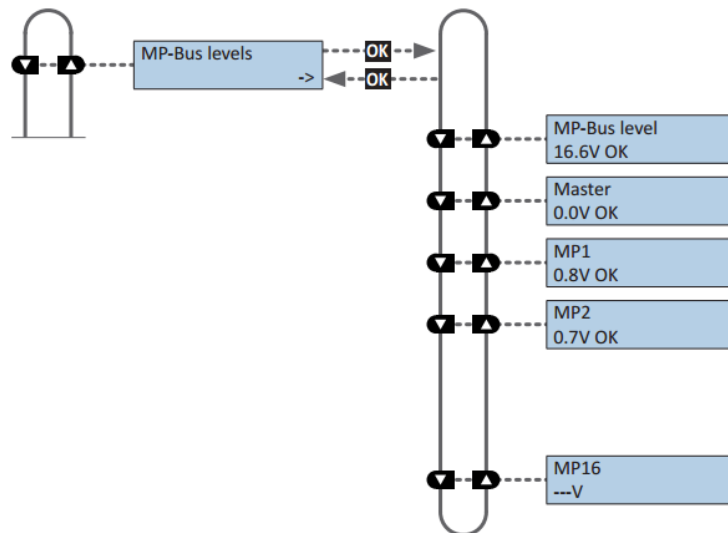


MP tester

With the MP tester function, the ZTH EU offers the possibility to determine the MP-Bus level on the MP-Master, as well as on the MP Slave node, and to check the MP-Bus communication by means of the counting of the telegrams

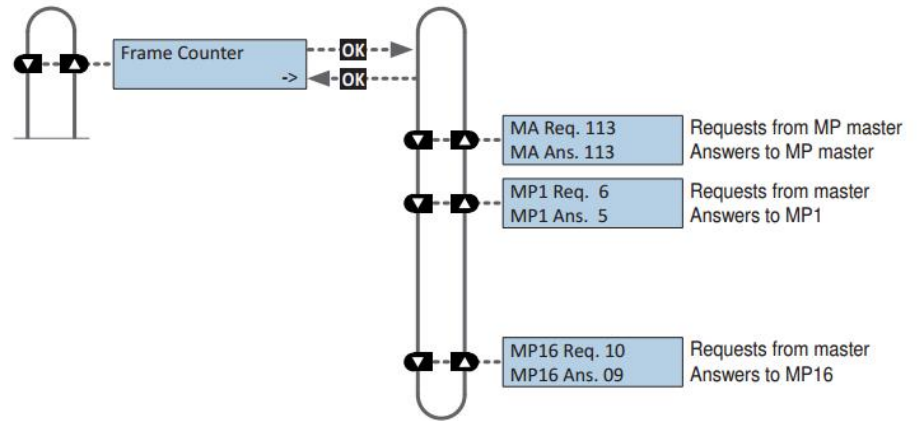
MP-Bus levels

The MP signal levels from the MP-Master and the MP slave nodes are measured against GND and compared with the limit values of the protocol specification..



Frame counter

The number of telegrams and also the correctness of telegrams (checksum) are checked.

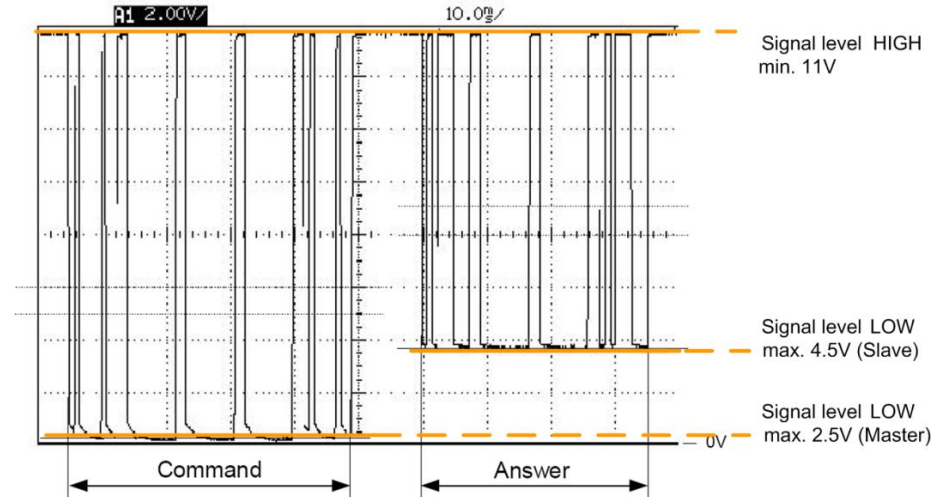


14. MP specifications

Brief description of the MP communication	Communication	Master-Slave The slave (MP node) responds only to commands from the MP-Master
	Data transfer	Bidirectional, half-duplex Communication takes place via the U5 connector, referenced to GND.
	Communication parameters	1200 Baud, 8 data bits, 1 start bit, 1 stop bit, no parity
	Number of nodes on the MP-Bus	The communication protocol is enabled for 1 MP-Master and 1 ... 8 (16) slaves (MP nodes).

MP signal level

The MP communication takes place on a carrier signal of 18V between the ground and the wire 5.
The signals for commands from the MP-Master and the corresponding response are as follows (see figure below).



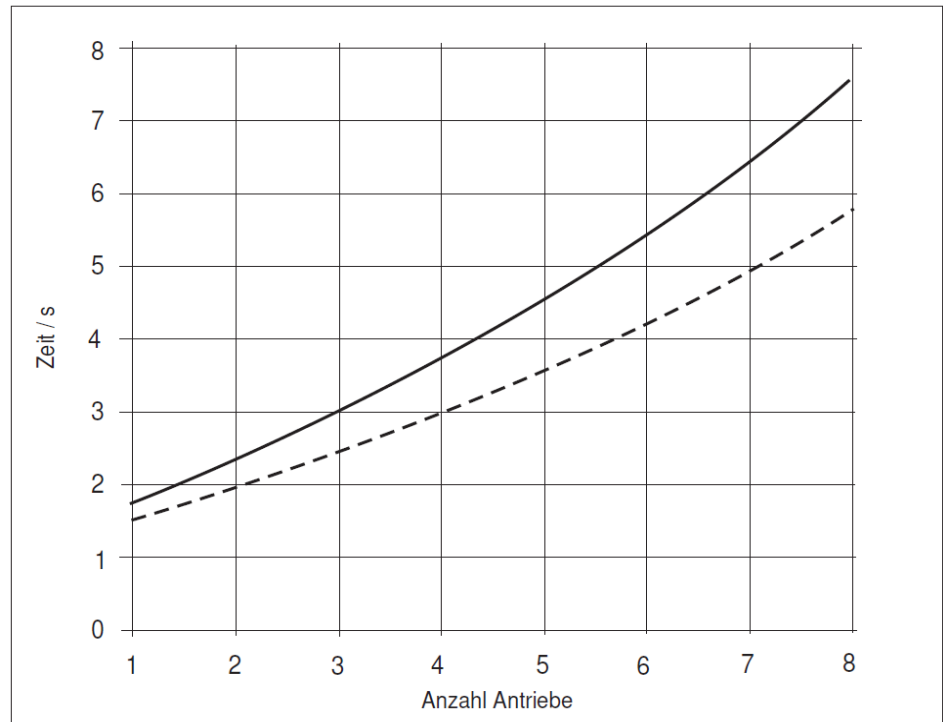
Measurement conditions

At least one MP node is connected to the MP-Master. All signals are measured across U5 and GND.	min	normal
Voltage level high Command und Answer	>11V	12.5V
Voltage level low Command (MP-Master)		>2.5V
Voltage level low Answer (MP-Slave)		>4.5V

14. MP specifications (Continuation)

Query interval / Cycle times

The more actuators there are to be served on the bus and the more sensors there are to be read at the MP nodes, the longer the query intervals will be on the BELIMO MP-Bus. The cycle times that result on the MP-Bus, are displayed in the curve below.



----- 8 actuators without sensors
 _____ 8 actuators with sensors

Note Reduction of the cycle times by prioritizing the MP commands (high, medium, low) possible.

15 MP Partner Program



With the MP Partner Program, Belimo offers system integrators the possibility to become MP cooperation partners. Belimo provides the MP specifications to all interested manufacturers of control units in order to implement a corresponding MP interface in hardware and software in the own DDC controller

Advantages of MP cooperation

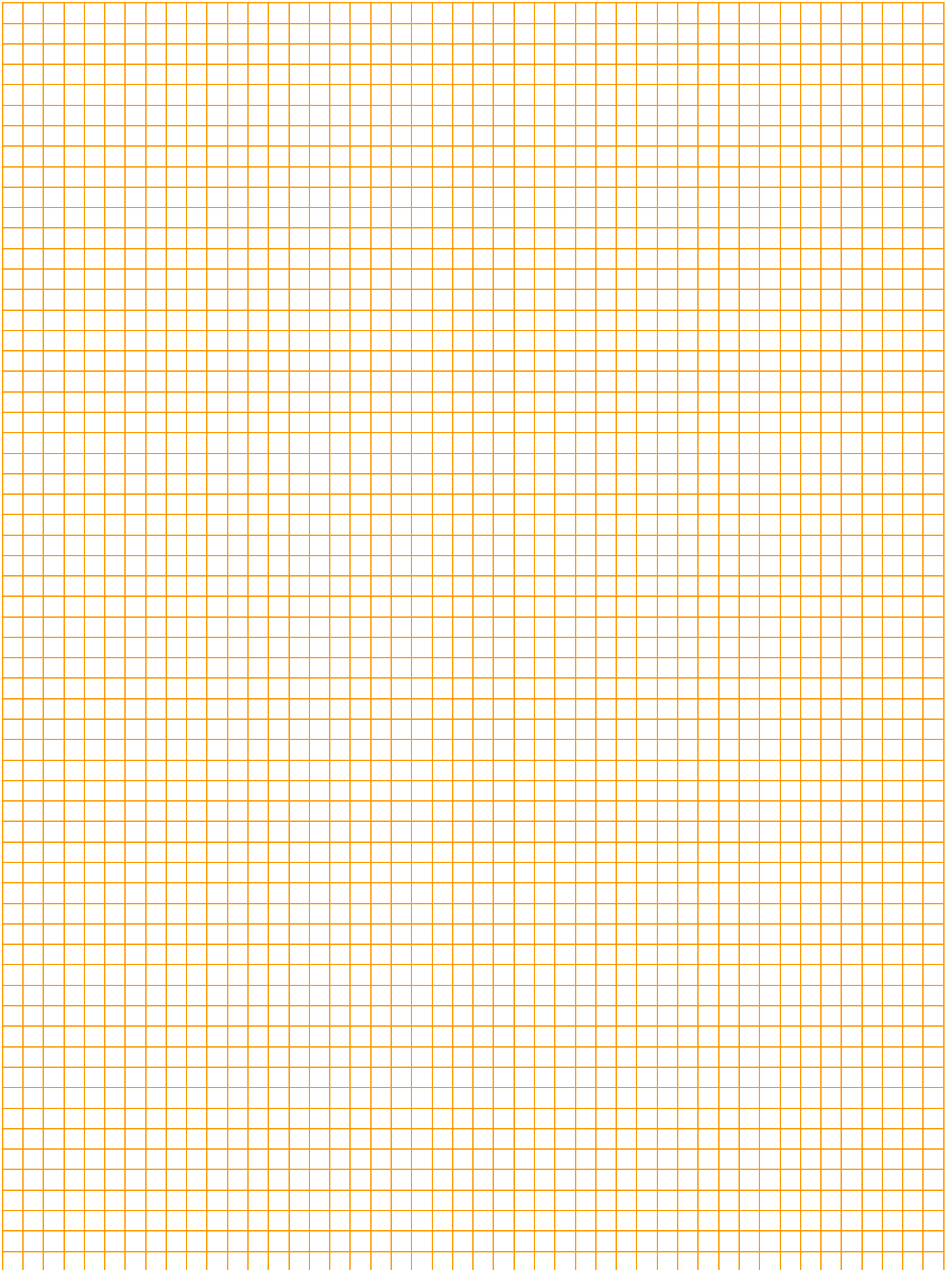
The MP-Partner:

- receives a certificate which corresponds to the DDC used in the MP standard
- may use the MP logo
- is officially listed by Belimo as a cooperation partner for MP solutions in the MP cooperation list
- undergoes a quality improvement
 - Protection of the end user against malfunctions
 - Avoidance of quality problems (no conformity tests are necessary on the site!)
 - Avoid image loss

Furthermore, new MP-Bus products will be made available to the MP partners at an early stage to ensure that they are already available with your DDC solution during market launch.

Apply MP cooperation

If you are interested, please contact your local Belimo representative.



Alles inklusive.



5 Jahre
Garantie



Weltweit
vor Ort



Komplettes
Sortiment aus
einer Hand



Geprüfte
Qualität



Kurze
Lieferzeiten



Umfassender
Support

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