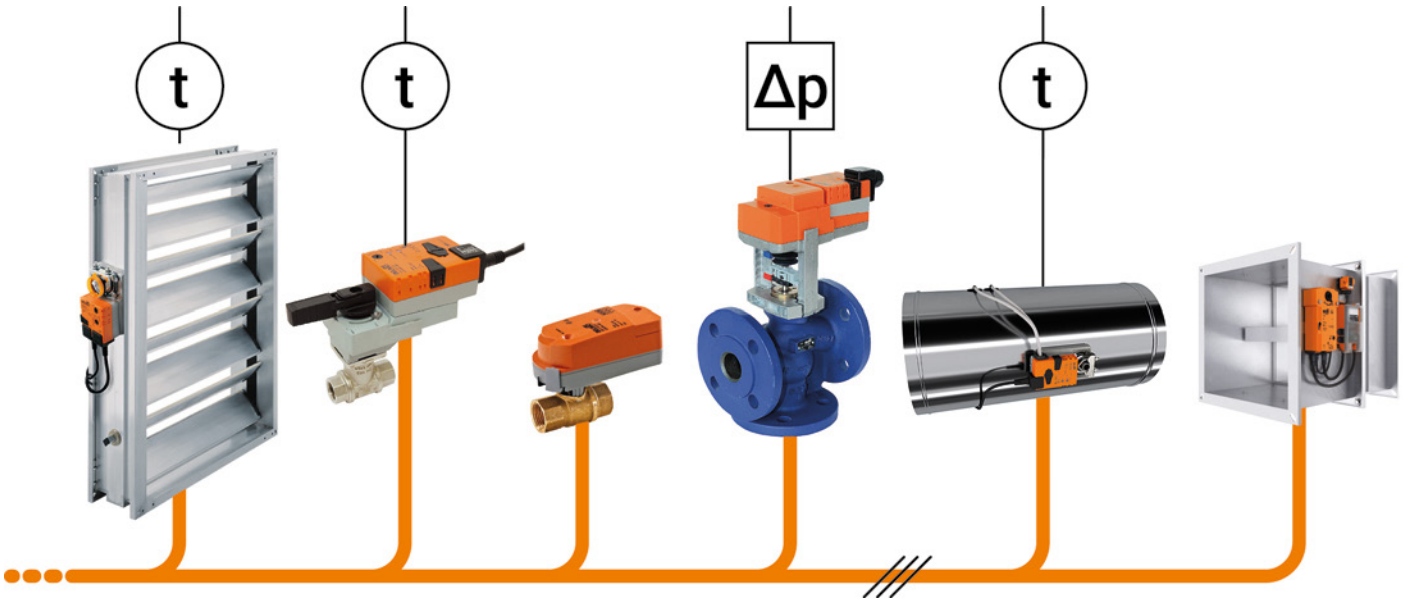


Notes for project planning

MP-BUS®

Introduction to MP-Bus Technology

Edition 2023-03/B

BELIMO®

Table of contents

	Page
Introduction to MP-Bus Technology	4
Connection to MP client	5
MP node connection	6
Cable	8
Cable lengths	10
Override control function	13
Tools and accessories	14
Overview of MP-Bus-capable devices	15
MP-Bus function profiles	16
Bus fail position	20
PC-Tool MFT-P: Parametrisation	21
PC-Tool MFT-P as diagnostics tool	23
PC-Tool MFT-P: Connection possibilities	24
Diagnostics options with ZTH EU	26
MP specifications	28
MP Partner Program	30

Introduction to MP-Bus technology

MP-Bus

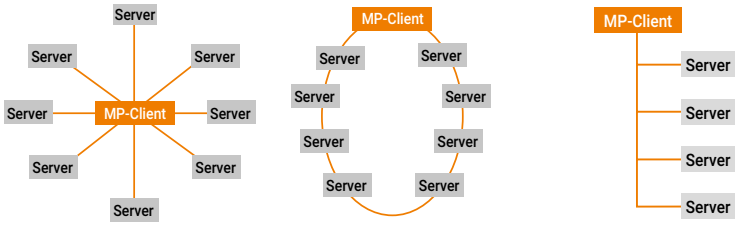
The MP-Bus is the Belimo Single-Client/Multi-Server bus. Up to 8 MP nodes can be connected to one MP client device. 16 devices can be connected if only actuators of the latest design (e.g. ..-MPL) are used. The specifications of the respective MP partner apply.

MP node

Generic term for MP-capable actuators, sensors and sensor/actuator combinations (e.g. Energy Valve, 6-way-PI-Valve).

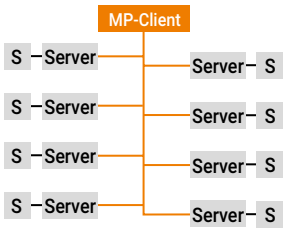
Network topologies

There are no restrictions regarding network topology. Star, ring, bus or hybrid forms are permissible.



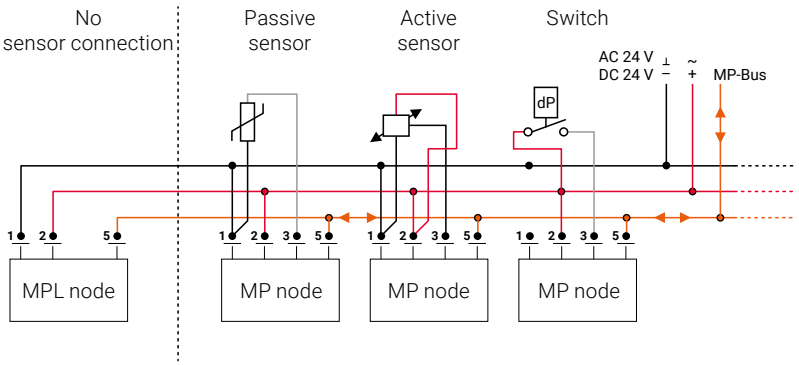
Sensor interface

MP-Bus mode



One sensor per MP node can be connected in MP-Bus mode. The sensor value is recorded with its raw value (Ω, mA, 0/1) and transferred by the MP node in digital form to the MP-Bus. Scaling and evaluation of the sensor value are performed in the MP client or DDC controller, respectively.
Active sensors (output DC 0...10 V) and switches (0/1) can be connected to the MP nodes. Passive resistance sensors (e.g. Pt1000, NTC10K) can also be connected. Please observe the respective product information/the data sheet of the MP node.

Sensor connection



Restrictions

MPL actuators
These actuator types do not have any options for a sensor connection.

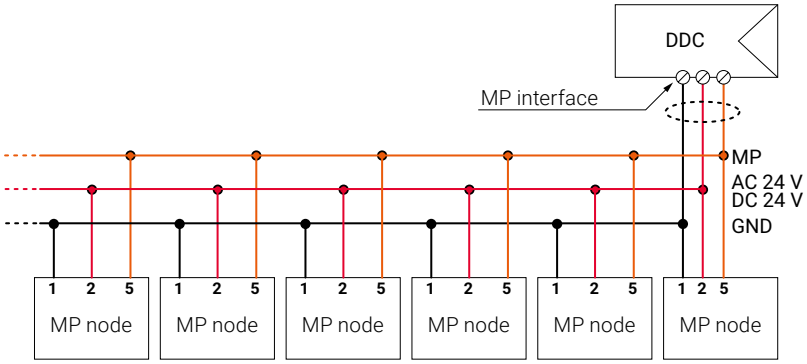
2-Way-EPIV
On actuator types with the designation EP..R + MP / EP..R-KMP as well P6..W ..- MP / P6..W ..- KMP, no passive sensors can be connected.

Connection to MP client

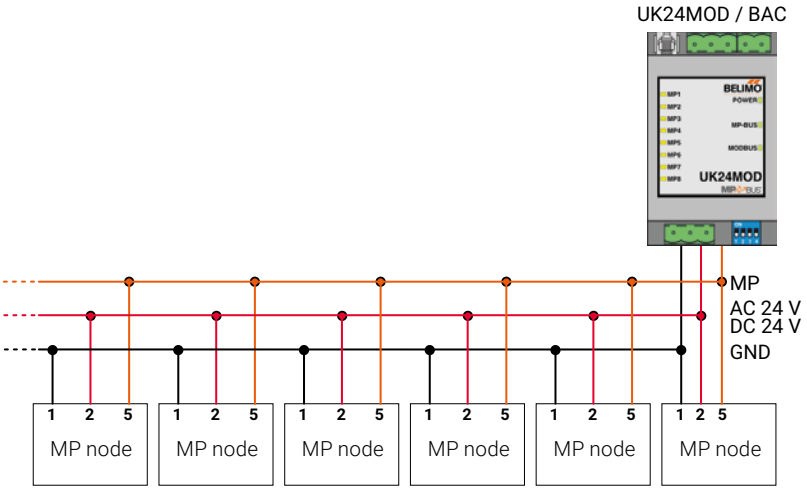
Definition

MP clients are MP cooperation nodes (PLC or DDC controllers 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 client.

MP partner solution



Belimo MP gateway

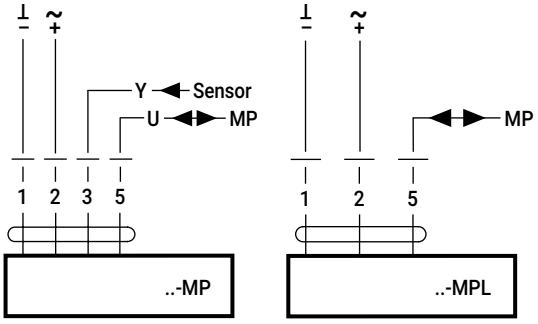


MP node connection

Standard

MP nodes are usually connected on the basis of the connections.
Wire 1 GND/black
Wire 2 24 V/red
Wire 5 MP/orange

MP(L) actuators

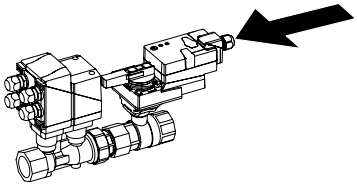


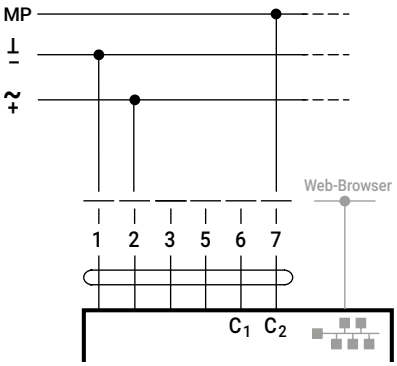
Exceptions

The connection of some actuator types differs from the standard MP nodes.
Please refer to the product-specific data sheet.
Examples:

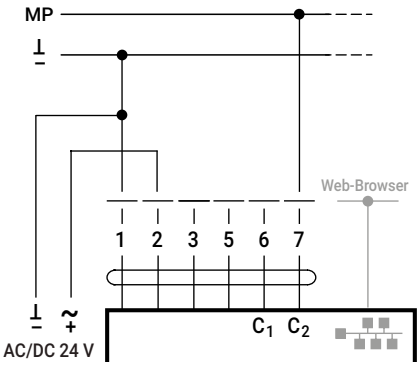
Belimo Energy Valve™

with Ethernet on the actuator



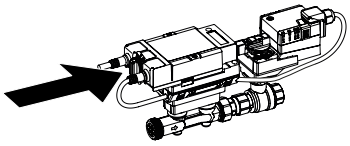


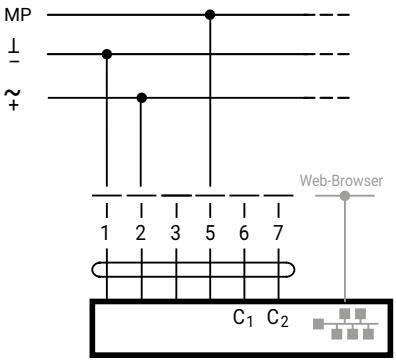
with local power supply



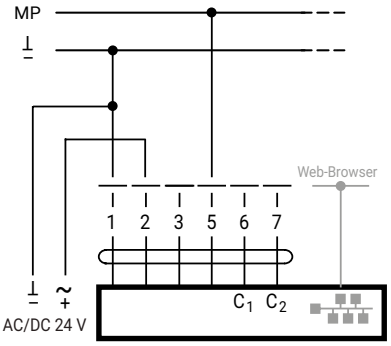
Belimo Energy Valve™

with Ethernet on the flow sensor

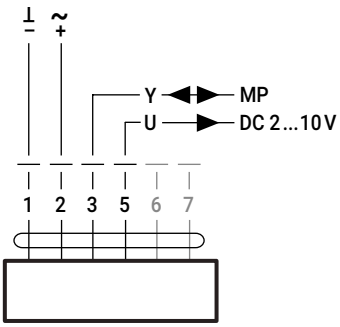




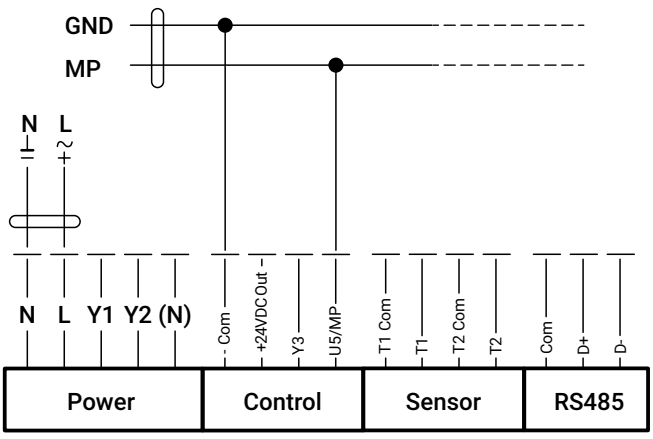
with local power supply



6-way-PI-Valve



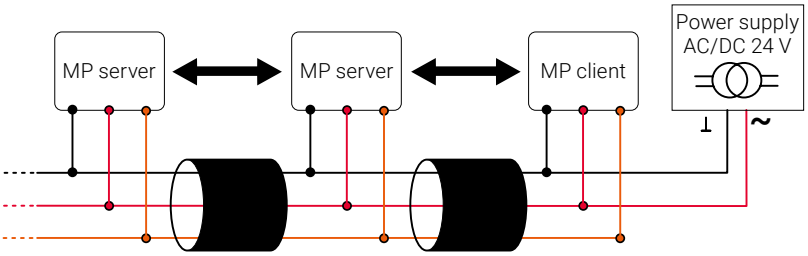
PR..A-S2-BAC



Cable

One cable for communication and power supply

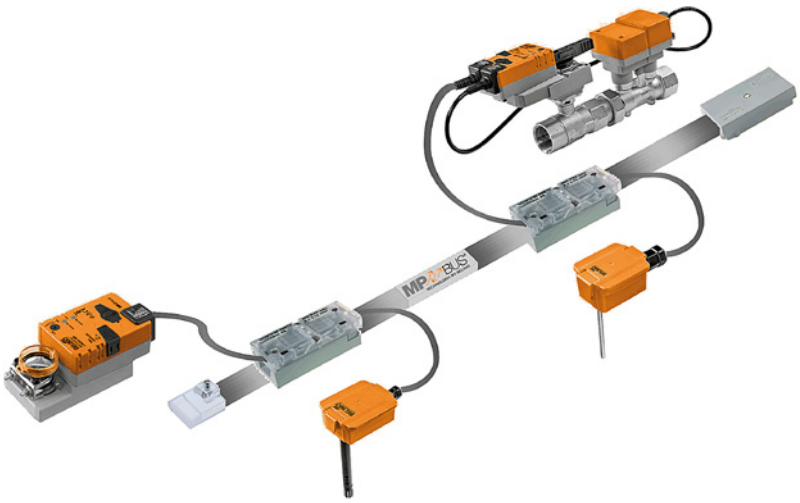
Communication and power supply can be carried in the same cable on the MP-Bus. GND and AC/DC 24 V are used to ensure the power supply to the MP nodes. The MP client communicates with the connected nodes via the MP communication connection, which references the same GND as the power supply.



Neither special cables nor terminating resistors are required. An MP-Bus connection can be established using conventional installation cables, but special bus cables are available for simplified wiring.

Example of flat ribbon cable

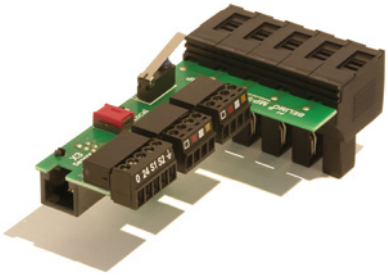
Flat ribbon cable from Woertz with adapter for MP-Bus connection of MP nodes and sensors.

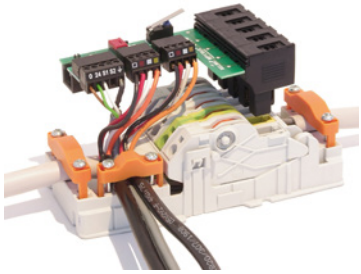


Contact: www.woertz.ch

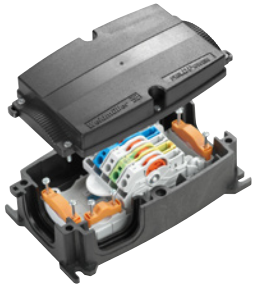
Example of a connecting board

With the ZFP2-MP connecting board it is possible to connect 2 MP nodes, including 2 sensors, to the MP-Bus by using the connector socket. Preassembled and colour-coded connector plugs on the MP nodes prevent wiring errors and ensure fast installation and commissioning. The RJ12 diagnostics connector can be used to parametrise or check the MP nodes independently of the MP-Bus.





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



For more information on the connecting board and wiring box, visit your local website.

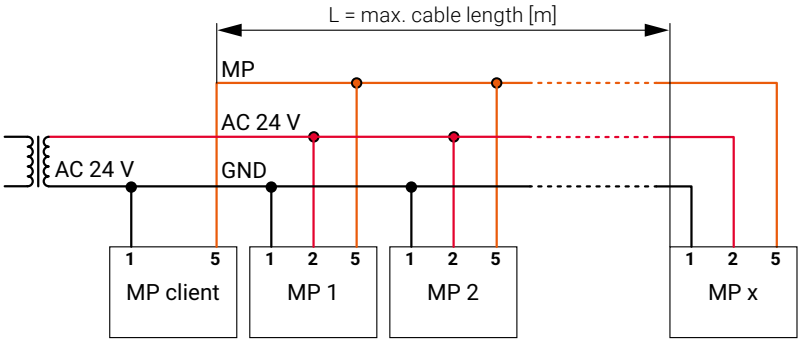
Cable lengths

Definition of cable length

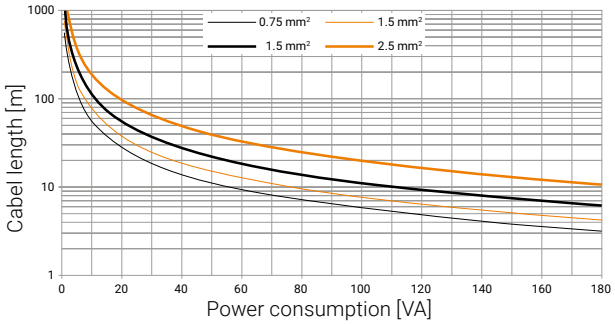
The cable length of an MP network is limited by the following factors:
– Sum of the power consumption of the connected MP nodes
– Type of power supply (AC or DC via MP-Bus/AC or DC local power supply)
– Cable cross-section

The Belimo MP-Bus cable length calculator is available on the Belimo website for calculating the maximum cable length for the complete MP-Bus product range.

Determination of the maximum cable length for AC 24 V power supply



Add up the power rating outputs [VA] of the MP nodes used and read off the corresponding cable lengths in the diagram.

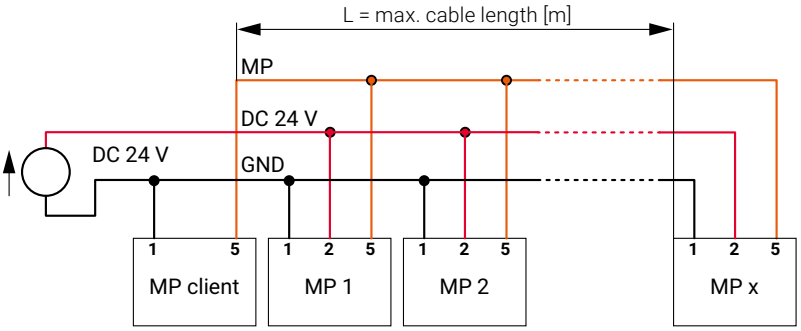


Example:
Connected to the MP-Bus:
1 x NM24A-MP, 1 x SM24A-MP, 1 x LMV-D3-MP... and 1 x NV24A-MP-TPC

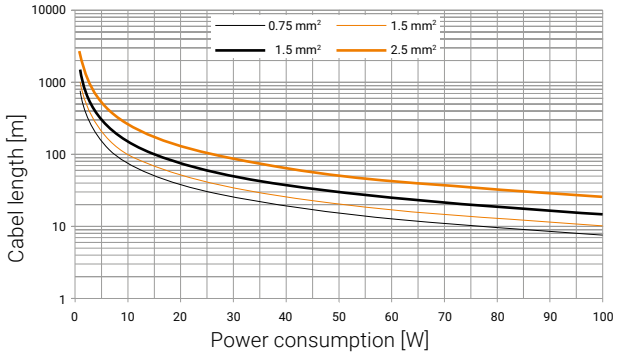
Power rating output total:
5.5 VA + 6 VA + 4 VA + 4.5 VA = 20 VA

To be read out in the set of curves:
– For cables with wire Ø 0.75 mm²: **Cable length 30 m**
– For cables with wire Ø 1.00 mm²: **Cable length 40 m**
– For cables with wire Ø 1.50 mm²: **Cable length 60 m**
– For cables with wire Ø 2.50 mm²: **Cable length 100 m**

Determination of the maximum cable length for DC 24 V power supply



Add up the power consumption [W] of the MP nodes used and read off the corresponding cable lengths in the diagram.



Example:
Connected to the MP-Bus:
1 x NM24A-MP, 1 x SM24A-MP, 1 x LMV-D3-MP... and 1 x NV24A-MP-TPC

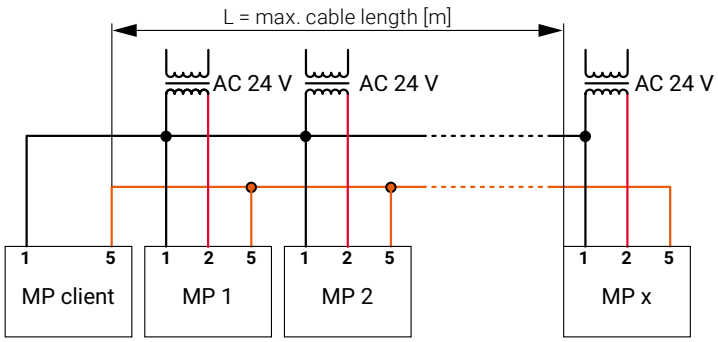
Total power consumption:
3.5 W + 4 W + 2 W + 3 W = 12.5 W

To be read out in the set of curves:
– For cables with wire Ø 0.75 mm^2: **Cable length 60 m**
– For cables with wire Ø 1.00 mm^2: **Cable length 80 m**
– For cables with wire Ø 1.50 mm^2: **Cable length 120 m**
– For cables with wire Ø 2.50 mm^2: **Cable length 180 m**

Local power supply on site

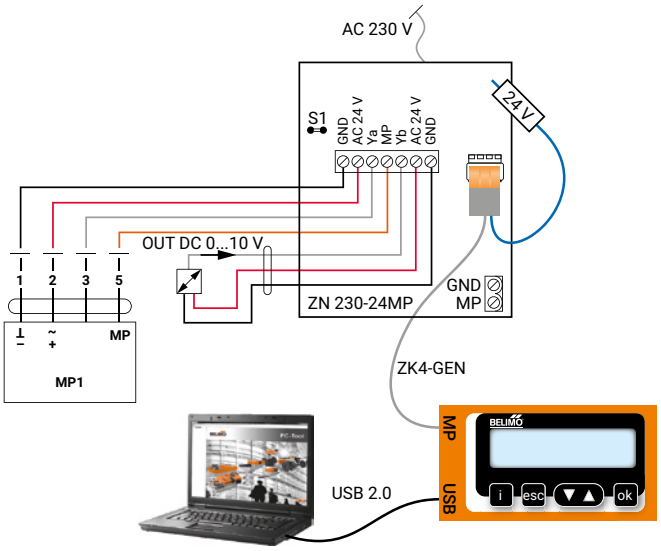
If the MP nodes are supplied locally via a separate transformer with AC/DC 24 V, then cable lengths can be considerably increased. Independent of the power rating of the connected MP nodes and independent of the wire Ø of the MP wiring, the cable lengths are in accordance with the table.

Wire Ø [mm²]	L = max. cable length [m]
0.75	800
1.0	
1.5	
2.5	



Example Power supply unit ZN230-24MP

The supply on site can be provided by any commercially available transformer. Belimo also offers a device that is especially suitable for on-site supply. The MP nodes are supplied locally with AC 24 V by the ZN230-24MP. This means that long MP-Bus lines can be implemented.
Sensors can be connected to the MP nodes via ZN230-24MP. The ZTH EU or PC-Tool MFT-P can also be connected to the MP node via ZN230-24MP. Communication with the MP network is disconnected as soon as an MFT service tool is plugged into the "Tool" connector socket. This prevents data collisions.



Override control function

It is possible to have the override control function have a local effect on the MP node while it is running on the MP-Bus, i.e. controlled digitally by the MP-Bus gateway or by a DDC cooperation node via the MP-Bus.

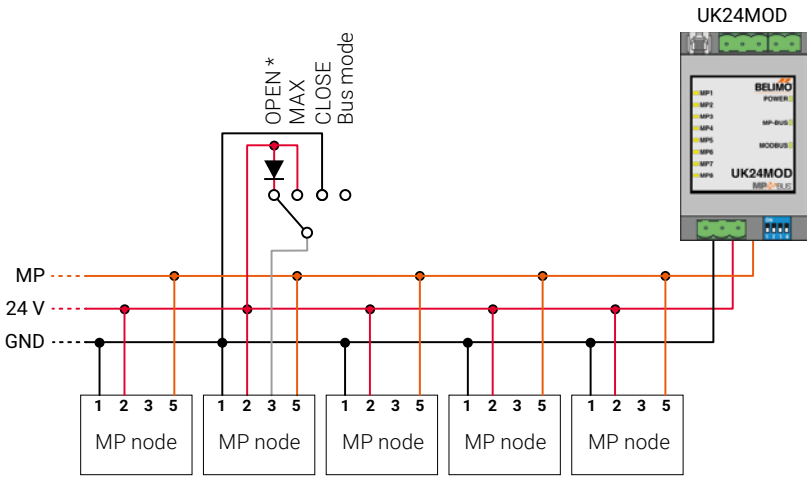
Restrictions

- Analogue override control functions only if the actuator is supplied with AC 24 V.
- The override control can be used only if the sensor integration is not used at the same time on the same MP node.
- The override control function is not available or only partially available for individual MP-Bus-capable actuator types (e.g. Energy Valve, 6-way-PI-Valve).

Example of override control for an MP client

Analogue override control in an application with the UK24MOD gateway.

Note:
For volume and flow controllers, MAX corresponds to the set maximum volumetric flow V'_{max}.
A diode is absolutely necessary for moving the volume or flow controller to the override open position.



* Not available with DC 24 V supply.

Tools and accessories

For the operation of the MP-Bus, various accessories are available for the installation, parametrisation, operation and maintenance of the MP network.

ZTH EU

Service tool for parametrisable and communicative Belimo actuators/VAV controllers and HVAC performance devices. The ZTH EU is powered by the MP node when connected to the service socket.

The ZTH EU can be used as follows:
– for parametrisation of MP nodes
– as USB/MP-Bus level converter (ZIP function)
See also "Tool Connections" document on your local website.

Belimo Assistant App

Belimo Assistant App for parametrisation of designated MP nodes via NFC.
For example, VAV-Compact MP, PR actuators and 6-way-PI-Valve.
– efficient commissioning as data can be read and written in powerless state
– simple, wireless connection via integrated NFC interface
Install the Belimo Assistant app via "Google Play" or "App Store".
Prerequisite:
– NFC-capable or Bluetooth-capable smartphone

ZIP-BT-NFC

BT/NFC converter for parametrisation via Bluetooth. Supply via integrated rechargeable battery, incl. USB charging cable and retaining strap.
The converter enables Belimo devices (NFC-enabled actuators, etc.) to be operated with an iPhone or Android device. Data transmission between smartphone and Belimo device is wireless with a Bluetooth® BLE or NFC connection.

MFT-C

Adapter for ZTH EU service tool
Simple connection via quick-release terminals, parametrisation of actuators with ZTH EU or PC-Tool.

The actuator is connected to the MFT-C adapter using the quick-release terminals. The Belimo ZN230-24 plug-in power supply unit plugged into the jack socket supplies the connected actuator with voltage.
See also "Tool Connections" document on your local website.

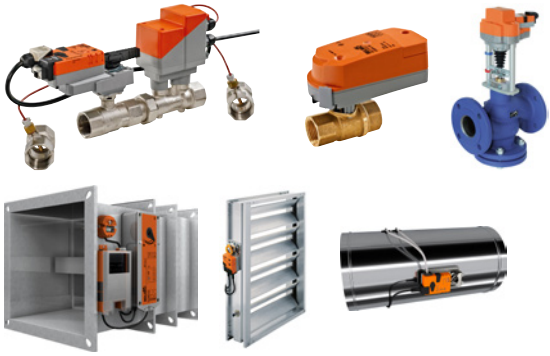
ZN230-24

Plug-in power supply for the MFT-C.

Overview of MP-Bus-capable devices

MP nodes from Belimo

You can find an up-to-date overview of all MP-Bus-capable devices on your local website.



Third-party MP nodes

Third-party MP nodes are devices which were not developed by Belimo but which can nevertheless be used together with the MP-Bus. The devices are not supported by all MP partners. Therefore, please check the respective documentation of the MP partners.

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 applied when analogue 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 Analogue Signal Transmitter is used to measure and output analogue variables via the MP-Bus.

Multi sensor PTH

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

In order for the MP client to be able to read out the measured values for pressure, temperature and humidity, the necessary MP commands must be implemented in the MP client. Walter Müller AG provides a corresponding MP data profile.

Further MP-Bus-capable modules and sensors as well as contact details can be found at www.wmag.ch.

MP-Bus function 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
  - MPL
  - Air/water module
  - VAV/EPIV
  - Fire protection
- Data pool device

MP function profiles

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

Implementation of data profiles

Depending on the MP partner, the data profiles are sometimes not fully integrated. The function block description of the respective MP partner or the product description of the Belimo gateway used must therefore be consulted.

MPL profile

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

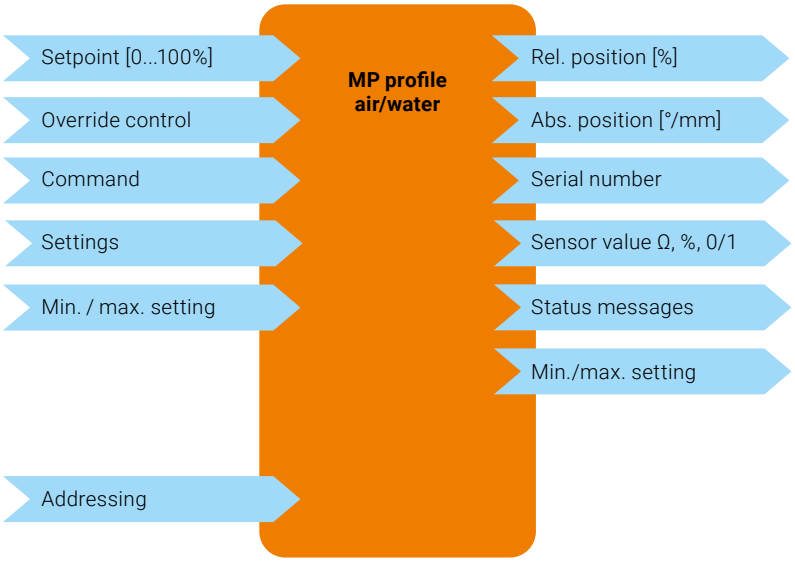
Profile overview

Typical actuator variants

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

Air/water actuators

Control of air dampers and valves.

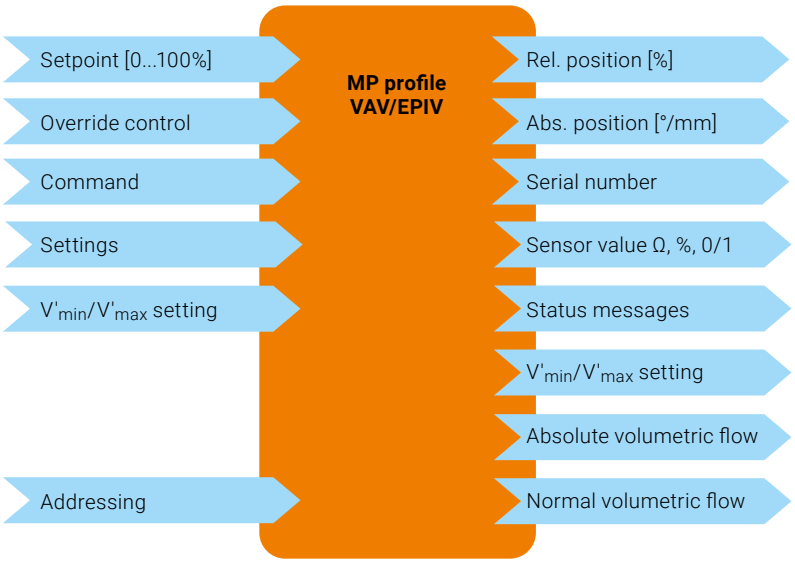


Examples

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/EPIV

Control of VAV controllers and electronic pressure-independent characterised control valves (EPIV)

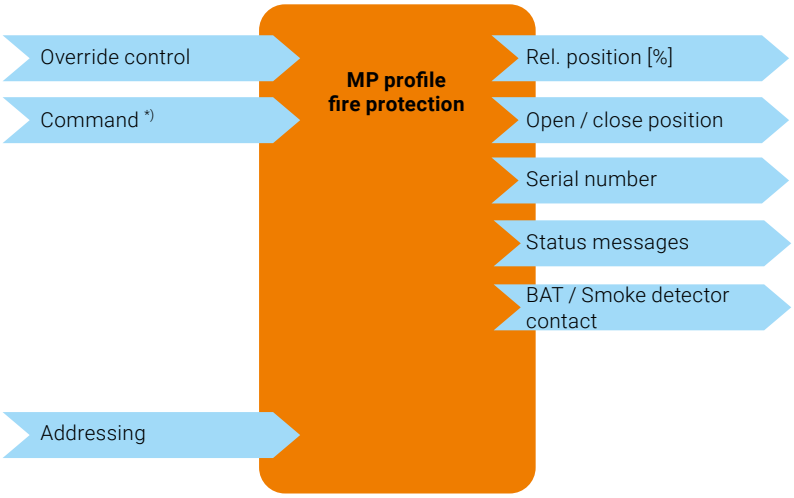


Examples

VAV controllers:	..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

Fire protection

Control of fire dampers.



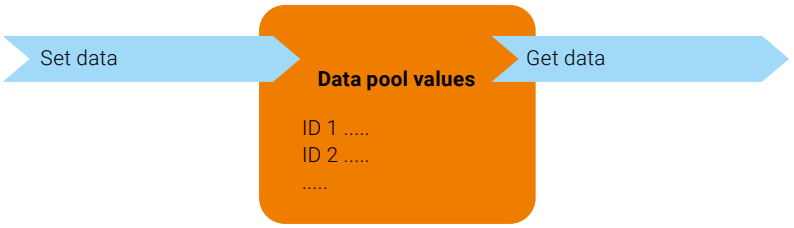
*) Depending on the device type individual status messages and commands are available or are interpreted logically. The product-specific data must be consulted.

Examples

Fire protection and smoke control:	BKN230-24MP & BF(G)24TL-T-ST*, BKN230-24-C-MP and actuator

Data pool devices

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



Functions

The device-specific data pool values for each MP node are available on the Belimo website.

Examples

Belimo Energy Valve™:	EV..R..(K)+BAC/EV..R..+(K)BAC
Room sensor:	22RT..-19-1

Support MP profile MP client

Control of air dampers and valves.

	UK24MOD	UK24BAC	MP co-operation partners
Air / water actuators	■	■	■ [1)]
VAV / 2-way EPIV	■	■	■ [1)]
Fire protection	■	■	■ [1)]
MPL profile	■	■	■ [1)]
Data pool devices	–	–	■ [1)]

[1)] Clarify the scope of functions directly with the respective MP partner.

Note

The devices that are supported by each MP cooperation partner can be viewed in the "MP Cooperation Partner List" on the Belimo website.

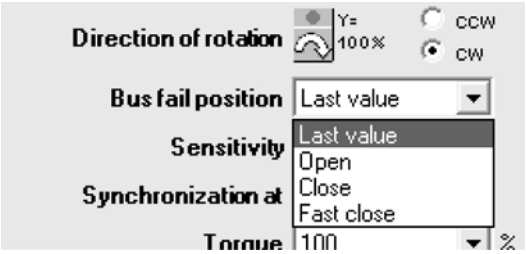
Bus fail position

Definition

For MP actuators, so-called bus fail positions can be set with the PC-Tool. This allows you to define how the actuator is to behave if communication with the MP client is lost. In the event of a loss of MP communication, the actuator detects this within 60 seconds and moves to the preset position.

Example

If bus communication fails, the valve actuator of a heating coil is opened completely (frost protection function).



Possible settings Bus fail position

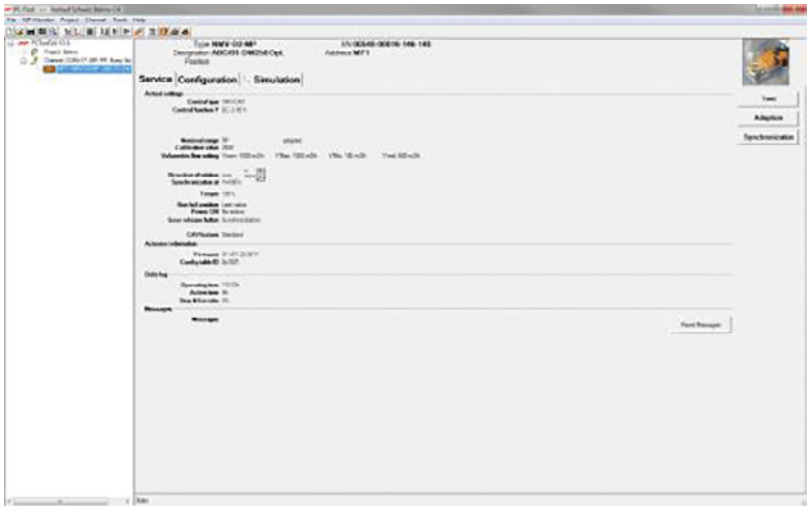
Actuator type	Possible bus fail positions, adjustable with PC-Tool	Default setting (factory setting)
..24 A-MP	– Last setpoint (actuator stops) – Open (actuator opens completely) – Close (actuator closes completely) – Fast close (actuator closes completely)	– Last setpoint (actuator stops)
...MV-Dx-MP	– Last setpoint (control mode) – Open (actuator opens completely) – Close (actuator closes completely) – Min./V'_{min} – Max./V'_{max}	– Last setpoint (control mode)

PC-Tool MFT-P: Parametrisation

The PC-Tool offers the following functions. Detailed instructions for the PC-Tool MFT-P can be found in the specific documentation in the PC-Tool itself.

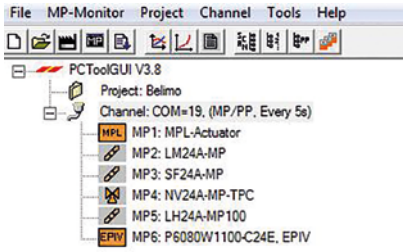
MP client operation

– Parametrisation of the actuators via MP-Bus
– Specification of setpoints for simulation of the actuators via MP-Bus
– Reading in the sensors connected to the MP actuator
– Recording of graphic trends



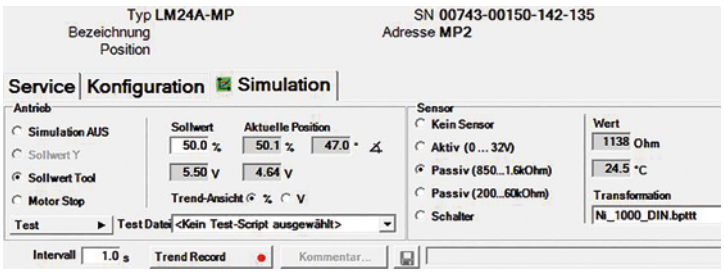
MP-Bus scan

After starting 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.



MP client simulation function

The following options are available in the "Simulation" section of the PC-Tool:
– Control of the connected MP nodes, independent of an MP client, and read the sensor values (setpoint tool).
– Readout and display of the setpoint signal of the MP client and the behaviour of the connected MP nodes (setpoint Y).



Recording a trend

Example of an LM24A-MP with passive sensor connected.

1 = Actuator setpoint

2 = Actuator actual value

3 = Sensor value in Ω

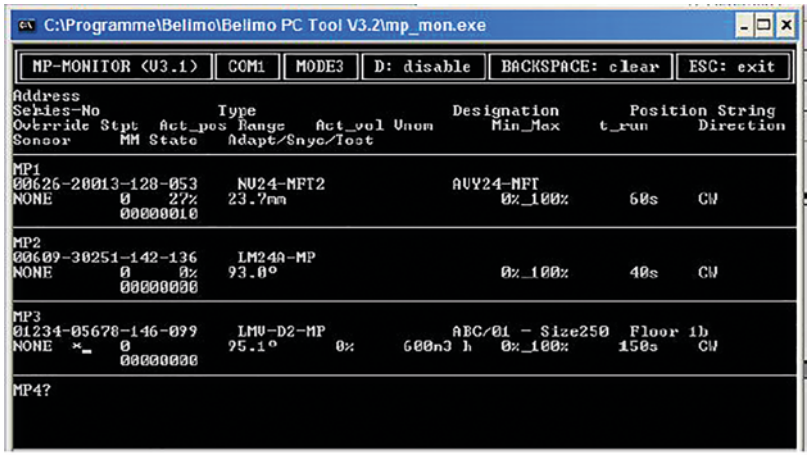
Note on sensor values

Sensor values are acquired with their raw value (Ω, mA, 0/1) and sent accordingly to the connected MP client.

PC-Tool MFT-P as diagnostics tool

Monitor function

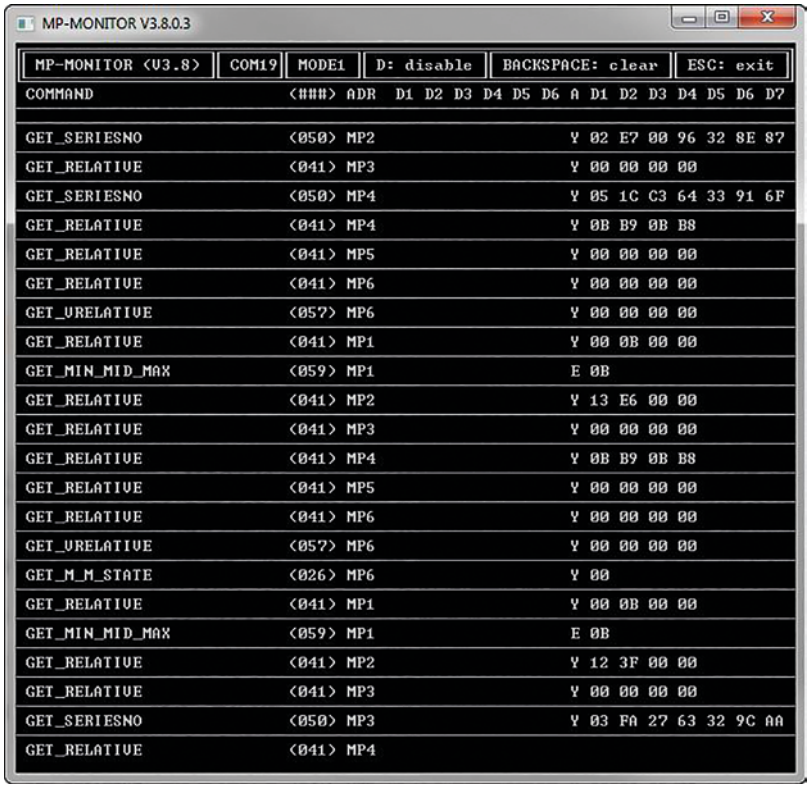
Checking MP communication with the MP monitor tool (module from PC-Tool V3.x).



The monitor function can be used to monitor and evaluate the MP-Bus communication. The following two functions are available for this purpose:

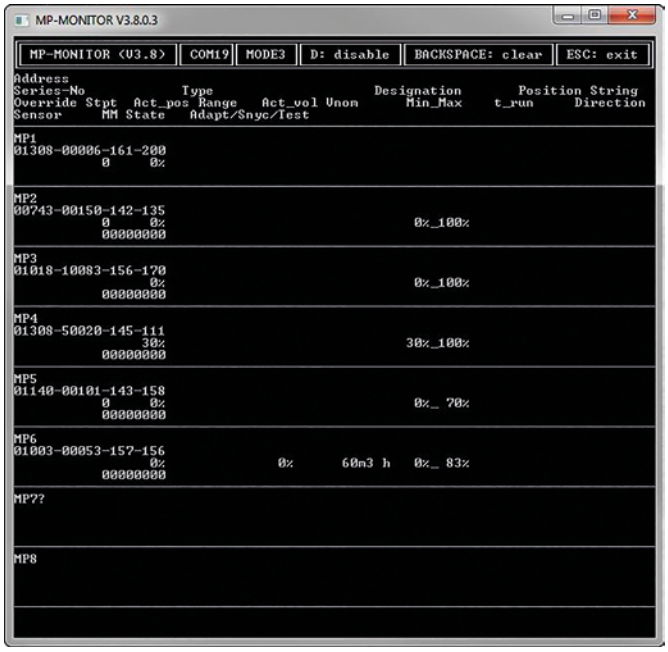
F1: MP logging at command level

Monitoring of the MP commands sent from the MP client to the MP nodes.



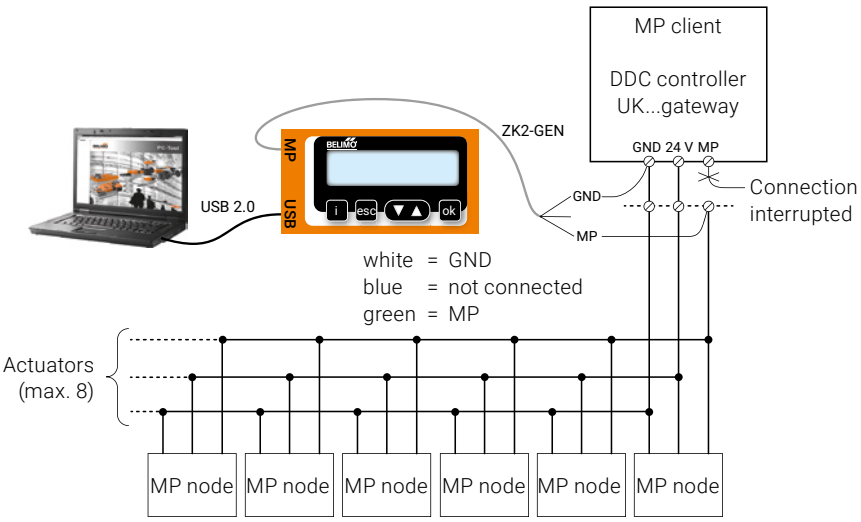
F3: MP logging at application level

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

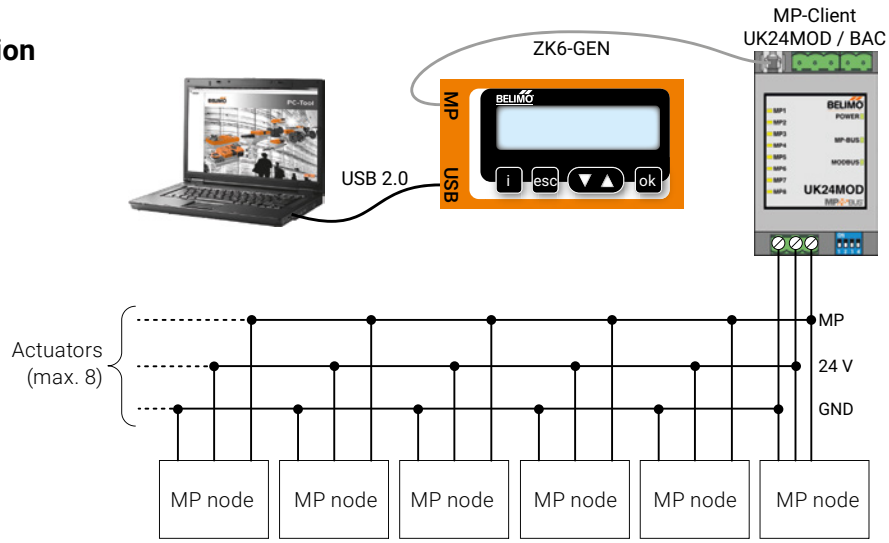


PC-Tool MFT-P: Connection possibilities

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



PC-Tool (MP client) at gateways with tool connection



Behaviour

When the PC-Tool is connected to the tool connector socket, the MP client is automatically deactivated (disabled) and the PC-Tool is recognised as the MP client. The higher-level bus system (e.g. BACnet, Modbus) becomes inactive.

As soon as the cable is removed from the tool connector plug, the gateway is operated (enabled) once again as MP client; the higher-level bus system activates the MP nodes and reads out their values once more.

Additional connection possibilities

For other connection options, see the "Tool connections" document on your local website.

Diagnostics options with ZTH EU

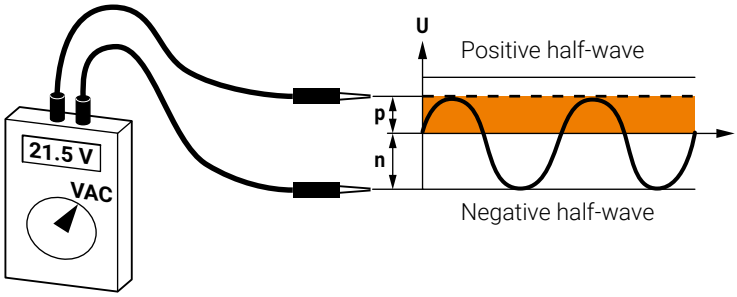
The following diagnostics options are available with the ZTH EU:

– Checking the power supply
– MP tester
  – Checking the MP-Bus levels
  – Telegram counter

Checking the power supply

The ZTH EU can be used to test the AC 24 V (III protective extra-low voltage (PELV)) power supply including the half-wave ratio (VHW) of the Belimo MP-Bus nodes.

Supply OK
AC 25 V, VHW: 85%

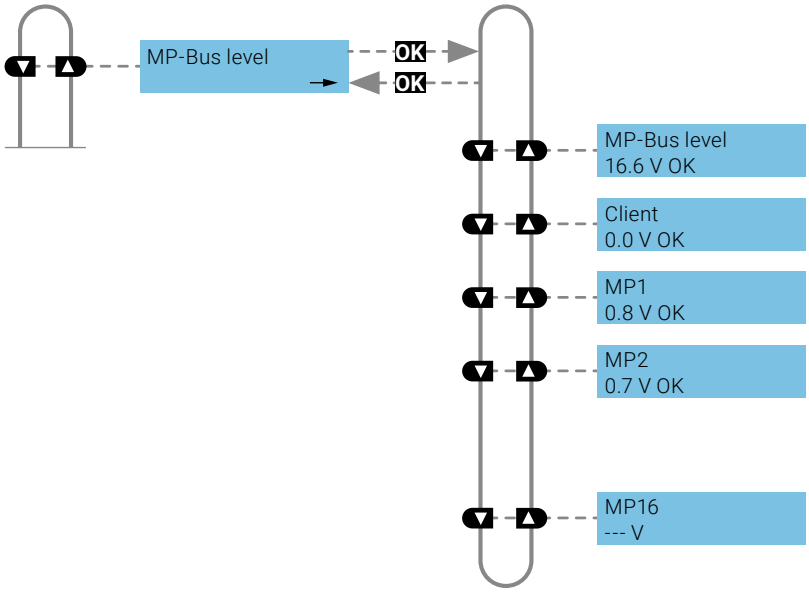


MP tester

With the MP tester function, the ZTH EU offers the possibility of determining the MP-Bus level at both the MP client and the MP server nodes. In addition, MP-Bus communication can be checked by counting the telegrams.

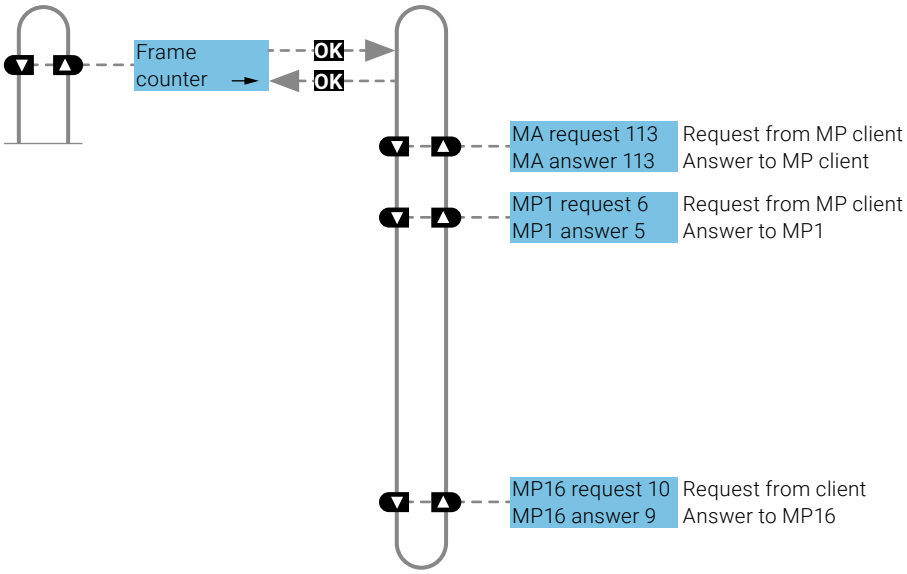
MP-Bus level

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



Frame counter

The number of telegrams is recorded and the correctness of telegrams (checksum) is checked.



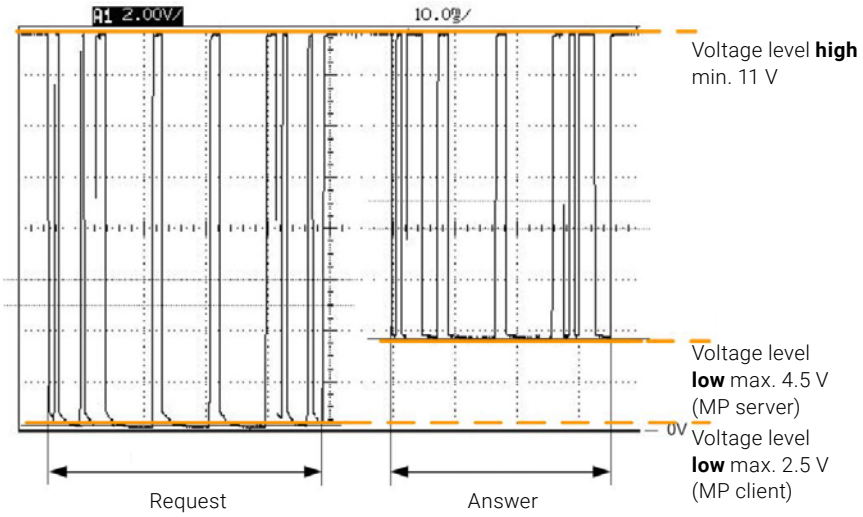
MP specifications

Brief description of MP communication

Communication	Single-Client/Multi-Server The server (MP node) answers only to commands from the MP clients
Data transmission	Bi-directional, half-duplex Communication takes place via the MP/U5 connection, referenced to GND.
Communication parameters	1200 baud, 8 data bits, 1 start bit, 1 stop bit, no parity
Number of participants on the MP-Bus	The communication protocol is enabled for 1 MP client and 1...8 (16) servers (MP nodes).

MP signal level

MP communication takes place on a carrier signal of 18 V between the ground and wire 5. The signals for commands from the MP client and the corresponding answer look like this (see figure below).

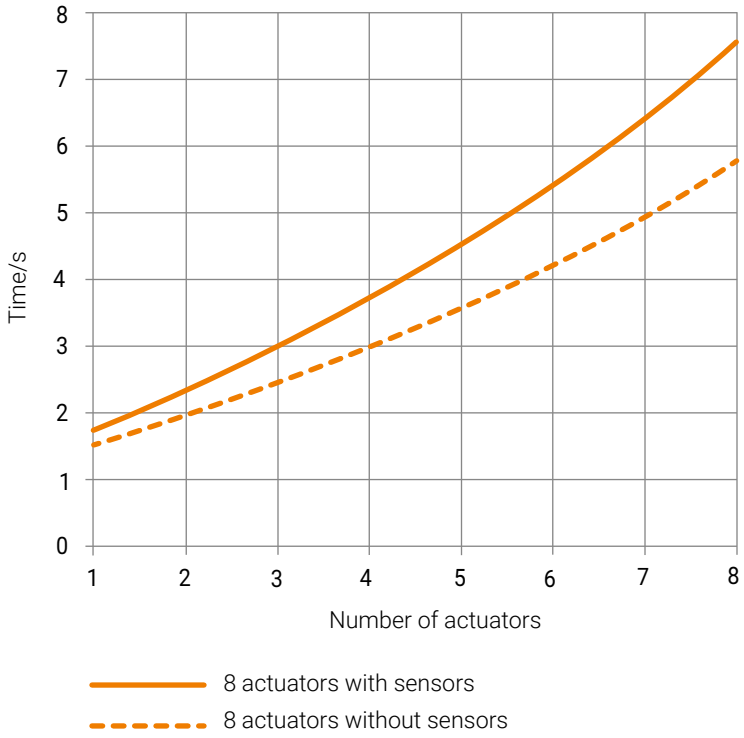


Measurement conditions

At least one MP node is connected to the MP client. All signals are measured from U5 to GND.	**min.**	**normal**
Voltage level **high** Request and answer	>11 V	12.5 V
Voltage level **low** Request (MP client)		>2.5 V
Voltage level **low** Answer (MP server)		>4.5 V

Polling intervals/cycle times

The more actuators to be operated on the bus and the more sensors for readout at the MP nodes, the longer the polling intervals on the Belimo MP-Bus.
The resulting cycle times on the MP-Bus are shown in the curve below.



Note

Cycle times can be reduced by prioritizing the MP commands (high, medium, low).

MP Partner Program

With the MP Partner Program, Belimo offers system integrators the opportunity to become MP cooperation partners.
Belimo makes the MP specifications available to all interested manufacturers of control devices in order to implement a corresponding MP interface in terms of hardware and software in their own DDC controllers.

Advantages of MP cooperation

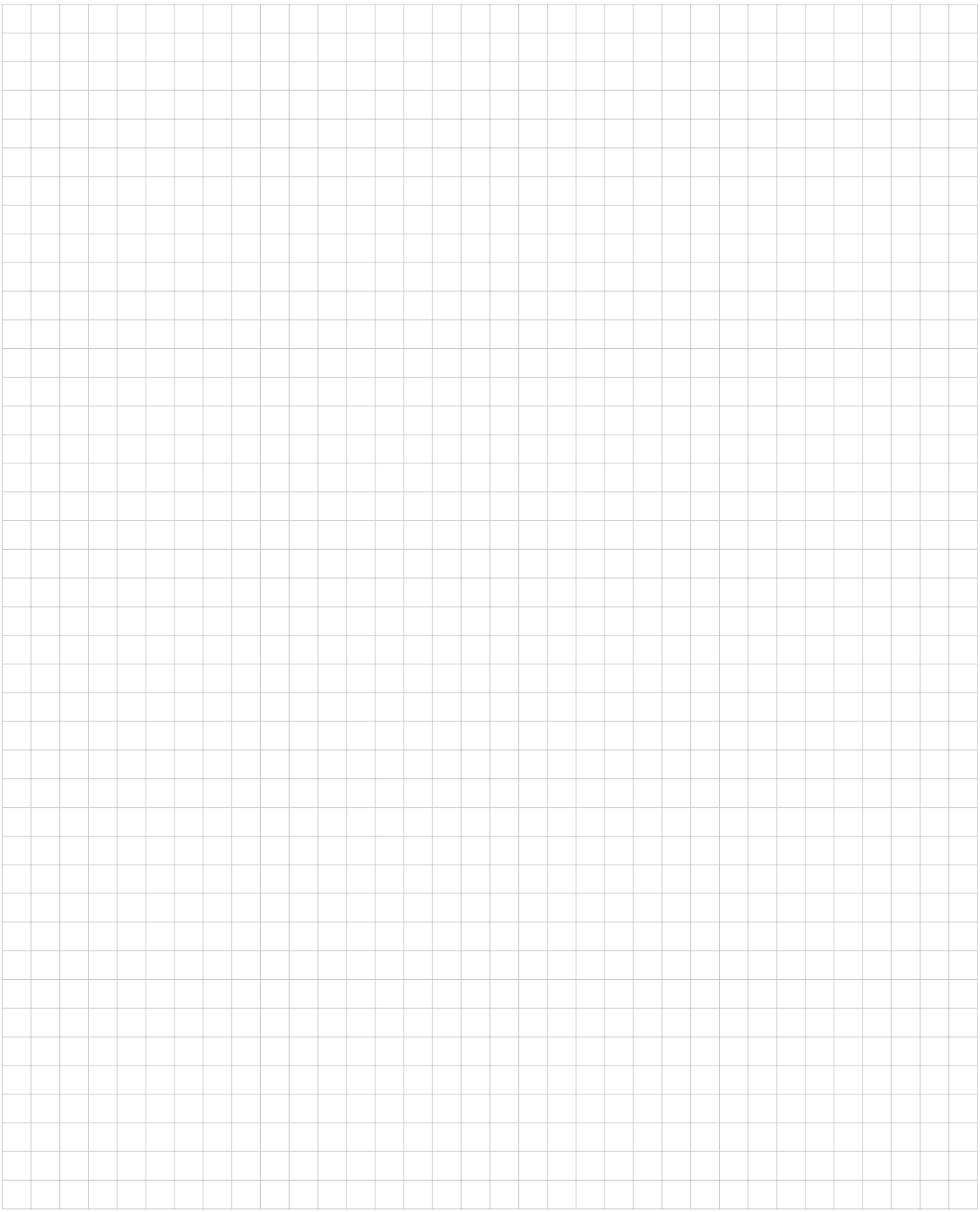
The MP partner benefits from the following advantages:

- It receives a certificate that the DDC used complies with the MP standard.
- It may use the MP logo.
- It is officially listed by Belimo as a cooperation partner for MP solutions in the MP cooperation list.
- It experiences an increase in quality due to:
  - Protection of the end customer against malfunctions
  - Avoidance of quality problems (no conformity tests on the plant necessary!)
  - Avoidance of reputational damage

Furthermore, new MP-Bus products are made available to MP partners for implementation at an early stage. This ensures that they are already available with your DDC solution at the time of market launch.

Request MP cooperation

If this is of interest to you, please contact your local Belimo representative.



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The “small” Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

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- Short delivery times
- Comprehensive support

EN – 2023-03/B – Subject to technical modifications

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