Application Note DK9222-0810-0035
IO/, Building Automation

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KL6771
HVAC
Belimo
Flap
MFT
MFT2
Building Automation
TwinCAT

MP-Bus for the control of actuators in HVAC systems

This application example from the series 'Building Automation Sub-bus Systems' conveys the basic principles of the MP-Bus and provides an overview of the KL6771 MP-Bus Master Terminal for the Beckhoff Bus Terminal system. Primarily intended for field devices in HVAC systems, the MP-Bus covers up to eight devices per master; the range of functions can be extended by one sensor per device. The bus devices in the MP-Bus network are integrated in the TwinCAT automation software via simple function blocks, making communication with each individual device possible from the PLC.

1. The MP-Bus

The MP-Bus (Multi-Point) is a simple sensor/actuator bus, which is used for certain sub-systems of building automation systems. The MP-Bus serves to control HVAC actuators for flaps, control valves and volumetric flow rate controllers from the Belimo Bus Solutions product range. Up to eight different devices from HVAC systems can be connected to an MP-Bus master using 3-wire technology. Additionally, a sensor can be connected to each of these eight devices; the sensor is addressed by the MP-Bus. An additional range of products with an MP-Bus connection is the FLS window ventilation system by the Belimo company (see Belimo documentation for the connection of the Belimo drives).

2. Origin

The MP-Bus was developed by Belimo Automation AG for connecting valves, throttle valves, air valves, fire dampers, and for window ventilation systems.

3. Typical field devices

- Exhaust flaps
- VAV boxes
- Fire dampers
- Window ventilation systems
- Regulating valves

In MP-Bus operating mode, one sensor can be connected per MP drive. The sensor value is acquired by the drive and transferred in digital form to the MP-Bus. The sensor value is scaled and evaluated in the MP master. Active sensors (output 0 – 10 V DC) and ON/OFF switches can be connected to MP/MFT drives. Passive resistance sensors (e.g. PT1000) can additionally be connected to MP/MFT2 drives.

3.1 MFT = multi-function technology

The MP-Bus-compatible actuators with the suffix MFT or MFT2 and also the NMV-D2M volumetric flow rate controller are structured according to the multi-function technology:

1. Parameterizable

   The drives can be adapted in terms of application or service using an MFT parameterizing device. For example, running time and torque or actuating force can be adjusted.

2. MP-Bus operating mode

   An MFT2 actuator can be changed from conventional control to bus control by assigning it an MP address (MP1 to MP8).

3. Sensor connection

   In MP-Bus operating mode, one sensor can be connected per MFT/MFT2 drive. The sensor value is acquired by the drive and transmitted in digital form to the MP-Bus.

3.2 MFT and MFT2

MFT and MFT2 drives differ only by the types of sensors that can be connected to them in MP-Bus operating mode. Only active sensors (output 0 – 10 V DC) and digital signals can be connected to MFT drives. Passive resistance sensors (e.g. PT1000) can also be connected to MFT2 drives.

4. Master versions

An MP-Bus master can control up to eight MP drives. An MP cooperation node (e.g. PLC or DDC controller with MP interfaces) or an MP gateway with connection to any fieldbus system can serve as a master.

Application Note DK9222-0810-0035

IO/, Building Automation

5. Topology

There are no restrictions whatsoever with regard to the topological structure of MP-Bus strands: star, ring, tree or mixed topologies are possible. The length of the entire bus strand depends on the selected cable cross-section and the type as well as the number of connected drives! Documentation from the Belimo Automation AG contains further information.

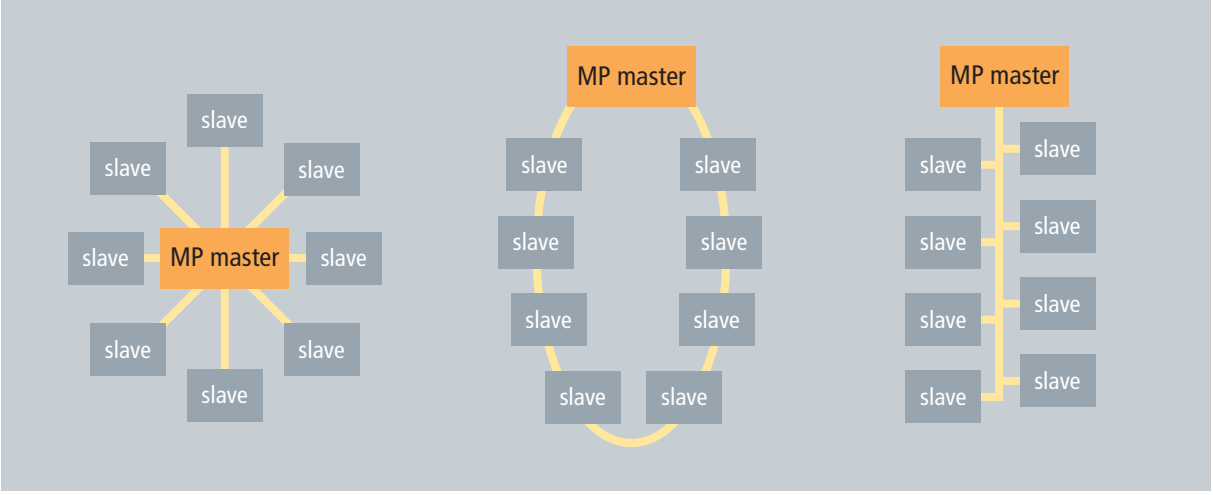

Fig. 1 MP-Bus topologies

6. Communication: short description

Communication

Master-Slave – the slave answers only to commands from the MP master

Data transfer

Bi-directional, half-duplex.Communication takes place via the Belimo U5 connector, referenced to GND.

Communication parameter

1200 Baud, 8 data bits, 1 start bit, 1 stop bit, no parity

Number of devices on the MP-Bus

The communication protocol is released for 1 MP master and 1 to 8 MP/MFT(2) slaves.

Communication times

A command has an average propagation delay of approx. 150 ms and always consists of instruction and answer. One command is sent per device, so that the propagation delays add up. The more drives that have to be served on the bus and the more sensors that need to be read, the longer the query intervals will be on the MP-Bus.

Application Note DK9222-0810-0035

IO/, Building Automation

7. Power supply

Power can be supplied inside the MP-Bus in three different ways:

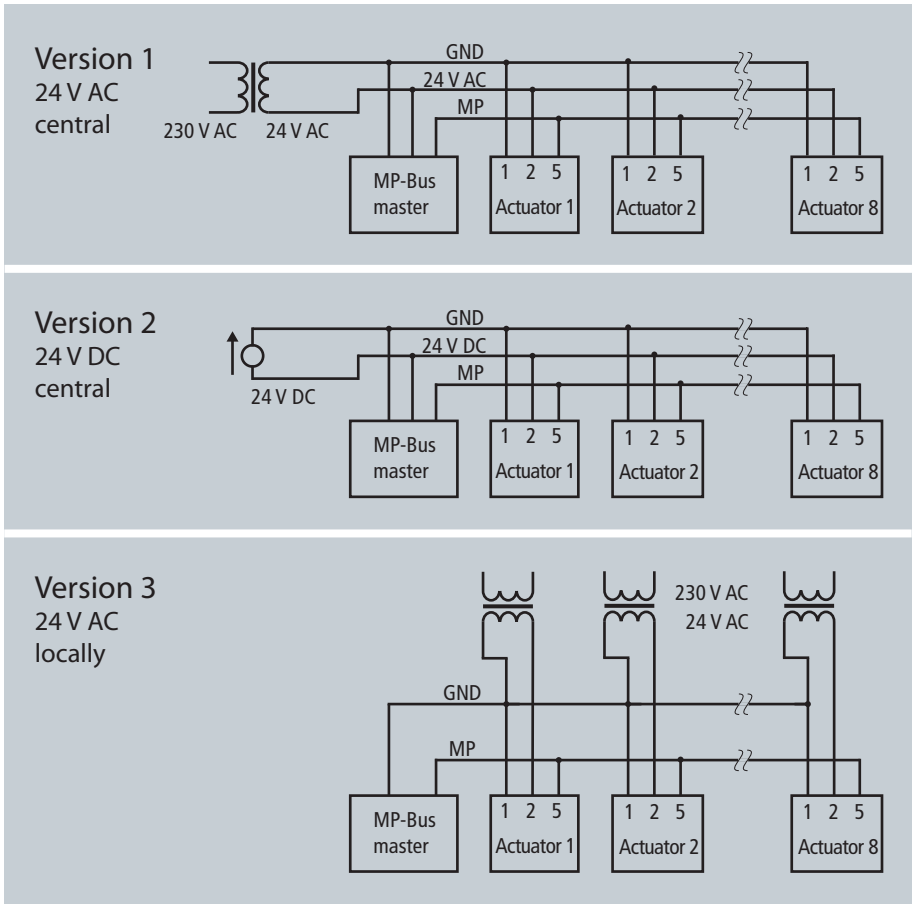

Fig. 2 Power supply in the MP-Bus

Communication and power supply for the MP-Bus can take place via the same cable. The MP drives are supplied with power with GND plus 24 V AC or V DC. The MP master communicates with the connected drives via the communication connection, which is referenced to the GND of the power supply. Neither special cables nor end resistors are necessary; an MP-Bus connection can be established using conventional installation cables. .

8. MP-Bus master terminal KL6771

The KL6771 MP-Bus Master Terminal from Beckhoff makes the direct connection of MP-Bus slave devices possible. Up to 16 field devices (eight drives and eight sensors) can be connected to the KL6771. Process data exchange is fieldbus-independent. The Bus Terminal is configured and commissioned via TwinCAT function blocks. Status LEDs directly indicate the

Application Note DK9222-0810-0035

IO/, Building Automation

bus status. Several KL6771 Bus Terminals can be connected to the same Bus Coupler or Bus Terminal Controller. The KL6771 supports only a DC power supply.

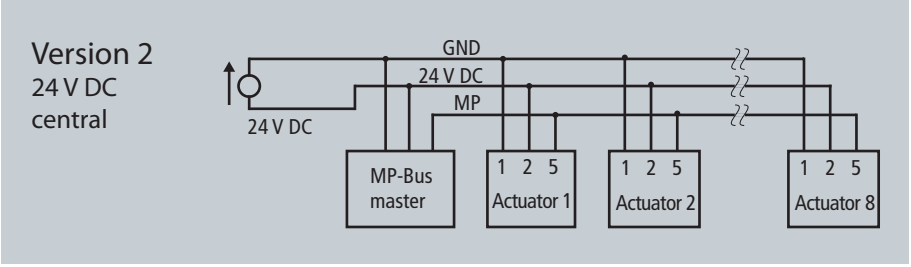

Fig. 3 Power supply when using the KL6771

Supported sensors and drives

- VAVs (volumetric flow rate controllers, for example NMV-D2M)
- FLS window opener
- Valve drives and actuators, for example NM24-MFT2, NV23-MFT2
- Fire dampers, for example BF24TL-T-ST
- PTH sensors (combination sensors for pressure, temperature and moisture)

Notice: The designations used above correspond to Belimo Automation's part numbers !

There is a function block that carries out communication with the device for each of these drives or sensors. The MP-Bus slave is addressed through an addressing block. The slaves can be addressed manually or automatically.

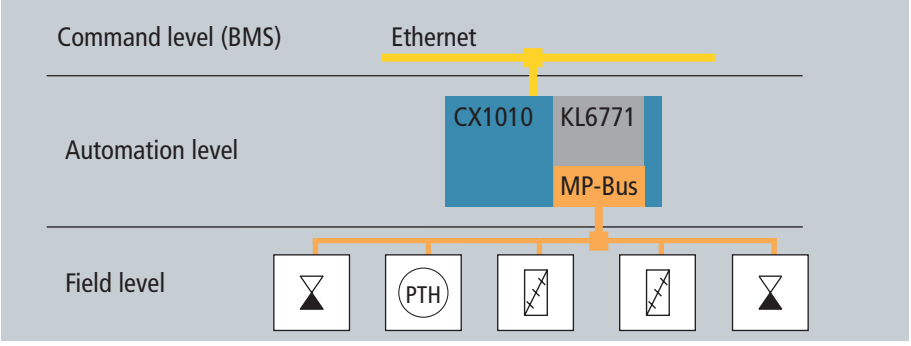

Fig. 4 Integration of the typical MP-Bus field devices in the automation level

Application Note DK9222-0810-0035

IO/, Building Automation

9. Integration in TwinCAT

TwinCAT supports the KL6771 with its own library. TwinCAT PLC has an appropriate library for addressing the KL6771 from the application via function blocks. These enable the exchange of data between the application program running on the higher level controller and the MP devices connected to the KL6771. The use of a Bus Terminal controller, on which the MP-Bus library then works, is necessary for the use of the KL6771 on an external controller. Operation of the KL6771 on a PC or CX Embedded PC without TwinCAT PLC is not supported!

KL6771	Function block for communication with the KL6771
MP_Addressing	Addresses the MP-Bus devices
MP_DamperLinearActuator	Controls the flap drives
MP_PTH	Reads a PTH sensor
MP_Smoker	Controls a fire protection flap
MP_VAV	Controls a volume flow rate regulator
MP_Window	Controls a window opener (FLS)
MP_UST-3	Controls a UST-3 multi-I/O module

Fig. 5 Function blocks available in TwinCAT for the KL6771

10. Application example: control of the inlet air temperature in an air conditioning system

The control of inlet air within an air conditioning system is schematically represented by the following example. The field devices that can be controlled via the MP bus are marked by the "MP BUS" symbol.

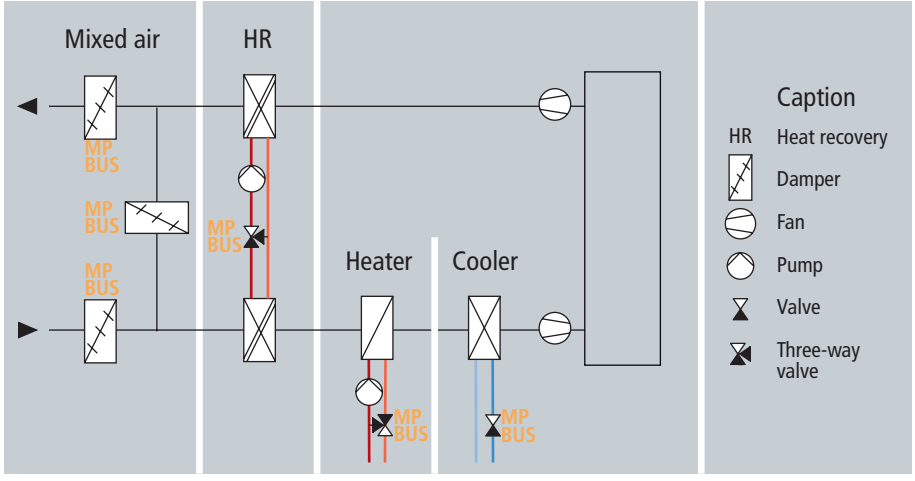

Fig. 6 Use of the MP-Bus for the control of the inlet air temperature in an air conditioning system

Control of the inlet air temperature for an air conditioning system by means of MP-Bus results in advantages for control and cabling.

Application Note DK9222-0810-0035

IO/, Building Automation

All drives can be controlled centrally via the PLC and can also be addressed directly from the PLC. This provides the advantage that the integrated status messages and process information are available on the CPU. Therefore, functions such as diagnostics or feedback are also present in the PLC and can be used for further functions, depending on the programming. In addition, the parameters of the individual field devices can be changed either locally or from the outside.

The integration of the sensors directly on the drive reduces installation expenditure and commissioning time. Furthermore, cabling that is typically structured for a bus can be used.

– MP-Bus master terminal **www.beckhoff.com/KL6771**
– Building Automation **www.beckhoff.com/building**
– TwinCAT PLC Libraries
  www.beckhoff.com/english/twincat/twincat_supplements_building_automation.htm
– Belimo Automation AG **www.belimo.eu**