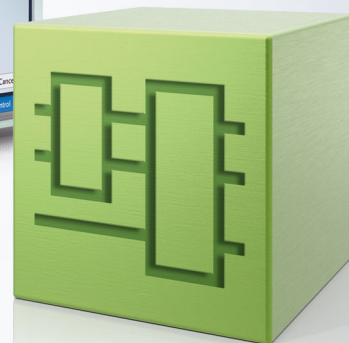
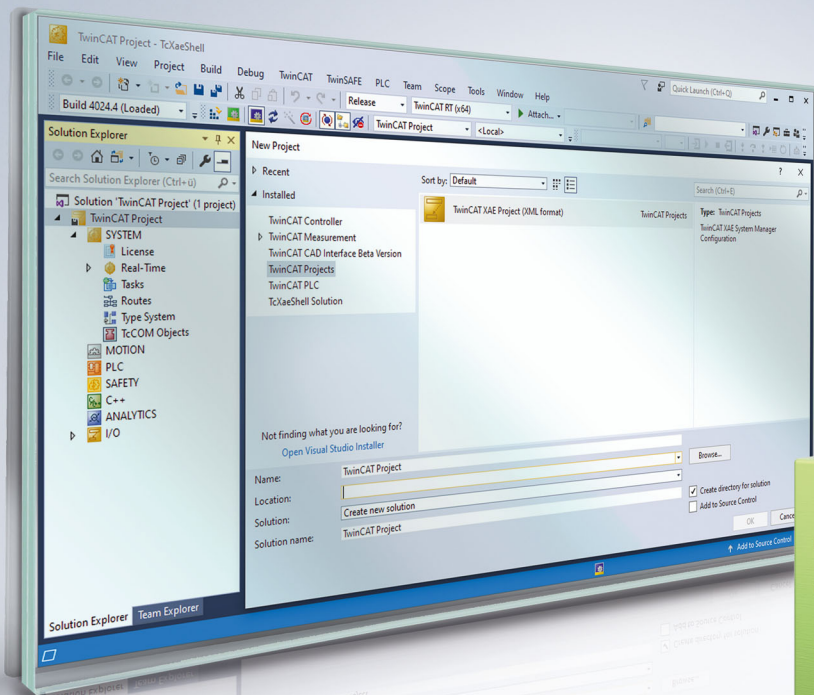


# BECKHOFF New Automation Technology

Manual | EN

# TE1000

TwinCAT 3 | PLC Library: Tc2\_MPBUS





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# 1 Foreword

## 1.1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.

For installation and commissioning of the components, it is absolutely necessary to observe the documentation and the following notes and explanations.

The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfies all requirements for safety, including all the relevant laws, regulations, guidelines, and standards.

### Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without notice.

No claims to modify products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation.

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EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702  
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## 1.2 For your safety

### Safety regulations

Read the following explanations for your safety.

Always observe and follow product-specific safety instructions, which you may find at the appropriate places in this document.

**Exclusion of liability**

All the components are supplied in particular hardware and software configurations which are appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

**Personnel qualification**

This description is only intended for trained specialists in control, automation, and drive technology who are familiar with the applicable national standards.

**Signal words**

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

**Personal injury warnings****⚠ DANGER**

Hazard with high risk of death or serious injury.

**⚠ WARNING**

Hazard with medium risk of death or serious injury.

**⚠ CAUTION**

There is a low-risk hazard that could result in medium or minor injury.

**Warning of damage to property or environment****NOTICE**

The environment, equipment, or data may be damaged.

**Information on handling the product**

This information includes, for example:  
recommendations for action, assistance or further information on the product.

## 1.3 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our <https://www.beckhoff.com/secguide>.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at <https://www.beckhoff.com/secinfo>.

## 2 Introduction

The Tc2\_MPBus library is a TwinCAT PLC library for data exchange with MP-Bus devices.

This library should only be used in conjunction with a KL6771 (MP-Bus master terminal).

The user of this library requires basic knowledge of the following:

- TwinCAT XAE
- PC and network knowledge
- Structure and properties of the Beckhoff Embedded PC and its Bus Terminal system
- Technology of MP-Bus devices
- Relevant safety regulations for building technical equipment

This software library is intended for building automation system partners of Beckhoff Automation GmbH & Co. KG. The system partners operate in the field of building automation and are concerned with the installation, commissioning, expansion, maintenance and service of measurement, control and regulating systems for the technical equipment of buildings.

The Tc2\_MPBus library is usable on all hardware platforms that support TwinCAT 3.1 or higher.

Hardware documentation in the Beckhoff information system: [KL6771](#)



## 3 MP-Bus

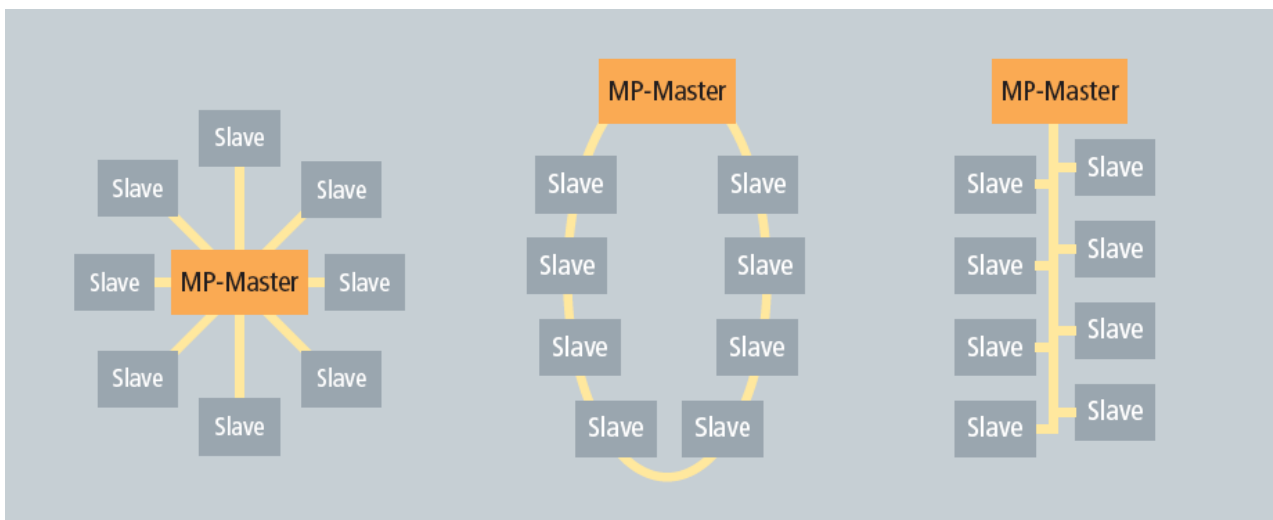
MP-bus = multi-point bus

The MP-Bus (Multi-Point) is a simple sensor/actuator bus, which is used for certain technical systems of the building automation system. The MP-Bus serves to control HVAC actuators for dampers, control valves and volume flow controllers from the Belimo 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 Belimo (see Belimo documentation for the connection of the Belimo actuators).

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

### 3.1 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! The documentation from the Belimo company contains further information.



## **3.2 Actuator solutions**

Types <sup>1</sup>	Unit	ready for extended MP-Bus® <sup>2</sup>	Beckhoff function block
<b>General air solutions</b>			
<b>Rotary actuators</b>			
CM24-MPL-L	2 Nm	•	MPL_DamperLinearActuator
CM24-MPL-R	2 Nm	•	
LM24A-MP	5 Nm		MP_DamperLinearActuator
NM24A-MP	10 Nm		
SM24A-MP	20 Nm		
GM24A-MP	40 Nm		
<b>Rotary actuators with emergency control function</b>			
TF24-MFT	2 Nm		MP_DamperLinearActuator
LF24-MFT2	4 Nm		
NF24A-MP	10 Nm		
SF24A-MP	20 Nm		
EF24A-MP	30 Nm		
GK24A-MP	40 Nm		
<b>Linear actuators</b>			
LH24A-MP... 60/100/200/300	150 Nm		MP_DamperLinearActuator
SH24A-MP... 100/200/300	450 Nm		
<b>Linear actuators with emergency control function</b>			
LHK24A-MP100	150 Nm		MP_DamperLinearActuator
SHK24A-MP100	450 Nm		
<b>Rotary actuators</b>			
LU24A-MP	3 Nm		MP_DamperLinearActuator
<b>Fast running rotary actuators</b>			
NMC24A-MP	10 Nm		MP_DamperLinearActuator
SMC24A-MP	20 Nm		
<b>Rotary actuators for special applications</b>			
NM24P-MP	10 Nm		MP_DamperLinearActuator
SM24P-MP	20 Nm		
GM24G-MP-T	40 Nm		
<b>Rotary actuators with emergency control function for special applications</b>			
NF24G-MP-L	10 Nm		MP_DamperLinearActuator
SF24G-MP-L	20 Nm		
GK24G-MP	40 Nm		
<b>Water solutions</b>			
<b>Actuators for control ball valves / open-close control ball valves</b>			
CQ24A-MPL	1 Nm	•	MPL_DamperLinearActuator
LR24A-MP	5 Nm		MP_DamperLinearActuator
NR24A-MP	10 Nm		
SR24A-MP	20 Nm		
<b>Actuators with emergency control function for control ball valves / open-close control ball valves</b>			
TRF24-MFT	2 Nm		MP_DamperLinearActuator
LRF24-MP	4 Nm		
NRF24A-MP	10 Nm		
<b>Actuators for globe valves</b>			

Types <sup>1</sup>	Unit	ready for extended MP-Bus® <sup>2</sup>	Beckhoff function block
LV24A-MP-TPC	500 N		MP_DamperLinearActuator
NV24A-MP-TPC	1000 N		
SV24A-MP-TPC	1500 N		
EV24A-MP-TPC	2500 N		
<b>Actuators with emergency control function for globe valves</b>			
NVK24A-MP-TPC	1000 N		MP_DamperLinearActuator
AVK24A-MP-TPC	2000 N		
<b>Fast running actuators for globe valves</b>			
LVC24A-MP-TPC	500 N		MP_DamperLinearActuator
NVC24A-MP-TPC	1000 N		
SVC24A-MP-TPC	1500 N		
<b>Fast running actuators with emergency control function for globe valves</b>			
NVVC24A-MP-TPC	1000 N		MP_DamperLinearActuator
<b>Actuators for dampers</b>			
SR24A-MP-5	20 Nm		MP_DamperLinearActuator
GR24A-MP-5/7	40 Nm		
DR24A-MP-...5/7	90 Nm		
PRCA-BAC-S2-T	160 Nm		
PRKCA-BAC-S2-T	160 Nm		
SY2-24-MP-T	90 Nm		
SY2-230-MP-T	90 Nm		
SY3-24-MP-T	150 Nm		
SY3-230-MP-T	150 Nm		
SY4-24-MP-T	400 Nm		
SY4-230-MP-T	400 Nm		
SY5-24-MP-T	500 Nm		
<b>Flow measurement / heating or cooling circuit</b>			
22PF-...		•	MP_FlowMeter_Process MP_FlowMeter_Configuration
<b>Safety solutions</b>			
<b>"BF-TopLine" actuators for fire dampers</b>			
BKN230-24MP for connection of BF(G)24TL-T-ST	11 / 18 Nm		MP_Smoker
<b>Standard actuator for fire dampers</b>			
BKN230-24-C-MP for connection of BF..24-..ST	4 / 9 / 11 / 18 Nm		MP_Smoker
<b>Room and system solutions</b>			
<b>VAV compact rotary actuators</b>			
LMV-D3-MP	5 Nm		MP_VAV
NMV-D3-MP	10 Nm		
SMV-D3-MP	20 Nm		
<b>VAV compact linear actuators</b>			
LHV-D3-MP	150 N		MP_VAV
<b>VAV Universal</b>			
VRP-M			MP_VAV
VRU-D3-BAC			MP_VRU_Process
VRU-M1-BAC			MP_VRU_Configuration
VRU-M1R-BAC			

Types <sup>1</sup>	Unit	ready for extended MP-Bus® <sup>2</sup>	Beckhoff function block
<b>VAV indoor climate control system</b>			
CMV-100-MP	DN 100	•	MP_CMV
CMV-125-MP	DN 125	•	
CMV-150-MP	DN 150	•	
CMV-160-MP	DN 160	•	
<b>HVAC performance devices</b>			
<b>EPIV</b>			
EP..R-R6+BAC	DN 15-20	•	MP_EPIV_R6 MP_EPIV_R6_Parameter
EP..R+MP	DN 15-20		MP_EPIV
P..W..E-MP	DN 65-150		
<b>EPIV V4</b>			
EP..R2+(K)BAC	DN 15-50	•	MP_EPIV_V4_Process MP_EPIV_V4_Configuration
<b>Energy Valve™</b>			
EV..R+BAC	DN 15-50	•	MP_EV
P..W..EV-BAC	DN 65-150	•	MP_EV_Parameter
<b>Energy Valve™ V4</b>			
EV..R2+..	DN 15-50	•	MP_EnergyValveV4_Process MP_EnergyValveV4_Configuration
<b>Thermal Energy Meter</b>			
22PE- ..		•	MP_TEM_Process
22PEM-..		•	MP_TEM_Configuration
<b>Flow Meter</b>			
22PF-..		•	MP_FlowMeter_Process MP_FlowMeter_Configuration
<b>Sensors</b>			
<b>Room sensors in the comfort zone</b>			
22RT-19-1 (temp.)		•	MP_RoomSensor
22RTH-19-1 (temp., rh)		•	MP_RoomSensor_Parameter
22RTM-19-1 (temp., CO <sub>2</sub> , rh)		•	
MS24A-R02-MPX (temp., CO <sub>2</sub> )		•	
MS24A-R08-MPX (temp., VOC, CO <sub>2</sub> , rH)		•	MP_MPX
<b>Room control units</b>			

Types <sup>1</sup>	Unit	ready for extended MP-Bus® <sup>2</sup>	Beckhoff function block
P-22Rxx-1900x-1		•	MP_OperatingUnit MP_OperatingUnit_ConfigurationCO2 MP_OperatingUnit_ConfigurationTemp MP_OperatingUnit_ConfigurationDisplay MP_OperatingUnit_ConfigurationVentilation MP_OperatingUnit_ConfigurationStatusIcons MP_OperatingUnit_ConfigurationOffsetValues

<sup>1</sup> The currently available product range can be found online at [www.belimo.com](http://www.belimo.com).

<sup>2</sup> The marked devices support the extended address range. Up to 16 MP devices (addressed MP1 ... MP16) can be connected to a data line. If unmarked devices are connected to the same data line, the common address range should be limited to 8 MP devices.

# 4 Programming

Function blocks

Function blocks	Description
<a href="#">KL6771</a> [ <a href="#">▶ 25</a> ]	Communication with a KL6771 MP-Bus master terminal.
<a href="#">MP Addressing</a> [ <a href="#">▶ 26</a> ]	This function block allows an MP-Bus slave to be addressed.
<a href="#">MP CMV</a> [ <a href="#">▶ 28</a> ]	This function block is used to control and monitor a volume flow controller.
<a href="#">MP DamperLinearActuator</a> [ <a href="#">▶ 30</a> ]	This function block is used to control and monitor an actuator of a damper and of a globe valve.
<a href="#">MP EnergyValveV4 Configuration</a> [ <a href="#">▶ 32</a> ]	This function block is used to configure the Energy Valve actuators EV...R2+... (V4).
<a href="#">MP EnergyValveV4 Process</a> [ <a href="#">▶ 36</a> ]	This function block is suitable for Energy Valve actuators EV...R2+... (V4).
<a href="#">MP EPIV</a> [ <a href="#">▶ 39</a> ]	This function block is used to control a pressure-independent control ball valve.
<a href="#">MP EPIV R6</a> [ <a href="#">▶ 41</a> ]	This function block is used to control a control ball valve of series EP...R-R6+BAC.
<a href="#">MP EPIV R6 Parameter</a> [ <a href="#">▶ 43</a> ]	This function block is used to parameterize actuators of series EP...R-R6+BAC.
<a href="#">MP EPIV V4 Configuration</a> [ <a href="#">▶ 44</a> ]	This function block is used to configure the 2-way EPIV V4 DN 15...50 EP...R2+(K)BAC.
<a href="#">MP EPIV V4 Process</a> [ <a href="#">▶ 46</a> ]	This function block is suitable for 2-way EPIV V4 DN 15...50 EP...R2+(K)BAC.
<a href="#">MP EV</a> [ <a href="#">▶ 49</a> ]	This function block is used to control a control ball valve of series P6...W..EV-BAC.
<a href="#">MP EV Parameter</a> [ <a href="#">▶ 51</a> ]	This function block is used to parameterize actuators.
<a href="#">MP FlowMeter Configuration</a> [ <a href="#">▶ 52</a> ]	This function block is used to configure the flow meters (FM).
<a href="#">MP FlowMeter Process</a> [ <a href="#">▶ 53</a> ]	This function block is suitable for the flow meters (FM).
<a href="#">MP MPX</a> [ <a href="#">▶ 54</a> ]	For BELIMO room sensor MS24A-R...-MPX.
<a href="#">MP OperatingUnit</a> [ <a href="#">▶ 56</a> ]	This function block is used to read room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration CO2</a> [ <a href="#">▶ 58</a> ]	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration Display</a> [ <a href="#">▶ 60</a> ]	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration OffsetValues</a> [ <a href="#">▶ 62</a> ]	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration StatusIcons</a> [ <a href="#">▶ 63</a> ]	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit ConfigurationTemp</a> [ <a href="#">▶ 64</a> ]	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration Ventilation</a> [ <a href="#">▶ 66</a> ]	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP PTH</a> [ <a href="#">▶ 67</a> ]	This function block is used to control and monitor a PTH sensor.
<a href="#">MP RoomSensor</a> [ <a href="#">▶ 69</a> ]	This function block is used to read room sensors.
<a href="#">MP RoomSensor Parameter</a> [ <a href="#">▶ 70</a> ]	This function block is used for the parameterization of room sensors.
<a href="#">MP Smoker</a> [ <a href="#">▶ 72</a> ]	This function block is used to control and monitor a fire damper.
<a href="#">MP TEM Configuration</a> [ <a href="#">▶ 73</a> ]	This function block is used to configure the Thermal Energy Meter type 22PE-... and 22PEM-... .



Function blocks	Description
<a href="#">MP_TEM_Process</a> [ <a href="#">▶ 75</a> ]	This function block is suitable for the Thermal Energy Meter type 22PE-... and 22PEM-... .
<a href="#">MP_UST_3</a> [ <a href="#">▶ 76</a> ]	This function block is used to control and monitor a multi-I/O module UST3.
<a href="#">MP_VAV</a> [ <a href="#">▶ 79</a> ]	This function block is used to control and monitor a volume flow controller.
<a href="#">MP_VRU_Configuration</a> [ <a href="#">▶ 81</a> ]	This function block is used to configure the VAV actuators VRU-D3-BAC, VRU-M1-BAC and VRU-M1R-BAC.
<a href="#">MP_VRU_Process</a> [ <a href="#">▶ 83</a> ]	This function block is suitable for VAV actuators VRU-D3-BAC, VRU-M1-BAC and VRU-M1R-BAC.
<a href="#">MP_Window</a> [ <a href="#">▶ 85</a> ]	This function block is used to control and monitor a window ventilation system (FLS).
<a href="#">MPL_DamperLinearActuator</a> [ <a href="#">▶ 87</a> ]	This function block is used to control and monitor an actuator of a damper and of a globe valve.

**Functions**

Function blocks	Description
<a href="#">NI1000_LuS_TO_INT</a> [ <a href="#">▶ 88</a> ]	This function calculates a temperature from the value of an NI1000 L&S resistor.
<a href="#">NI1000_TO_INT</a> [ <a href="#">▶ 88</a> ]	This function calculates a temperature from the value of an NI1000 resistor.
<a href="#">NTC_TO_INT</a> [ <a href="#">▶ 89</a> ]	This function calculates a temperature from the value of an NTC resistor.
<a href="#">PT1000_TO_INT</a> [ <a href="#">▶ 89</a> ]	This function calculates a temperature from the value of a PT1000 resistor.

## Enums

Data types	Description
Data_Window [ <a href="#">▶ 95</a> ]	Ventilation type.
E_MP_AirQualityStatus [ <a href="#">▶ 95</a> ]	Status of the measured air quality.
E_MP_DisplayBackground [ <a href="#">▶ 96</a> ]	Background color of the display.
E_MP_DisplayModeButton [ <a href="#">▶ 96</a> ]	Display mode of the buttons.
E_MP_DisplayModeHeatingCooling [ <a href="#">▶ 96</a> ]	Display mode of heating or cooling icons.
E_MP_DisplayModelconWarning [ <a href="#">▶ 96</a> ]	Display mode of the warning icon.
E_MP_DisplayModelconWindow [ <a href="#">▶ 97</a> ]	Display mode of the window icon.
E_MP_DisplayModeTemp [ <a href="#">▶ 97</a> ]	Display mode temperature.
E_MP_DisplayModeTempUnit [ <a href="#">▶ 97</a> ]	Display mode of the unit for the temperature.
E_MP_DisplayModeVentilationStage [ <a href="#">▶ 97</a> ]	Number of adjustable ventilation stages shown on the display.
E_MP_DisplayVisibility [ <a href="#">▶ 98</a> ]	Visibility on the display.
E_MP_EnabledStatus [ <a href="#">▶ 98</a> ]	Enabled status.
E_MP_EP_R_R6_UnitSel [ <a href="#">▶ 98</a> ]	Scaling.
E_MP_EV_V4_BusFailAction [ <a href="#">▶ 99</a> ]	Bus failure action.
E_MP_EV_V4_Command [ <a href="#">▶ 99</a> ]	Command for service and test functions of the actuator.
E_MP_EV_V4_ControlMode [ <a href="#">▶ 99</a> ]	Control mode.
E_MP_EV_V4_DeltaTLimitation [ <a href="#">▶ 100</a> ]	Response to a low delta T.
E_MP_EV_V4_DeltaTManagerStatus [ <a href="#">▶ 100</a> ]	Status from Delta T Manager.
E_MP_EV_V4_OverrideControl [ <a href="#">▶ 100</a> ]	Setpoint override.
E_MP_EV_V4_Sensor1Type [ <a href="#">▶ 101</a> ]	External sensor at input S1.
E_MP_SystemOperationMode [ <a href="#">▶ 101</a> ]	Operation mode of the system.
E_MP_VRU_Application [ <a href="#">▶ 101</a> ]	Visualization of the application selected by the manufacturer.
E_MP_VRU_Command [ <a href="#">▶ 102</a> ]	Commands for service and test functions of the actuator.
E_MP_VRU_OverrideControl [ <a href="#">▶ 102</a> ]	Setpoint override.
E_MP_VRU_RoomPressureCascade [ <a href="#">▶ 103</a> ]	Room pressure cascade control.
E_MP_VRU_Sensor1Type [ <a href="#">▶ 103</a> ]	External sensor at input S1.
E_MPBus_ControlMode [ <a href="#">▶ 103</a> ]	Control mode.
E_MPBus_DeltaTLimitation [ <a href="#">▶ 104</a> ]	Delta T (dT) limitation.
E_MPBus_Override [ <a href="#">▶ 104</a> ]	Override mode.
E_MPBus_Override_6wayMPIV [ <a href="#">▶ 105</a> ]	Override control mode.
MP_ERROR [ <a href="#">▶ 105</a> ]	Error messages.
UST3_EX [ <a href="#">▶ 107</a> ]	Voltage scaling.
UST3_R_SET [ <a href="#">▶ 107</a> ]	Resistance scaling.

**Structures**

<b>Data types</b>	<b>Description</b>
<a href="#">DataKL6771 [►_108]</a>	Links the send and receive blocks with the function block KL6771.
<a href="#">MP_BUS_MPX_ERROR [►_108]</a>	Error messages of the "MPX" sensors.
<a href="#">MP_Serial_Number [►_109]</a>	Serial number of the device.
<a href="#">St_MP_EV_V4_MalfunctionServiceInfo [►_109]</a>	Fault and service information.
<a href="#">St_MP_VRU_ServiceInfo [►_110]</a>	Fault and service information.
<a href="#">St_StateEV [►_111]</a>	Information on the state of the EV.
<a href="#">UST3_SET [►_111]</a>	Data structure for setting the scaling and the resistance measurement.

## **4.1 POU**

### **Function blocks**

Function blocks	Description
<a href="#">KL6771 [▶ 25]</a>	Communication with a KL6771 MP-Bus master terminal.
<a href="#">MP Addressing [▶ 26]</a>	This function block allows an MP-Bus slave to be addressed.
<a href="#">MP CMV [▶ 28]</a>	This function block is used to control and monitor a volume flow controller.
<a href="#">MP DamperLinearActuator [▶ 30]</a>	This function block is used to control and monitor an actuator of a damper and of a globe valve.
<a href="#">MP EnergyValveV4 Configuration [▶ 32]</a>	This function block is used to configure the Energy Valve actuators EV...R2+... (V4).
<a href="#">MP EnergyValveV4 Process [▶ 36]</a>	This function block is suitable for Energy Valve actuators EV...R2+... (V4).
<a href="#">MP EPIV [▶ 39]</a>	This function block is used to control a pressure-independent control ball valve.
<a href="#">MP EPIV R6 [▶ 41]</a>	This function block is used to control a control ball valve of series EP...R-R6+BAC.
<a href="#">MP EPIV R6 Parameter [▶ 43]</a>	This function block is used to parameterize actuators of series EP...R-R6+BAC.
<a href="#">MP EPIV V4 Configuration [▶ 44]</a>	This function block is used to configure the 2-way EPIV V4 DN 15...50 EP...R2+(K)BAC.
<a href="#">MP EPIV V4 Process [▶ 46]</a>	This function block is suitable for 2-way EPIV V4 DN 15...50 EP...R2+(K)BAC.
<a href="#">MP EV [▶ 49]</a>	This function block is used to control a control ball valve of series P6...W..EV-BAC.
<a href="#">MP EV Parameter [▶ 51]</a>	This function block is used to parameterize actuators.
<a href="#">MP FlowMeter Configuration [▶ 52]</a>	This function block is used to configure the flow meters (FM).
<a href="#">MP FlowMeter Process [▶ 53]</a>	This function block is suitable for the flow meters (FM).
<a href="#">MP MPX [▶ 54]</a>	For BELIMO room sensor MS24A-R...-MPX.
<a href="#">MP OperatingUnit [▶ 56]</a>	This function block is used to read room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration CO2 [▶ 58]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration Display [▶ 60]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration OffsetValues [▶ 62]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration StatusIcons [▶ 63]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit ConfigurationTemp [▶ 64]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration Ventilation [▶ 66]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP PTH [▶ 67]</a>	This function block is used to control and monitor a PTH sensor.
<a href="#">MP RoomSensor [▶ 69]</a>	This function block is used to read room sensors.
<a href="#">MP RoomSensor Parameter [▶ 70]</a>	This function block is used for the parameterization of room sensors.
<a href="#">MP Smoker [▶ 72]</a>	This function block is used to control and monitor a fire damper.
<a href="#">MP TEM Configuration [▶ 73]</a>	This function block is used to configure the Thermal Energy Meter type 22PE-... and 22PEM-... .

Function blocks	Description
<a href="#">MP_TEM_Process [▶ 75]</a>	This function block is suitable for the Thermal Energy Meter type 22PE-... and 22PEM-... .
<a href="#">MP_UST_3 [▶ 76]</a>	This function block is used to control and monitor a multi-I/O module UST3.
<a href="#">MP_VAV [▶ 79]</a>	This function block is used to control and monitor a volume flow controller.
<a href="#">MP_VRU_Configuration [▶ 81]</a>	This function block is used to configure the VAV actuators VRU-D3-BAC, VRU-M1-BAC and VRU-M1R-BAC.
<a href="#">MP_VRU_Process [▶ 83]</a>	This function block is suitable for VAV actuators VRU-D3-BAC, VRU-M1-BAC and VRU-M1R-BAC.
<a href="#">MP_Window [▶ 85]</a>	This function block is used to control and monitor a window ventilation system (FLS).
<a href="#">MPL_DamperLinearActuator [▶ 87]</a>	This function block is used to control and monitor an actuator of a damper and of a globe valve.

## Functions

Function blocks	Description
<a href="#">NI1000_LuS_TO_INT [▶ 88]</a>	This function calculates a temperature from the value of an NI1000 L&S resistor.
<a href="#">NI1000_TO_INT [▶ 88]</a>	This function calculates a temperature from the value of an NI1000 resistor.
<a href="#">NTC_TO_INT [▶ 89]</a>	This function calculates a temperature from the value of an NTC resistor.
<a href="#">PT1000_TO_INT [▶ 89]</a>	This function calculates a temperature from the value of a PT1000 resistor.

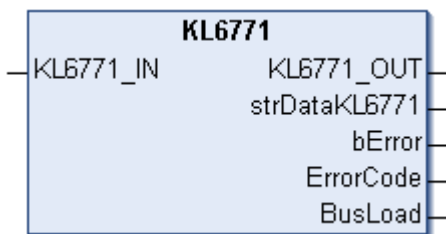
**4.1.1      Function blocks**

Function blocks	Description
<a href="#">KL6771 [▶ 25]</a>	Communication with a KL6771 MP-Bus master terminal.
<a href="#">MP Addressing [▶ 26]</a>	This function block allows an MP-Bus slave to be addressed.
<a href="#">MP CMV [▶ 28]</a>	This function block is used to control and monitor a volume flow controller.
<a href="#">MP DamperLinearActuator [▶ 30]</a>	This function block is used to control and monitor an actuator of a damper and of a globe valve.
<a href="#">MP EnergyValveV4 Configuration [▶ 32]</a>	This function block is used to configure the Energy Valve actuators EV...R2+... (V4).
<a href="#">MP EnergyValveV4 Process [▶ 36]</a>	This function block is suitable for Energy Valve actuators EV...R2+... (V4).
<a href="#">MP EPIV [▶ 39]</a>	This function block is used to control a pressure-independent control ball valve.
<a href="#">MP EPIV R6 [▶ 41]</a>	This function block is used to control a control ball valve of series EP...R-R6+BAC.
<a href="#">MP EPIV R6 Parameter [▶ 43]</a>	This function block is used to parameterize actuators of series EP...R-R6+BAC.
<a href="#">MP EPIV V4 Configuration [▶ 44]</a>	This function block is used to configure the 2-way EPIV V4 DN 15...50 EP...R2+(K)BAC.
<a href="#">MP EPIV V4 Process [▶ 46]</a>	This function block is suitable for 2-way EPIV V4 DN 15...50 EP...R2+(K)BAC.
<a href="#">MP EV [▶ 49]</a>	This function block is used to control a control ball valve of series P6...W..EV-BAC.
<a href="#">MP EV Parameter [▶ 51]</a>	This function block is used to parameterize actuators.
<a href="#">MP FlowMeter Configuration [▶ 52]</a>	This function block is used to configure the flow meters (FM).
<a href="#">MP FlowMeter Process [▶ 53]</a>	This function block is suitable for the flow meters (FM).
<a href="#">MP MPX [▶ 54]</a>	For BELIMO room sensor MS24A-R...-MPX.
<a href="#">MP OperatingUnit [▶ 56]</a>	This function block is used to read room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration CO2 [▶ 58]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration Display [▶ 60]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration OffsetValues [▶ 62]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration StatusIcons [▶ 63]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit ConfigurationTemp [▶ 64]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP OperatingUnit Configuration Ventilation [▶ 66]</a>	This function block is used to configure room sensors of types P-22Rxx-1900x-1.
<a href="#">MP PTH [▶ 67]</a>	This function block is used to control and monitor a PTH sensor.
<a href="#">MP RoomSensor [▶ 69]</a>	This function block is used to read room sensors.
<a href="#">MP RoomSensor Parameter [▶ 70]</a>	This function block is used for the parameterization of room sensors.
<a href="#">MP Smoker [▶ 72]</a>	This function block is used to control and monitor a fire damper.
<a href="#">MP TEM Configuration [▶ 73]</a>	This function block is used to configure the Thermal Energy Meter type 22PE-... and 22PEM-... .



Function blocks	Description
<a href="#">MP_TEM_Process</a> [▶ 75]	This function block is suitable for the Thermal Energy Meter type 22PE-... and 22PEM-... .
<a href="#">MP_UST_3</a> [▶ 76]	This function block is used to control and monitor a multi-I/O module UST3.
<a href="#">MP_VAV</a> [▶ 79]	This function block is used to control and monitor a volume flow controller.
<a href="#">MP_VRU_Configuration</a> [▶ 81]	This function block is used to configure the VAV actuators VRU-D3-BAC, VRU-M1-BAC and VRU-M1R-BAC.
<a href="#">MP_VRU_Process</a> [▶ 83]	This function block is suitable for VAV actuators VRU-D3-BAC, VRU-M1-BAC and VRU-M1R-BAC.
<a href="#">MP_Window</a> [▶ 85]	This function block is used to control and monitor a window ventilation system (FLS).
<a href="#">MPL_DamperLinearActuator</a> [▶ 87]	This function block is used to control and monitor an actuator of a damper and of a globe valve.

### 4.1.1.1 KL6771



This function block takes care of communication with the KL6771 MP-Bus master terminal. The KL6771 is configured with this function block, and data exchange with the MP network is started.

#### **i** Restrictions

- Only one call per instance
- Call must be made once per PLC cycle
- Instance must be called in the same PLC task as the send and receive blocks assigned to it

#### Inputs

```
VAR_INPUT
  KL6771_IN : ARRAY [0..11] OF BYTE;
END_VAR
```

Name	Type	Description
KL6771_IN	ARRAY OF BYTE	Is linked with the MP-Bus master terminal's input process image.

#### Outputs

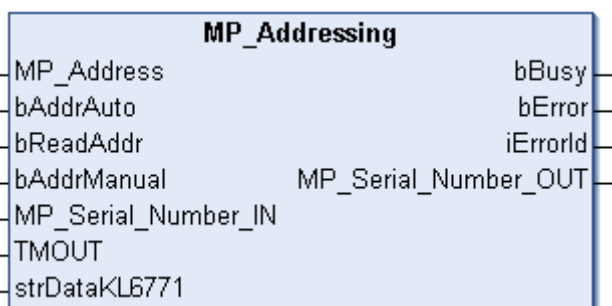
```
VAR_OUTPUT
  KL6771_OUT : ARRAY [0..11] OF BYTE;
  strDataKL6771 : DataKL6771;
  bError : BOOL;
  ErrorCode : MP_Error;
  BusLoad : INT := -1;
END_VAR
```

Name	Type	Description
KL6771_OUT	ARRAY OF BYTE	Is linked with the MP-Bus master terminal's output process image.
strDataKL6771	DataKL6771 [▶ 108]	A data structure that is linked with the various MP-Bus function blocks, and which contains communication with the KL6771 function block.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
ErrorCode	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time
BusLoad	INT	MP-Bus load in percent.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.1.1.2 MP\_Addressing**



This function block allows an MP-Bus slave to be addressed. It is also possible to use this function block to read the serial number of the slave.

*MP\_Address* is used to transfer the address of the slave that is addressed or whose serial number is to be read. The serial number is read out on a rising edge of *bReadAddr*. It is output through *MP\_Serial\_Numer\_Out*. A rising edge of *bAddrAuto* addresses a slave whose address is *MP\_Address*. The function block waits for the time set in *TMOUT* for the transmission of the slave with its serial number. Transmission of the serial number is initiated differently from one slave to another. Please see the documentation for the MP-Bus device for how the serial number can be sent (in most cases there is a switch on the drive which will trigger this action when pressed). No telegrams are sent to the slaves during the time specified by *TMOUT*.

A rising edge at *bAddrManual* initiates manual addressing. This requires the serial number of the drive to be stored in *MP\_Serial\_Number\_In*. The serial number of the slave can be found on a sticker on the drive.

Sample: 00234-00016-002-031. Enter the following in the variable *MP\_Serial\_Number\_IN*:

YearAndWeek = 234

DayAndNumber = 16

DeviceFamily = 2

TestStation = 31

FamilySuffix = is not evaluated, and should therefore be ignored.

*bBusy* is set for as long as the function block is active. An error is indicated through *bError*, while the error number can be read with *iErrorId*.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bAddrAuto      : BOOL;
  bReadAddr      : BOOL;
  bAddrManual    : BOOL;
  MP_Serial_Number_IN : MP_Serial_Number;
  TMOU           : TIME := t#30s;
  strDataKL6771  : DataKL6771;
END_VAR
```

Name	Type	Description
MP_Address	USINT	The MP address that is to be used for the addressing or for reading the serial number. Valid values (1..8).
bAddrAuto	BOOL	A positive edge starts the function block. The function block halts other MP-Bus communication, and waits until the time set through <i>TMOU</i> has elapsed for an MP-Bus slave has transmitted its serial number, for instance in response to pressing a switch. The MP-Bus address that has been configured in the <i>MP_Address</i> variable is then transmitted to the slave.
bReadAddr	BOOL	A positive edge starts the function block. The function block reads the serial number of the MP-Bus slave whose address is <i>MP_Address</i> .
bAddrManual	BOOL	A positive edge starts the function block. The function block addresses the slave that has serial number <i>MP_Serial_Number_IN</i> . The slave's addresses configured with <i>MP_Address</i> .
MP_Serial_Number_IN	MP_Serial_Number [▶ 109]	Serial number of the device
TMOU	TIME	Automatic addressing is interrupted after the time specified by <i>TMOU</i> .
strDataKL6771	DataKL6771 [▶ 108]	The data structure with which the <i>KL6771()</i> [▶ 25] function block must be linked.

 **Outputs**

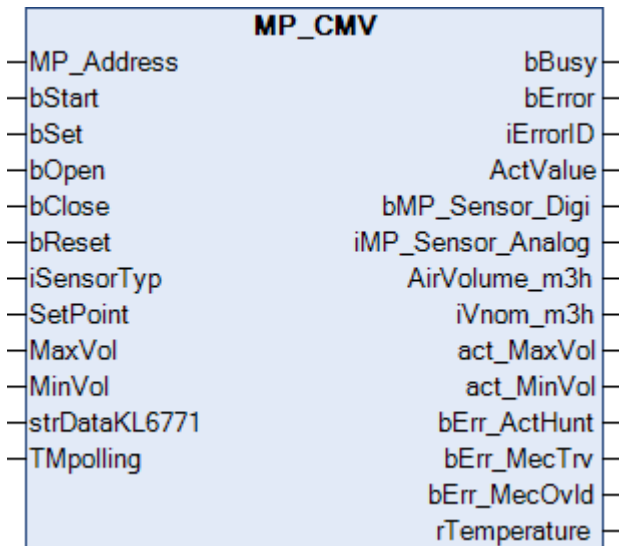
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  MP_Serial_Number_OUT : MP_Serial_Number;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
MP_Serial_Number_OUT	MP_Serial_Number [▶ 109]	The serial number of the addressed or requested slave.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

### 4.1.1.3 MP\_CMV



This function block is used to control and monitor a volume flow regulator.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the drive. The type of the error can be read with *iErrorID*.

#### Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  bSet            : BOOL;
  bOpen          : BOOL;
  bClose         : BOOL;
  bReset         : BOOL;
  iSensorTyp     : INT;
  SetPoint       : USINT;
  MaxVol         : WORD;
  MinVol         : WORD;
  strDataKL6771 : DataKL6771;
  TMpolling      : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bSet	BOOL	A positive edge writes the data <i>MaxVol</i> and <i>MinVol</i> to the actuator.
bOpen	BOOL	A positive edge opens the dampers of the actuator, while a negative edge cancels the forced ventilation.
bClose	BOOL	A positive edge closes the dampers of the actuator, while a negative edge cancels the forced closure.
bReset	BOOL	A positive edge resets the actuator's error messages.
iSensorTyp	INT	0: no sensor connected, 1: digital sensor connected, 2: analog sensor connected (0...35 V), 3...6: output of a resistance in ohms (3..5 applies to PT1000, NI1000 and NI1000LuS; 6 applies to NTC). To convert to a temperature, use the corresponding conversion functions.
SetPoint	USINT	0...100 % set volume flow rate
MaxVol	WORD	30...100 % Maximum volume flow rate
MinVol	WORD	0...100 % Minimum volume flow rate
strDataKL6771	<a href="#">DataKL6771</a> [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

 **Outputs**

```

VAR_OUTPUT
  bBusy           : BOOL;
  bError          : BOOL;
  iErrorId        : MP_Error;
  ActValue        : WORD;
  bMP_Sensor_Digi : BOOL;
  iMP_Sensor_Analog : INT;
  AirVolume_m3h   : WORD;
  iVnom_m3h       : INT;
  act_MaxVol      : INT;
  act_MinVol      : INT;
  bErr_ActHunt    : BOOL;
  bErr_MecTrv     : BOOL;
  bErr_MecOvld    : BOOL;
  rTemperature    : LREAL;
END_VAR

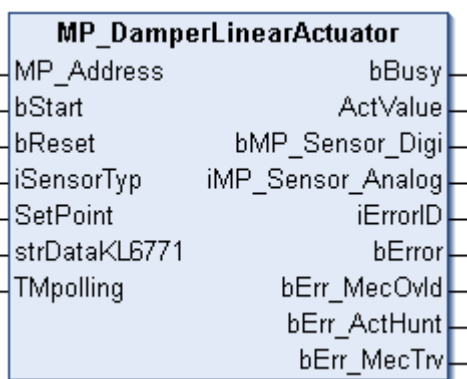
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
ActValue	WORD	Contains the current position of the actuator (0...100 %).
bMP_Sensor_Digi	BOOL	If a digital sensor is connected, its state is indicated through this variable. <i>iSensorTyp</i> must be "1".
iMP_Sensor_Analog	INT	If an analog sensor is connected, its value is indicated through this variable. <i>iSensorTyp</i> must be "2...6".
AirVolume_m3h	WORD	Output of the volume flow rate in m <sup>3</sup> /h.
iVnom_m3h	INT	Nominal air volume flow in m <sup>3</sup> /h. This output is available from version 1.12.0. VAV is read and must be > 0. If 0, then the calculation of <i>AirVolume_m3h</i> is not correct.
act_MaxVol	INT	Maximum set volume flow rate in %.
act_MinVol	INT	Minimum set volume flow rate in %.
bErr_ActHunt	BOOL	Actuator error, "Regulating oscillation"; the actuator is swinging backwards and forwards.
bErr_MecTrv	BOOL	Actuator error, "Positioning angle exceeded"; the actuator has passed more than 10° beyond the adaptation position.
bErr_MecOvld	BOOL	Actuator error, "Overload"; the set position could not be reached.
rTemperature	LREAL	Temperature in the duct in °C.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4022.14	Tc2_MPBus from 3.4.8.0

**4.1.1.4 MP\_DamperLinearActuator**



This function block is used to control and monitor a drive of a damper and of a globe valve.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMPolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the drive. The type of the error can be read with *iErrorID*.

A rising edge at *bReset* clears any pending error messages from the drive. This resets errors that affect the output variables *bErr\_MecOvld*, *bErr\_ActHunt* and *bErrMecTrv*. If the error itself is still present, the drive will set these error bits again.

*SetPoint* is used to adjust the position of the damper from 0...100%. The current position of the drive can be read through *ActValue*.

If a sensor is connected to the drive, *iSensorTyp* should be used to specify the sensor type. If no sensor is connected, the value "0" should be entered, or the variable should be left blank. A digital sensor should be parameterized with "1". The state of the sensor can be interrogated through *bMP\_Sensor\_Digi*. Analog sensors "2...6" are output in variable *iMP\_Sensor\_Analog*.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL := TRUE;
  bReset          : BOOL;
  iSensorTyp      : INT;
  SetPoint        : USINT;
  strDataKL6771  : DataKL6771;
  TMPolling       : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bReset	BOOL	A positive edge resets the actuator's error messages.
iSensorTyp	INT	0: no sensor connected, 1: digital sensor connected, 2: analog sensor connected (0..35 V), 3..6: output of a resistance in ohms (3..5 applies to PT1000, NI1000 and NI1000LuS; 6 applies to NTC). To convert to a temperature, use the corresponding conversion functions.
SetPoint	USINT	0..100 % set damper position of the actuator.
strDataKL6771	<a href="#">DataKL6771</a> [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

 **Outputs**

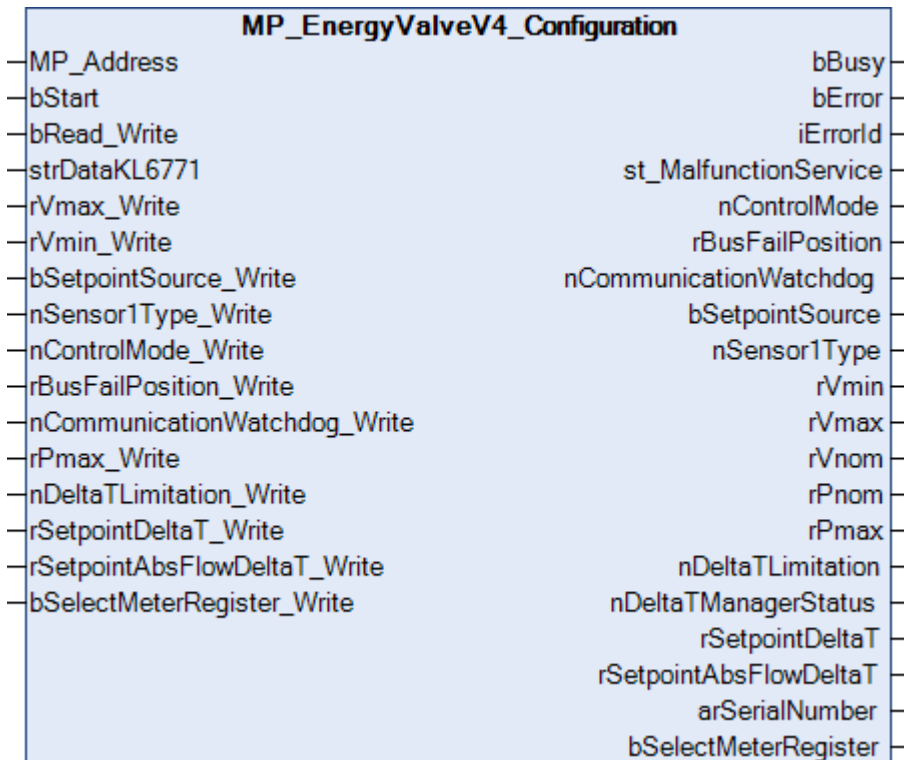
```
VAR_OUTPUT
  bBusy           : BOOL;
  ActValue        : WORD;
  bMP_Sensor_Digi : BOOL;
  iMP_Sensor_Analog : INT;
  iErrorID        : MP_Error;
  bError          : BOOL;
  bErr_MecOvld    : BOOL;
  bErr_ActHunt    : BOOL;
  bErr_MecTrv     : BOOL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
ActValue	WORD	Contains the current position of the actuator (0...100 %).
bMP_Sensor_Digi	BOOL	If a digital sensor is connected, its state is indicated through this variable. <i>iSensorTyp</i> must be "1".
iMP_Sensor_Analog	INT	If an analog sensor is connected, its value is indicated through this variable. <i>iSensorTyp</i> must be "2...6".
iErrorId	MP_ERROR [▶_105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
bErr_MecOvld	BOOL	Actuator error, "Overload"; the set position could not be reached.
bErr_ActHunt	BOOL	Actuator error, "Regulating oscillation"; the actuator is swinging backwards and forwards.
bErr_MecTrv	BOOL	Actuator error, "Positioning angle exceeded"; the actuator has passed more than 10° beyond the adaptation position.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.1.1.5 MP\_EnergyValveV4\_Configuration**



This function block is used to configure the Energy Valve actuators EV..R2+.. (V4). For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.



 **Inputs**

```

VAR_INPUT
  MP_Address          : USINT := 1;
  bStart              : BOOL;
  bRead_Write        : BOOL;
  strDataKL6771      : DataKL6771;
  rVmax_Write         : LREAL := 100;
  rVmin_Write         : LREAL;
  bSetpointSource_Write : BOOL := TRUE;
  nSensor1Type_Write : E_MP_EV_V4_Sensor1Type;
  nControlMode_Write : E_MP_EV_V4_ControlMode := 1;
  rBusFailPosition_Write : LREAL;
  nCommunicationWatchdog_Write : UINT;
  rPmax_Write         : LREAL := 100;
  nDeltaTLimitation_Write : E_MP_EV_V4_DeltaTLimitation;
  rSetpointDeltaT_Write : LREAL := 1.0;
  rSetpointAbsFlowDeltaT_Write : LREAL;
  bSelectMeterRegister_Write : BOOL;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bRead_Write	BOOL	If FALSE then READ only; if TRUE then READ and WRITE.
strDataKL6771	<a href="#">DataKL6771 [► 108]</a>	The data structure with which the <a href="#">KL6771()</a> <a href="#">[► 25]</a> function block must be linked.
rVmax_Write	LREAL	Max. setpoint in % (25...100). Standard 100 %. Refers to Vnom and is taken into account when control mode = flow control.
rVmin_Write	LREAL	Min. setpoint in % (0...Vmax). Vmin must be smaller than Vmax.
bSetpointSource_Write	BOOL	TRUE = bus; FALSE = analog.
nSensor1Type_Write	<a href="#">E_MP_EV_V4_Sensor1Type [► 101]</a>	Sensor 1 type
nControlMode_Write	<a href="#">E_MP_EV_V4_ControlMode [► 103]</a>	Control mode
rBusFailPosition_Write	LREAL	Bus failure position in % (0...100). Not functional (reserved for future extensions).
nCommunicationWatchdog_Write	UINT	Communication monitoring in s (0...3600). Not functional (reserved for future extensions).
bSetpointSource_Write	BOOL	TRUE = bus; FALSE = analog.
rPmax_Write	LREAL	Max. setpoint in % (5...100). Standard 100 %. Refers to Pnom and is taken into account if control mode = power control.
nDeltaTLimitation_Write	<a href="#">E_MP_EV_V4_DeltaTLimitation [► 104]</a>	Determines whether the device responds to a low delta T.
rSetpointDeltaT_Write	LREAL	Setpoint Delta T in K (0...60). Standard 1.0K. Is taken into account if the delta T limitation is active (not disabled).
rSetpointAbsFlowDeltaT_Write	LREAL	Setpoint Abs flow Delta T in l/s (0...100.000). Considered when Delta T limitation is set to "Delta T Manager scaled".
bSelectMeterRegister_Write	BOOL	FALSE = certified meter; TRUE = lifetime meter.

 **Outputs**

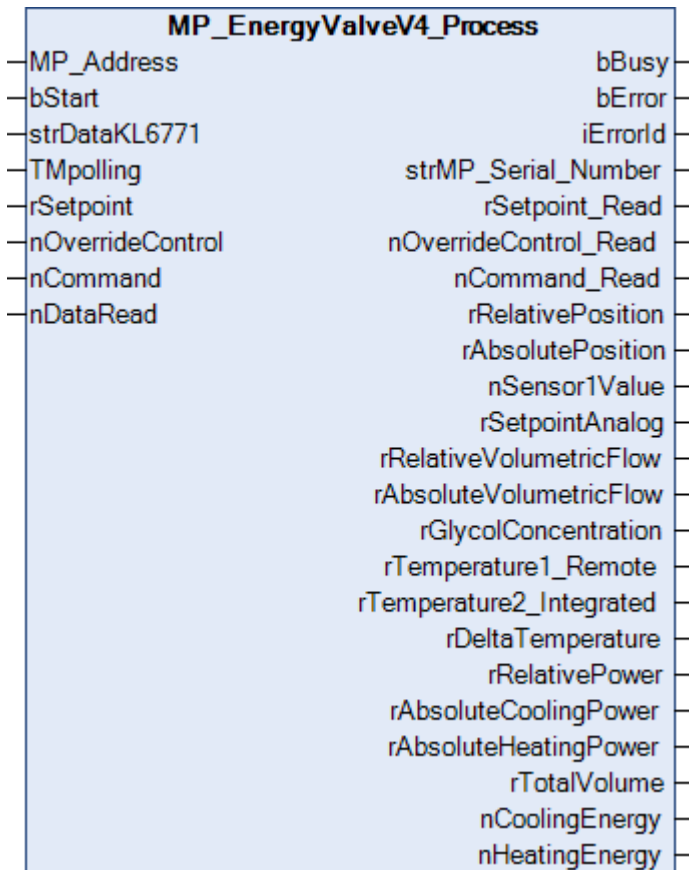
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  st_MalfunctionService : St_MP_EV_V4_MalfunctionServiceInfo;
  nControlMode   : E_MP_EV_V4_ControlMode;
  rBusFailPosition : LREAL;
  nCommunicationWatchdog : UINT;
  bSetpointSource : BOOL;
  nSensor1Type   : E_MP_EV_V4_Sensor1Type;
  rVmin          : LREAL;
  rVmax          : LREAL;
  rVnom          : LREAL;
  rPnom          : LREAL;
  rPmax          : LREAL;
  nDeltaTLimitation : E_MP_EV_V4_DeltaTLimitation;
  nDeltaTManagerStatus : E_MP_EV_V4_DeltaTManagerStatus;
  rSetpointDeltaT : LREAL;
  rSetpointAbsFlowDeltaT : LREAL;
  arSerialNumber : ARRAY[0..1] OF DWORD;
  bSelectMeterRegister : BOOL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	<a href="#">MP_ERROR [► 105]</a>	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
st_MalfunctionService	<a href="#">St_MP_EV_V4_MalfunctionServiceInfo [► 109]</a>	Malfunction and service information
nControlMode	<a href="#">E_MP_EV_V4_ControlMode [► 103]</a>	Control mode
rBusFailPosition	LREAL	Bus failure position in % (0...100). Not functional (reserved for future extensions).
nCommunicationWatchdog	UINT	Communication monitoring in sec (0...3600). Not functional (reserved for future extensions).
bSetpointSource	BOOL	TRUE = bus; FALSE = analog
nSensor1Type	<a href="#">E_MP_EV_V4_Sensor1Type [► 101]</a>	Sensor 1 type
rVmin	LREAL	Min. setpoint in % (0...Vmax). Refers to Vnom and is taken into account when control mode = flow control.
rVmax	LREAL	Max. setpoint in % (25...100). Refers to Vnom and is taken into account when control mode = flow control.
rVnom	LREAL	Nominal volume flow in l/s (0...100)
rPnom	LREAL	Nominal output in kW (0...21.5).
rPmax	LREAL	Max. setpoint in % (5...100). Refers to Pnom and is taken into account if control mode = power control.
nDeltaTLimitation	<a href="#">E_MP_EV_V4_DeltaTLimitation [► 104]</a>	Indicates whether the device responds to a low delta T.
nDeltaTManagerStatus	<a href="#">E_MP_EV_V4_DeltaTManagerStatus [► 100]</a>	Indicates the status of the Delta T Manager.
rSetpointDeltaT	LREAL	Setpoint Delta T in K (0...60). Is taken into account if delta T limitation is active (not disabled).
rSetpointAbsFlowDeltaT	LREAL	Setpoint Abs flow Delta T in l/s (0...100.000). Considered when Delta T limitation is set to "Delta T Manager scaled".
arSerialNumber	ARRAY OF DWORD	Serial number of the device
bSelectMeterRegister	BOOL	FALSE = certified meter; TRUE = lifetime meter.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

#### 4.1.1.6 MP\_EnergyValveV4\_Process



This function block is suitable for Energy Valve actuators EV..R2+.. (V4). For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

#### Inputs

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  strDataKL6771  : DataKL6771;
  TMpolling      : TIME := t#10s;
  rSetpoint      : LREAL;
  nOverrideControl : E_MP_EV_V4_OverrideControl;
  nCommand       : E_MP_EV_V4_Command;
  nDataRead      : WORD := 16#FFFF;
END_VAR

```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	DataKL6771 [► 108]	The data structure with which the <i>KL6771()</i> [► 25] function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.
rSetpoint	LREAL	Setpoint in % (0...100)
nOverrideControl	E_MP_EV_V4_OverrideControl	Override the setpoint with defined values.
nCommand	E_MP_EV_V4_Command	Command for service and test functions of the actuator.
nDataRead	WORD	0xFFFF - read all data; bit 0 - read relative position; bit 1 - read absolute position; bit 2 - read value sensor 1; bit 3 - read analog setpoint; bit 4 - read relative volume flow rate; bit 5 - read absolute volume flow rate; bit 6 - read glycol concentration; bit 7 - read temperature1 remote; bit 8 - read temperature2 integrated; bit 9 - read temperature delta; bit 10 - read relative power; bit 11 - read absolute cooling power; bit 12 - read absolute heating power; bit 13 - total volume; bit 14 - cooling energy; bit 15 - heating energy

 **Outputs**

```

VAR_OUTPUT
  bBusy           : BOOL;
  bError          : BOOL;
  iErrorId        : MP_Error;
  strMP_Serial_Number : MP_Serial_Number;
  rSetpoint_Read  : LREAL;
  nOverrideControl_Read : E_MP_EV_V4_OverrideControl;
  nCommand_Read   : E_MP_EV_V4_Command;
  rRelativePosition : LREAL;
  rAbsolutePosition : LREAL;
  nSensor1Value   : DINT;
  rSetpointAnalog : LREAL;
  rRelativeVolumetricFlow : LREAL;
  rAbsoluteVolumetricFlow : LREAL;
  rGlycolConcentration : LREAL;
  rTemperature1_Remote : LREAL;
  rTemperature2_Integrated : LREAL;
  rDeltaTemperature : LREAL;
  rRelativePower   : LREAL;
  rAbsoluteCoolingPower : LREAL;
  rAbsoluteHeatingPower : LREAL;
  rTotalVolume     : LREAL;
  nCoolingEnergy   : DINT;
  nHeatingEnergy   : DINT;
END_VAR

```

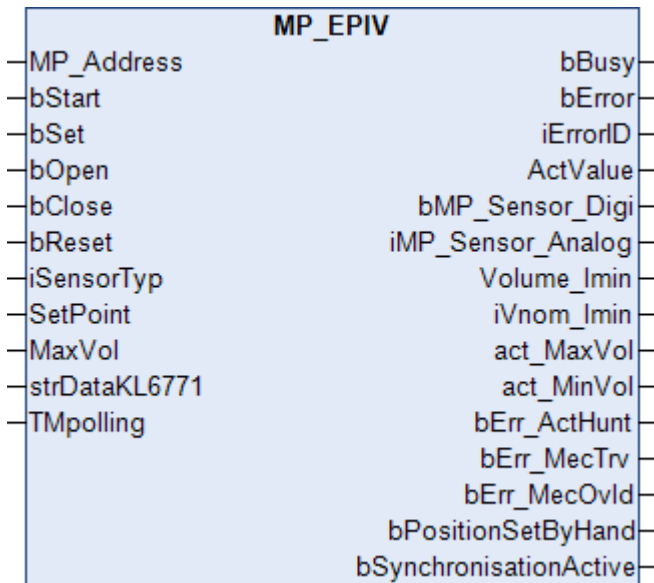
Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	<a href="#">MP_ERROR [▶ 105]</a>	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
strMP_Serial_Number	<a href="#">MP_Serial_Number [▶ 109]</a>	Structure for the serial number
rSetpoint_Read	LREAL	Setpoint in % (0...100)
nOverrideControl_Read	<a href="#">E_MP_EV_V4_OverrideControl [▶ 100]</a>	Overridden setpoint
nCommand_Read	<a href="#">E_MP_EV_V4_Command [▶ 99]</a>	Command
rRelativePosition	LREAL	Relative position in % (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.0 = TRUE).
rAbsolutePosition	LREAL	Absolute position in ° (0...96). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.1 = TRUE).
nSensor1Value	DINT	Sensor 1 Value in mV/ohm (0...65535). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.2 = TRUE).
rSetpointAnalog	LREAL	Analog setpoint in % (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.3 = TRUE).
rRelativeVolumetricFlow	LREAL	Relative volume flow rate in % (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.4 = TRUE).
rAbsoluteVolumetricFlow	LREAL	Absolute volume flow rate in l/s (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.5 = TRUE).
rGlycolConcentration	LREAL	Glycol concentration in % (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.6 = TRUE).
rTemperature1_Remote	LREAL	Temperature1 remote in °C (-20...12). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.7 = TRUE).
rTemperature2_Integrated	LREAL	Temperature2 integrated in °C (-20...12). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.8 = TRUE).
rDeltaTemperature	LREAL	Temperature Delta in K (0...14). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.9 = TRUE).
rRelativePower	LREAL	Relative power in % (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.10 = TRUE).
rAbsoluteCoolingPower	LREAL	Absolute cooling power in kW (0...21.5). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.11 = TRUE).
rAbsoluteHeatingPower	LREAL	Absolute heating power in kW (0...21.5). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.12 = TRUE).
rTotalVolume	LREAL	Total volume in m <sup>3</sup> (0...214748.36). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.13 = TRUE).
nCoolingEnergy	DINT	Cooling energy in kWh (0...21474836). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.14 = TRUE).

Name	Type	Description
nHeatingEnergy	DINT	Heating energy in kWh (0...21474836). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.15 = TRUE).

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

**4.1.1.7 MP\_EPIV**



This function block is used to control a pressure-independent control ball valve. For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 s. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

 **Inputs**

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  bSet            : BOOL;
  bOpen           : BOOL;
  bClose          : BOOL;
  bReset          : BOOL;
  iSensorTyp      : INT;
  SetPoint        : USINT;
  MaxVol          : WORD;
  strDataKL6771  : DataKL6771;
  Tmpolling       : TIME := t#10s;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bSet	BOOL	A positive edge writes the data <i>MaxVol</i> and <i>MinVol</i> to the actuator.
bOpen	BOOL	A positive edge opens the dampers of the actuator, while a negative edge cancels the forced ventilation.
bClose	BOOL	A positive edge closes the dampers of the actuator, while a negative edge cancels the forced closure.
bReset	BOOL	A positive edge resets the actuator's error messages.
iSensorTyp	INT	0: no sensor connected, 1: digital sensor connected, 2: analog sensor connected (0...35 V), 3...6: output of a resistance in ohms (3..5 applies to PT1000, NI1000 and NI1000LuS; 6 applies to NTC). To convert to a temperature, use the corresponding conversion functions.
SetPoint	USINT	0...100 % set volume flow rate
MaxVol	WORD	30...100 % Maximum volume flow rate
strDataKL6771	<a href="#">DataKL6771 [► 108]</a>	The data structure with which the <a href="#">KL6771()</a> [► 25] function block must be linked.
TMPolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

## Outputs

```

VAR_OUTPUT
  bBusy           : BOOL;
  bError          : BOOL;
  iErrorId        : MP_Error;
  ActValue        : WORD;
  bMP_Sensor_Digi : BOOL;
  iMP_Sensor_Analog : INT;
  Volume_lmin     : WORD;
  iVnom_lmin      : INT;
  act_MaxVol      : INT;
  act_MinVol      : INT;
  bErr_ActHunt    : BOOL;
  bErr_MecTrv     : BOOL;
  bErr_MecOvld    : BOOL;
  bPositionSetByHand : BOOL;
  bSynchronisationActive : BOOL;
END_VAR

```

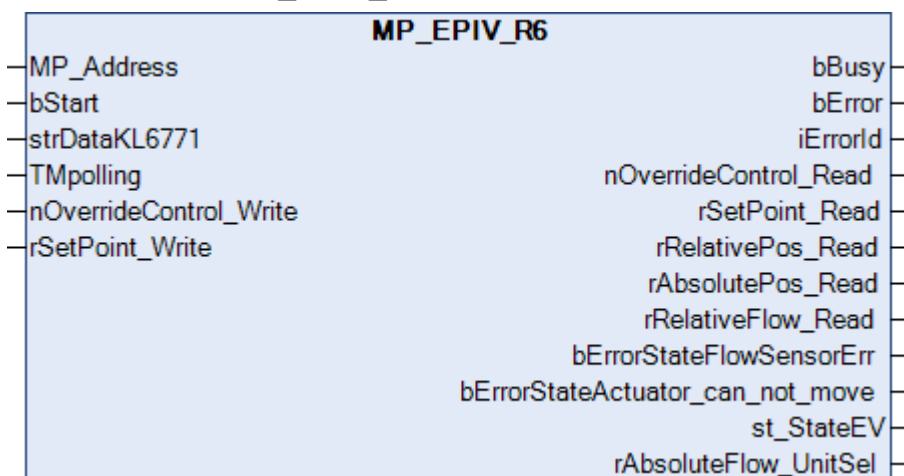


Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
ActValue	WORD	Contains the current position of the actuator (0..100 %).
bMP_Sensor_Digi	BOOL	If a digital sensor is connected, its state is indicated through this variable. <i>iSensorTyp</i> must be "1".
iMP_Sensor_Analog	INT	If an analog sensor is connected, its value is indicated through this variable. <i>iSensorTyp</i> must be "2...6".
Volume_lmin	WORD	Output of volume flow rate in l/min.
iVnom_lmin	INT	Nominal air volume flow in l/min.
act_MaxVol	INT	Maximum set volume flow rate in %.
act_MinVol	INT	Minimum set volume flow rate in %.
bErr_ActHunt	BOOL	Actuator error, "Regulating oscillation"; the actuator is swinging backwards and forwards.
bErr_MecTrv.	BOOL	Actuator error, "Positioning angle exceeded": the actuator has passed more than 10° beyond the adaptation position.
bErr_MecOvld.	BOOL	Actuator error, "Overload"; the set position could not be reached.
bPositionSetByHand	BOOL	The actuator position was changed manually.
bSynchronisationActive	BOOL	The actuator is synchronizing.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.32	Tc2_MPBus from 3.4.6.0

**4.1.1.8 MP\_EPIV\_R6**



This function block is used to control a control ball valve of series EP..R-R6+BAC.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMPolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the drive. The type of the error can be read with *iErrorID*.

 **Inputs**

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL  := TRUE;
  strDataKL6771  : DataKL6771;
  TMPolling       : TIME  := t#10s;
  nOverrideControl_Write : E_MPBus_Override_6wayMPIV := MPBus_6wayMPIV_None;
  rSetPoint_Write : LREAL;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <i>KL6771()</i> [ <a href="#">▶ 25</a> ] function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.
nOverrideControl_Write	E_MPBus_Override_6wayMPIV [ <a href="#">▶ 105</a> ]	The relative setpoint is ignored in override control mode. Overriding is disabled if the command is not repeated within 120 minutes.
rSetPoint_Write	LREAL	0...100 %.

 **Outputs**

```

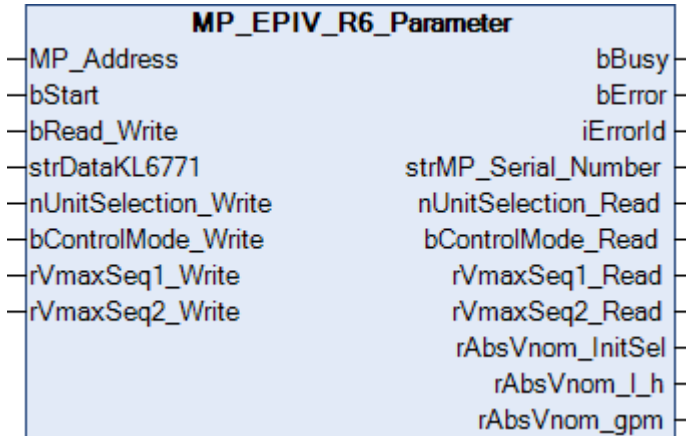
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  nOverrideControl_Read : E_MPBus_Override_6wayMPIV;
  rSetPoint_Read : LREAL;
  rRelativePos_Read : LREAL;
  rAbsolutePos_Read : LREAL;
  rRelativeFlow_Read : LREAL;
  bErrorStateFlowSensorErr : BOOL;
  bErrorStateActuator_can_not_move : BOOL;
  st_StateEV     : st_StateEV;
  rAbsoluteFlow_UnitSel : LREAL;
END_VAR
    
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [ <a href="#">▶ 105</a> ]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
nOverrideControl_Read).	E_MPBus_Override_6wayMPIV [ <a href="#">▶ 105</a> ]).	Current override control mode
rSetPoint_Read	LREAL	Setpoint in % (0...100 %)..
rRelativePos_Read	LREAL	Relative position in % (0...100 %).
rAbsolutePos_Read	LREAL	Absolute position in °.
rRelativeFlow_Read	LREAL	Relative flow rate in % (0...100 %).
bErrorStateFlowSensorErr	BOOL	Flow sensor is faulty.
bErrorStateActuator_can_not_move	BOOL	Actuator cannot move.
st_StateEV	St_StateEV [ <a href="#">▶ 111</a> ]	Only devices from 27 March 2014.
rAbsoluteFlow_UnitSel	LREAL	Absolute flow rate in UnitSel (0...4294967295).

Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4022.14	Tc2_MPBus from 3.4.8.0

4.1.1.9 MP\_EPIV\_R6\_Parameter



This function block is used to parameterize drives of series EP..R-R6+BAC.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the drive. The type of the error can be read with *iErrorID*.

Inputs

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL := TRUE;
  bRead_Write    : BOOL;
  strDataKL6771  : DataKL6771;
  nUnitSelection_Write : E_MP_EP_R_R6_UnitSel := E_MP_l_h;
  bControlMode_Write : BOOL;
  rVmaxSeq1_Write : LREAL;
  rVmaxSeq2_Write : LREAL;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bRead_Write	BOOL	If FALSE then READ only; if TRUE then READ and WRITE.
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <i>KL6771()</i> [ <a href="#">▶ 25</a> ] function block must be linked.
nUnitSelection_Write	E_MP_EP_R_R6_UnitSel [ <a href="#">▶ 98</a> ]	Scaling for <i>rAbsoluteFlow_UnitSel</i>
bControlMode_Write	BOOL	FALSE: position-controlled, TRUE: flow-controlled.
rVmaxSeq1_Write	LREAL	0...100 %.
rVmaxSeq2_Write	LREAL	0...100 %.

Outputs

```

VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  strMP_Serial_Number : MP_Serial_Number;
    
```

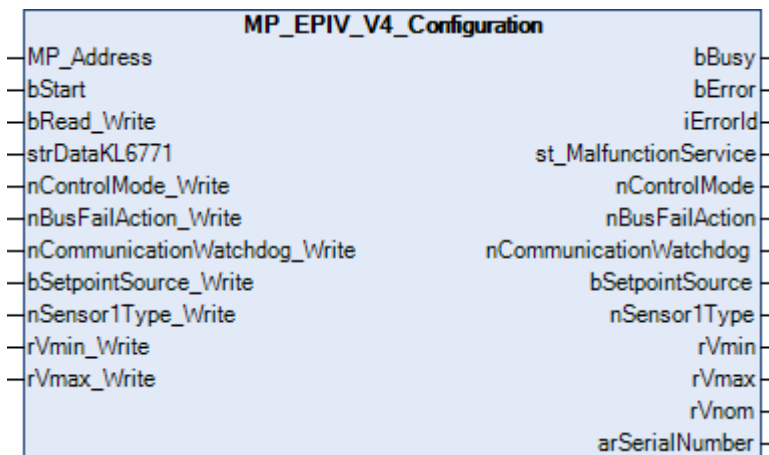
```
nUnitSelection_Read : E_MP_EP_R_R6_UnitSel;
bControlMode_Read  : BOOL;
rVmaxSeq1_Read     : LREAL;
rVmaxSeq2_Read     : LREAL;
rAbsVnom_InitSel   : LREAL;
rAbsVnom_l_h       : LREAL;
rAbsVnom_gpm       : LREAL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
strMP_Serial_Number	MP_Serial_Number [▶ 109]	Structure for the serial number
nUnitSelection_Read	E_MP_EP_R_R6_UnitSel [▶ 98]	Setting the scaling
bControlMode_Read	BOOL	FALSE: position-controlled, TRUE: flow-controlled.
rVmaxSeq1_Read	LREAL	Maximum sequence speed 1 in % (0...100 %).
rVmaxSeq2_Read	LREAL	Maximum sequence speed 2 in % (0...100 %).
rAbsVnom_InitSel	LREAL	Nominal volume (see <i>rAbsoluteFlow_UnitSel</i> ).
rAbsVnom_l_h	LREAL	Nominal volume in l/h (0...4294967295).
rAbsVnom_gpm	LREAL	Nominal volume in gpm (0...4294967295).

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4022.14	Tc2_MPBUS from 3.4.8.0

**4.1.1.10 MP\_EPIV\_V4\_Configuration**



This function block is used to configure the 2-way EPIV V4 DN 15..50 EP..R2+(K)BAC. For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

**Inputs**

```
VAR_INPUT
MP_Address      : USINT := 1;
bStart          : BOOL;
bRead_Write     : BOOL;
```

```

strDataKL6771      : DataKL6771;
nControlMode_Write : E_MP_EV_V4_ControlMode := 1;
nBusFailAction_Write : E_MP_EV_V4_BusFailAction;
nCommunicationWatchdog_Write : UINT := 120;
bSetpointSource_Write : BOOL := TRUE;
nSensor1Type_Write : E_MP_EV_V4_Sensor1Type;
rVmin_Write       : LREAL;
rVmax_Write       : LREAL := 100;
END_VAR

```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bRead_Write	BOOL	If FALSE then READ only; if TRUE then READ and WRITE.
strDataKL6771	DataKL6771 [▶ 108]	The data structure with which the KL6771() [▶ 25] function block must be linked.
nControlMode_Write	E_MP_EV_V4_ControlMode [▶ 103]	Control mode
nBusFailAction_Write	E_MP_EV_V4_BusFailAction [▶ 99]	Bus failure action
nCommunicationWatchdog_Write	UINT	Communication monitoring in s (0..3600).
bSetpointSource_Write	BOOL	TRUE = bus; FALSE = analog.
nSensor1Type_Write	E_MP_EV_V4_Sensor1Type [▶ 101]	Sensor 1 type
rVmin_Write	LREAL	Min. setpoint in % (0...Vmax). Vmin must be smaller than Vmax.
rVmax_Write	LREAL	Max. setpoint in % (25...100). Standard 100 %. Refers to Vnom and is taken into account when control mode = flow control.

 **Outputs**

```

VAR_OUTPUT
bBusy      : BOOL;
bError     : BOOL;
iErrorId   : MP_Error;
st_MalfunctionService : St_MP_EV_V4_MalfunctionServiceInfo;
nControlMode : E_MP_EV_V4_ControlMode;
nBusFailAction : E_MP_EV_V4_BusFailAction;
nCommunicationWatchdog : UINT;
bSetpointSource : BOOL;
nSensor1Type : E_MP_EV_V4_Sensor1Type;
rVmin      : LREAL;
rVmax      : LREAL;
rVnom      : LREAL;
arSerialNumber : ARRAY[0..1] OF DWORD;
END_VAR

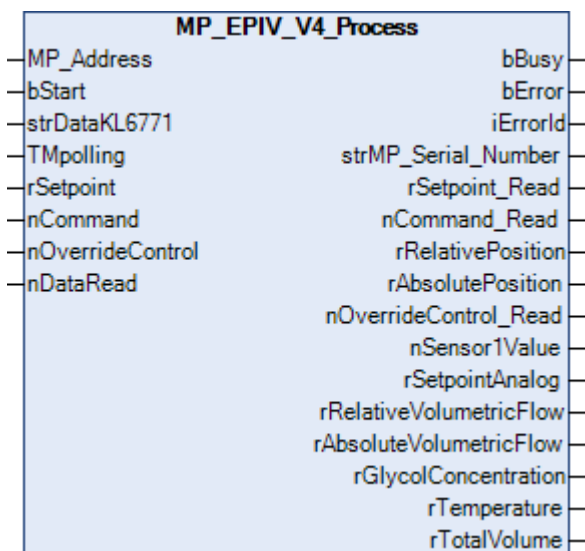
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
st_MalfunctionService	St_MP_EV_V4_MalfunctionServiceInfo [▶ 109]	Malfunction and service information
nControlMode	E_MP_EV_V4_ControlMode [▶ 103]	Control mode
nBusFailAction	E_MP_EV_V4_BusFailAction [▶ 99]	Bus failure action
nCommunicationWatchdog	UINT	Communication monitoring in sec (0...3600). Not functional (reserved for future extensions).
bSetpointSource	BOOL	TRUE = bus; FALSE = analog
nSensor1Type	E_MP_EV_V4_Sensor1Type [▶ 101]	Sensor 1 type
rVmin	LREAL	Min. setpoint in % (0...Vmax). Refers to Vnom and is taken into account when control mode = flow control.
rVmax	LREAL	Max. setpoint in % (25...100). Refers to Vnom and is taken into account when control mode = flow control.
rVnom	LREAL	Nominal volume flow in l/s (0...100)
arSerialNumber	ARRAY OF DWORD	Serial number of the device

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

**4.1.1.11 MP\_EPIV\_V4\_Process**



This function block is suitable for 2-way EPIV V4 DN 15..50 EP..R2+(K)BAC. For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMPolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  strDataKL6771  : DataKL6771;
  TMPolling       : TIME := t#10s;
  rSetpoint       : LREAL;
  nCommand        : E_MP_EV_V4_Command;
  nOverrideControl : E_MP_EV_V4_OverrideControl;
  nDataRead       : WORD := 16#FFFF;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <i>KL6771()</i> [ <a href="#">▶ 25</a> ] function block must be linked.
TMPolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.
rSetpoint	LREAL	Setpoint in % (0...100)
nCommand	E_MP_EV_V4_Command	Command for service and test functions of the actuator.
nOverrideControl	E_MP_EV_V4_OverrideControl	Override the setpoint with defined values.
nDataRead	WORD	0xFFFF - read all data; bit 0 - read relative position; bit 1 - read absolute position; bit 2 - read value sensor 1; bit 3 - read analog setpoint; bit 4 - read relative volume flow rate; bit 5 - read absolute volume flow rate; bit 6 - read glycol concentration; bit 7 - read temperature1 remote; bit 8 - read temperature2 integrated; bit 9 - read temperature delta; bit 10 - read relative power; bit 11 - read absolute cooling power; bit 12 - read absolute heating power; bit 13 - total volume; bit 14 - cooling energy; bit 15 - heating energy

 **Outputs**

```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  strMP_Serial_Number : MP_Serial_Number;
  rSetpoint_Read : LREAL;
  nCommand_Read  : E_MP_EV_V4_Command;
  rRelativePosition : LREAL;
  rAbsolutePosition : LREAL;
  nOverrideControl_Read : E_MP_EV_V4_OverrideControl;
  nSensor1Value  : DINT;
  rSetpointAnalog : LREAL;
  rRelativeVolumetricFlow : LREAL;
  rAbsoluteVolumetricFlow : LREAL;
  rGlycolConcentration : LREAL;
  rTemperature   : LREAL;
  rTotalVolume   : LREAL;
END_VAR
```

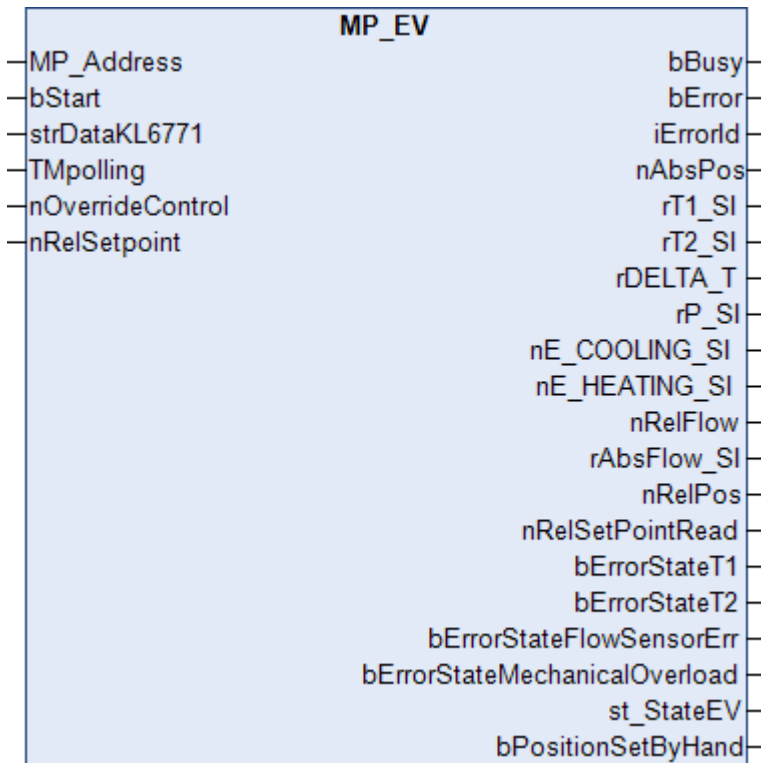
Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
strMP_Serial_Number	MP_Serial_Number	Structure for the serial number
rSetpoint_Read	LREAL	Setpoint in % (0...100).
nCommand_Read	E_MP_EV_V4_Command	Command
rRelativePosition	LREAL	Relative position in % (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.0 = TRUE).
rAbsolutePosition	LREAL	Absolute position in ° (0...96). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.1 = TRUE).
nOverrideControl_Read	E_MP_EV_V4_OverrideControl	Overridden setpoint
nSensor1Value	DINT	Sensor 1 Value in mV/ohm (0...65535). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.2 = TRUE).
rSetpointAnalog	LREAL	Analog setpoint in % (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.3 = TRUE).
rRelativeVolumetricFlow	LREAL	Relative volume flow rate in % (0...150). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.4 = TRUE).
rAbsoluteVolumetricFlow	LREAL	Absolute volume flow rate in l/s (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.5 = TRUE).
rGlycolConcentration	LREAL	Glycol concentration in % (0...100). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.6 = TRUE).
rTemperature	LREAL	Temperature in °C (-20...120). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.8 = TRUE).
rTotalVolume	LREAL	Total volume in m <sup>3</sup> (0...214748.36). A value of -1 means that the data is disabled (see VAR_INPUT nDataRead.13 = TRUE).

## Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0



4.1.1.12 MP\_EV



This function block is used to control a control ball valve of series P6..W..EV-BAC. For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 s. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL := TRUE;
  strDataKL6771  : DataKL6771;
  Tmpolling       : TIME := t#10s;
  nOverrideControl : E_MPBus_Override := MPBus_Override_Auto;
  nRelSetpoint    : INT;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMpolling</i> .
strDataKL6771	<a href="#">DataKL6771 [► 108]</a>	The data structure with which the <a href="#">KL6771() [► 25]</a> function block must be linked.
Tmpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.
nOverrideControl	<a href="#">E_MPBus_Override [► 104]</a>	<b>nOverrideControl:</b> The relative setpoint <i>nRelSetpoint</i> is ignored in override mode. Overriding is disabled if the command is not repeated within 120 minutes.
nRelSetpoint	INT	The setpoint is interpreted either as position setpoint or as advance setpoint.

## Outputs

```

VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  nAbsPos        : INT;
  rT1_SI         : REAL;
  rT2_SI         : REAL;
  rDELTA_T       : REAL;
  rP_SI          : REAL;
  nE_COOLING_SI  : DINT;
  nE_HEATING_SI  : DINT;
  nRelFlow       : INT;
  rAbsFlow_SI    : REAL;
  nRelPos        : INT;
  nRelSetPointRead : INT;
  bErrorStateT1  : BOOL;
  bErrorStateT2  : BOOL;
  bErrorStateFlowSensorErr : BOOL;
  bErrorStateMechanicalOverload : BOOL;
  st_StateEV     : St_StateEV;
  bPositionSetByHand : BOOL;
END_VAR

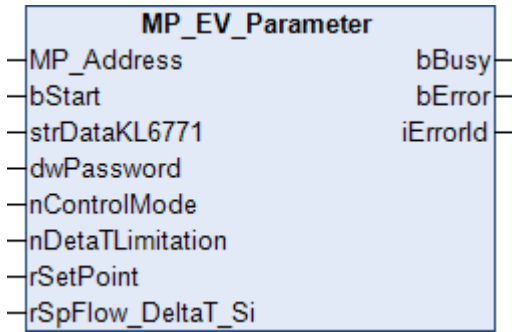
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	<a href="#">MP_ERROR</a> [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
nAbsPos	INT	Absolute position in °
rT1_SI	REAL	Temperature 1 (remote) in °C
rT2_SI	REAL	Temperature 2 (embedded) in °C
rDELTA_T	REAL	Delta temperature in °C
rP_SI	REAL	Energy in kW
nE_COOLING_SI	DINT	Cooling energy in kWh
nE_HEATING_SI	DINT	Heating energy in kWh
nRelFlow	INT	Relative flow rate in %
rAbsFlow_SI	REAL	Absolute flow rate in l/min
nRelPos	INT	Relative position in %
nRelSetPointRead	INT	The setpoint is interpreted either as position setpoint or as advance setpoint (relative to Vmax) in %.
bErrorStateT1	BOOL	Error temperature sensor T1
bErrorStateT2	BOOL	Error temperature sensor T2.
bErrorStateFlowSensorErr	BOOL	Flow sensor is faulty.
bErrorStateMechanicalOverload	BOOL	Mechanical overload detected.
st_StateEV	<a href="#">St_StateEV</a> [▶ 111]	Only devices from 27 March 2014
bPositionSetByHand	BOOL	The actuator position was changed manually.

## Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

### 4.1.1.13 MP\_EV\_Parameter



This function block is used to parameterize drives.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the drive. The type of the error can be read with *iErrorID*.

#### Inputs

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  strDataKL6771  : DataKL6771;
  dwPassword     : DWORD;
  nControlMode   : E_MPBus_ControlMode := MPBus_ControlMode_Disable;
  nDeltaTLimitation : E_MPBus_DeltaTLimitation := MPBus_DeltaTLimitation_Disable;
  rSetPoint      : REAL := 0.0;
  rSpFlow_DeltaT_Si: REAL := 0.0;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	<a href="#">DataKL6771 [► 108]</a>	The data structure with which the <a href="#">KL6771() [► 25]</a> function block must be linked.
dwPassword	DWORD	The actuator password is usually 0x0000.
nControlMode	<a href="#">E_MPBus_ControlMode [► 103]</a>	Defines the control mode
nDeltaTLimitation	<a href="#">E_MPBus_DeltaTLimitation [► 104]</a>	dT limitation
rSetPoint	REAL	dT limit value.
rSpFlow_DeltaT_Si	REAL	Flow rate at saturation.

#### Outputs

```

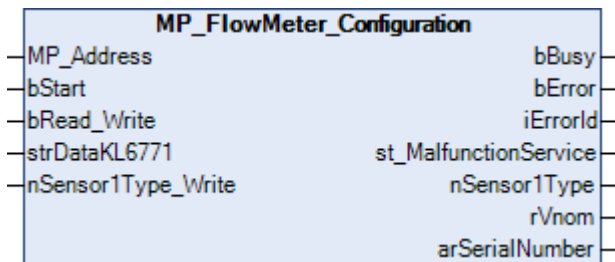
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
END_VAR
    
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	<a href="#">MP_ERROR [► 105]</a>	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.32	Tc2_MPBus from 3.4.6.0

**4.1.1.14 MP\_FlowMeter\_Configuration**



This function block is used to configure the flow meters (FM). For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

 **Inputs**

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  bRead_Write    : BOOL;
  strDataKL6771  : DataKL6771;
  nSensor1Type_Write : E_MP_EV_V4_Sensor1Type;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bRead_Write	BOOL	If FALSE then READ only; if TRUE then READ and WRITE.
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
nSensor1Type_Write	E_MP_EV_V4_Sensor1Type [ <a href="#">▶ 101</a> ]	Sensor 1 type

 **Outputs**

```

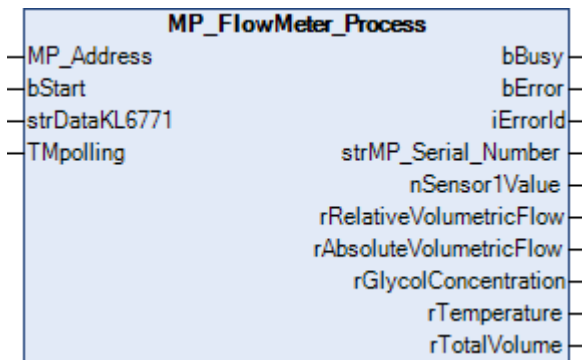
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  st_MalfunctionService : St_MP_EV_V4_MalfunctionServiceInfo;
  nSensor1Type   : E_MP_EV_V4_Sensor1Type;
  rVnom          : LREAL;
  arSerialNumber : ARRAY[0..1] OF DWORD;
END_VAR
    
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
st_MalfunctionService	St_MP_EV_V4_MalfunctionServiceInfo [▶ 109]	Malfunction and service information
nSensor1Type	E_MP_EV_V4_Sensor1Type [▶ 101]	Sensor 1 type
rVnom	LREAL	Nominal volume flow in l/s (0...100)
arSerialNumber	ARRAY OF DWORD	Serial number of the device

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

**4.1.1.15 MP\_FlowMeter\_Process**



This function block is suitable for the flow meters (FM). For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

**Inputs**

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  strDataKL6771  : DataKL6771;
  TMpolling      : TIME := t#10s;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMpolling</i> .
strDataKL6771	DataKL6771 [▶ 108]	The data structure with which the <i>KL6771()</i> [▶ 25] function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

**📡 Outputs**

```

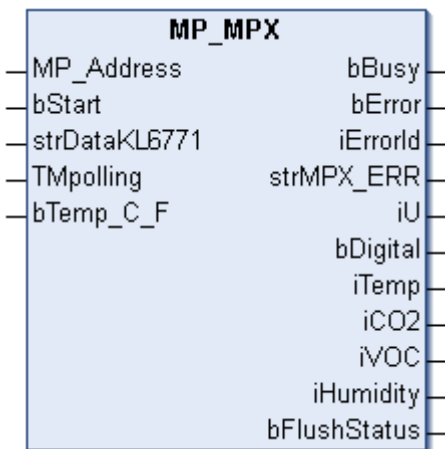
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  strMP_Serial_Number : MP_Serial_Number;
  nSensor1Value  : DINT;
  rRelativeVolumetricFlow : LREAL;
  rAbsoluteVolumetricFlow : LREAL;
  rGlycolConcentration : LREAL;
  rTemperature   : LREAL;
  rTotalVolume   : LREAL;
END_VAR
    
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
strMP_Serial_Number	MP Serial Number [▶ 109]	Structure for the serial number
nSensor1Value	DINT	Sensor 1 Value in mV/ohm (0...65535).
rRelativeVolumetricFlow	LREAL	Relative volume flow rate in % (0...150).
rAbsoluteVolumetricFlow	LREAL	Absolute volume flow rate in l/s (0...100).
rGlycolConcentration	LREAL	Glycol concentration in % (0...100).
rTemperature	LREAL	Temperature in °C (-20...120).
rTotalVolume	LREAL	Total volume in m³ (0...214748.36).

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

**4.1.1.16 MP\_MPX**



For BELIMO room sensor MS24A-R..-MPX

MS24A-R01-MPX temperature

MS24A-R02-MPX temperature, CO2

- MS24A-R03-MPX temperature, VOC
- MS24A-R04-MPX temperature, CO2, VOC
- MS24A-R05-MPX temperature, air humidity
- MS24A-R06-MPX temperature, air humidity, CO2
- MS24A-R07-MPX temperature, air humidity, VOC
- MS24A-R08-MPX temperature, air humidity, CO2, VOC

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  strDataKL6771  : DataKL6771;
  TMPolling       : TIME := t#10s;
  bTemp_C_F      : BOOL;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	<a href="#">DataKL6771 [► 108]</a>	The data structure with which the <a href="#">KL6771() [► 25]</a> function block must be linked.
TMPolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.
bTemp_C_F	BOOL	FALSE = °C / TRUE = F

 **Outputs**

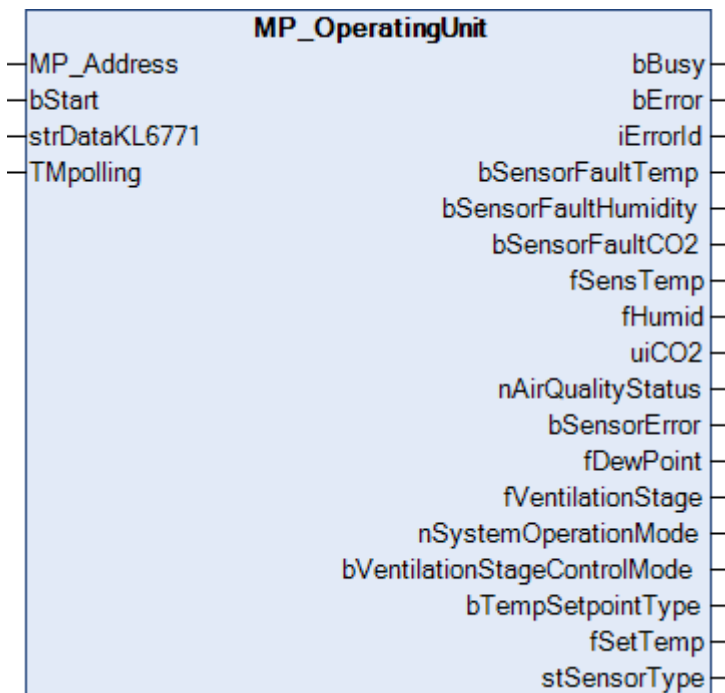
```
VAR_OUTPUT
  bBusy           : BOOL;
  bError          : BOOL;
  iErrorId        : MP_Error;
  strMPX_ERR      : MP_BUS_MPX_ERROR;
  iU              : INT;
  bDigital        : BOOL;
  iTemp           : INT;
  iCO2            : INT;
  iVOC            : INT;
  iHumidity       : INT;
  bFlushStatus    : BOOL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
strMPX_ERR	MP_BUS_MPX_ERROR [▶ 108]	Error messages of the sensors
iU	INT	0...10 V UNIT 1 mV
bDigital	BOOL	DI 24 V
iTemp	INT	0...50 °C Unit:0.01 °C
iCO2	INT	0...2000 ppm Unit:1 ppm
iVOC	INT	0...2000 ppm Unit:1 ppm (pseudo)
iHumidity	INT	10...90 % Unit: 0.01 %
bFlushStatus	BOOL	VOC gradient threshold exceeded, FALSE = air quality OK, 1 TRUE = air quality not OK, flush

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.1.1.17 MP\_OperatingUnit**



This function block is used to read room sensors of types P-22Rxx-1900x-1. It is compatible with 22Rxx-19-1 room sensors produced as of May 2022 (before May 2022, see [MP\\_RoomSensor \[▶ 69\]](#)). For more information, see [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMPolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.



 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  strDataKL6771  : DataKL6771;
  Tmpolling      : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMpolling</i> .
strDataKL6771	<a href="#">DataKL6771</a> [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
Tmpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

 **Outputs**

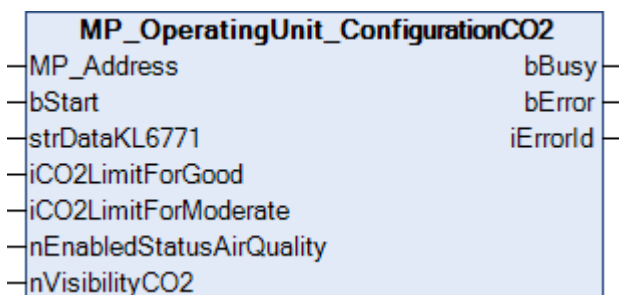
```
VAR_OUTPUT
  bBusy           : BOOL;
  bError          : BOOL;
  iErrorId       : MP_Error;
  bSensorFaultTemp      : BOOL;
  bSensorFaultHumidity  : BOOL;
  bSensorFaultCO2      : BOOL;
  fSensTemp        : LREAL;
  fHumid          : LREAL;
  uiCO2           : UINT;
  nAirQualityStatus : E_MP_AirQualityStatus;
  bSensorError    : BOOL;
  fDewPoint       : LREAL;
  fVentilationStage : LREAL;
  nSystemOperationMode : E_MP_SystemOperationMode;
  bVentilationStageControlMode : BOOL;
  bTempSetpointType : BOOL;
  fSetTemp        : LREAL;
  stSensorType    : STRING;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
bSensorFaultTemp	BOOL	Temperature sensor has a fault
bSensorFaultHumidity	BOOL	Humidity sensor has a fault.
bSensorFaultCO2	BOOL	CO2 sensor has a fault.
fSensTemp	LREAL	Room temperature in °C or °F (0..50 or 32..122).
fHumid	LREAL	Relative air humidity in % (0..100).
uiCO2	UINT	CO2 value in ppm (0..2000).
nAirQualityStatus	E_MP_AirQualityStatus [▶ 95]	Air quality status
bSensorError	BOOL	One of the sensors has an error.
fDewPoint	LREAL	Dew point temperature in °C (-50...50).
fVentilationStage	LREAL	Ventilation stage in % (0..100).
nSystemOperationMode	E_MP_SystemOperationMode [▶ 101]	Operation mode of the system
bVentilationStageControlMode	BOOL	FALSE = Manual; TRUE = Automatic.
bTempSetpointType	BOOL	FALSE = Absolute; TRUE = Relative
fSetTemp	LREAL	<i>bTempSetpointType</i> FALSE = setpoint room temperature in °C; <i>bTempSetpointType</i> TRUE = setpoint relative room temperature in °C.
stSensorType	STRING	DSensor type. '?' = not read; 'unknown' = number unknown.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

**4.1.1.18 MP\_OperatingUnit\_ConfigurationCO2**



This function block is used to configure room sensors of types P-22Rxx-1900x-1. It is compatible with 22Rxx-19-1 room sensors produced as of May 2022 (before May 2022, see MP\_RoomSensor\_Parameter [▶ 70]).

For more information, see [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  strDataKL6771  : DataKL6771;
  iCO2LimitForGood : UINT := 1000;
  iCO2LimitForModerate : UINT := 1500;
  nEnabledStatusAirQuality : E_MP_EnabledStatus;
  nVisibilityCO2 : E_MP_DisplayVisibility;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>MPolling</i> .
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
iCO2LimitForGood	UINT	CO2 limit for "Good" air quality in ppm (600..1249).
iCO2LimitForModerate	UINT	CO2 limit for "Moderate" air quality in ppm (1250..2000).
nEnabledStatusAirQuality	E_MP_EnabledStatus [ <a href="#">▶ 98</a> ]	Status of the air quality display
nVisibilityCO2	E_MP_DisplayVisibility [ <a href="#">▶ 98</a> ]	Visibility of the CO2 value

 **Outputs**

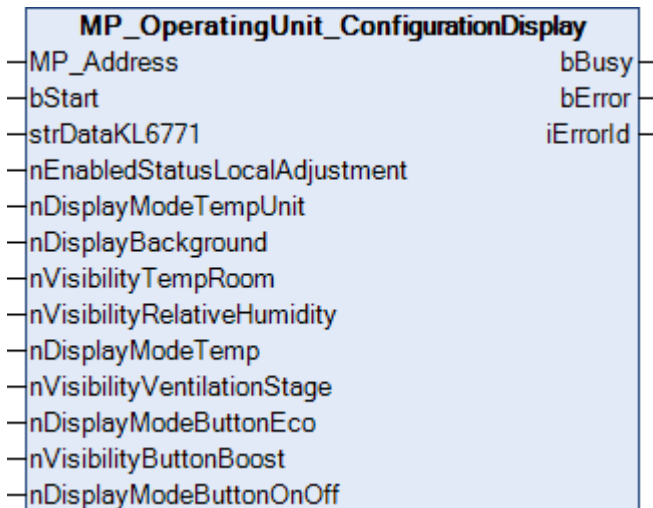
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [ <a href="#">▶ 105</a> ]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

#### 4.1.1.19 MP\_OperatingUnit\_ConfigurationDisplay



This function block is used to configure room sensors of types P-22Rxx-1900x-1. It is compatible with 22Rxx-19-1 room sensors produced as of May 2022 (before May 2022, see [MP\\_RoomSensor\\_Parameter \[► 70\]](#)).

For more information, see [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

#### Inputs

```

VAR_INPUT
  MP_Address          : USINT := 1;
  bStart             : BOOL;
  strDataKL6771      : DataKL6771;
  nEnabledStatusLocalAdjustment : E_MP_EnabledStatus;
  nDisplayModeTempUnit : E_MP_DisplayModeTempUnit;
  nDisplayBackground : E_MP_DisplayBackground;
  nVisibilityTempRoom : E_MP_DisplayVisibility;
  nVisibilityRelativeHumidity : E_MP_DisplayVisibility;
  nDisplayModeTemp   : E_MP_DisplayModeTemp;
  nVisibilityVentilationStage : E_MP_DisplayVisibility;
  nDisplayModeButtonEco : E_MP_DisplayModeButton;
  nVisibilityButtonBoost : E_MP_DisplayVisibility;
  nDisplayModeButtonOnOff : E_MP_DisplayModeButton;
END_VAR

```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	<a href="#">DataKL6771 [▶ 108]</a>	The data structure with which the <a href="#">KL6771()</a> <a href="#">[▶ 25]</a> function block must be linked.
nEnabledStatusLocalAdjustment	<a href="#">E_MP_EnabledStatus [▶ 98]</a>	Status of access permission for local adjustments
nDisplayModeTempUnit	<a href="#">E_MP_DisplayModeTempUnit [▶ 97]</a>	Status of access permission for local adjustments
nDisplayBackground	<a href="#">E_MP_DisplayBackground [▶ 96]</a>	Background color of the display
nVisibilityTempRoom	<a href="#">E_MP_DisplayVisibility [▶ 98]</a>	Visibility of the room temperature
nVisibilityRelativeHumidity	<a href="#">E_MP_DisplayVisibility [▶ 98]</a>	Visibility of the relative humidity
nDisplayModeTemp	<a href="#">E_MP_DisplayModeTemp [▶ 96]</a>	Display mode of the temperature
nVisibilityVentilationStage	<a href="#">E_MP_DisplayVisibility [▶ 98]</a>	Visibility of the ventilation stage
nDisplayModeButtonEco	<a href="#">E_MP_DisplayModeButton [▶ 96]</a>	Display mode of the Eco button
nVisibilityButtonBoost	<a href="#">E_MP_DisplayVisibility [▶ 98]</a>	Display mode of the Boost button
nDisplayModeButtonOnOff	<a href="#">E_MP_DisplayModeButton [▶ 96]</a>	Display mode of the OnOff button

 **Outputs**

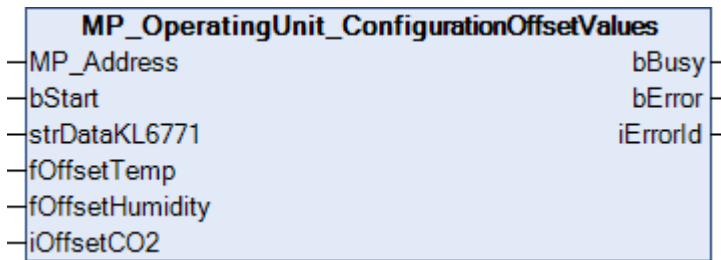
```
VAR_OUTPUT
  bBusy           : BOOL;
  bError          : BOOL;
  iErrorId       : MP_Error;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	<a href="#">MP_ERROR [▶ 105]</a>	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

### 4.1.1.20 MP\_OperatingUnit\_ConfigurationOffsetValues



This function block is used to configure room sensors of types P-22Rxx-1900x-1. It is compatible with 22Rxx-19-1 room sensors produced as of May 2022 (before May 2022, see [MP\\_RoomSensor\\_Parameter](#) [► 70]).

For more information, see [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

#### Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  strDataKL6771  : DataKL6771;
  fOffsetTemp    : LREAL := 0;
  fOffsetHumidity : LREAL := 0;
  iOffsetCO2     : INT := 0;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	DataKL6771 [► 108]	The data structure with which the <code>KL6771()</code> [► 25] function block must be linked.
fOffsetTemp	LREAL	Offset applied to the measured temperature in °C or °F (-15...15 or -27...27).
fOffsetHumidity	LREAL	Offset applied to the measured relative humidity in % (-20...20).
iOffsetCO2	INT	Offset applied to the measured CO2 content in ppm (-500...500).

#### Outputs

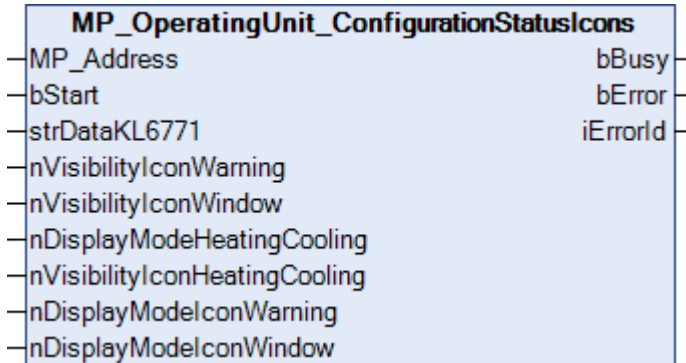
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [► 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.

Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

4.1.1.21 MP\_OperatingUnit\_ConfigurationStatusIcons



This function block is used to configure room sensors of types P-22Rxx-1900x-1. It is compatible with 22Rxx-19-1 room sensors produced as of May 2022 (before May 2022, see [MP\\_RoomSensor\\_Parameter \[p. 70\]](#)).

For more information, see [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

Inputs

```

VAR_INPUT
    MP_Address          : USINT := 1;
    bStart              : BOOL;
    strDataKL6771      : DataKL6771;
    nVisibilityIconWarning : E_MP_DisplayVisibility;
    nVisibilityIconWindow  : E_MP_DisplayVisibility;
    nDisplayModeHeatingCooling : E_MP_DisplayModeHeatingCooling;
    nVisibilityIconHeatingCooling : E_MP_DisplayVisibility;
    nDisplayModeIconWarning  : E_MP_DisplayModeIconWarning;
    nDisplayModeIconWindow   : E_MP_DisplayModeIconWindow;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	DataKL6771 [▶ 108]	The data structure with which the <i>KL6771()</i> [▶ 25] function block must be linked.
nVisibilityIconWarning	E_MP_DisplayVisibility [▶ 98]	Visibility of the warning symbol. Applies if nDisplayModelIconWarning is set to 1
nVisibilityIconWindow	E_MP_DisplayVisibility [▶ 98]	Visibility of the window icon. Applies if nDisplayModelIconWindow is set to 1
nDisplayModeHeatingCooling	E_MP_DisplayModeHeatingCooling [▶ 96]	Display mode of heating or cooling icons
nVisibilityIconHeatingCooling	E_MP_DisplayVisibility [▶ 98]	Visibility of heating or cooling icons
nDisplayModelIconWarning	E_MP_DisplayModelIconWarning [▶ 96]	Display mode of the warning icon
nDisplayModelIconWindow	E_MP_DisplayModelIconWindow [▶ 97]	Display mode of the window icon

 **Outputs**

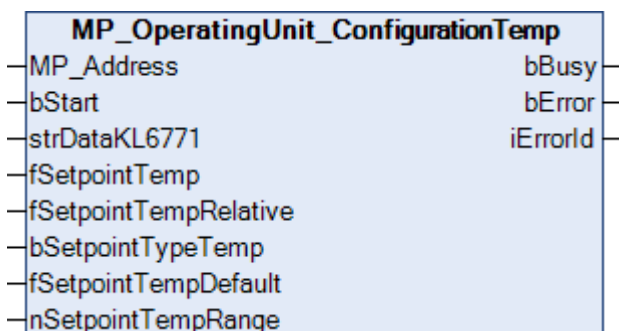
```
VAR_OUTPUT
  bBusy           : BOOL;
  bError          : BOOL;
  iErrorId        : MP_Error;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

**4.1.1.22 MP\_OperatingUnit\_ConfigurationTemp**



This function block is used to configure room sensors of types P-22Rxx-1900x-1. It is compatible with 22Rxx-19-1 room sensors produced as of May 2022 (before May 2022, see MP\_RoomSensor\_Parameter [▶ 70]).

For more information, see [www.belimo.com](http://www.belimo.com).



*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  strDataKL6771  : DataKL6771;
  fSetpointTemp  : LREAL := 20;
  fSetpointTempRelative : LREAL := 0;
  bSetpointTypeTemp : BOOL;
  fSetpointTempDefault : LREAL := 20;
  nSetpointTempRange : USINT := 10;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	<a href="#">DataKL6771</a> [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
fSetpointTemp	LREAL	Setpoint for the room temperature in °C (5...45).
fSetpointTempRelative	LREAL	Setpoint for the relative room temperature in °C (5.6...5.6).
bSetpointTypeTemp	BOOL	FALSE = Absolute; TRUE = Relative.
fSetpointTempDefault	LREAL	Default setpoint for the room temperature in °C (15...35).
nSetpointTempRange	USINT	Setpoint range for the temperature in °C (0...10).

 **Outputs**

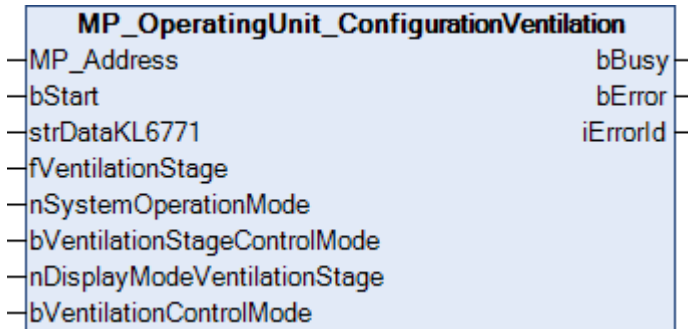
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	<a href="#">MP_ERROR</a> [ <a href="#">▶ 105</a> ]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

### 4.1.1.23 MP\_OperatingUnit\_ConfigurationVentilation



This function block is used to configure room sensors of types P-22Rxx-1900x-1. It is compatible with 22Rxx-19-1 room sensors produced as of May 2022 (before May 2022, see [MP\\_RoomSensor\\_Parameter](#) [► 70]).

For more information, see [www.belimo.com](http://www.belimo.com).

`MP_Address` is used to specify the MP-Bus device with which the function block is to communicate. `bStart` activates communication with the MP-Bus device. `bBusy` indicates that the function block is active. `bError` is used to indicate an error in communication with the actuator. The type of the error can be read with `iErrorId`.

#### Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  strDataKL6771   : DataKL6771;
  fVentilationStage : LREAL;
  nSystemOperationMode : E_MP_SystemOperationMode;
  bVentilationStageControlMode : BOOL;
  nDisplayModeVentilationStage : E_MP_DisplayModeVentilationStage := MPBus_DisplayModeVentilationStage_7;
  bVentilationControlMode : BOOL;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	<a href="#">DataKL6771</a> [► 108]	The data structure with which the <a href="#">KL6771()</a> [► 25] function block must be linked.
fVentilationStage	LREAL	Ventilation stage in the room/zone in % (0...100).
nSystemOperationMode	<a href="#">E_MP_SystemOperationMode</a> [► 101]	Operation mode of the system
bVentilationStageControlMode	BOOL	Mode of ventilation stage control. Applies if <i>bVentilationControlMode</i> is set to TRUE.
nDisplayModeVentilationStage	<a href="#">E_MP_DisplayModeVentilationStage</a> [► 97]	Display mode of the ventilation stage.
bVentilationControlMode	BOOL	FALSE = manual mode only; TRUE = hybrid control mode (setpoint invisible in auto mode).

#### Outputs

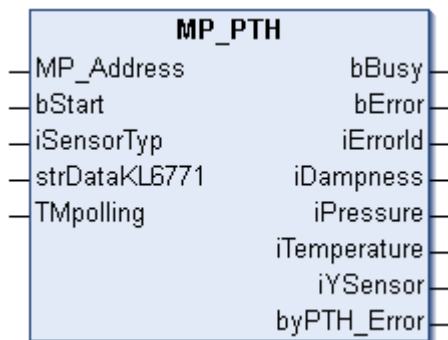
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR  ▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

**4.1.1.24 MP\_PTH**



This function block is used to control and monitor a PTH sensor.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the sensor. The type of the error can be read with *iErrorID*.

If an external sensor is connected to the sensor, *iSensorTyp* should be used to specify the sensor type. If no sensor is connected, the value "0" should be entered, or the variable should be left blank. A digital sensor should be parameterized with "3". The state of the sensor is output through the variable *iYSensor*.

**Inputs**

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL := TRUE;
  iSensorTyp      : INT;
  strDataKL6771  : DataKL6771;
  TMpolling      : TIME := t#10s;
END_VAR
    
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
iSensorTyp	INT	"0" or blank: no sensor is connected; "1": an analog sensor is connected with voltage output in mV; "2": an output of a resistance in ohms - 1.0 ohm; "3": an output of a resistance in ohms - 0.1 ohm; "4": digital sensor.
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

 **Outputs**

```
VAR_OUTPUT
  bBusy      : BOOL;
  bError     : BOOL;
  iErrorId   : MP_Error;
  iDampness  : INT;
  iPressure  : INT;
  iTemperature : INT;
  iYSensor   : INT;
  byPTH_Error : BYTE;;
END_VAR
```

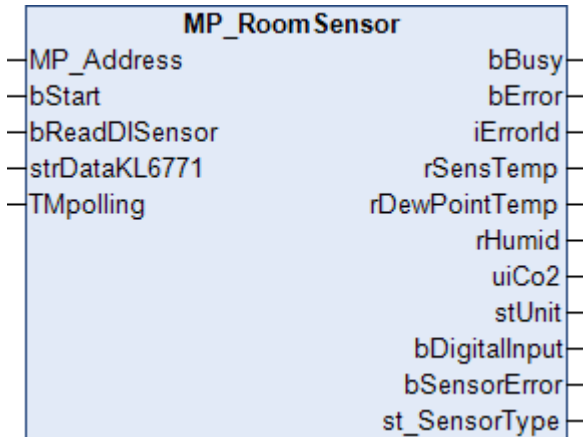
Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [ <a href="#">▶ 105</a> ]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
iDampness	INT	Relative humidity in 0.01 %
iPressure	INT	Differential pressure, output in 0.1 Pa.
iTemperature	INT	Temperature in 0.01 °C
iYSensor	INT	Y-input, iSensorTyp = "1": voltage 0...10 V output in mV; iSensorTyp = "2": resistance output in 1.0 ohm; iSensorTyp = "3": resistance output in 0.1 ohm; iSensorTyp = "3": digital switch 0 or 1
byPTH_Error	BYTE	Sensor error - 0 - no error.

byPTH_Error	Description
Bit 0	Servicing error
Bit 1	Error message, sensor faulty
Bit 2	-
Bit 3	-
Bit 4	Sensor (temperature/humidity) faulty
Bit 5	A/D converter (pressure) faulty
Bit 6	A/D converter (Y-input) faulty
Bit 7	-

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

### 4.1.1.25 MP\_RoomSensor



This function block is used to read out room sensors of types 22Rxx-19-1 that were produced before May 2022 (as of May 2022, see [MP\\_OperatingUnit \[▶ 56\]](#)).

For more information, see [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 s. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

#### Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  bReadDISensor  : BOOL;
  strDataKL6771  : DataKL6771;
  TMpolling      : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMpolling</i> .
bReadDISensor	BOOL	If TRUE, the DI sensor is read and the result is available in <i>bDigitalInput</i> .
strDataKL6771	<a href="#">DataKL6771 [▶ 108]</a>	The data structure with which the <a href="#">KL6771() [▶ 25]</a> function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

#### Outputs

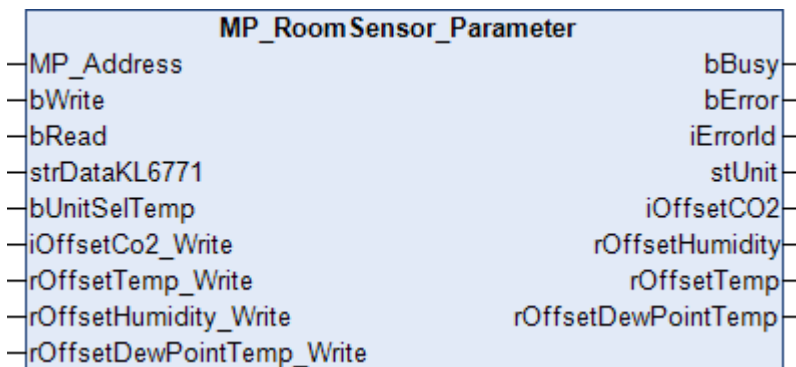
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  rSensTemp      : LREAL;
  rDewPointTemp  : LREAL;
  rHumid         : LREAL;
  uiCo2          : UINT;
  stUnit         : STRING;
  bDigitalInput  : BOOL;
  bSensorError   : BOOL;
  st_SensorType  : STRING;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
rSensTemp	LREAL	Sensor temperature in °C or °F.
rDewPointTemp	LREAL	Temperature of the calculated dew point in °C or °F.
rHumid	LREAL	Humidity in percent (% 0.01).
uiCo2.	UINT	CO2 content in ppm.
stUnit	STRING	C = °C or F = °F, ? = not read.
bDigitalInput	BOOL	DI sensor read if <i>bReadDISensor</i> is TRUE.
bSensorError	BOOL	One of the sensors has an error.
st_SensorType	STRING	Sensor type. '?' = not read / type / 'unknown' = number unknown.

### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.10	Tc2_MPBus from 3.4.12.0

#### 4.1.1.26 MP\_RoomSensor\_Parameter



This function block is used to parameterize room sensors of types 22Rxx-19-1 that were produced before May 2022 (as of May 2022, see *MP\_OperatingUnit\_Configuration*).

For more information, see [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bRead* reads the parameters, *bWrite* writes them to the room sensor. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

#### Inputs

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bWrite          : BOOL;
  bRead          : BOOL;
  strDataKL6771  : DataKL6771;
  bUnitSelTemp   : BOOL;
  iOffsetCo2_Write : INT;
  rOffsetTemp_Write : LREAL;
  rOffsetHumidity_Write : LREAL;
  rOffsetDewPointTemp_Write : LREAL;;
END_VAR

```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bWrite	BOOL	A positive edge starts the function block and writes the parameter.
bRead	BOOL	A positive edge starts the function block and reads the parameter.
strDataKL6771	DataKL6771 [► 108]	The data structure with which the KL6771() [► 25] function block must be linked.
bUnitSelTemp	BOOL	FALSE = °C, TRUE = °F.
iOffsetCo2_Write	INT	OffsetCO2 [ppm] -500...500.
rOffsetTemp_Write	LREAL	OffsetTemp [UnitSel] -15...15 °C (-27...27 °F)
rOffsetHumidity_Write	LREAL	OffsetHumidity [%] -20...+20.
rOffsetDewPointTemp_Write	LREAL	OffsetDewPointTemp [UnitSel] -15...15 °C (-27...27 °F).

 **Outputs**

```

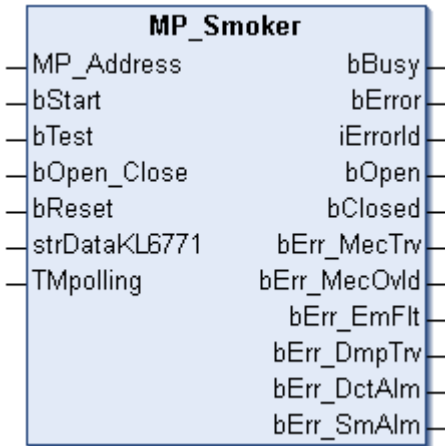
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  stUnit         : STRING;
  iOffsetCO2     : INT;
  rOffsetHumidity : LREAL;
  rOffsetTemp    : LREAL;
  rOffsetDewPointTemp : LREAL;
END_VAR
    
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [► 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
stUnit	STRING	C = °C or F = °F, ? = not read.
iOffsetCO2	INT	OffsetCO2 [ppm].
rOffsetHumidity	LREAL	OffsetHumidity [%] 0.01.
rOffsetTemp	LREAL	OffsetTemp [°C or °F] 0.01.
rOffsetDewPointTemp	LREAL	DewOffsetTemp [°C or °F] 0.01.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.10	Tc2_MPBus from 3.4.12.0

### 4.1.1.27 MP\_Smoker



This function block is used to control and monitor a fire damper.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 s, maximum 30 s. *bError* is used to indicate an error in communication with the drive. The type of the error can be read with *iErrorID*.

A rising edge at *bReset* clears any pending error messages from the drive. A telegram is thus sent to the drive that acknowledges the errors in the drive.

If they persist, they remain set. This applies to all *bErr\_\** error bits.

*bOpen\_Close* is used to open or close the fire damper. TRUE causes the fire damper to open, while FALSE closes it. *bOpen* indicates that the damper is open, *bClosed* indicates that it is closed. If both bits are FALSE, the drive is currently opening or closing.

A rising edge at *bTest* initiates a test run on the fire damper. Errors that have been set can be cleared with this if they are no longer present.

#### Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL := TRUE;
  bTest          : BOOL;
  bOpen_Close    : BOOL;
  bReset         : BOOL;
  strDataKL6771  : DataKL6771;
  Tmpolling      : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMpolling</i> .
bTest	BOOL	A positive edge starts the test run at a fire damper.
bOpen_Close	BOOL	TRUE opens a damper, while FALSE closes a damper.
bReset	BOOL	A positive edge resets the actuator's error messages.
strDataKL6771	DataKL6771 [► 108]	The data structure with which the <a href="#">KL6771()</a> [► 25] function block must be linked.
Tmpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.



**🔌 Outputs**

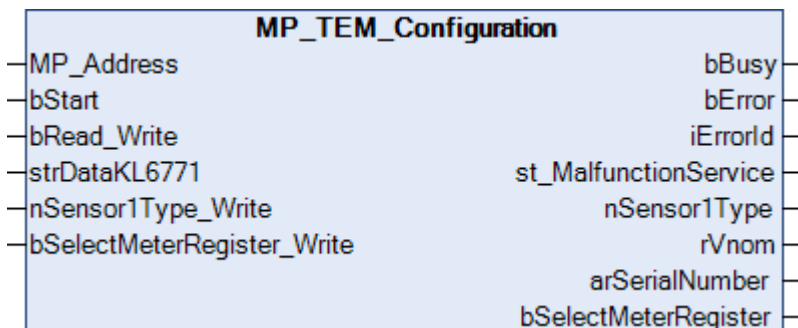
```
VAR_OUTPUT
  bBusy      : BOOL;
  bError     : BOOL;
  iErrorId   : MP_Error;
  bOpen      : BOOL;
  bClosed    : BOOL;
  bErr_MecTrv : BOOL;
  bErr_MecOvld : BOOL;
  bErr_EmFlt : BOOL;
  bErr_DmpTrv : BOOL;
  bErr_DctAlm : BOOL;
  bErr_SmAlm : BOOL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
bOpen	BOOL	Fire damper is open.
bClosed:	BOOL	Fire damper is closed.
bErr_MecTrv	BOOL	Actuator error, "Positioning angle exceeded"; the actuator has passed more than 10° beyond the adaptation position.
bErr_MecOvld	BOOL	Actuator error, "Overload"; the set position could not be reached.
bErr_EmFlt	BOOL	Actuator error, "Safety-relevant error"; ambient temperature above 72 °C or motor temperature above 85 °C. Error can only be reset at the factory.
bErr_DmpTrv	BOOL	Actuator error "Damper test error" is canceled if the test run is OK.
bErr_DctAlm	BOOL	Actuator error, "Channel temperature too high"; the actuator is swinging backwards and forwards.
bErr_SmAlm	BOOL	Actuator error, "Smoke alarm"

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.1.1.28 MP\_TEM\_Configuration**



This function block is used to configure the Thermal Energy Meter type 22PE-.. and 22PEM-... For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  bRead_Write    : BOOL;
  strDataKL6771  : DataKL6771;
  nSensor1Type_Write : E_MP_EV_V4_Sensor1Type;
  bSelectMeterRegister_Write : BOOL;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bRead_Write	BOOL	If FALSE then READ only; if TRUE then READ and WRITE.
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <code>KL6771()</code> [ <a href="#">▶ 25</a> ] function block must be linked.
nSensor1Type_Write	E_MP_EV_V4_Sensor1Type [ <a href="#">▶ 101</a> ]	Sensor 1 type
bSelectMeterRegister_Write	BOOL	FALSE = certified meter; TRUE = lifetime meter.

 **Outputs**

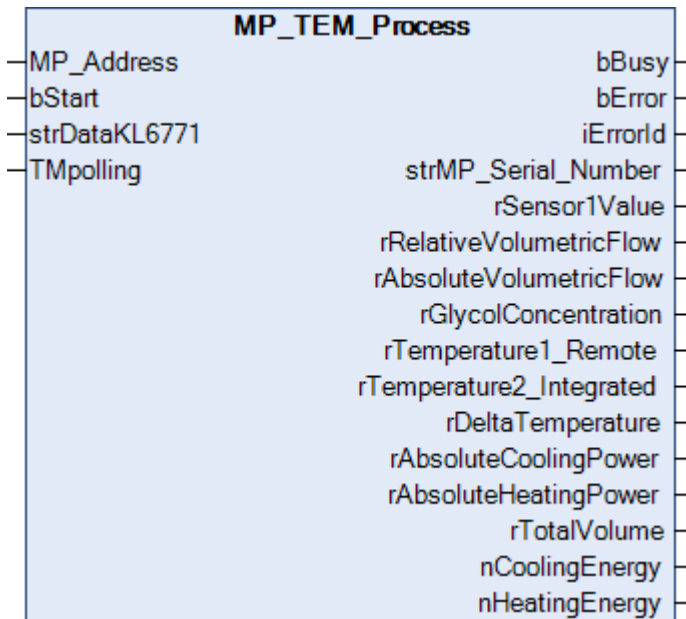
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  st_MalfunctionService : St_MP_EV_V4_MalfunctionServiceInfo;
  nSensor1Type   : E_MP_EV_V4_Sensor1Type;
  rVnom          : LREAL;
  arSerialNumber : ARRAY[0..1] OF DWORD;
  bSelectMeterRegister : BOOL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [ <a href="#">▶ 105</a> ]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
st_MalfunctionService	St MP EV V4 Malfunction ServiceInfo [ <a href="#">▶ 109</a> ]	Malfunction and service information
nSensor1Type	E_MP_EV_V4_Sensor1Type [ <a href="#">▶ 101</a> ]	Sensor 1 type
rVnom	LREAL	Nominal volume flow in l/s (0...100).
arSerialNumber	ARRAY OF DWORD	Serial number of the device.
bSelectMeterRegister	BOOL	FALSE = certified meter; TRUE = lifetime meter.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

4.1.1.29 MP\_TEM\_Process



This function block is suitable for the Thermal Energy Meter type 22PE-.. and 22PEM-.. . For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  strDataKL6771  : DataKL6771;
  TMpolling      : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMpolling</i> .
strDataKL6771	<a href="#">DataKL6771</a> [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

Outputs

```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  strMP_Serial_Number : MP_Serial_Number;
  rSensor1Value  : LREAL;
  rRelativeVolumetricFlow : LREAL;
  rAbsoluteVolumetricFlow : LREAL;
  rGlycolConcentration : LREAL;
  rTemperature1_Remote : LREAL;
  rTemperature2_Integrated : LREAL;
  rDeltaTemperature : LREAL;
  rAbsoluteCoolingPower : LREAL;
```

```
rAbsoluteHeatingPower : LREAL;
rTotalVolume          : LREAL;
nCoolingEnergy        : DINT;
nHeatingEnergy        : DINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR  ▶ 105	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
strMP_Serial_Number	MP_Serial_Number	Structure for the serial number.
rSensor1Value	LREAL	Sensor 1 Value in mV/ohm (0...65535).
rRelativeVolumetricFlow	LREAL	Relative volume flow rate in % (0...100).
rAbsoluteVolumetricFlow	LREAL	Absolute volume flow rate in l/s (0...100).
rGlycolConcentration	LREAL	Glycol concentration in % (0...100).
rTemperature1_Remote	LREAL	Temperatur1 remote in °C (-20...12).
rTemperature2_Integrated	LREAL	Temperature2 integrated in °C (-20...12).
rDeltaTemperature	LREAL	Temperature delta in K (0...14).
rAbsoluteCoolingPower	LREAL	Absolute cooling power in kW (0...21.5).
rAbsoluteHeatingPower	LREAL	Absolute heating power in kW (0...21.5).
rTotalVolume	LREAL	Total volume in m³ (0...214748.36).
nCoolingEnergy	DINT	Cooling energy in kWh (0...21474836).
nHeatingEnergy	DINT	Heating energy in kWh (0...21474836).

**Requirements**

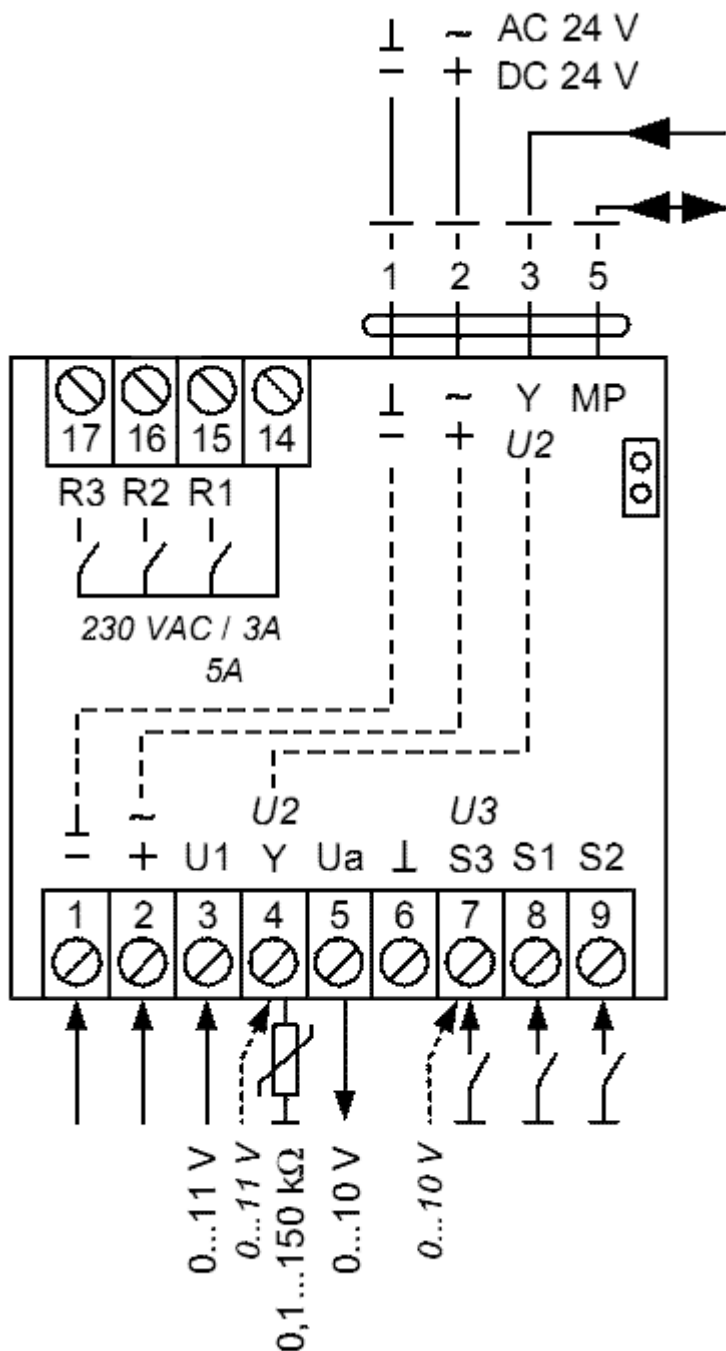
Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

**4.1.1.30 MP\_UST\_3**



This function block is used to control and monitor a multi-IO module UST3.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMPolling*. The time should be set to greater than one second. *bError* indicates an error in the communication with the drive. The type of the error can be read with *iErrorID*.



The input data *bRelay\_R1* to *bRelay\_R3* switch the relays R1 to R3 (PIN 15 to PIN 17). The variable *iUa* switches the analog output 0...10 V to PIN 5. One digit corresponds to 1 mV.

The data structure *SETTINGS* is used for parameterization of the UST3. The scaling of the analog input data can be set, and the resistance measurement can be enabled on PIN4. The scaling of the measured resistance value can be changed for the resistance measurement. This can be done during operation. *iU1* is the analog input on PIN 3. One digit corresponds to 1 mV, or 250  $\mu$ V if the scaling in the data structure *SETTINGS* was changed. The same applies to the analog inputs *iU2\_YSensor* (PIN 4) and *iU3* (PIN 7). *iU2\_YSensor* can also be used for resistance measurement. This must be set via the data structure *SETTINGS*. *bDigital\_S1* to *bDigital\_S3* correspond to the digital inputs of UST3, PIN 7 to PIN 9.

All data is automatically polled by the KL6771. The polling speed depends on the number of connected MP-Bus devices and the set polling time. The digital inputs are unsuitable for connecting buttons or sensors, which only issue short pulses. In order to be able to register a change in signal level reliably, it must be present for at least one second.

### Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  strDataKL6771  : DataKL6771;
  TMPolling       : TIME := t#10s;
  bRelay_R1       : BOOL;
  bRelay_R2       : BOOL;
  bRelay_R3       : BOOL;
  iUa             : UINT;
  SETTINGS        : UST3_SET;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	<a href="#">DataKL6771 [► 108]</a>	The data structure with which the <a href="#">KL6771()</a> <a href="#">[► 25]</a> function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.
bRelay_R1	BOOL	Relay PIN 15
bRelay_R2	BOOL	Relay PIN 16
bRelay_R3	BOOL	Relay PIN 17
iUa	UINT	Analog output PIN 5 (1 mV = 1 digit)
SETTINGS	<a href="#">UST3_SET [► 111]</a>	Data structure for setting the scaling and the resistance measurement.

### Outputs

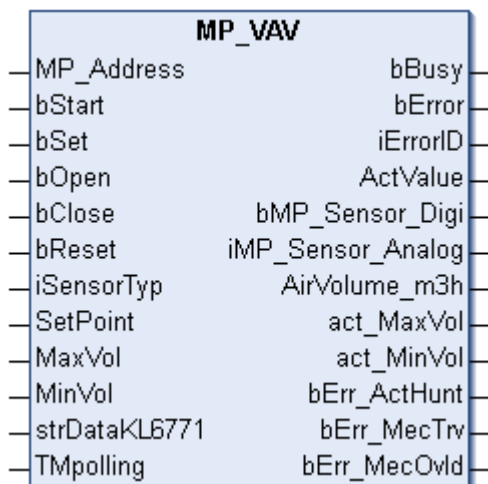
```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  iU1            : INT;
  iU2_YSensor    : INT;
  iU3            : INT;
  bDigital_S1    : BOOL;
  bDigital_S2    : BOOL;
  bDigital_S3    : BOOL;
  iResistor      : INT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
iU1	INT	analog input PIN 3 (1 digit = 1 mV or 1 digit = 250 µV)
iU2_YSensor	INT	analog input PIN 4 (1 digit = 1 mV or 1 digit = 250 µV)
iU3	INT	analog input PIN 7 (1 digit = 1 mV or 1 digit = 250 µV)
bDigital_S1	BOOL	digital input PIN 8
bDigital_S2	BOOL	digital input PIN 9
bDigital_S3	BOOL	digital input PIN 7
iResistor	INT	Resistance value PIN 4

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.1.1.31 MP\_VAV**



This function block is used to control and monitor a volume flow regulator.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMPolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the drive. The type of the error can be read with *iErrorID*.

A rising edge at *bReset* clears any pending error messages from the drive. This resets errors that affect the output variables *bErr\_MecOvld*, *bErr\_ActHunt* and *bErrMecTrv*. If the error itself is still present, the drive will set these error bits again.

*SetPoint* is used to adjust the volume flow rate from 0..100%. The current position of the damper can be read through *ActValue*.

If a sensor is connected to the drive, *iSensorTyp* should be used to specify the sensor type. If no sensor is connected, the value "0" should be entered, or the variable should be left blank. A digital sensor should be parameterized with "1". The state of the sensor can be interrogated through *bMP\_Sensor\_Digi*. Analog sensors "2...6" are output in variable *iMP\_Sensor\_Analog*.

A rising edge at the *bOpen* or *bClose* inputs opens or closes the damper of the drive. A falling edge at these two inputs clears the command again.

*MaxVol* and *MinVol* can be used to store a maximum and minimum flow rate in the drive. A rising edge at *bSet* writes the data to the drive. You can obtain the current value from the output data *act\_MaxVol* and *act\_MinVol*. The current volume flow rate is output in the *AirVolume\_m3h* variable.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  bSet            : BOOL;
  bOpen           : BOOL;
  bClose         : BOOL;
  bReset          : BOOL;
  iSensorTyp     : INT;
  SetPoint        : USINT;
  MaxVol          : WORD;
  MinVol          : WORD;
  strDataKL6771  : DataKL6771;
  Tmpolling       : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMpolling</i> .
bSet	BOOL	A positive edge writes the data <i>MaxVol</i> and <i>MinVol</i> to the actuator.
bOpen	BOOL	A positive edge opens the dampers of the actuator, while a negative edge cancels the forced ventilation.
bClose	BOOL	A positive edge closes the dampers of the actuator, while a negative edge cancels the forced closure.
bReset	BOOL	A positive edge resets the actuator's error messages.
iSensorTyp	INT	0: no sensor connected, 1: digital sensor connected, 2: analog sensor connected (0...35 V), 3..6: output of a resistance in ohms (3..5 applies to PT1000, NI1000 and NI1000LuS; 6 applies to NTC). To convert to a temperature, use the corresponding conversion functions.
SetPoint	USINT	0...100 % set volume flow rate
MaxVol	WORD	30...100 % Maximum volume flow rate
MinVol	WORD	0...100 % Minimum volume flow rate
strDataKL6771	<a href="#">DataKL6771 [► 108]</a>	The data structure with which the <a href="#">KL6771()</a> <a href="#">[► 25]</a> function block must be linked.
Tmpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

 **Outputs**

```
VAR_OUTPUT
  bBusy           : BOOL;
  bError          : BOOL;
  iErrorId        : MP_Error;
  ActValue        : WORD;
  bMP_Sensor_Digi : BOOL;
  iMP_Sensor_Analog : INT;
  AirVolume_m3h   : WORD;
  act_MaxVol      : INT;
  act_MinVol      : INT;
  bErr_ActHunt    : BOOL;
  bErr_MecTrv     : BOOL;
  bErr_MecOvld    : BOOL;
END_VAR
```

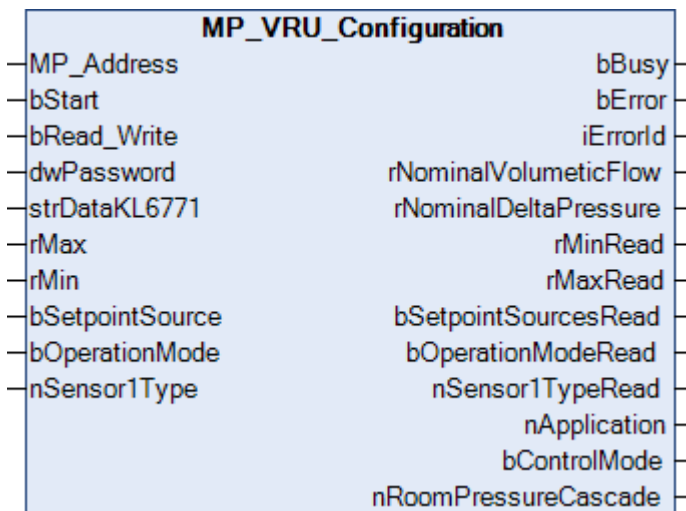


Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
ActValue	WORD	Contains the current position of the actuator (0...100 %).
bMP_Sensor_Digi	BOOL	If a digital sensor is connected, its state is indicated through this variable. <i>iSensorTyp</i> must be "1".
iMP_Sensor_Analog	INT	If an analog sensor is connected, its value is indicated through this variable. <i>iSensorTyp</i> must be "2...6".
AirVolume_m3h	WORD	Output of the volume flow rate in m <sup>3</sup> /h.
act_MaxVol	INT	Maximum set volume flow rate in %.
act_MinVol	INT	Minimum set volume flow rate in %.
bErr_ActHunt	BOOL	Actuator error, "Regulating oscillation"; the actuator is swinging backwards and forwards.
bErr_MecTrv	BOOL	Actuator error, "Positioning angle exceeded"; the actuator has passed more than 10° beyond the adaptation position.
bErr_MecOvld	BOOL	Actuator error, "Overload"; the set position could not be reached.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.1.1.32 MP\_VRU\_Configuration**



This function block is used to configure the VAV actuators VRU-D3-BAC, VRU-M1-BAC and VRU-M1R-BAC (max. 8 slaves). For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

**Inputs**

```

VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  bRead_Write    : BOOL;
  dwPassword     : DWORD;
  strDataKL6771 : DataKL6771;

```

```

rMax      : LREAL := 100;
rMin      : LREAL;
bSetpointSource : BOOL;
bOperationMode : BOOL := TRUE;
nSensor1Type : E_MP_VRU_Sensor1Type := MPBus_VRU_Sensor_Active;
END_VAR

```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
bRead_Write	BOOL	If FALSE then READ only; if TRUE then READ and WRITE.
dwPassword	DWORD	The password for the actuators. Usually 0x0000.
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <a href="#">KL6771()</a> [ <a href="#">▶ 25</a> ] function block must be linked.
rMax	LREAL	Max in % (20...100 %).
rMin	LREAL	Min in % (0...rMax). rMin must be smaller than rMax.
bSetpointSource	BOOL	TRUE = bus; FALSE = analog
bOperationMode	BOOL	TRUE = overpressure; FALSE = underpressure
nSensor1Type	<a href="#">E_MP_VRU_Sensor1Type</a> <a href="#">▶ 103</a>	Sensor 1 type

 **Outputs**

```

VAR_OUTPUT
bBusy      : BOOL;
bError     : BOOL;
iErrorId   : MP_Error;
rNominalVolumetricFlow : LREAL;
rNominalDeltaPressure : LREAL;
rMinRead   : LREAL;
rMaxRead   : LREAL;
bSetpointSourcesRead : BOOL;
bOperationModeRead : BOOL;
nSensor1TypeRead : E_MP_VRU_Sensor1Type;
nApplication : E_MP_VRU_Application;
bControlMode : BOOL;
nRoomPressureCascade : E_MP_VRU_RoomPressureCascade;
END_VAR

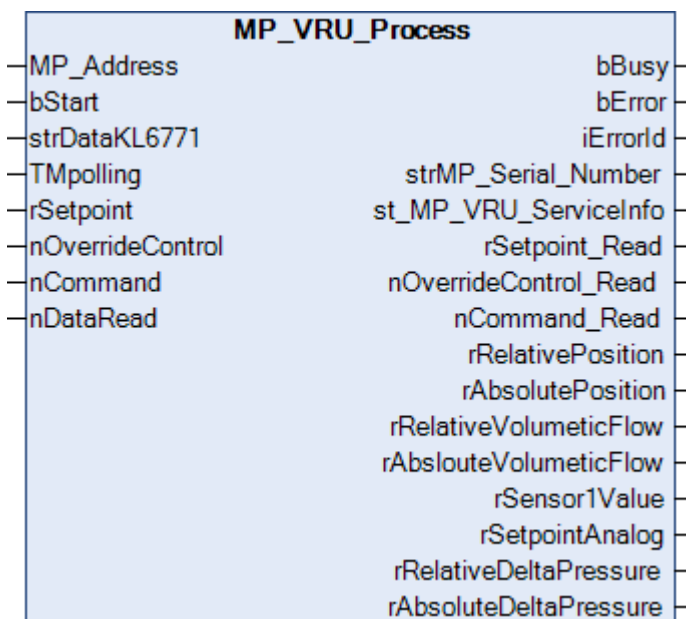
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
rNominalVolumetricFlow	LREAL	Nominal volume flow in m <sup>3</sup> /h (0...60,000).
rNominalDeltaPressure	LREAL	Nominal differential pressure in Pa (0...10,000).
rMinRead	LREAL	Min in % (0... <i>rMax</i> ). <i>rMin</i> must be smaller than <i>rMax</i> .
rMaxRead	LREAL	Max in % (20...100 %).
bSetpointSourcesRead	BOOL	TRUE = bus; FALSE = analog
bOperationModeRead	BOOL	TRUE = overpressure; FALSE = underpressure
nSensor1TypeRead	E_MP_VRU_Sensor1Type [▶ 103]	Sensor 1 type
nApplication	E_MP_VRU_Application [▶ 101]	Visualization of the application selected by the manufacturer.
bControlMode	BOOL	Visualization of the control function selected by the manufacturer. TRUE = volume flow rate control; FALSE = position control.
nRoomPressureCascade	E_MP_VRU_RoomPressureCascade [▶ 103]	Room pressure cascade control

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.22	Tc2_MPBUS from 3.4.13.0

**4.1.1.33 MP\_VRU\_Process**



This function block is suitable for VAV actuators VRU-D3-BAC, VRU-M1-BAC and VRU-M1R-BAC (max. 8 slaves). For more information please visit [www.belimo.com](http://www.belimo.com).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMPolling*. The time should be set longer than 1 s. *bError* is used to indicate an error in communication with the actuator. The type of the error can be read with *iErrorId*.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  strDataKL6771  : DataKL6771;
  TMPolling       : TIME := t#10s;
  rSetpoint       : LREAL;
  nOverrideControl : E_MP_VRU_OverrideControl;
  nCommand        : E_MP_VRU_Command;
  nDataRead       : BYTE;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <i>KL6771()</i> [ <a href="#">▶ 25</a> ] function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.
rSetpoint	LREAL	Value in % (0.. 100 %).
nOverrideControl	E_MP_VRU_OverrideControl [ <a href="#">▶ 102</a> ]	Setpoint override
nCommand	E_MP_VRU_Command [ <a href="#">▶ 102</a> ]	Command for service and test functions of the actuator.
nDataRead	BYTE	0xFF - read all data; bit 0 - read relative position; bit 1 - read absolute position; bit 2 - read relative volume flow rate; bit 3 - read absolute volume flow rate; bit 4 - read value sensor 1; bit 5 - read analog setpoint; bit 6 - read relative differential pressure; bit 7 - read absolute differential pressure

 **Outputs**

```
VAR_OUTPUT
  bBusy          : BOOL;
  bError         : BOOL;
  iErrorId       : MP_Error;
  strMP_Serial_Number : MP_Serial_Number;
  st_MP_VRU_ServiceInfo : St_MP_VRU_ServiceInfo;
  rSetpoint_Read : LREAL;
  nOverrideControl_Read : E_MP_VRU_OverrideControl;
  nCommand_Read  : E_MP_VRU_Command;
  rRelativePosition : LREAL;
  rAbsolutePosition : LREAL;
  rRelativeVolumetricFlow : LREAL;
  rAbsoluteVolumetricFlow : LREAL;
  rSensor1Value   : LREAL;
  rSetpointAnalog : LREAL;
  rRelativeDeltaPressure : LREAL;
  rAbsoluteDeltaPressure : LREAL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [▶ 105]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
strMP_Serial_Number	MP_Serial_Number [▶ 109]	Structure for the serial number
st_MP_VRU_ServiceInfo	St_MP_VRU_ServiceInfo [▶ 110]	Malfunction and service information
rSetpoint_Read	LREAL	Setpoint
nOverrideControl_Read	E_MP_VRU_OverrideControl [▶ 102]	Override
nCommand_Read	E_MP_VRU_Command [▶ 102]	Command
rRelativePosition	LREAL	Relative position in %. Value -1 means data disabled (see VAR_INPUT <i>nDataRead</i> ).
rAbsolutePosition	LREAL	Absolute position in °. Value -1 means data disabled (see VAR_INPUT <i>nDataRead</i> ).
rRelativeVolumetricFlow	LREAL	Relative volume flow rate in %. Value -1 means data disabled (see VAR_INPUT <i>nDataRead</i> ).
rAbsoluteVolumetricFlow	LREAL	Absolute volume flow rate in m³/h. Value of -1 means data disabled (see VAR_INPUT <i>nDataRead</i> ).
rSensor1Value	LREAL	Value of sensor 1 in mV/Ohm. Value -1 means data disabled (see VAR_INPUT <i>nDataRead</i> ).
rSetpointAnalog	LREAL	Analog setpoint in %. Value -1 means data disabled (see VAR_INPUT <i>nDataRead</i> ).
rRelativeDeltaPressure	LREAL	Relative differential pressure %. Value -1 means data disabled (see VAR_INPUT <i>nDataRead</i> ).
rAbsoluteDeltaPressure	LREAL	Absolute differential pressure in Pa. Value -1 means data disabled (see VAR_INPUT <i>nDataRead</i> ).

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.22	Tc2_MPBus from 3.4.13.0

**4.1.1.34 MP\_Window**



This function block is used to control and monitor a window ventilation system (FLS).

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMPolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the FLS. The type of the error can be read with *iErrorID*.

*ManualMode* can be used to enable or disable manual operation. The type of ventilation can be specified through *WindowSettings*.

 **Inputs**

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart         : BOOL;
  WindowSettings : Data_Window;
  ManuelMode     : BOOL;
  strDataKL6771 : DataKL6771;
  Tmpolling      : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMPolling</i> .
WindowSettings	Data_Window [ <a href="#">▶ 95</a> ]	Nominal ventilation settings.
ManuelMode	BOOL	FALSE = manual operation permitted, TRUE = manual operation disabled.
strDataKL6771	DataKL6771 [ <a href="#">▶ 108</a> ]	The data structure with which the <i>KL6771()</i> [ <a href="#">▶ 25</a> ] function block must be linked.
Tmpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

 **Outputs**

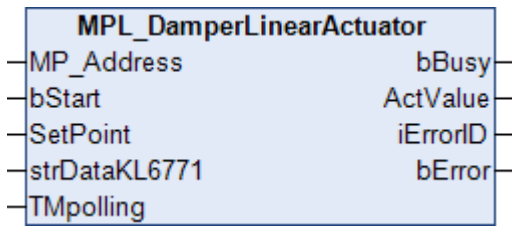
```
VAR_OUTPUT
  bBusy      : BOOL;
  bError     : BOOL;
  iErrorId   : MP_Error;
  WindowState : Data_Window;
  Window_Mech_Error : BOOL;
  Memory_Error : BOOL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorId</i> variable.
iErrorId	MP_ERROR [ <a href="#">▶ 105</a> ]	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
WindowState	Data_Window [ <a href="#">▶ 95</a> ]	Current ventilation settings.
Window_Mech_Error:	BOOL	The window or actuator is blocked
Memory_Error	BOOL	The actuator has a memory error. Reprogram or replace.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

### 4.1.1.35 MPL\_DamperLinearActuator



This function block is used to control and monitor a drive of a damper and of a globe valve.

*MP\_Address* is used to specify the MP-Bus device with which the function block is to communicate. *bStart* activates communication with the MP-Bus device. *bBusy* indicates that the function block is active. If *bStart* remains TRUE, the device is addressed cyclically with a period specified by the time in *TMpolling*. The time should be set longer than 1 second. *bError* is used to indicate an error in communication with the drive. The type of the error can be read with *iErrorID*.

*SetPoint* is used to adjust the position of the damper from 0..100%. The current position of the drive can be read through *ActValue*.

#### Inputs

```
VAR_INPUT
  MP_Address      : USINT := 1;
  bStart          : BOOL;
  SetPoint        : USINT;
  strDataKL6771  : DataKL6771;
  TMpolling       : TIME := t#10s;
END_VAR
```

Name	Type	Description
MP_Address	USINT	MP-Bus address of the slave.
bStart	BOOL	A positive edge starts the function block. If this remains continuously TRUE, the function block will be activated cyclically with a period specified by the time in <i>TMpolling</i> .
SetPoint	USINT	0...100 % set damper position of the actuator.
strDataKL6771	<a href="#">DataKL6771 [► 108]</a>	The data structure with which the <a href="#">KL6771() [► 25]</a> function block must be linked.
TMpolling	TIME	The time for which the function block should address the actuator. Default 10 s, minimum time 1 s.

#### Outputs

```
VAR_OUTPUT
  bBusy          : BOOL;
  ActValue       : WORD;
  iErrorID       : MP_ERROR;
  bError         : BOOL;
END_VAR
```

Name	Type	Description
bBusy	BOOL	This bit is set for as long as the function block is active.
ActValue	WORD	Contains the current position (0...100 %) of the actuator.
iErrorID	<a href="#">MP_ERROR [► 105]</a>	This output outputs an error code in the event of an error. <i>bError</i> goes TRUE at the same time.
bError	BOOL	This output goes TRUE as soon as an error occurs. This error is described via the <i>iErrorID</i> variable.

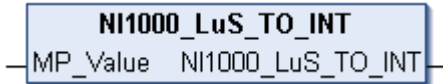
#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

## 4.1.2 Functions

Function blocks	Description
NI1000_LuS_TO_INT [▶ 88]	This function calculates a temperature from the value of an NI1000 L&S resistor.
NI1000_TO_INT [▶ 88]	This function calculates a temperature from the value of an NI1000 resistor.
NTC_TO_INT [▶ 89]	This function calculates a temperature from the value of an NTC resistor.
PT1000_TO_INT [▶ 89]	This function calculates a temperature from the value of a PT1000 resistor.

### 4.1.2.1 NI1000\_LuS\_TO\_INT: INT



This function calculates a temperature from the value of an NI1000 L&S resistor.

Connect this function to **iMP\_Sensor\_Analog**. As output, you receive an INT variable that represents the temperature with a resolution of 0.01°C (20.5°C, for example, is represented as 2050).

The lowest valid value of 872 ohms corresponds to -30°C. If the value is smaller than this, 16#7FFD is output.

The largest valid value of 1586 ohms corresponds to 115°C. If the value is greater than this, 16#7FFE is output.

#### VAR\_INPUT

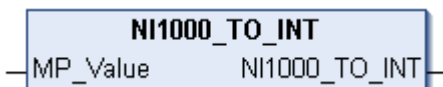
MP\_Value : WORD;

**MP\_Value:** Input for an ohmic NI1000 L&S sensor

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

### 4.1.2.2 NI1000\_TO\_INT: INT



This function calculates a temperature from the value of an NI1000 resistor.

Connect this function to **iMP\_Sensor\_Analog**. As output, you receive an INT variable that represents the temperature with a resolution of 0.01°C (20.5°C, for example, is represented as 2050).

The lowest valid value of 867 ohms corresponds to -25°C. If the value is smaller than this, 16#7FFD is output.

The largest valid value of 1583 ohms corresponds to 95°C. If the value is greater than this, 16#7FFE is output.

#### VAR\_INPUT

MP\_Value : WORD;

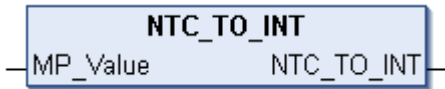
**MP\_Value:** Input for an ohmic NI1000 sensor



**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.1.2.3 NTC\_TO\_INT: INT**



This function calculates a temperature from the value of an NTC resistor.

Connect this function to **iMP\_Sensor\_Analog**. As output, you receive an INT variable that represents the temperature with a resolution of 0.01°C (20.5°C, for example, is represented as 2050).

The lowest valid value of 104 ohms corresponds to 145°C. If the value is smaller than this, 16#7FFD is output.

The largest valid value of 48555 ohms corresponds to -20°C. If the value is greater than this, 16#7FFE is output.

**VAR\_INPUT**

MP\_Value : WORD;

**MP\_Value:** Input for an ohmic NTC sensor

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.1.2.4 PT1000\_TO\_INT: INT**



This function calculates a temperature from the value of a PT1000 resistor.

Connect this function to **iMP\_Sensor\_Analog**. As output, you receive an INT variable that represents the temperature with a resolution of 0.01°C (20.5°C, for example, is represented as 2050).

The lowest valid value of 862 ohms corresponds to -35°C. If the value is smaller than this, 16#7FFD is output.

The largest valid value of 1592 ohms corresponds to 155°C. If the value is greater than this, 16#7FFE is output.

**VAR\_INPUT**

MP\_Value : WORD;

**MP\_Value:** Input for an ohmic PT1000 sensor

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

### **4.1.3 Error codes**

Value (hex)	Value (dec)	Value (enum)	Description
0x0000	0	NO_MP_ERROR	No error.
0x0001	1	WRONG_TERMINAL	Incorrect terminal connected.
0x0002	2	NO_ANSWER_FROM_KL6771	No answer from the KL6771 MP-Bus master terminal. This message usually means that there is no connection to the terminal. Terminal linked to the variables in the System Manager? Terminal plugged in incorrectly? Clean all, rebuild all and read again in the System Manager?
0x0003	3	NO_LINK_TO_STRUCTURE_strDataKL6771	Check the link to the structure <a href="#">DataKL6771</a> [▶ 108].
0x000A	10	WRONG_MP_ADDRESS_IS_0	MP-Bus address is 0. Only addresses between 1 and 8 are allowed.
0x000B	11	WRONG_MP_ADDRESS	MP-Bus address is >8. Only addresses between 1 and 8 are allowed.
0x0015	21	WRONG_SET_POINT	Incorrect set point.
0x0019	25	MP_BUS_TIMEOUT_NO_ANSWER_FROM_SLAVE	MP-Bus timeout, no answer from slave.
0x0020	26	MP_BUS_SETPOINT_DIFF_TOO_HIGH	Difference from setpoint too high.
0x001F	31	KL6771_TIME_OUT	KL6771 timeout.
0x0020	32	MP_ADDRESS_IS_IN_USE	MP-Bus address is in use.
0x0021	33	MP_DISABLED	MP-Bus disabled.
0x0057	87	MP_BUS_ERROR	MP-Bus error.
0x0058	88	MP_NO_ANSWER_ON_EVENT	MP-Bus no answer to an event.
0x0059	89	MP_NO_ANSWER	MP-Bus no answer.
0x005A	90	MP_COM_BREAK	MP-Bus abort communication.
0x0062	98	MP_LENGTH_PARITY_ERROR	MP-Bus length parity error.
0x0063	99	MP_CROSS_PARITY_ERROR	MP-Bus cross parity error.
0x0065	101	MP_MASTER_CONFLICT_ERROR	MP-Bus MASTER_CONFLICT_ERROR.
0x0066	102	MP_GAP_TIMEOUT_ERROR	MP-Bus GAP Timeout.
0x0067	103	MP_NO_ANSWER_SLAVE	MP-Bus no answer from slave.
0x006E	110	MP_ANSWER_ERROR_FLAG	MP-Bus error bit in answer telegram is set.
0x006F	111	MP_ANSWER_WRONG_LEN	MP-Bus wrong telegram length.
0x0070	112	MP_ANSWER_WRONG_TELEG	MP-Bus wrong telegram received.
0x0073	115	MP_ANSWER_WITH_ERROR	Answer contains an error.
0x00C8	200	MP_ERROR_WrongDeviceFamily	Wrong device family.
0x012C	300	MP_CONF_ERROR_CO2LimitGood	Configuration error for CO2 limitation "Good".
0x012D	301	MP_CONF_ERROR_CO2LimitModerate	Configuration error for CO2 limitation "Moderate".
0x012E	302	MP_CONF_ERROR_CO2Limit	Configuration error for CO2 limitation.
0x012F	303	MP_CONF_ERROR_WRONG_TEMP_OFFSET	Configuration error for temperature offset.
0x0130	304	MP_CONF_ERROR_WRONG_HUMIDITY_OFFSET	Configuration error for humidity offset.
0x0131	305	MP_CONF_ERROR_WRONG_CO2_OFFSET	Configuration error for CO2 offset.
0x0132	306	MP_CONF_ERROR_WRONG_TempSetpoint	Configuration error for temperature setpoint.

Value (hex)	Value (dec)	Value (enum)	Description
0x0133	307	MP_CONF_ERROR_WRONG_RelativeTempSetpoint	Configuration error for relative temperature setpoint.
0x0134	308	MP_CONF_ERROR_WRONG_DefaultTempSetpoint	Configuration error for preset temperature setpoint.
0x0135	309	MP_CONF_ERROR_WRONG_TempSetpointRange	Configuration error for temperature setpoint range.
0x800A	32778	MP_ANSWER_Reserve	Reserve.
0x800B	32779	MP_ANSWER_UnknowCommand	Unknown command.
0x800C	32780	MP_ANSWER_WrongOrNoPassword	Wrong or no password.
0x800D	32781	MP_ANSWER_CommandExecution	Command execution.
0x800E	32782	MP_ANSWER_ParameterError	Parameter error.
0x800F	32783	MP_ANSWER_UnknowId	Unknown ID.
0x8010	32784	MP_ANSWER_SizeMismatch	Wrong size.
0x8011	32785	MP_ANSWER_IllegalBlockNr	Invalid block number.
0x8012	32786	MP_ANSWER_InternalBusBusy	Internal bus is busy.
0x80FF	33023	MP_ANSWER_ReservedForFuture	Reserve.

## 4.2 DUTs

### 4.2.1 Enums

Data types	Description
Data_Window [ <a href="#">▶ 95</a> ]	Ventilation type.
E_MP_AirQualityStatus [ <a href="#">▶ 95</a> ]	Status of the measured air quality.
E_MP_DisplayBackground [ <a href="#">▶ 96</a> ]	Background color of the display.
E_MP_DisplayModeButton [ <a href="#">▶ 96</a> ]	Display mode of the buttons.
E_MP_DisplayModeHeatingCooling [ <a href="#">▶ 96</a> ]	Display mode of heating or cooling icons.
E_MP_DisplayModelconWarning [ <a href="#">▶ 96</a> ]	Display mode of the warning icon.
E_MP_DisplayModelconWindow [ <a href="#">▶ 97</a> ]	Display mode of the window icon.
E_MP_DisplayModeTemp [ <a href="#">▶ 97</a> ]	Display mode temperature.
E_MP_DisplayModeTempUnit [ <a href="#">▶ 97</a> ]	Display mode of the unit for the temperature.
E_MP_DisplayModeVentilationStage [ <a href="#">▶ 97</a> ]	Number of adjustable ventilation stages shown on the display.
E_MP_DisplayVisibility [ <a href="#">▶ 98</a> ]	Visibility on the display.
E_MP_EnabledStatus [ <a href="#">▶ 98</a> ]	Enabled status.
E_MP_EP_R_R6_UnitSel [ <a href="#">▶ 98</a> ]	Scaling.
E_MP_EV_V4_BusFailAction [ <a href="#">▶ 99</a> ]	Bus failure action.
E_MP_EV_V4_Command [ <a href="#">▶ 99</a> ]	Command for service and test functions of the actuator.
E_MP_EV_V4_ControlMode [ <a href="#">▶ 99</a> ]	Control mode.
E_MP_EV_V4_DeltaTLimitation [ <a href="#">▶ 100</a> ]	Response to a low delta T.
E_MP_EV_V4_DeltaTManagerStatus [ <a href="#">▶ 100</a> ]	Status from Delta T Manager.
E_MP_EV_V4_OverrideControl [ <a href="#">▶ 100</a> ]	Setpoint override.
E_MP_EV_V4_Sensor1Type [ <a href="#">▶ 101</a> ]	External sensor at input S1.
E_MP_SystemOperationMode [ <a href="#">▶ 101</a> ]	Operation mode of the system.
E_MP_VRU_Application [ <a href="#">▶ 101</a> ]	Visualization of the application selected by the manufacturer.
E_MP_VRU_Command [ <a href="#">▶ 102</a> ]	Commands for service and test functions of the actuator.
E_MP_VRU_OverrideControl [ <a href="#">▶ 102</a> ]	Setpoint override.
E_MP_VRU_RoomPressureCascade [ <a href="#">▶ 103</a> ]	Room pressure cascade control.
E_MP_VRU_Sensor1Type [ <a href="#">▶ 103</a> ]	External sensor at input S1.
E_MPBus_ControlMode [ <a href="#">▶ 103</a> ]	Control mode.
E_MPBus_DeltaTLimitation [ <a href="#">▶ 104</a> ]	Delta T (dT) limitation.
E_MPBus_Override [ <a href="#">▶ 104</a> ]	Override mode.
E_MPBus_Override_6wayMPIV [ <a href="#">▶ 105</a> ]	Override control mode.
MP_ERROR [ <a href="#">▶ 105</a> ]	Error messages.
UST3_EX [ <a href="#">▶ 107</a> ]	Voltage scaling.
UST3_R_SET [ <a href="#">▶ 107</a> ]	Resistance scaling.

### 4.2.1.1 Data\_Window

This ENUM can be used to specify the ventilation method.

```

TYPE Data_Window :
(
  Window_Close := 8,
  Window_Unlock := 9,
  Window_Open := 16#0A,
  Window_20 := 16#0B,
  Window_40 := 16#0C,
  Window_60 := 16#0D,
  Window_80 := 16#0E,
  Window_100 := 16#0F,
  Auto_Close := 1,
  Auto_5_15min := 2,
  Auto_8_30min := 3,
  Auto_10_50min := 4,
  Auto_open := 5,
  Auto := 0
)
END_TYPE
    
```

**Window\_Close:** Closes the window

**Window\_Unlock:** If you use "Unlock", use the switch in the window to restart the MP-Bus communication

**Window\_Open:** Opens the window

**Window\_20:** Opens the window 20%

**Window\_40:** Opens the window 40%

**Window\_60:** Opens the window 60%

**Window\_80:** Opens the window 80%

**Window\_100:** Opens the window 100%

**Auto\_Close:** Automatic closing

**Auto\_5\_15min:** Automatic ventilation every 5..15 minutes

**Auto\_8\_30min:** Automatic ventilation every 8..30 minutes

**Auto\_10\_50min:** Automatic ventilation every 10..50 minutes

**Auto\_open:** Automatic ventilation open

**Auto:** Automatic mode

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

### 4.2.1.2 E\_MP\_AirQualityStatus

Status of the measured air quality.

```

TYPE E_MP_AirQualityStatus :
(
  MPBus_AirQualityStatus_Deactivated := 0,
  MPBus_AirQualityStatus_OK := 1,
  MPBus_AirQualityStatus_Warning := 2,
  MPBus_AirQualityStatus_Alarm := 3
);
END_TYPE
    
```

**MPBus\_AirQualityStatus\_Deactivated:** Deactivated.

**MPBus\_AirQualityStatus\_OK:** OK.

**MPBus\_AirQualityStatus\_Warning:** Warning.

**MPBus\_AirQualityStatus\_Alarm:** Alarm.

#### 4.2.1.3 E\_MP\_DisplayBackground

Background color of the display.

```
TYPE E_MP_DisplayBackground :
(
  MPBus_DisplayBackground_WhiteOnBlack := 0,
  MPBus_DisplayBackground_BlackOnWhite := 1
);
END_TYPE
```

**MPBus\_DisplayBackground\_WhiteOnBlack:** White on black.

**MPBus\_DisplayBackground\_BlackOnWhite:** Black on white.

#### 4.2.1.4 E\_MP\_DisplayModeButton

Display mode of the buttons.

```
TYPE E_MP_DisplayModeButton :
(
  MPBus_DisplayModeButton_Invisible := 0,
  MPBus_DisplayModeButton_Status    := 1,
  MPBus_DisplayModeButton_Setpoint  := 2
);
END_TYPE
```

**MPBus\_DisplayModeButton\_Invisible:** Invisible.

**MPBus\_DisplayModeButton\_Status:** Status.

**MPBus\_DisplayModeButton\_Setpoint:** Setpoint.

#### 4.2.1.5 E\_MP\_DisplayModeHeatingCooling

Display mode of heating or cooling icons.

```
TYPE E_MP_DisplayModeHeatingCooling :
(
  MPBus_DisplayModeHeatingCooling_None      := 0,
  MPBus_DisplayModeHeatingCooling_Heating   := 1,
  MPBus_DisplayModeHeatingCooling_Cooling   := 2
);
END_TYPE
```

**MPBus\_DisplayModeHeatingCooling\_None:** None.

**MPBus\_DisplayModeHeatingCooling\_Heating:** Heating.

**MPBus\_DisplayModeHeatingCooling\_Cooling:** Cooling.

#### 4.2.1.6 E\_MP\_DisplayModelconWarning

Display mode of the warning icon.

```
TYPE E_MP_DisplayModeIconWarning :
(
  MPBus_DisplayModeIconWarning_Invisible      := 0,
  MPBus_DisplayModeIconWarning_Icon          := 1,
  MPBus_DisplayModeIconWarning_DeviceErrorState := 2
);
END_TYPE
```

**MPBus\_DisplayModelconWarning\_Invisible:** Invisible.

**MPBus\_DisplayModelconWarning\_Icon:** Icon.

**MPBus\_DisplayModelconWarning\_DeviceErrorState:** Error state of the device.



### 4.2.1.7 E\_MP\_DisplayModelconWindow

Display mode of the window icon.

```
TYPE E_MP_DisplayModeIconWindow :
(
  MPBus_DisplayModeIconWindow_Invisible := 0,
  MPBus_DisplayModeIconWindow_Icon     := 1,
  MPBus_DisplayModeIconWindow_Reserve   := 2
);
END_TYPE
```

**MPBus\_DisplayModelconWindow\_Invisible:** Invisible.

**MPBus\_DisplayModelconWindow\_Icon:** Icon.

**MPBus\_DisplayModelconWindow\_Reserve:** Reserve.

### 4.2.1.8 E\_MP\_DisplayModeTemp

Display mode temperature.

```
TYPE E_MP_DisplayModeTemp :
(
  MPBus_DisplayModeTemp_Invisible           := 0,
  MPBus_DisplayModeTemp_ActualRoomTemp     := 1,
  MPBus_DisplayModeTemp_RoomTempSetpoint   := 2
);
END_TYPE
```

**MPBus\_DisplayModeTemp\_Invisible:** Invisible.

**MPBus\_DisplayModeTemp\_ActualRoomTemp:** Actual room temperature.

**MPBus\_DisplayModeTemp\_RoomTempSetpoint:** Setpoint of the room temperature.

### 4.2.1.9 E\_MP\_DisplayModeTempUnit

Display mode of the unit for the temperature.

```
TYPE E_MP_DisplayModeTempUnit :
(
  MPBus_DisplayModeTempUnit_C             := 0,
  MPBus_DisplayModeTempUnit_Reserve      := 1,
  MPBus_DisplayModeTempUnit_F            := 2
);
END_TYPE
```

**MPBus\_DisplayModeTempUnit\_C:** °C.

**MPBus\_DisplayModeTempUnit\_Reserve:** Reserve.

**MPBus\_DisplayModeTempUnit\_F:** °F.

### 4.2.1.10 E\_MP\_DisplayModeVentilationStage

Number of adjustable ventilation stages shown on the display.

```
TYPE E_MP_DisplayModeVentilationStage :
(
  MPBus_DisplayModeVentilationStage_Reserve1 := 0,
  MPBus_DisplayModeVentilationStage_Reserve2 := 1,
  MPBus_DisplayModeVentilationStage_3       := 2,
  MPBus_DisplayModeVentilationStage_4       := 3,
  MPBus_DisplayModeVentilationStage_7       := 4
);
END_TYPE
```

**MPBus\_DisplayModeVentilationStage\_Reserve1:** Reserve 1.

**MPBus\_DisplayModeVentilationStage\_Reserve2:** Reserve 2.

**MPBus\_DisplayModeVentilationStage\_3:** 3 ventilation stages.

**MPBus\_DisplayModeVentilationStage\_4:** 4 ventilation stages.

**MPBus\_DisplayModeVentilationStage\_7:** 7 ventilation stages.

#### 4.2.1.11 E\_MP\_DisplayVisibility

Visibility on the display.

```
TYPE E_MP_DisplayVisibility :
(
  MPBus_DisplayVisibility_Invisible := 0,
  MPBus_DisplayVisibility_Visible  := 1
);
END_TYPE
```

**MPBus\_DisplayVisibility\_Invisible:** Invisible.

**MPBus\_DisplayVisibility\_Visible:** Visible.

#### 4.2.1.12 E\_MP\_EnabledStatus

Enabled status.

```
TYPE E_MP_EnabledStatus :
(
  MPBus_EnabledStatus_Disabled := 0,
  MPBus_EnabledStatus_Enabled  := 1
);
END_TYPE
```

**MPBus\_EnabledStatus\_Disabled:** Disabled.

**MPBus\_EnabledStatus\_Enabled:** Enabled.

#### 4.2.1.13 E\_MP\_EP\_R\_R6\_UnitSel

Scaling.

```
TYPE E_MP_ER_R_R6_UnitSel :
(
  E_MP_m3_s := 0,
  E_MP_m3_h := 1,
  E_MP_l_s  := 2,
  E_MP_l_min := 3,
  E_MP_l_h  := 4,
  E_MP_gpm  := 5,
  E_MP_cfm  := 6
);
END_TYPE
```

**E\_MP\_m3\_s:** Sets scaling to m3/s.

**E\_MP\_m3\_h:** Sets scaling to m3/h.

**E\_MP\_l\_s:** Sets scaling to l/s.

**E\_MP\_l\_min:** Sets scaling to l/min.

**E\_MP\_l\_h:** Sets scaling to l/h.

**E\_MP\_gpm:** Sets scaling to gpm.

**E\_MP\_cfm:** Sets scaling to cfm.

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4022.14	Tc2_MPBus from 3.4.8.0

### 4.2.1.14 E\_MP\_EV\_V4\_BusFailAction

Bus failure action.

```
TYPE E_MP_EV_V4_BusFailAction :
(
  MPBus_EV_BusFailAction_None      := 0,
  MPBus_EV_BusFailAction_OpenValve := 1,
  MPBus_EV_BusFailAction_CloseValve := 2,
  MPBus_EV_BusFailAction_MaxFlow   := 3,
  MPBus_EV_BusFailAction_MinFlow   := 4,
  MPBus_EV_BusFailAction_Stop      := 6
);
END_TYPE
```

**MPBus\_EV\_BusFailAction\_None:** None.

**MPBus\_EV\_BusFailAction\_OpenValve:** Open valve.

**MPBus\_EV\_BusFailAction\_CloseValve:** Close valve.

**MPBus\_EV\_BusFailAction\_MaxFlow:** Maximum flow.

**MPBus\_EV\_BusFailAction\_MinFlow:** Minimum flow.

**MPBus\_EV\_BusFailAction\_Stop:** Stop.

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.46	Tc2_MPBus from 3.6.1.0

### 4.2.1.15 E\_MP\_EV\_V4\_Command

Command for service and test functions of the actuator.

```
TYPE E_MP_EV_V4_Command :
(
  MPBus_EV_Command_None := 0,
  MPBus_EV_Command_Sync := 2
);
END_TYPE
```

**MPBus\_EV\_Command\_None:** none.

**MPBus\_EV\_Command\_Sync:** sync.

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

### 4.2.1.16 E\_MP\_EV\_V4\_ControlMode

Control mode.

```
TYPE E_MP_EV_V4_ControlMode :
(
  MPBus_EV_PositionControl := 0,
  MPBus_EV_FlowControl     := 1,
  MPBus_EV_PowerControl    := 2
);
END_TYPE
```

**MPBus\_EV\_PositionControl:** position control.

**MPBus\_EV\_FlowControl:** flow control.

**MPBus\_EV\_PowerControl:** power control.

## Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

## 4.2.1.17 E\_MP\_EV\_V4\_DeltaTLimitation

Response to a low delta T.

```
TYPE E_MP_EV_V4_DeltaTLimitation :
(
  MPBus_EV_Disabled           := 0,
  MPBus_EV_DeltaT_Manager     := 1,
  MPBus_EV_DeltaT_Manager_Scaled := 2
);
END_TYPE
```

**MPBus\_EV\_Disabled:** disabled.

**MPBus\_EV\_DeltaT\_Manager:** Delta T Manager.

**MPBus\_EV\_DeltaT\_Manager\_Scaled:** Delta T Manager scaled.

## Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

## 4.2.1.18 E\_MP\_EV\_V4\_DeltaTManagerStatus

Status from Delta T Manager.

```
TYPE E_MP_EV_V4_DeltaTManagerStatus :
(
  MPBus_EV_NotSelect := 0,
  MPBus_EV_Standby   := 1,
  MPBus_EV_Active    := 2
);
END_TYPE
```

**MPBus\_EV\_NotSelect:** not selected.

**MPBus\_EV\_Standby:** standby.

**MPBus\_EV\_Active:** active.

## Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

## 4.2.1.19 E\_MP\_EV\_V4\_OverrideControl

Setpoint override.

```
TYPE E_MP_EV_V4_OverrideControl :
(
  MPBus_EV_Override_None       := 0,
  MPBus_EV_Override_Open       := 1,
  MPBus_EV_Override_Close      := 2,
  MPBus_EV_Override_MinFlow    := 3,
  MPBus_EV_Override_MaxFlow    := 5,
  MPBus_EV_Override_NomFlow    := 6,
  MPBus_EV_Override_Motor_Stop := 10
);
END_TYPE
```

**MPBus\_EV\_Override\_None:** none.

**MPBus\_EV\_Override\_Open:** open.

**MPBus\_EV\_Override\_Close:** close.

**MPBus\_EV\_Override\_MinFlow:** minimum flow.

**MPBus\_EV\_Override\_MaxFlow:** maximum flow.

**MPBus\_EV\_Override\_NomFlow:** nominal flow.

**MPBus\_EV\_Override\_Motor\_Stop:** motor stop.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

**4.2.1.20 E\_MP\_EV\_V4\_Sensor1Type**

External sensor at input S1.

```
TYPE E_MP_EV_V4_Sensor1Type :
(
  MPBus_EV_Sensor_None      := 0,
  MPBus_EV_Sensor_Active   := 1,
  MPBus_EV_Sensor_Passive  := 3,
  MPBus_EV_Sensor_Switch   := 4
);
END_TYPE
```

**MPBus\_EV\_Sensor\_None:** none.

**MPBus\_EV\_Sensor\_Active:** active.

**MPBus\_EV\_Sensor\_Passive:** passive.

**MPBus\_EV\_Sensor\_Switch:** switch.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.28	Tc2_MPBus from 3.4.15.0

**4.2.1.21 E\_MP\_SystemOperationMode**

Operation mode of the system.

```
TYPE E_MP_SystemOperationMode :
(
  MPBus_SystemOperationMode_OffProtection := 0,
  MPBus_SystemOperationMode_OnComfort    := 1,
  MPBus_SystemOperationMode_Eco          := 2,
  MPBus_SystemOperationMode_Boost        := 3
);
END_TYPE
```

**MPBus\_SystemOperationMode\_OffProtection:** Off/protection.

**MPBus\_SystemOperationMode\_OnComfort:** On/comfort.

**MPBus\_SystemOperationMode\_Eco:** Eco mode.

**MPBus\_SystemOperationMode\_Boost:** Boost mode.

**4.2.1.22 E\_MP\_VRU\_Application**

Visualization of the application selected by the manufacturer.

```

TYPE E_MP_VRU_Application :
(
  MPBus_VRU_Application_FlowControl      := 0,
  MPBus_VRU_Application_PressureControl  := 1,
  MPBus_VRU_Application_RoomPressureControl := 2,
  MPBus_VRU_Application_FlowMeasurement := 3
);
END_TYPE

```

**MPBus\_VRU\_Application\_FlowControl:** Flow control.

**MPBus\_VRU\_Application\_PressureControl:** Pressure control.

**MPBus\_VRU\_Application\_RoomPressureControl:** Room pressure control.

**MPBus\_VRU\_Application\_FlowMeasurement:** Flow measurement.

### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.22	Tc2_MPBus from 3.4.13.0

#### 4.2.1.23 E\_MP\_VRU\_Command

Commands for service and test functions of the drive.

```

TYPE E_MP_VRU_Command :
(
  MPBus_VRU_Command_None      := 0,
  MPBus_VRU_Command_Adaption  := 1,
  MPBus_VRU_Command_Test      := 2,
  MPBus_VRU_Command_Sync      := 3
);
END_TYPE

```

**MPBus\_VRU\_Command\_None:** None.

**MPBus\_VRU\_Command\_Adaption:** Adaptation.

**MPBus\_VRU\_Command\_Test:** Test.

**MPBus\_VRU\_Command\_Sync:** Sync.

### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.22	Tc2_MPBus from 3.4.13.0

#### 4.2.1.24 E\_MP\_VRU\_OverrideControl

Setpoint override.

```

TYPE E_MP_VRU_OverrideControl :
(
  MPBus_VRU_Override_None      := 0,
  MPBus_VRU_Override_Open      := 1,
  MPBus_VRU_Override_Close     := 2,
  MPBus_VRU_Override_Max       := 3,
  MPBus_VRU_Override_Min       := 4,
  MPBus_VRU_Override_Reserve   := 5,
  MPBus_VRU_Override_Motor_Stop := 6,
  MPBus_VRU_Override_Vnom_Pnom := 7
);
END_TYPE

```

**MPBus\_VRU\_Override\_None:** None.

**MPBus\_VRU\_Override\_Open:** Open.

**MPBus\_VRU\_Override\_Close:** Close.

**MPBus\_VRU\_Override\_Max:** Maximum.

**MPBus\_VRU\_Override\_Min:** Minimum.

**MPBus\_VRU\_Override\_Reserve:** Reserve.

**MPBus\_VRU\_Override\_Motor\_Stop:** Motor stop.

**MPBus\_VRU\_Override\_Vnom\_Pnom:** Vnom / Pnom.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.22	Tc2_MPBus from 3.4.13.0

**4.2.1.25 E\_MP\_VRU\_RoomPressureCascade**

Room pressure cascade control.

```

TYPE E_MP_VRU_RoomPressureCascade :
(
  MPBus_VRU_RoomPressureCascade_Disabled := 0,
  MPBus_VRU_RoomPressureCascade_Enabled := 1,
  MPBus_VRU_RoomPressureCascade_EnabledFast := 2
);
END_TYPE
    
```

**MPBus\_VRU\_RoomPressureCascade\_Disabled:** Room pressure cascade control disabled.

**MPBus\_VRU\_RoomPressureCascade\_Enabled:** Room pressure cascade control enabled.

**MPBus\_VRU\_RoomPressureCascade\_EnabledFast:** Room pressure cascade control enabled (fast).

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.22	Tc2_MPBus from 3.4.13.0

**4.2.1.26 E\_MP\_VRU\_Sensor1Type**

External sensor at input S1.

```

TYPE E_MP_VRU_Sensor1Type :
(
  MPBus_VRU_Sensor_None := 0,
  MPBus_VRU_Sensor_Active := 1,
  MPBus_VRU_Sensor_Passive := 2,
  MPBus_VRU_Sensor_Switch := 4
);
END_TYPE
    
```

**MPBus\_VRU\_Sensor\_None:** None.

**MPBus\_VRU\_Sensor\_Active:** Active.

**MPBus\_VRU\_Sensor\_Passive:** Passive.

**MPBus\_VRU\_Sensor\_Switch:** Switch.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.22	Tc2_MPBus from 3.4.13.0

**4.2.1.27 E\_MPBus\_ControlMode**

Control mode.

```

TYPE E_MPBus_ControlMode :
(
  MPBus_ControlMode_PosCtrl   := 0,
  MPBus_ControlMode_FlowCtrl  := 1,
  MPBus_ControlMode_PowerCtrl := 2,
  MPBus_ControlMode_Disable   := 16#FF
);
END_TYPE

```

**MPBus\_ControlMode\_PosCtrl:** Control based on position.

**MPBus\_ControlMode\_FlowCtrl:** Control based on flow rate.

**MPBus\_ControlMode\_PowerCtrl:** Control based on amount of energy.

**MPBus\_ControlMode\_Disable:** Disabled.

### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

#### 4.2.1.28 E\_MPBus\_DeltaTLimitation

Delta T (dT) limitation. Details can be found in the Belimo Energy Valve documentation.

```

TYPE E_MPBus_DeltaTLimitation :
(
  MPBus_DeltaTLimitation_Disable      := 0,
  MPBus_DeltaTLimitation_dT_Manager   := 1,
  MPBus_DeltaTLimitation_dT_ManagerScal := 2
);
END_TYPE

```

**MPBus\_DeltaTLimitation\_Disable:** dT disabled.

**MPBus\_DeltaTLimitation\_dT\_Manager:** Simple dT limitation.

**MPBus\_DeltaTLimitation\_dT\_ManagerScal:** Extended dT limitation.

### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.32	Tc2_MPBus from 3.4.6.0

#### 4.2.1.29 E\_MPBus\_Override

Override mode.

```

TYPE E_MPBus_Override :
(
  MPBus_Override_None   := 0,
  MPBus_Override_Auto   := 1,
  MPBus_Override_Close  := 2,
  MPBus_Override_Open   := 3,
  MPBus_Override_Vnom   := 4,
  MPBus_Override_Vmax   := 5,
  MPBus_Override_Stop   := 6,
  MPBus_Override_Pnom   := 7,
  MPBus_Override_Pmax   := 8
);
END_TYPE

```

### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0



### 4.2.1.30 E\_MPBus\_Override\_6wayMPIV

Override control mode.

```

TYPE E_MPBus_Override_6wayMPIV :
(
  MPBus_6wayMPIV_None      := 0,
  MPBus_6wayMPIV_Seq1Open := 1,
  MPBus_6wayMPIV_Seq2Open := 2,
  MPBus_6wayMPIV_Close    := 3,
  MPBus_6wayMPIV_Seq1Vmax := 4,
  MPBus_6wayMPIV_Seq2Vmax := 5
);
END_TYPE

```

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4022.14	Tc2_MPBus from 3.4.8.0

### 4.2.1.31 MP\_ERROR

Library error messages.

```

TYPE MP_ERROR :
(
  NO_MP_ERROR                := 0,
  WRONG_TERMINAL             := 1,
  NO_ANSWER_FROM_KL6771     := 2,
  NO_LINK_TO_STRUCTURE_strDataKL6771 := 3,
  WRONG_MP_ADDRESS_IS_0     := 10,
  WRONG_MP_ADDRESS          := 11,
  WRONG_SET_POINT           := 21,
  MP_BUS_TIMEOUT_NO_ANSWER_FROM_SLAVE := 25,
  MP_BUS_SETPOINT_DIFF_TOO_HIGH := 26,
  KL6771_TIME_OUT          := 31,
  MP_ADDRESS_IS_IN_USE      := 32,
  MP_DISABLED               := 33,
  MP_BUS_ERROR              := 87,
  MP_NO_ANSWER_ON_EVENT     := 88,
  MP_NO_ANSWER              := 89,
  MP_COM_BREAK              := 90,
  MP_LENGTH_PARITY_ERROR    := 98,
  MP_CROSS_PARITY_ERROR     := 99,
  MP_MASTER_CONFLICT_ERROR  := 101,
  MP_GAP_TIMEOUT_ERROR      := 102,
  MP_NO_ANSWER_SLAVE        := 103,
  MP_ANSWER_ERROR_FLAG      := 110,
  MP_ANSWER_WRONG_LEN       := 111,
  MP_ANSWER_WRONG_TELEG     := 112,
  MP_ANSWER_WITH_ERROR      := 115,
  MP_ERROR_WrongDeviceFamily := 200,
  MP_CONF_ERROR_CO2LimitGood := 300,
  MP_CONF_ERROR_CO2LimitModerate := 301,
  MP_CONF_ERROR_CO2Limit    := 302,
  MP_CONF_ERROR_WRONG_TEMP_OFFSET := 303,
  MP_CONF_ERROR_WRONG_HUMIDITY_OFFSET := 304,
  MP_CONF_ERROR_WRONG_CO2_OFFSET := 305,
  MP_CONF_ERROR_WRONG_TempSetpoint := 306,
  MP_CONF_ERROR_WRONG_RelativeTempSetpoint := 307,
  MP_CONF_ERROR_WRONG_DefaultTempSetpoint := 308,
  MP_CONF_ERROR_WRONG_TempSetpointRange := 309,
  MP_ANSWER_Reserve         := 16#800A,
  MP_ANSWER_UnknowCommand  := 16#800B,
  MP_ANSWER_WrongOrNoPassword := 16#800C,
  MP_ANSWER_CommandExecution := 16#800D,
  MP_ANSWER_ParameterError  := 16#800E,
  MP_ANSWER_UnknowId        := 16#800F,
  MP_ANSWER_SizeMismatch    := 16#8010,
  MP_ANSWER_IllegalBlockNr  := 16#8011,
  MP_ANSWER_InternalBusBusy := 16#8012,
  MP_ANSWER_ReservedForFuture := 16#80FF
)
END_TYPE

```

**NO\_MP\_ERROR:** No error.

**WRONG\_TERMINAL:** Wrong terminal connected.

**NO\_ANSWER\_FROM\_KL6771:** No answer from KL6771. This message usually means that there is no connection to the terminal. Are the I/O variables of the terminal linked? Terminal plugged in incorrectly? Everything revised, compiled and read again?

**NO\_LINK\_TO\_STRUCTURE\_strDataKL6771:** Check link to structure DataKL6771.

**WRONG\_MP\_ADDRESS\_IS\_0:** MP-Bus address is 0. Only addresses between 1 and 8 are allowed.

**WRONG\_MP\_ADDRESS:** MP-Bus address is >8. Only addresses between 1 and 8 are allowed.

**WRONG\_SET\_POINT:** Wrong setpoint.

**MP\_BUS\_TIMEOUT\_NO\_ANSWER\_FROM\_SLAVE:** MP-Bus timeout, no answer from slave.

**MP\_BUS\_SETPOINT\_DIFF\_TOO\_HIGH:** Difference from setpoint too high.

**KL6771\_TIME\_OUT:** KL6771 timeout.

**MP\_ADDRESS\_IS\_IN\_USE:** MP-Bus address is in use.

**MP\_DISABLED:** MP-Bus disabled.

**MP\_BUS\_ERROR:** MP-Bus error.

**MP\_NO\_ANSWER\_ON\_EVENT:** MP-Bus no answer on event.

**MP\_NO\_ANSWER:** MP-Bus no answer.

**MP\_COM\_BREAK:** MP-Bus communication break.

**MP\_LENGTH\_PARITY\_ERROR:** MP-Bus length parity error.

**MP\_CROSS\_PARITY\_ERROR:** MP-Bus cross parity error.

**MP\_MASTER\_CONFLICT\_ERROR:** MP-Bus MASTER\_CONFLICT\_ERROR.

**MP\_GAP\_TIMEOUT\_ERROR:** MP-Bus GAP timeout.

**MP\_NO\_ANSWER\_SLAVE:** MP-Bus no answer from slave.

**MP\_ANSWER\_ERROR\_FLAG:** MP-Bus error bit in the answer telegram is set.

**MP\_ANSWER\_WRONG\_LEN:** MP-Bus wrong telegram length.

**MP\_ANSWER\_WRONG\_TELEG:** MP-Bus wrong telegram received.

**MP\_ANSWER\_WITH\_ERROR:** MP-Bus answer contains an error.

**MP\_ERROR\_WrongDeviceFamily:** Wrong device family.

**MP\_CONF\_ERROR\_CO2LimitGood:** Configuration error for CO2 limit "Good".

**MP\_CONF\_ERROR\_CO2LimitModerate:** Configuration error for CO2 limit "Moderate".

**MP\_CONF\_ERROR\_CO2Limit:** Configuration error for CO2 limit.

**MP\_CONF\_ERROR\_WRONG\_TEMP\_OFFSET:** Configuration error for temperature offset.

**MP\_CONF\_ERROR\_WRONG\_HUMIDITY\_OFFSET:** Configuration error for humidity offset.

**MP\_CONF\_ERROR\_WRONG\_CO2\_OFFSET:** Configuration error for CO2 offset.

**MP\_CONF\_ERROR\_WRONG\_TempSetpoint:** Configuration error for temperature setpoint.

**MP\_CONF\_ERROR\_WRONG\_RelativeTempSetpoint:** Configuration error for relative temperature setpoint.

**MP\_CONF\_ERROR\_WRONG\_DefaultTempSetpoint:** Configuration error for default temperature setpoint.

**MP\_CONF\_ERROR\_WRONG\_TempSetpointRange:** Configuration error for temperature setpoint range.

- MP\_ANSWER\_Reserve:** Reserve.
- MP\_ANSWER\_UnknowCommand:** Unknown command.
- MP\_ANSWER\_WrongOrNoPassword:** Wrong or no password.
- MP\_ANSWER\_CommandExecution:** Execution of the command.
- MP\_ANSWER\_ParameterError:** Parameter error.
- MP\_ANSWER\_UnknowId:** Unknown Id.
- MP\_ANSWER\_SizeMismatch:** Size does not match.
- MP\_ANSWER\_IllegalBlockNr:** Invalid block number.
- MP\_ANSWER\_InternalBusBusy:** Internal bus is busy.
- MP\_ANSWER\_ReservedForFuture:** Reserve.

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.2.1.32 UST3\_EX**

Voltage scaling

```

TYPE UST3_EX :
(
  Ex_1mV    := 0,
  Ex_250uV := 1
)
END_TYPE
    
```

**Ex\_1mV:** Scaling 0..11 V

**Ex\_250uV:** Scaling 0..3 V

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

**4.2.1.33 UST3\_R\_SET**

Resistance scaling

```

TYPE UST3_R_SET :
(
  R_1Ohm    := 0,
  R_250mOhm := 1,
  R_4Ohm    := 2
)
END_TYPE
    
```

**R\_1Ohm:** Scaling 0..20 kOhm

**R\_250mOhm:** Scaling 0..5 kOhm

**R\_4Ohm:** Scaling 0..262 kOhm

**Requirements**

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

## 4.2.2 Structures

Data types	Description
<a href="#">DataKL6771</a> [ <a href="#">▶ 108</a> ]	Links the send and receive blocks with the function block KL6771.
<a href="#">MP_BUS_MPX_ERROR</a> [ <a href="#">▶ 108</a> ]	Error messages of the "MPX" sensors.
<a href="#">MP Serial Number</a> [ <a href="#">▶ 109</a> ]	Serial number of the device.
<a href="#">St MP EV V4 MalfunctionServiceInfo</a> [ <a href="#">▶ 109</a> ]	Fault and service information.
<a href="#">St MP VRU ServiceInfo</a> [ <a href="#">▶ 110</a> ]	Fault and service information.
<a href="#">St StateEV</a> [ <a href="#">▶ 111</a> ]	Information on the state of the EV.
<a href="#">UST3_SET</a> [ <a href="#">▶ 111</a> ]	Data structure for setting the scaling and the resistance measurement.

### 4.2.2.1 DataKL6771

Links the send and receive blocks with the function block *KL6771*

```

TYPE DataKL6771 :
STRUCT
  OrderNumber : BYTE;
  ReceiveData : BOOL;
  SendData    : BOOL;
  Error       : BOOL;
  ErrorID     : MP_Error;
  pNumber     : DWORD;
END_STRUCT
END_TYPE

```

**OrderNumber:** Internal byte

**ReceiveData:** Data is being received.

**SendData:** Data is being sent.

**Error:** This output goes TRUE as soon as an error occurs. This error is described via the *ErrorID* variable.

**ErrorID:** This output outputs an error code in the event of an error (see [MP\\_Error](#) [[▶ 105](#)]). *Error* goes TRUE at the same time.

**pNumber:** Internal pointer

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

### 4.2.2.2 MP\_BUS\_MPX\_ERROR

Error messages of the "MPX" sensors (function block [MP\\_MPX](#) [[▶ 54](#)]).

```

TYPE MP_BUS_MPX_ERROR :
STRUCT
  MP_BUS_MPX_TempSensorErr : BOOL;
  MP_BUS_MPX_HumiditySensorErr : BOOL;
  MP_BUS_MPX_CO2SensorErr : BOOL;
  MP_BUS_MPX_VocSensorErr : BOOL;
END_STRUCT
END_TYPE

```

**MP\_BUS\_MPX\_TempSensorErr:** The temperature sensor is faulty

**MP\_BUS\_MPX\_HumiditySensorErr:** The humidity sensor is faulty

**MP\_BUS\_MPX\_CO2SensorErr:** The CO2 sensor is faulty

**MP\_BUS\_MPX\_VocSensorErr:** The VOC sensor is faulty

Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

4.2.2.3 MP\_Serial\_Number

Serial number of the device

```

TYPE MP_Serial_Number :
STRUCT
  YearAndWeek : WORD;
  DayAndNumber : WORD;
  DeviceFamily : BYTE;
  TestStation : BYTE;
  FamilySuffix : BYTE;
END_STRUCT
END_TYPE
    
```

**YearAndWeek:** Year and week

**DayAndNumber:** Day and number

**DeviceFamily:** Device family

**TestStation:** Test station

**FamilySuffix:** Device family suffix

Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

4.2.2.4 St\_MP\_EV\_V4\_MalfunctionServiceInfo

Malfunction and service information.

```

TYPE St_MP_EV_V4_MalfunctionServiceInfo :
STRUCT
  bNoCommunicationToActuator : BOOL;
  bGearDisengaged : BOOL;
  bActuatorCannotMove : BOOL;
  bReverseFlow : BOOL;
  bFlowSetpointNotReached : BOOL;
  bFlowWithClosedValve : BOOL;
  bActualFlowVnom : BOOL;
  bFlowMeasurementError : BOOL;
  bRemoteTempError : BOOL;
  bIntegratedTempError : BOOL;
  bCommToSensorInterrupted : BOOL;
  bFreezeWarning : BOOL;
  bGlycolDetected : BOOL;
  bPowerSetpointNotReached : BOOL;
  bBusWatchdogTriggered : BOOL;
END_STRUCT
END_TYPE
    
```

**bNoCommunicationToActuator:** No communication to the actuator.

**bGearDisengaged:** Gear disengaged.

**bActuatorCannotMove:** Actuator cannot move.

**bReverseFlow:** Reverse flow.

**bFlowSetpointNotReached:** Setpoint for flow not reached.

**bFlowWithClosedValve:** Flow with closed valve.

**bActualFlowVnom:** Actual flow > nominal flow.

**bFlowMeasurementError:** Error during flow measurement.

**bRemoteTempError:** Remote temperature error.

**bIntegratedTempError:** Integrated temperature error.

**bCommToSensorInterrupted:** Communication to the sensor is interrupted.

**bFreezeWarning:** Freeze warning.

**bGlycolDetected:** Glycol detected.

**bPowerSetpointNotReached:** Power setpoint not reached.

**bBusWatchdogTriggered:** Watchdog from the bus has triggered.

### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.26	Tc2_MPBus from 3.4.14.0

#### 4.2.2.5 St\_MP\_VRU\_ServiceInfo

Fault and service information.

```

TYPE St_MP_VRU_ServiceInfo :
STRUCT
  bError_dP_Sensor          : BOOL;
  bReverseAirflowDetected  : BOOL;
  bAirflowNotReached       : BOOL;
  bFlowInClosedPosition    : BOOL;
  bInternalActivity        : BOOL;
  bGearDisengaged         : BOOL;
  bBusWatchdogTriggered    : BOOL;
  bActuatorDoseNotFitToApplication : BOOL;
  bPressSensorWrongConnected : BOOL;
  bPressureSensorNotReached : BOOL;
  bError_dP_SensorOutOfRange : BOOL;
END_STRUCT
END_TYPE

```

**bError\_dP\_Sensor:** Error dp sensor.

**bReverseAirflowDetected:** Reverse airflow detected.

**bAirflowNotReached:** Airflow not reached.

**bFlowInClosedPosition:** Flow in closed position.

**bInternalActivity:** Internal activity.

**bGearDisengaged:** Gear unit disengaged.

**bBusWatchdogTriggered:** Bus watchdog triggered.

**bActuatorDoseNotFitToApplication:** Actuator does not fit the application.

**bPressSensorWrongConnected:** Pressure sensor connected incorrectly.

**bPressureSensorNotReached:** Pressure sensor not reached.

**bError\_dP\_SensorOutOfRange:** dP sensor out of range.

### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4024.22	Tc2_MPBus from 3.4.13.0

### 4.2.2.6 St\_StateEV

Information on the state of the EV.

```

TYPE St_StateEV :
STRUCT
  bFlow_with_closed_valve : BOOL;
  bAir_bubbles             : BOOL;
  bFlow_not_reached       : BOOL;
  bPower_not_realized     : BOOL;
  bGear_disengaged        : BOOL;
END_STRUCT
END_TYPE
    
```

**bFlow\_with\_closed\_valve:** Flow rate with closed valve. Check valve.

**bAir\_bubbles:** Too many air bubbles (system venting inadequate). Flow measurement no longer exact. EV switches from volume flow control to position control.

**bFlow\_not\_reached:** Flow rate not reached, despite the fact that the ball valve is fully open. Check hydraulics, switch on pump or increase pump pressure.

**bPower\_not\_realized:** Power not reached. In addition to position control and volume flow control, the EV can be used to supply power. Primary side provides too little flow or dT.

**bGear\_disengaged:** Gear disengagement active. Manual adjustment possible on site. For other MP drives this information can be read with MP\_Get\_State.

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.32	Tc2_MPBus from 3.4.6.0

### 4.2.2.7 UST3\_SET

Data structure for setting the scaling and the resistance measurement

```

TYPE UST3_SET :
STRUCT
  E1      : UST3_Ex;
  E2      : UST3_Ex;
  E3      : UST3_Ex;
  R_SET   : UST3_R_set;
  R_ON_OFF : BOOL;
END_STRUCT
END_TYPE
    
```

**E1:** parameter U1 (see [UST3\\_Ex \[▶ 107\]](#))

**E2:** parameter U2 (see [UST3\\_Ex \[▶ 107\]](#))

**E3:** parameter U3 (see [UST3\\_Ex \[▶ 107\]](#))

**R\_SET:** parameter Y (see [UST3\\_R\\_set \[▶ 107\]](#))

**R\_ON\_OFF:** Measurement R or U

#### Requirements

Development environment	required TC3 PLC library
TwinCAT from v3.1.4020.14	Tc2_MPBus from 3.3.5.0

## 4.3 Integration into TwinCAT

### 4.3.1 KL6771 with CX5120

This sample describes how a simple PLC program for MP-Bus can be written in TwinCAT and how it is linked with the hardware. The task is to control an individual damper drive and change it with a button.

Sample: [https://infosys.beckhoff.com/content/1033/tcplclib\\_tc2\\_mpbus/Resources/6222419595/.zip](https://infosys.beckhoff.com/content/1033/tcplclib_tc2_mpbus/Resources/6222419595/.zip)

#### Hardware

##### Setting up the components

The following hardware is required:

- 1x CX5120 Embedded PC
- 1x digital 4-channel input terminal KL1104 (for the Open and Close functions)
- 1x KL6771 MP-Bus master terminal
- 1x KL9010 end terminal

Set up the hardware and the MP-Bus components as described in the associated documentation.

This sample assumes that the address of the damper drive is known.

#### Software

##### Creation of the PLC program

Create a new "TwinCAT XAE project" and a "Standard PLC project".

Add the library Tc2\_MPBUS under "References" in the PLC project.

Generate a Global Variable List with the name GVL\_MPBUS and create the following variables:

```
VAR_GLOBAL
  bOpen          AT %I* : BOOL;
  bClose         AT %I* : BOOL;
  arrKL6771_IN   AT %I* : ARRAY [0..11] OF BYTE;
  arrKL6771_OUT  AT %Q* : ARRAY [0..11] OF BYTE;
  stDataKL6771   : DataKL6771;
END_VAR
```

**bOpen:** Input variable for the Open button.

**bClose:** Input variable for the Close button.

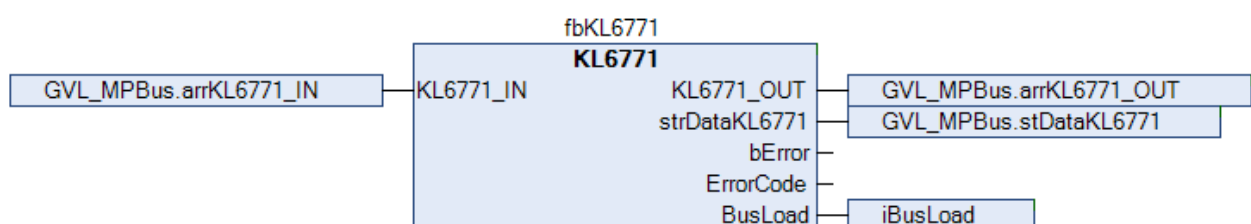
**arrKL6771\_IN:** Input variable for the MP-Bus terminal.

**arrKL6771\_OUT:** Output variable for the MP-Bus terminal.

**stDataKL6771:** Required for communication with MP-Bus (see [DataKL6771 \[► 108\]](#)).

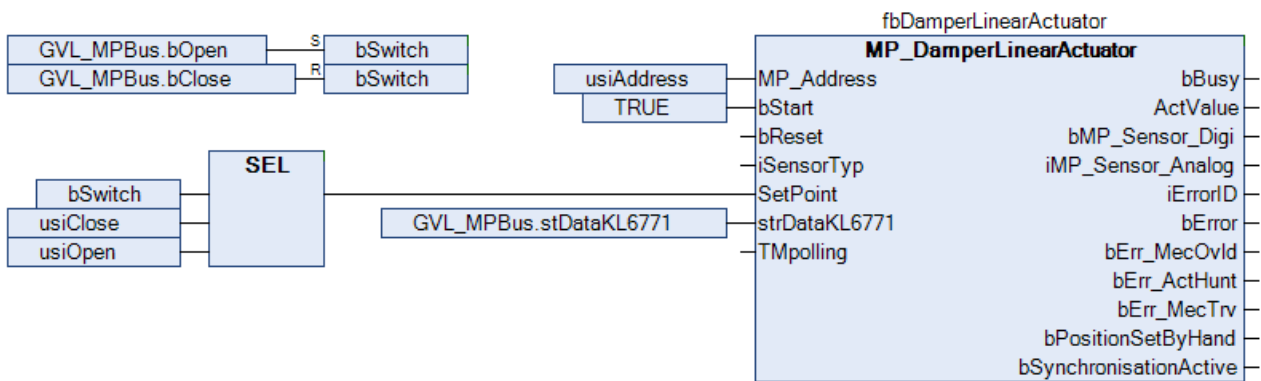
All MP-Bus function blocks must be called in the same task.

Therefore, create a MAIN program (CFC) in which the [KL6771 \[► 25\]](#) and [MP\\_DamperLinearActuator \[► 30\]](#) function blocks are called. Make sure to link `arrKL6771_IN`, `arrKL6771_OUT` and `stDataKL6771` in the communication block.



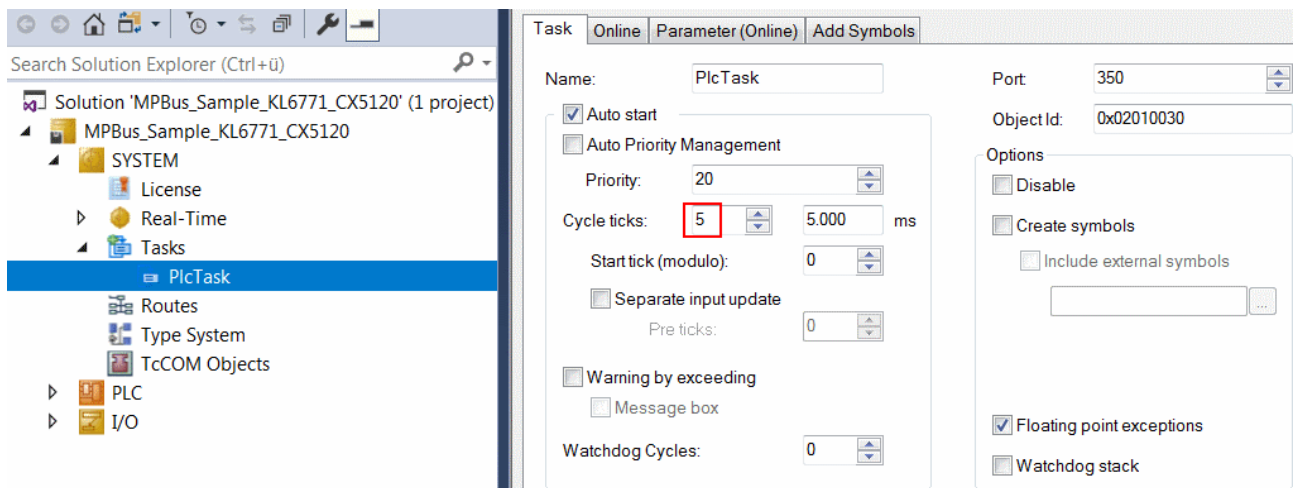


The input *SetPoint* is set depending on the selected function. Link the global variables *bOpen* and *bClose* with an auxiliary variable.



Go to the task configuration and give the task a lower interval time.

Further conditions can be found in the description of the function block [KL6771](#) [▶ 25].



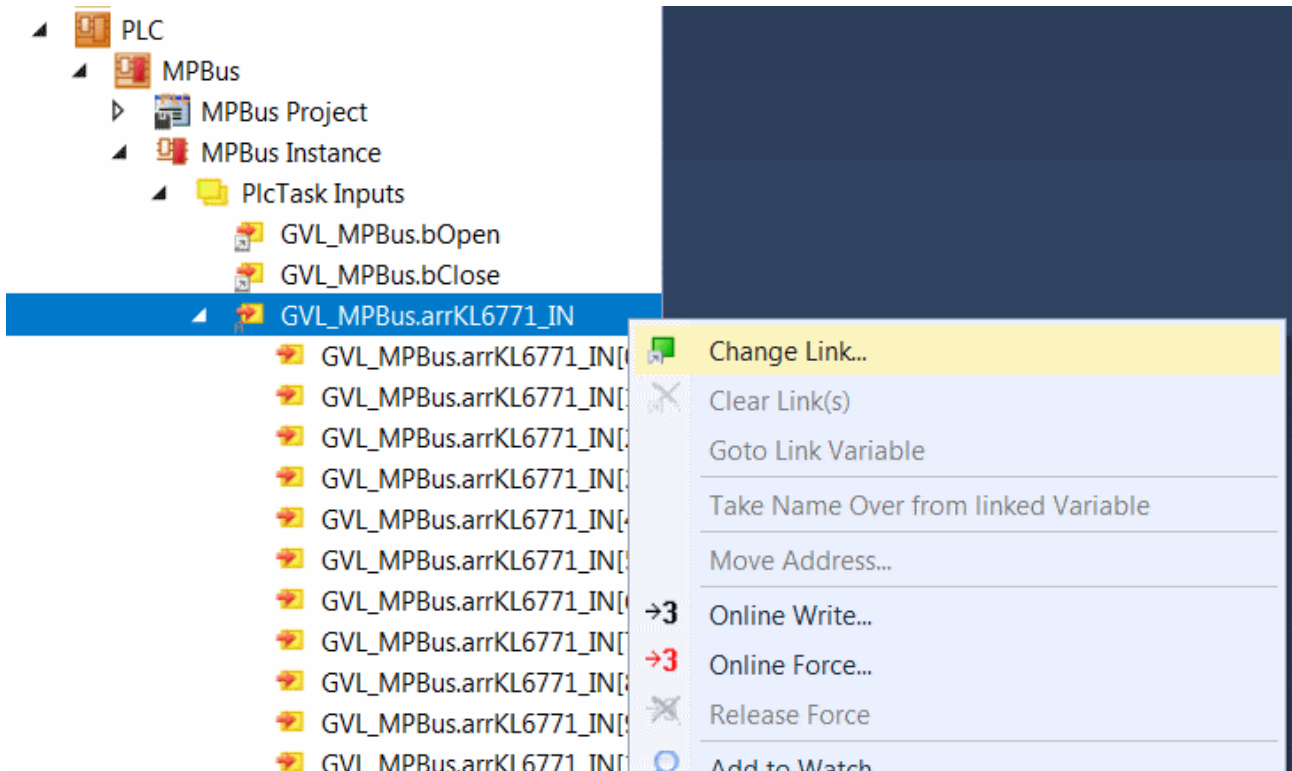
**I/O configuration**

Select the CX as target system and initiate a search for its hardware. In the project instance within the PLC section, you can see that the input and output variables are assigned to the task.

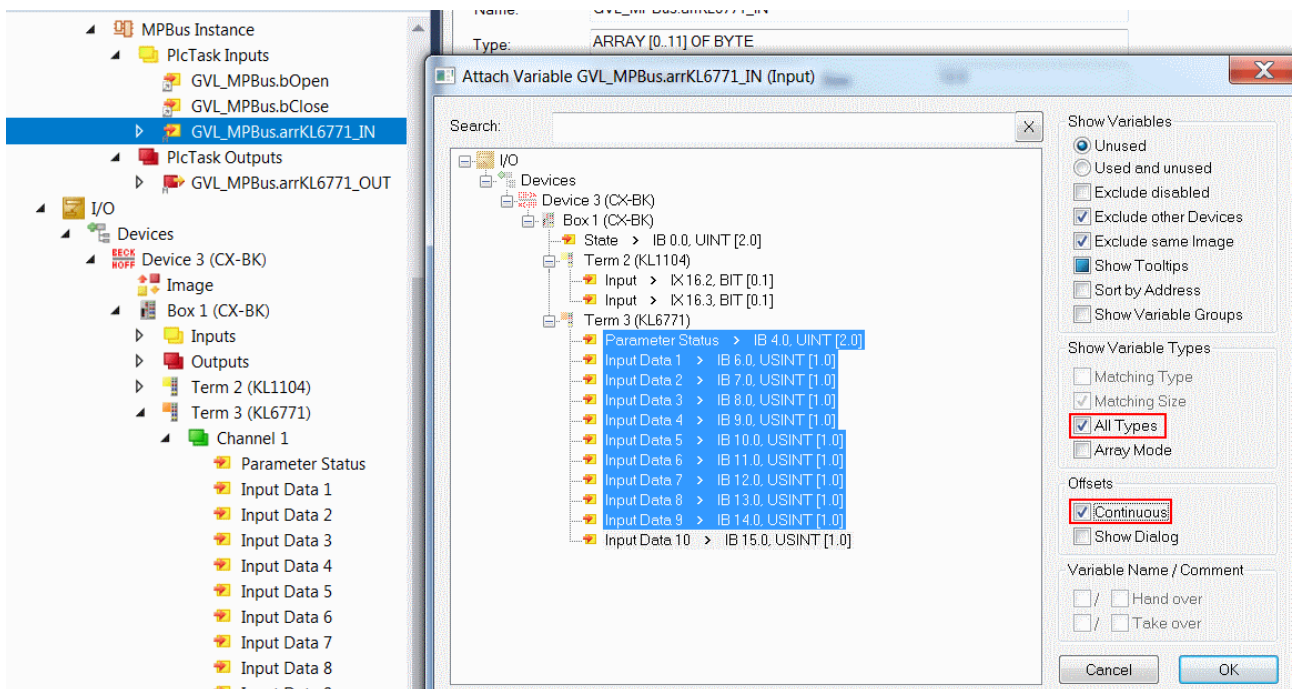
Now link the global variables with the inputs and outputs of the Bus Terminals.

The linking of MP-Bus variables is described in detail below.






















Right-click the array *arrKL6771\_IN* and select "Change Link".



Under "I/O Configuration" select the terminal, select "All Types" and "Continuous", then select "ParameterStatus", "InputData1" to "InputData10" with the left mouse button and the >SHIFT< key. Then click "OK".



You can now check the connection. To do this, go to the KL6771 and open it. All terminal data should now show a small arrow. If that is the case, then proceed in exactly the same way with the outputs.

- ▲  Device 3 (CX-BK)
  -  Image
  - ▲  Box 1 (CX-BK)
    - ▷  Inputs
    - ▷  Outputs
    - ▷  Term 2 (KL1104)
    - ▲  Term 3 (KL6771)
      - ▲  Channel 1
        -  Parameter Status
        -  Input Data 1
        -  Input Data 2
        -  Input Data 3
        -  Input Data 4
        -  Input Data 5
        -  Input Data 6
        -  Input Data 7
        -  Input Data 8
        -  Input Data 9
        -  Input Data 10
        -  Parameter Control
        -  Output Data 1

## 5 Appendix

### 5.1 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

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