Electric Actuator with Process Controllers
TROVIS 5724-8 (without fail-safe action)
TROVIS 5725-8 (with fail-safe action)

For heating and cooling applications

Translation of original instructions

Configuration Manual

KH 5724-8 EN

Firmware version 1.1x/2.1x

Edition April 2016

Notes on this configuration manual

The documentation for TROVIS 5724-8 and TROVIS 5725-8 Electric Actuators with Process Controllers is divided into two parts:

- Mounting and Operating Instructions ► EB 5724-8
- Configuration Manual KH 5724-8

This Configuration Manual KH 5724-8 is intended for qualified personnel with experience in control engineering. All the ready-configured systems are described.

It is assumed that users are familiar with the operation of the device, i.e. know how to select and change a configuration item or parameter. If necessary, refer to EB 5724-8 which describes the design and principle of operation, mounting, start-up and operation of the electric actuator with process controller.

The mounting and operating instructions for all supplied devices are included in the delivery. The latest versions of the documents are available on our website at www.samson.de > Product documentation. You can enter the document number or type number in the [Find:] field to look for a document.

Definition of signal words

DANGER

Hazardous situations which, if not avoided, will result in death or serious injury

WARNING

Hazardous situations which, if not avoided, could result in death or serious injury

NOTICE

Property damage message or malfunction

Note

Additional information

Tip

Recommended action

1 Ready-configured applications

The system code numbers allow the user to preconfigure the electric actuators with process controllers in TROVIS-VIEW for a certain application. After selecting a system code number ≠ 0, the user can only change the parameters required for the selected application.

All the parameters of the electric actuator with process controller can be configured as required when the system code number 0 is selected (user-defined).

NOTICE

If a system code number ≠0 is switched to system code number 0, the data of previously selected system code number are adopted. Any parameters not used in this configured system are written with the default setting.

State of delivery

Upon delivery, the system code number 10 (Fixed set point control, heating with mean value calculation using two sensors and set point decrease) is active by default (see section 1.2).

NOTICE

The electric actuator with process controller is available in four versions [A], [B], [C], and [D]. See ▶ EB 5824-8. These versions are adapted to the ready-configured applications. The recommended versions are listed in the following descriptions. In many cases, it is also possible to use the electric actuator with process controller with another device version for other applications. See Table 1.

Table 1: *Device versions ([A], [B], [C], [D]) and their possible implementation*

	[A]	[B]	[C]	[D]
System code numbers 20, 60	• (recommended)	•	•	•
System code numbers 1, 10, 21, 30, 50, 70, 80	o	• (recommended)	o	•
System code numbers 65, 66	–	–	• (recommended)	•
System code numbers 35, 55, 95	–	–	o	• (recommended)

• (shaded) Recommended
• Possible
o Possible when the switching output is not used
– Not possible

Setting the system code number

The system code number is selected and set in the M0 parameter in the [Control] folder in TROVIS-VIEW. See section 2.2.1.

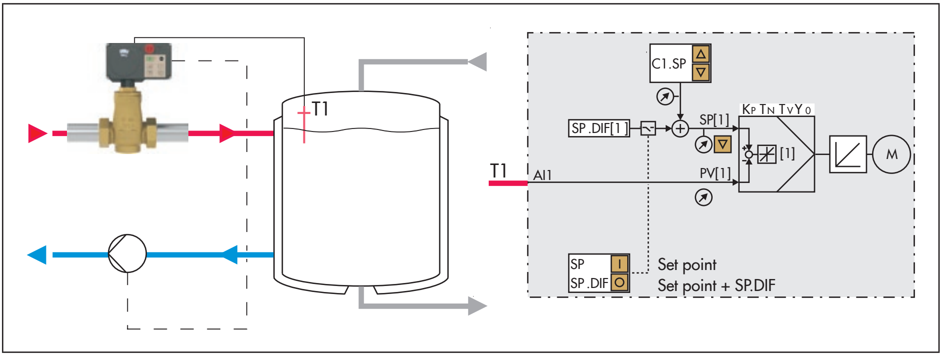
All the ready-configured systems are described in the following sections 1.1 to 1.14. The default settings based on the application are listed in the gray-shaded area.

– System code number 1 (see section 1.1):
  Heating · Fixed set point control · With one sensor · Internal set point decrease
– System code number 10 (see section 1.2):
  Heating · Fixed set point control · Temperature mean value calculation using two sensors · Internal set point decrease
– System code number 20 (see section 1.3):
  Cooling · Fixed set point control · Differential temperature between two sensors · Start/stop control sequence
– System code number 21 (see section 1.4):
  Cooling · Fixed set point control · Temperature mean value calculation using two sensors · Start/stop control sequence
– System code number 30 (see section 1.5):
  Heating · Follow-up control · Return flow temperature limitation · Internal set point decrease
– System code number 35 (see section 1.6):
  Heating · Follow-up control · Outdoor temperature controlled, return flow temperature limitation · External set point decrease with DI4
– System code number 50 (see section 1.7):
  Heating · Override control with minimum selection · Return flow temperature limitation · Internal set point decrease
– System code number 55 (see section 1.8):
  Heating · Override control with minimum selection · Outdoor temperature controlled, return flow temperature limitation · External set point decrease with DI4
– System code number 60 (see section 1.9):
  Cooling · Override control with minimum selection · Differential temperature with two sensors, return flow temperature limitation · Start/stop control sequence
– System code number 65 (see section 1.10):
  Cooling · Override control with minimum selection · Differential temperature with two sensors, return flow temperature limitation · Start/stop control sequence

- System code number 66 (see section 1.11):
  Cooling · Override control, district cooling · Minimum selection of the set point control · Start/stop control sequence with DI4
- System code number 70 (see section 1.12):
  Heating · Cascade control · With two sensors · Internal set point switchover
- System code number 80 (see section 1.13):
  Cooling · Cascade control · With two sensors · Start/stop control sequence
- System code number 95 (see section 1.14):
  Heating · Position transmitter / Fixed set point/follow-up control · 2–10 V position transmitter / 0–2 V Fixed set point/follow-up control · Return flow temperature limitation, set point decrease with DI3

1.1 Fixed set point control, heating with one sensor and set point decrease

Recommended device version: [B]



System code number 1

The flow temperature T1 is measured by a Pt 1000 sensor and recorded as the process variable PV 1 at the analog input AI1. The set point C1.SP can be entered directly using the operating keys on the actuator.

The integrated process controller positions the control valve (e.g. installed in the flow pipe) based on the set point and process variable. As a result, the flow temperature T1 can be maintained at a constant level. Furthermore, the set point (e.g. for day/night switchover) can be raised or lowered using the operating keys [I]/[O].

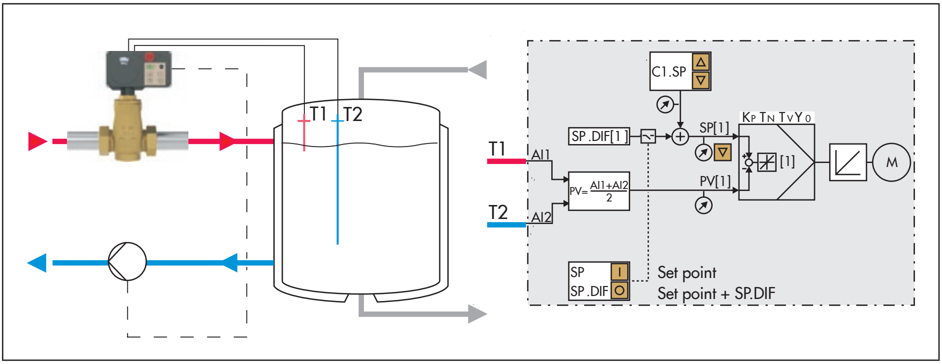
Additionally, the switching output L' allows a pump to be controlled.

Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 0	None
Function I3	I3 = 0	None
Function I4	I4 = 0	None
Switching output		
Function	M4 = 3	On at travel > 0 % / Off at 0 % with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 0	Fixed set point/follow-up
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C1.2 = 5	Set point = C1.SP
Set point	C1.SP = 50.0 °C	
Set point offset	C1.SP.DIF = –10.0 °C	
Lower adjustment limit	C1.SP.MIN = 10 °C	
Upper adjustment limit	C1.SP.MAX = 99 °C	
Proportional-action coefficient	C1.KP = 2.0	
Reset time	C1.TN = 120 s	
Operation		
[I]/[O] keys function	A1.1 = 2	[I] Set point / [O] Set point decrease/increase
Open loop control using [I]/[O] keys	A1.5 = 0	[I]/[O] keys

1.2 Fixed set point control, heating with mean value calculation using two sensors and set point decrease

Recommended device version: [B]



System code number 10 (selected system code number upon delivery)

The temperatures T1 and T2 are each measured by a Pt 1000 sensor and recorded at the analog inputs AI1 and AI2. The mean value of T1 and T2 is calculated based on a formula assigned to the process variable PV and compared with the set point. The set point C1.SP can be entered directly using the operating keys on the actuator.

The integrated process controller positions the control valve (e.g. installed in the flow pipe) based on the set point and process variable. As a result, the medium temperature can be maintained at a constant level. Furthermore, the set point (e.g. for day/night switchover) can be lowered using the operating keys [I]/[O].

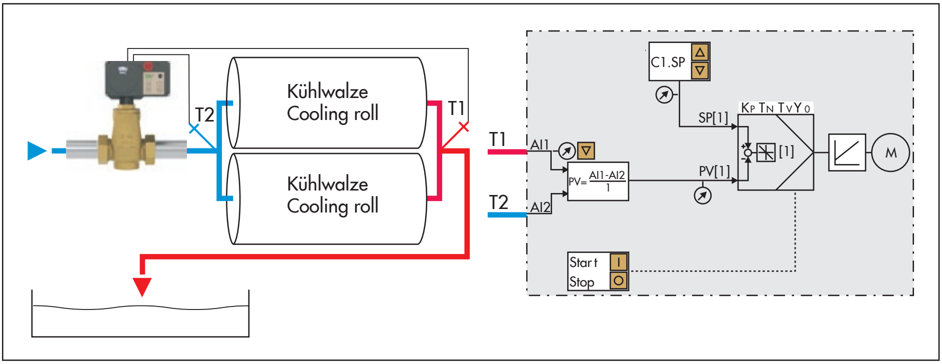
Additionally, the switching output L' allows a pump to be controlled.

Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 0	None
Function I4	I4 = 0	None
Switching output		
Function	M4 = 3	On at travel > 0 % / Off at 0 % with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 0	Fixed set point/follow-up
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 0	Process variable (actual value) = Formula
Factor AI1	C1.a = 1.0	
Factor AI2	C1.b = 1.0	
Factor AI3	C1.z = 2.0	
Source of set point	C1.2 = 5	Set point = C1.SP
Set point	C1.SP = 50.0 °C	
Set point offset	C1.SP.DIF = –10.0 °C	
Lower adjustment limit	C1.SP.MIN = 10 °C	
Upper adjustment limit	C1.SP.MAX = 99 °C	
Proportional-action coefficient	C1.KP = 2.0	
Reset time	C1.TN = 120 s	
Operation		
[I]/[O] keys function	A1.1 = 2	[I] Set point / [O] Set point decrease/increase
Open loop control using [I]/[O] keys	A1.5 = 0	[I]/[O] keys

1.3 Fixed set point control, differential temperature, cooling with two sensors and start/stop control sequence

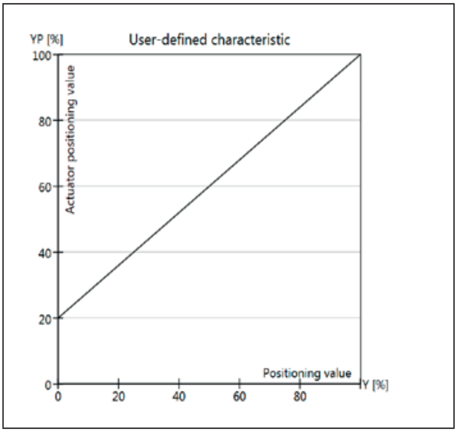
Recommended device version: [A]



System code number 20

Two Pt 1000 sensors at the analog inputs AI1 and AI2 measure the flow temperature T2 and the return flow temperature T1. The differential temperature ΔT = T1 – T2 is calculated based on a formula assigned to the process variable PV and compared with the set point C1.SP. Controller [1] is set to cool, i.e. the set point deviation is reversed in the controller. The set point C1.SP can be entered directly using the operating keys on the actuator.

The integrated process controller positions the control valve (e.g. installed in the flow pipe) based on the set point and process variable. As a result, the differential temperature is maintained at a constant level. Furthermore, the control function can be started or stopped using the operating keys [I]/[O].



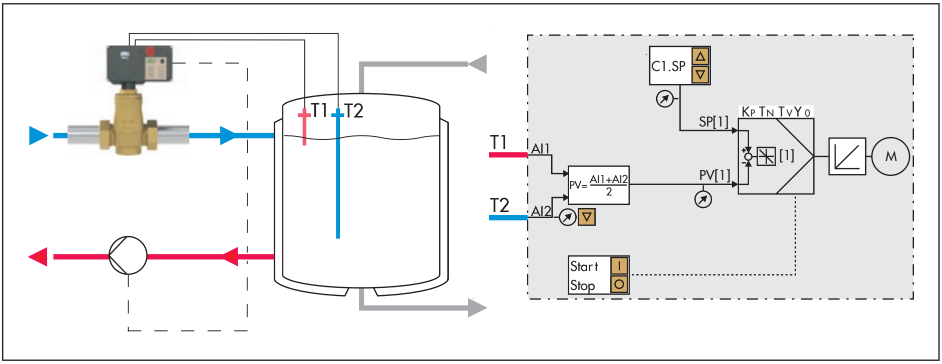
After the control function starts, the 'Rinsing' start sequence is performed for the period entered in Start-up time A1.T.ON (= 10 minutes). During the start-up time, the valve is opened to 100 % by the A1.YP.ON parameter. The control process starts after the start-up time has elapsed. As a result, the actuator moves through the restricted travel range. After pressing the [O] key (stop), the actuator completely closes the valve (A1.Y.OFF parameter = 0.0 %).

Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 0	None
Function I4	I4 = 0	None
Control		
Control mode	M1 = 0	Fixed set point/follow-up
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 0	Process variable (actual value) = Formula
Factor AI1	C1.a = 1.0	
Factor AI2	C1.b = –1.0	
Factor AI3	C1.z = 1.0	
Source of set point	C1.2 = 5	Set point = C1.SP
Set point	C1.SP = 2.0 °C	
Lower adjustment limit	C1.SP.MIN = 0 °C	
Upper adjustment limit	C1.SP.MAX = 10 °C	
Set point deviation function	C1.3 = 7	Set point deviation inverted
Operation		
[I]/[O] keys function	A1.1 = 1	[I] Start control sequence / [O] Stop control sequence
Open loop control using [I]/[O] keys	A1.5 = 0	[I]/[O] keys

1.4 Fixed set point control, cooling with mean value calculation using two sensors and start/stop control sequence

Recommended device version: [B]



System code number 21

The temperatures T1 and T2 are each measured by a Pt 1000 sensor and recorded at the analog inputs AI1 and AI2. The mean value of T1 and T2 is calculated based on a formula assigned to the process variable PV and compared with the set point. Controller [1] is set to cool, i.e. the set point deviation is reversed in the controller. The set point C1.SP can be entered directly using the operating keys on the actuator.

The integrated process controller positions the control valve (e.g. installed in the flow pipe) based on the set point and process variable. As a result, the medium temperature can be maintained at a constant level. Furthermore, the control function can be started or stopped using the operating keys [I]/[O].

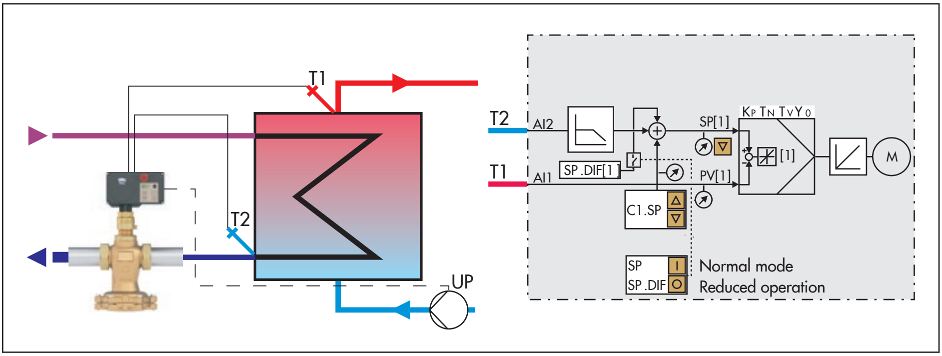
Additionally, the switching output L' allows a pump to be controlled.

Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 0	None
Function I4	I4 = 0	None
Switching output		
Function	M4 = 3	On at travel > 0 % / Off at 0 % with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 0	Fixed set point/follow-up
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 0	Process variable (actual value) = Formula
Factor AI1	C1.a = 1.0	
Factor AI2	C1.b = 1.0	
Factor AI3	C1.z = 2.0	
Source of set point	C1.2 = 5	Set point = C1.SP
Set point	C1.SP = 20.0 °C	
Lower adjustment limit	C1.SP.MIN = 0 °C	
Upper adjustment limit	C1.SP.MAX = 40 °C	
Set point deviation function	C1.3 = 7	Set point deviation inverted
Proportional-action coefficient	C1.KP = 10.0	
Reset time	C1.TN = 90 s	
Operation		
[I]/[O] keys function	A1.1 = 1	[I] Start control sequence / [O] Stop control sequence
Open loop control using [I]/[O] keys	A1.5 = 0	[I]/[O] keys

1.5 Fixed set point/follow-up control, heating with return flow temperature limitation and set point decrease

Recommended device version: [B]



System code number 30

Two Pt 1000 sensors at the analog inputs AI1 and AI2 measure the flow temperature T1 in the secondary circuit and the return flow temperature T2 in the primary circuit. T1 represents the process variable PV [1] in this system. The function generation of the input signal AI2 results in the characteristic for return flow temperature limitation based on the return flow temperature T2 in the primary circuit.

The set point before the comparator SP [1] of the follow-up control is calculated by adding both temperature-based characteristics after function generation of T2 and the set point C1.SP. Furthermore, the set point can be raised or lowered with the SP.DIF [1] parameter using the operating keys [I]/[O] or over DI4.

The integrated process controller positions the control valve (e.g. installed in the return flow pipe in the primary circuit) based on the set point and process variable. As a result, the flow temperature in the secondary circuit is controlled and the return flow temperature in the primary circuit limited.

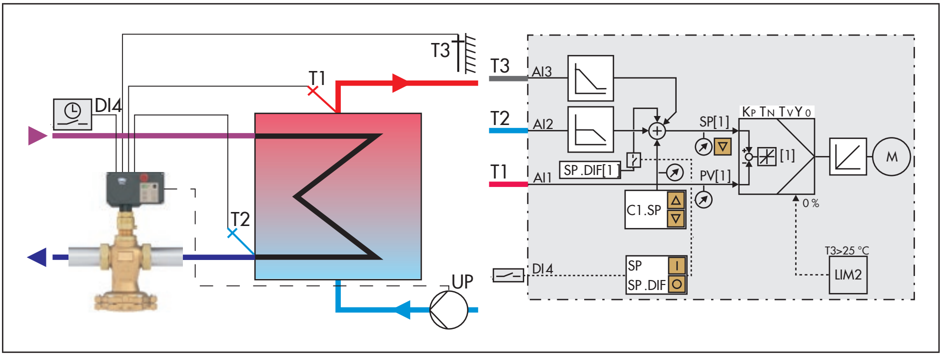
Additionally, the switching output L' allows a pump to be controlled.

Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 0	None
Function I4	I4 = 0	None
Switching output		
Function	M4 = 3	On at travel > 0 % / Off at 0 % with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 0	Fixed set point/follow-up
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C1.2 = 0	Set point = C1.SP + Formula
Set point	C1.SP = 50.0 °C	
Set point offset	C1.SP.DIF = –10.0 °C	
Lower adjustment limit	C1.SP.MIN = 10 °C	
Upper adjustment limit	C1.SP.MAX = 99 °C	
Factor AI2	C1.f = 1.0	
Proportional-action coefficient	C1.KP = 2.0	
Reset time	C1.TN = 120 s	
Operation		
[I]/[O] keys function	A1.1 = 2	[I] Set point / [O] Set point decrease/increase
Open loop control using [I]/[O] keys	A1.5 = 0	[I]/[O] keys

1.6 Follow-up control, outdoor temperature controlled heating with return flow temperature limitation and external set point decrease with DI4

Recommended device version: [D]



System code number 35

Three Pt 1000 sensors at the analog inputs AI1 to AI3 measure the flow temperature T1 in the secondary circuit, the return flow temperature T2 in the primary circuit and the outdoor temperature T3.

The flow temperature T1 represents the process variable PV [1] in this system.

The function generation of the input signal AI3 results in the characteristic for control operation based on the outdoor temperature T3. The return flow temperature limitation is preconfigured by the characteristic using function generation of input signal AI2.

The set point before the comparator SP [1] of the follow-up control is calculated by adding both temperature-based characteristics after function generation of T2 and T3. The set point C1.SP is used for the parallel shift of the set point before the comparator SP [1]. Furthermore, the set point can be raised or lowered with the SP.DIF [1] parameter using the operating keys [I]/[O] or over DI4. The outdoor temperature is monitored to the internal limit LIM2 ≥ 25 °C. If the outdoor temperature exceeds 25 °C, the valve is fully closed (parameter C1.YP = 0.0 %).

The integrated process controller positions the control valve (e.g. installed in the return flow pipe in the primary circuit) based on the set point and process variable. As a result, the flow temperature in the secondary circuit is controlled and the return flow temperature in the primary circuit limited.

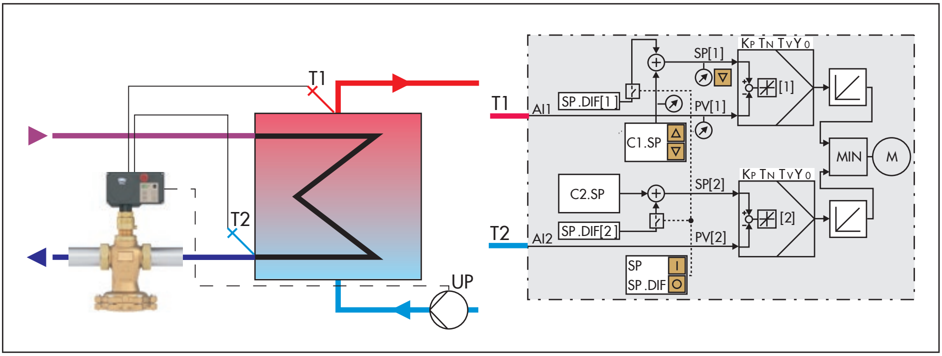
Additionally, the switching output L' allows a pump to be controlled.

Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 3	AI3 (Pt 1000)
Function I4	I4 = 1	DI4 not inverted
Switching output		
Function	M4 = 3	On at travel > 0 % / Off at 0 % with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 0	Fixed set point/follow-up
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C1.2 = 0	Set point = C1.SP + Formula
Set point	C1.SP = 0.0 °C	
Set point offset	C1.SP.DIF = –10.0 °C	
Lower adjustment limit	C1.SP.MIN = –9 °C	
Upper adjustment limit	C1.SP.MAX = 9 °C	
Factor AI2	C1.f = 1.0	
Factor AI3	C1.g = 1.0	
Proportional-action coefficient	C1.KP = 2.0	
Reset time	C1.TN = 120 s	
Operation		
[I]/[O] keys function	A1.1 = 2	[I] Set point / [O] Set point decrease/increase
Open loop control using [I]/[O] keys	A1.5 = 4	[I]/[O] keys or DI4

1.7 Override control, heating of the flow temperature in the secondary circuit with return flow temperature limitation and set point decrease

Recommended device version: [B]



System code number 50

Two Pt 1000 sensors at the analog inputs AI1 and AI2 measure the flow temperature T1 in the secondary circuit and the return flow temperature T2 in the primary circuit.

T1 represents the process variable PV [1] in this system. The return flow temperature T2 represents the process variable PV [2] to control the return flow temperature to the fixed set point C2.SP.

Due to the minimum selection, the controller with the smallest manipulated variable always acts on the actuator.

Furthermore, the set point can be lowered with the SP.DIF [1] and SP.DIF [2] parameters using the operating keys [I]/[O].

Additionally, the switching output L' allows a pump to be controlled.

The integrated process controller positions the control valve (e.g. installed in the return flow pipe in the primary circuit) based on the set point and process variable. As a result, the flow temperature in the secondary circuit and the return flow temperature in the primary circuit are controlled and limited.

Additionally, the switching output L' allows a pump to be controlled.

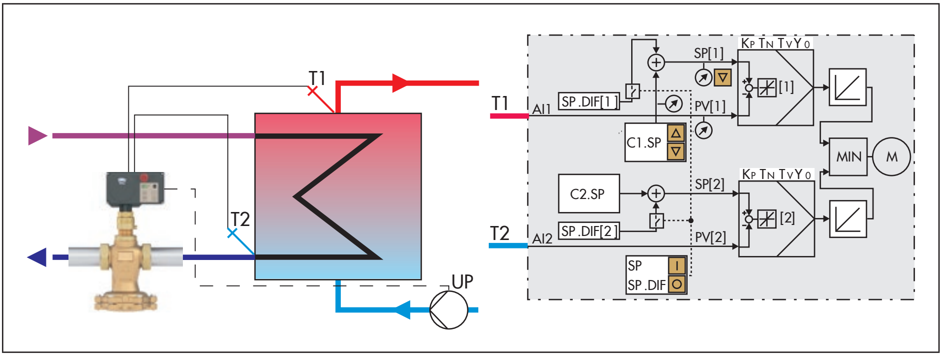
Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 0	None
Function I4	I4 = 0	None
Switching output		
Function	M4 = 3	On at travel > 0 % / Off at 0 % with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 1	Override (MIN selection)
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C1.2 = 5	Set point = C1.SP
Set point	C1.SP = 50.0 °C	
Set point offset	C1.SP.DIFF = –10.0 °C	
Lower adjustment limit	C1.SP.MIN = 10 °C	
Upper adjustment limit	C1.SP.MAX = 99 °C	
Proportional-action coefficient	C1.KP = 2.0	
Reset time	C1.TN = 120 s	
Controller [2]		
Source of actual value (process variable)	C2.1 = 2	Process variable (actual value) = AI2 after function generation
Source of set point	C2.2 = 6	Set point = C2.SP
Set point	C2.SP = 65.0 °C	
Set point offset	C2.SP.DIF = –5.0 °C	
Lower adjustment limit	C2.SP.MIN = 10 °C	
Upper adjustment limit	C2.SP.MAX = 90 °C	
Proportional-action coefficient	C2.KP = 2.0	
Reset time	C2.TN = 120 s	

Operation		
[I]/[O] keys function	A1.1 = 2	[I] Set point / [O] Set point decrease/increase
Open loop control using [I]/ [O] keys	A1.5 = 0	[I]/[O] keys

1.8 Override control, outdoor temperature controlled heating with return flow temperature limitation and external set point decrease with DI4

Recommended device version: [D]



System code number 55

Three Pt 1000 sensors at the analog inputs AI1 to AI3 measure the flow temperature T1 in the secondary circuit, the return flow temperature T2 in the primary circuit and the outdoor temperature T3.

T1 represents the process variable PV [1] in this system. By performing the function generation of the input signal AI3, the temperature T3 calculates the set point for control of T1. The return flow temperature T2 represents the process variable PV [2] to control the return flow temperature to the fixed set point C2.SP.

The set point before the comparator SP [1] of the controller [1] is calculated by adding the characteristic based on the outdoor temperature and the set point C1.SP. The set point C1.SP is used for the parallel shift of the characteristic based on outdoor temperature. The controller [2] and the set point C2.SP are used to control and limit the return flow temperature T2 to the adjusted set point.

Furthermore, the set point can be lowered with the SP.DIF [1] and SP.DIF [2] parameters using the operating keys [I]/[O] or over DI4. The outdoor temperature is monitored to the internal limit LIM2 ≥ 25 °C. If the outdoor temperature exceeds 25 °C, the valve is fully closed (parameters C1.YP and C2.YP = 0.0 %).

Due to the minimum selection, the controller with the smallest manipulated variable always acts on the actuator.

The integrated process controller positions the control valve (e.g. installed in the return flow pipe in the primary circuit) based on the set point and process variable. As a result, the flow temperature in the secondary circuit based on the outdoor temperature and the return flow temperature in the primary circuit are controlled and limited.

Additionally, the switching output L' allows a pump to be controlled.

The use of this system code number (in comparison to system code number 35) allows the return flow temperature to be controlled by using the second control circuit. Additionally, it is possible in this case to also control the return flow temperature based on the outdoor temperature T3. It uses the same set point at AI3 input on which a function generation has been performed. However, it can be processed in a different way using the factor C2.g.

Tip

To activate this setting, we recommend the parameter settings C2.SP = 45 °C and C2.g = 0.2.

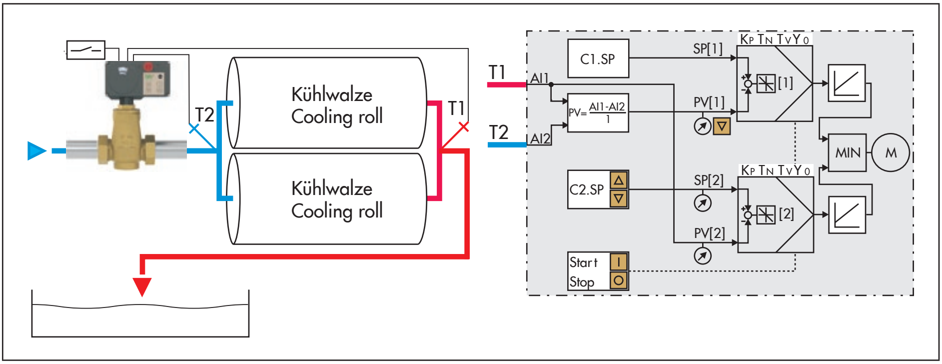
Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 3	AI3 (Pt 1000)
Function I4	I4 = 1	DI4 not inverted
Switching output		
Function	M4 = 3	On at travel > 0 % / Off at 0 % with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 1	Override (MIN selection)
Direction of action	M2 = 0	>> (increasing/increasing)

Controller [1]		
Source of actual value (process variable)	C1.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C1.2 = 0	Set point = C1.SP + Formula
Set point	C1.SP = 0.0 °C	
Set point offset	C1.SP.DIF = –10.0 °C	
Lower adjustment limit	C1.SP.MIN = –9 °C	
Upper adjustment limit	C1.SP.MAX = 9 °C	
Proportional-action coefficient	C1.KP = 2.0	
Reset time	C1.TN = 120 s	
Controller [2]		
Source of actual value (process variable)	C2.1 = 2	Process variable (actual value) = AI2 after function generation
Source of set point	C2.2 = 0	Set point = C2.SP + Formula
Set point	C2.SP = 65.0 °C	
Set point offset	C2.SP.DIF = –5.0 °C	
Lower adjustment limit	C2.SP.MIN = –50 °C	
Upper adjustment limit	C2.SP.MAX = 90 °C	
Proportional-action coefficient	C2.KP = 2.0	
Reset time	C2.TN = 120 s	
Operation		
[I]/[O] keys function	A1.1 = 2	[I] Set point / [O] Set point decrease/increase
Open loop control using [I]/[O] keys	A1.5 = 4	[I]/[O] keys or DI4

1.9 Override control, differential temperature, cooling with minimum selection with two sensors and start/stop control sequence

Recommended device version: [A]



System code number 60

Two Pt 1000 sensors at the analog inputs AI1 and AI2 measure the flow temperature T2 and the return flow temperature T1. The differential temperature ΔT = T1 – T2 is calculated based on a formula assigned to the process variable PV and compared with the set point C1.SP. Controller [1] and controller [2] are set to cool, i.e. the set point deviation is reversed in the controller. The temperature T1 can also be controlled to a maximum temperature using the set point C2.SP of controller [2]. Due to the minimum selection, the controller with the smallest manipulated variable always acts on the actuator.

The set point C2.SP can be entered directly using the operating keys on the actuator.

The integrated process controller positions the control valve installed in the flow pipe based on the set point and process variable. As a result, the differential temperature and the return flow temperature are maintained at a constant level. Furthermore, the control function can be started or stopped using the operating keys [I]/[O].

After the control function starts by pressing the [I] key, the "Rinsing" start sequence is performed for the period entered in Start-up time A1.T.ON (= 10 minutes). During the start-up time, the valve is opened to 100 % by the A1.YP.ON parameter. The control process starts after the start-up time has elapsed. As a result, the actuator moves through the travel range according to the characteristic in system code number 20. See section 2.2.2. After pressing the [O] key (stop), the actuator completely closes the valve (A1.Y.OFF parameter = 0.0 %).

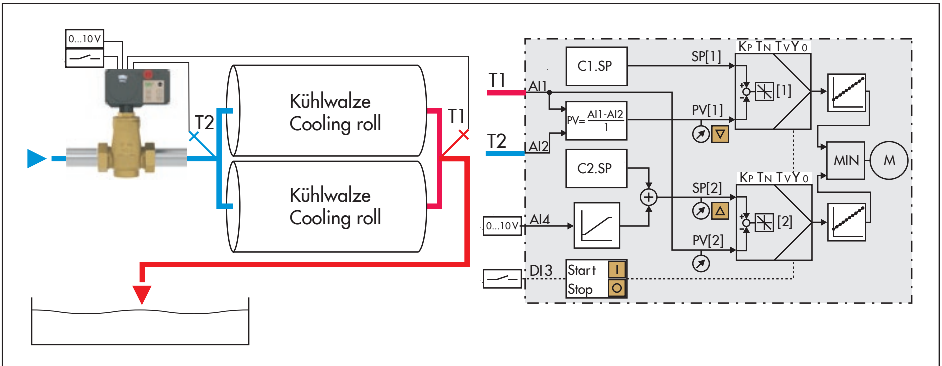
Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 1	DI3 not inverted
Function I4	I4 = 0	None
Control		
Control mode	M1 = 1	Override (MIN selection)
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 0	Process variable (actual value) = Formula
Factor AI1	C1.a = 1.0	
Factor AI2	C1.b = –1.0	
Divisor	C1.z = 1.0	
Source of set point	C1.2 = 5	Set point = C1.SP
Set point	C1.SP = 2.0 °C	
Lower adjustment limit	C1.SP.MIN = 0 °C	
Upper adjustment limit	C1.SP.MAX = 10 °C	
Set point deviation function	C1.3 = 7	Set point deviation inverted
Proportional-action coefficient	C1.KP = 40.0	
Controller [2]		
Source of actual value (process variable)	C2.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C2.2 = 6	Set point = C2.SP
Set point	C2.SP = 25.0 °C	
Lower adjustment limit	C2.SP.MIN = 10 °C	
Upper adjustment limit	C2.SP.MAX = 70 °C	
Set point deviation function	C2.3 = 7	Set point deviation inverted
Proportional-action coefficient	C2.KP = 40.0	

Operation		
[I]/[O] keys function	A1.1 = 1	[I] Start control sequence / [O] Stop control sequence
Open loop control using [I]/[O] keys	A1.5 = 3	[I]/[O] keys or DI3

1.10 Override control, differential temperature, cooling with minimum selection using two sensors, external set point over AI4 and start/stop control sequence with DI3

Recommended device version: [C]



System code number 65

Two Pt 1000 sensors at the analog inputs AI1 and AI2 measure the flow temperature T2 and the return flow temperature T1. The differential temperature ΔT = T1 – T2 is calculated based on a formula assigned to the process variable PV and compared with the set point C1.SP. Controller [1] and controller [2] are set to cool, i.e. the set point deviation is reversed in the controller. The temperature T1 can also be controlled and limited to a maximum temperature using the external set point AI4 of controller [2]. The external set point is recorded by a standardized 0 to 10 V signal at the AI4 input and a function generation is performed on it to generate a set point between 10 and 70 °C. In this case, the set point C2.SP serves as an offset or replacement value when the input variable AI4 fails.

Due to the minimum selection, the controller with the smallest manipulated variable always acts on the actuator.

The integrated process controller positions the control valve installed in the flow pipe based on the set point and process variable. As a result, the differential temperature and the return flow temperature are maintained at a constant level. Furthermore, the control function can be started or stopped using the operating keys [I]/[O] or externally over DI3.

After the control function starts, the 'Rinsing' start sequence is performed for the period entered in Start-up time A1.T.ON (= 10 minutes). During the start-up time, the valve is opened to 100 % by the A1.YP.ON parameter. The control process starts after the start-up time has elapsed. As a result, the actuator moves through the travel range according to the characteristic in system code number 20. See section 2.2.2. After pressing the [O] key (stop), the actuator completely closes the valve (A1.Y.OFF parameter = 0.0 %).

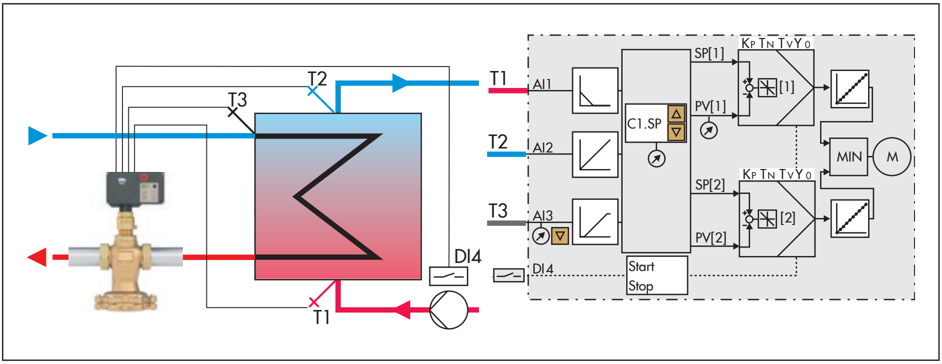
Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 3	DI3 not inverted
Function I4	I4 = 1	AI4 (0 to 10 V)
Control		
Control mode	M1 = 1	Override (MIN selection)
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 0	Process variable (actual value) = Formula
Factor AI1	C1.a = 1.0	
Factor AI2	C1.b = −1.0	
Divisor	C1.z = 1.0	
Source of set point	C1.2 = 5	Set point = C1.SP
Set point	C1.SP = 2.0 °C	
Lower adjustment limit	C1.SP.MIN = 0 °C	
Upper adjustment limit	C1.SP.MAX = 10 °C	
Set point deviation function	C1.3 = 7	Set point deviation inverted
Proportional-action coefficient	C1.KP = 40.0	

Controller [2]		
Source of actual value (process variable)	C2.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C2.2 = 0	Set point = C2.SP + Formula
Set point	C2.SP = 0.0 °C	
Lower adjustment limit	C2.SP.MIN = –9 °C	
Upper adjustment limit	C2.SP.MAX = 99 °C	
Set point deviation function	C2.3 = 7	Set point deviation inverted
Proportional-action coefficient	C2.KP = 40.0	
Operation		
[I]/[O] keys function	A1.1 = 1	[I] Start control sequence / [O] Stop control sequence
Open loop control using [I]/[O] keys	A1.5 = 3	[I]/[O] keys or DI3

1.11 Override control, district cooling with maximum selection of the set point control and start/stop control sequence

Recommended device version: [C]



System code number 66

Three Pt 1000 sensors at the analog inputs AI1 to AI3 measure the flow temperature T2 in the secondary circuit, the return flow temperature T1 in the secondary circuit, and the flow temperature in the primary circuit T3. Controller [1] and controller [2] are set to cool, i.e. the set point deviation is reversed in both controllers. The temperature T2 represents the process variable and C1.SP the set point in this system. The largest temperature T1 or T3 after function generation is used for control.

The integrated process controller positions the control valve (e.g. installed in the return flow pipe in the primary circuit) based on the set point and process variable. As a result, the flow temperature T2 in the secondary circuit is controlled. The control function can be released externally over the DI4 digital input.

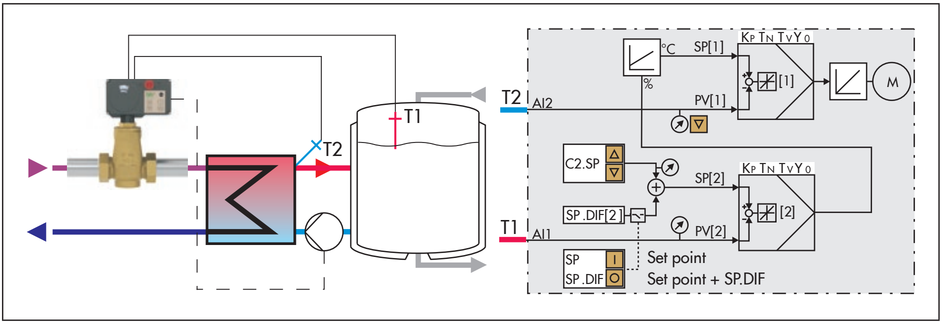
In special cases, a floating binary output signal for activating the pump in the secondary circuit is used to activate or stop the control function.

Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 3	AI3 (Pt 1000)
Function I4	I4 = 1	DI4 not inverted
Control		
Control mode	M1 = 1	Override (MIN selection)
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 2	Process variable (actual value) = AI2 after function generation
Factor AI1	C1.2 = 0	Set point = C1.SP + Formula
Factor AI2	C1.SP = 10.0 °C	
Divisor	C1.SP.MIN = 0 °C	
Source of set point	C1.SP.MAX = 40 °C	
Set point	C1.e = 0.0	
Lower adjustment limit	C1.3 = 7	Set point deviation inverted
Upper adjustment limit	C1.KP = 10.0	
Set point deviation function	C1.TN = 90 s	
Controller [2]		
Source of actual value (process variable)	C2.1 = 2	Process variable (actual value) = AI2 after function generation
Source of set point	C2.2 = 7	Set point = C1.SP + Formula
Set point	C2.g = 1.0	
Lower adjustment limit	C2.3 = 7	Set point deviation inverted
Upper adjustment limit	C2.KP = 10.0	
Set point deviation function	C2.TN = 90 s	
Operation		
[I]/[O] keys function	A1.1 = 1	[I] Start control sequence / [O] Stop control sequence
Open loop control using [I]/[O] keys	A1.5 = 8	DI4

1.12 Cascade control, heating with two sensors and set point limitation to the slave controller [1] as well as set point changeover

Recommended device version: [B]



System code number 70

Two Pt 1000 sensors at the analog inputs AI1 and AI2 measure the auxiliary controlled variable T2 and the main controlled variable T1.

T1 represents the process variable PV [2] of the master controller (controller [2]) and T2 the process variable PV [1] of the slave controller (controller [1]).

In the cascade control, the output of the master controller (controller [2]) is the set point of the slave controller (controller [1]). The set point of the slave controller can be limited using the C1.SP.MIN and C1.SP.MAX parameters.

Master and slave controllers can be configured and parameterized separately from one another. To parameterize the slave controller (controller [1]), the cascade must be opened.

In this case, the set point C1.SP must be assigned as the source to the slave controller instead of the output of controller [2]. The output of controller [1] acts on the actuator. As a result, the position of the actuator stem is controlled.

Furthermore, the set point can be lowered with the SP.DIF [1] and SP.DIF [2] parameters using the operating keys [I]/[O].

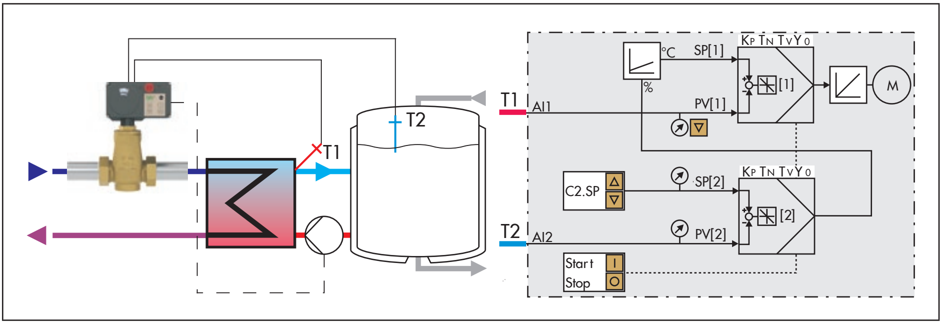
Additionally, the switching output L' allows a pump to be controlled. To save energy, an internal limit contact LIM1 allows it to be activated over the M1 function (LIM1 active with lag time) first when the set point of the slave controller SP [1] exceeds ≥ 11 °C.

Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 0	None
Function I4	I4 = 0	None
Switching output		
Function	M4 = 1	On with LIM1 / Off with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 5	Cascade
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 2	Process variable (actual value) = AI2 after function generation
Source of set point	C1.2 = 7	Set point = Output of controller [2]
Lower adjustment limit	C1.SP.MIN = 10 °C	
Upper adjustment limit	C1.SP.MAX = 70 °C	
Reset time	C1.TN = 120 s	
Controller [2]		
Source of actual value (process variable)	C2.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C2.2 = 6	Set point = C2.SP
Set point	C2.SP = 50 °C	
Set point offset	C2.SP.DIF = –10 °C	
Lower adjustment limit	C2.SP.MIN = 10 °C	
Upper adjustment limit	C2.SP.MAX = 99 °C	
Proportional-action coefficient	C2.KP = 2.0	
Reset time	C2.TN = 120 s	
Operation		
[I]/[O] keys function	A1.1 = 1	[I] Set point / [O] Set point decrease/increase
Open loop control using [I]/[O] keys	A1.5 = 4	[I]/[O] keys

1.13 Cascade control, cooling using two sensors and set point limitation to the slave controller [1] as well as set point changeover

Recommended device version: [B]



System code number 80

Two Pt 1000 sensors at the analog inputs AI1 and AI2 measure the auxiliary controlled variable T1 and the main controlled variable T2. T2 represents the process variable PV [2] of the master controller (controller [2]) and T1 the process variable PV [1] of the slave controller (controller [1]). In the cascade control, the output of the master controller (controller [2]) is the set point of the slave controller (controller [1]). The set point of the slave controller can be limited using the C1.SP.MIN and C1.SP.MAX parameters. Master and slave controllers can be configured and parameterized separately from one another. To parameterize the slave controller (controller [1]), the cascade must be opened. In this case, the set point C1.SP must be assigned to the slave controller instead of the output of controller [2]. The output of controller [1] acts on the actuator. As a result, the position of the actuator stem is controlled.

Furthermore, the control function can be released using the operating keys [I]/[O].

Additionally, the switching output L' allows a pump to be controlled. To save energy, an internal limit contact LIM1 allows it to be activated over the M1 function (LIM1 active with lag time) first when the set point of the slave controller SP [1] falls below ≤ 39 °C.

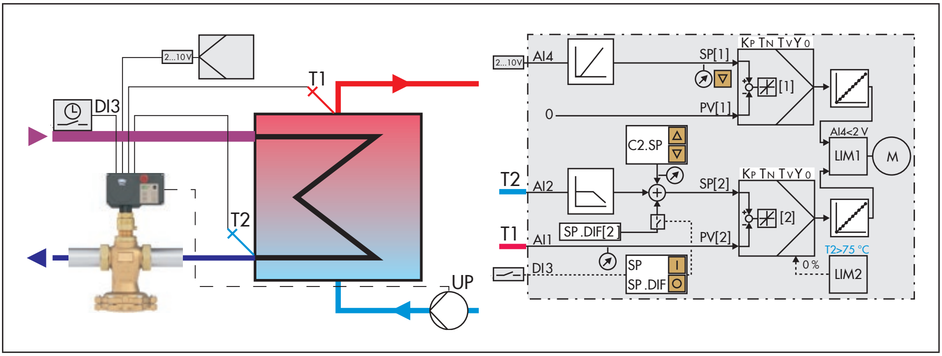
Controller presettings

Universal inputs I1 to I4		
I1 Function	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 0	None
Function I4	I4 = 0	None
Switching output		
Function	M4 = 1	On with LIM1 / Off with lag time
Lag time	M4.T = 60 s	
Control		
Control mode	M1 = 5	Cascade
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C1.2 = 7	Set point = Output of controller [2]
Set point	C1.SP = 20 °C	
Lower adjustment limit	C1.SP.MIN = 5 °C	
Upper adjustment limit	C1.SP.MAX = 40 °C	
Set point deviation function	C1.3 = 7	Set point deviation inverted
Proportional-action coefficient	C1.KP = 10.0	
Reset time	C1.TN = 90 s	
Controller [2]		
Source of actual value (process variable)	C2.1 = 2	Process variable (actual value) = AI2 after function generation
Source of set point	C2.2 = 6	Set point = C2.SP
Set point	C2.SP = 20 °C	
Lower adjustment limit	C2.SP.MIN = 0 °C	
Upper adjustment limit	C2.SP.MAX = 40 °C	
Set point deviation function	C2.3 = 7	Set point deviation inverted

Proportional-action coefficient	C2.KP = 10.0	
Reset time	C2.TN = 90 s	
Operation		
[I]/[O] keys function	A1.1 = 1	[I] Start control sequence / [O] Stop control sequence
Open loop control using [I]/[O] keys	A1.5 = 4	[I]/[O] keys

1.14 Position transmitter (2 to 10 V)/fixed set point control, heating with return flow temperature limitation when the AI4 input signal falls below 2 V and set point decrease with DI3

Recommended device version: [D]



System code number 95

In the input signal range between 2 and 10 V, the actuator acts as a position transmitter.

In this case, the analog input AI4, e.g. from a controller output, must be applied with a 2 to 10 V signal. If the voltage at AI4 falls below ≤ 2 V, the controller [2] is activated over the internal limit contact LIM1 and a fixed set point control with return flow temperature limitation is performed.

Two Pt 1000 sensors at the analog inputs AI1 and AI2 measure the flow temperature T1 in the secondary circuit and the return flow temperature T2 in the primary circuit. T1 represents the process variable PV [2] in this system. The function generation of the input signal AI2 results in the characteristic for return flow temperature limitation based on the return flow temperature T2 in the primary circuit. The set point before the comparator SP [2] is calculated by adding the temperature-based characteristic after function generation of T2 and the set point C1.SP.

Furthermore, the set point can be raised or lowered with the SP.DIF [1] and SP.DIF [2] parameters using the operating keys [I]/[O] or externally over DI3. The return flow temperature T2 is monitored to the internal limit LIM2 ≥ 75 °C. If it exceeds 75 °C, the valve is fully closed (parameter C2.YP = 0.0 %).

The integrated process controller positions the control valve (e.g. installed in the return flow pipe in the primary circuit) based on the set point and process variable. As a result, the flow temperature in the secondary circuit and the return flow temperature in the primary circuit are controlled and limited.

Additionally, the switching output L' allows a pump to be controlled.

Controller presettings

Universal inputs I1 to I4		
Function I1	I1 = 3	AI1 (Pt 1000)
Function I2	I2 = 3	AI2 (Pt 1000)
Function I3	I3 = 1	DI3 not inverted
Function I4	I4 = 1	AI4 (0 to 10 V)
Switching output		
Function	M4 = 1	On with LIM1 / Off with lag time
Lag time	M4.T = 0 s	
Control		
Control mode	M1 = 3	Controller [1] active when LIM1 = off Controller [2] active when LIM1 = on
Direction of action	M2 = 0	>> (increasing/increasing)
Controller [1]		
Source of actual value (process variable)	C1.1 = 0	Process variable (actual value) = Formula
Source of set point	C1.2 = 4	Set point = AI4 after function generation
Proportional-action coefficient	C1.KP = 1.0	
Controller [2]		
Source of actual value (process variable)	C2.1 = 1	Process variable (actual value) = AI1 after function generation
Source of set point	C2.2 = 0	Set point = C2.SP + Formula
Factor AI2	C2.f = 1.0	

Set point	C2.SP = 80 °C	
Set point offset	C2.SP.DIF = −10.0 °C	
Lower adjustment limit	C2.SP.MIN = 10 °C	
Upper adjustment limit	C2.SP.MAX = 99 °C	
Proportional-action coefficient	C2.KP = 2.0	
Reset time	C2.TN = 120 s	
Operation		
[I]/[O] keys function	A1.1 = 2	[I] Set point / [O] Set point decrease/increase
Open loop control using [I]/[O] keys	A1.5 = 3	[I]/[O] keys or DI3

2 User-defined settings

The functions and parameters are changed in the TROVIS-VIEW software.

NOTICE

The digits behind the decimal point are shown in the software and on the actuator display. The digit behind the decimal point is only shown on the actuator display for values between 0 to 9.9.

2.1 Inputs and outputs

2.1.1 Universal inputs I1 to I4

The universal inputs I1 to I4 can be configured as analog or digital inputs.

– **Digital input (floating contact)**
  The control of the digital inputs can be inverted or not inverted.
– **Analog input**
  Universal inputs I1 to I3 configured as analog inputs process the resistance values of a Pt 1000 sensor connected to the actuator. It is not necessary to calibrate the line.
  The universal input I4 configured as an analog input processes a 0 to 10 V voltage signal.
  The 'Offset AI1'/'Offset AI2'/'Offset AI3'/'Offset AI4' parameter raises or reduces the input signal of the corresponding input by a constant amount. This allows systematic correction of measuring errors. The measured value is not corrected by default.

NOTICE

Select 'None' for a universal input that is not used.

Universal input I1/Universal input I2/Universal input I3

CO/PA	Designation	Value range
I1/I2/I3	Function	0: None 1: DI1/DI2/DI3 not inverted 2: DI1/DI2/DI3 inverted 3: AI1 (Pt 1000)
AI1.COR/AI2.COR/AI3.COR*	Offset AI1/AI2/AI3	–9.9 to +9.9 °C

* Parameters are listed in [Service] folder > Start-up.

Universal input I4

CO/PA	Designation	Value range
I4	Function	0: None 1: DI4 not inverted 2: DI4 inverted 4: AI4 (0 to 10 V)
AI4.COR*	Offset AI4	–9.9 to +9.9 %

* Parameter is listed in [Service] folder > Start-up.

2.1.2 Function generation of AI1 to AI4

The function generation of an input signal causes it to be revaluated for further processing. If the correlation between the input signal and the output signal required is known (i.e. due to scientific laws, empirical data or measured data), function generation allows auxiliary, reference or equivalence variables, inherent in measurement or industrial processes, to be adapted for the control circuit or to perform a linearization. Two coordinates exist for function generation. Each coordinate is defined by an input value and an output value.

Analog input AI1/Analog input AI2/Analog input AI3

CO/PA	Designation	Value range
AI1.I1/AI2.I1/AI3.I1	Input signal, point 1	–50 to +149 °C
AI1.O1/AI2.O1/AI3.O1	Output signal, point 1	–50 to +150 °C
AI1.I2/AI2.I2/AI3.I2	Input signal, point 2	–49 to +150 °C
AI1.O2/AI2.O2/AI3.O2	Output signal, point 2	–50 to +150 °C

Analog input AI4

CO/PA	Designation	Value range
AI4.I1	Input signal, point 1	0.0 to 99.9 %
AI4.O1	Output signal, point 1	–50 to +150 °C
AI4.I2	Input signal, point 2	0.1 to 100.0 %
AI4.O2	Output signal, point 2	–50 to +150 °C

2.1.3 Switching output

Actuators in device versions [B] and [D] have a switching output that can be configured. The configuration determines after which event the signal at the switching output changes. This function is intended mainly for pump control. However, it can also be used, for example to indicate a limit violation or error.

– **On with LIM1/LIM2 / Off with lag time**
  The switching output is activated when the conditions for limit function ('Internal limit LIM1' or 'Internal limit LIM2') are met. See section 2.2.4. If this no longer applies, the switching output is deactivated after the time in 'Lag time' elapses.
– **On at travel > 0 % / Off at 0 % with lag time**
  The switching output is activated when the stem travel is greater than 0 %. If the travel reaches 0 %, the switching output is deactivated after the time in 'Lag time' elapses.
– **On at travel < 100 % / Off at 100 % with lag time**
  The switching output is activated when the stem travel is lower than 100 %. If the travel reaches 100 %, the switching output is deactivated after the time in 'Lag time' elapses.
– **Alarm active**
  The normally deactivated switching output is activated when an alarm has been generated which is indicated by the blinking E0 to E9 reading on the display.
– **Fixed actuator positioning value [1] reached/Fixed actuator positioning value [2] reached**
  The normally deactivated switching output is activated ('1' signal) as soon as the fixed positioning value of the selected controller [1] or [2] is reached or the function programmed in C1.4 (activated digital input or internal limit reached) is active. See section 2.3.5. The switching output is deactivated again as soon as the 'Fixed actuator positioning value [1] reached/Fixed actuator positioning value [2] reached' is no longer active. This function is only effective when C1.4 ≠ 0.

– **Manual mode active**
  The normally deactivated switching output is activated when the actuator is operated in manual mode.

NOTICE

The way the switching output functions can be inverted by reversing the logics ('Logic' parameter).

CO/PA	Designation	Value range
M4	Function	0: None 1: On with LIM1 / Off with lag time 2: On with LIM2 / Off with lag time 3: On at travel > 0 % / Off at 0 % with lag time 4: On at travel < 100 % / Off at 100 % with lag time 5: Alarm active 6: Fixed actuator positioning value [1] reached 7: Fixed actuator positioning value [2] reached 8: Manual mode active
M4.T	Lag time	0 to 999 s
M5	Logic	0: Not inverted 1: Inverted

2.2 Control

2.2.1 System code number

The system code numbers allow the user to preconfigure the electric actuators with process controllers in TROVIS-VIEW for a certain application. After selecting a system code number ≠ 0, the user can only change the parameters required for the selected application. See section 2.2.

All the parameters of the electric actuator with process controller can be configured as required when the system code number 0 is selected (user-defined).

CO/PA	Designation	Value range
M0	System code number	0: User-defined **Heating** 1: Heating · Fixed set point control · With one sensor · Internal set point decrease

CO/PA	Designation	Value range
M0	System code number	10: Heating · Fixed set point control · Temperature mean value calculation using two sensors · Internal set point decrease 30: Heating · Follow-up control · Return flow temperature limitation · Internal set point decrease 35: Heating · Follow-up control · Outdoor temperature controlled, return flow temperature limitation · External set point decrease with DI4 50: Heating · Override control with minimum selection · Return flow temperature limitation · Internal set point decrease 55: Heating · Override control with minimum selection · Outdoor temperature controlled, return flow temperature limitation · External set point decrease with DI4 95: Heating · Position transmitter / Fixed set point/follow-up control · 2–10 V position transmitter / 0–2 V Fixed set point/follow-up control · Return flow temperature limitation, set point decrease with DI3 **Cooling** 20: Cooling · Fixed set point control · Differential temperature between two sensors · Start/stop control sequence 21: Cooling · Fixed set point control · Temperature mean value calculation using two sensors · Start/stop control sequence 60: Cooling · Override control with minimum selection · Differential temperature with two sensors, return flow temperature limitation · Start/stop control sequence 65: Cooling · Override control with minimum selection · Differential temperature with two sensors, return flow temperature limitation · Start/stop control sequence 66: Cooling · Override control, district cooling · Minimum selection of the set point control · Start/stop control sequence with DI4 70: Heating · Cascade control · With two sensors · Internal set point switchover 80: Cooling · Cascade control · With two sensors · Start/stop control sequence

2.2.2 Control mode

The basic control structure, e.g. fixed set point/follow-up control of the integrated controllers is determined by selecting the control mode. The actuator has two integrated controllers which support the following control modes:

– **Fixed set point/follow-up control**
  Controller [1] is active for fixed set point and follow-up control.
  In fixed set point control, a constant value is determined for the set point SP [1]. See section 2.3.2 (setting C1.2 = 5/6).
  The set point SP [1] in follow-up control is not constant; it changes over time. It is either determined by one or more analog inputs or by the positioning value of controller [2]. See section 2.3.2 (setting C1.2 = 0/1/2/3/4/7).
– **Override control**
  Override control is used to control a process variable without a second process variable exceeding or falling below predefined limits. Both process variables are changed by the valve stem position and are therefore physically dependent on each other. For override control, two controllers [1] and [2] take effect by selection of a minimum and maximum value of the internal control signals. Depending on the control task, the largest or smallest control signal is applied to the valve. During minimum selection, the controller with the smallest manipulated variable takes command. Whereas during maximum selection, the controller with the largest manipulated variable takes command.
  Override control with minimum selection of the manipulated variable is used whenever a process variable is to be controlled and another process variable is to be limited to a maximum value.
  Override control with maximum selection of the manipulated variable is used whenever a process variable is to be controlled and another process variable is to be limited to a minimum value.
  After selecting the control mode, controller [1] and controller [2] are configured separately from one another.
– **Controller [1] active when LIM1 = off / Controller [2] active when LIM1 = on**
  Controller [1] switches to controller [2] or vice versa, depending on the internal temperature limit LIM1 (see section 2.2.1).

  Controller [1] active when LIM2 = off / Controller [2] active when LIM2 = on

  See (Controller [1] active when LIM1 = off / Controller [2] active when LIM1 = on)
– **Controller [1] active when DI1 = off/Controller [2] active when DI1 = on**
  Depending on the switching state of the DI1 digital input, switchover between controller [1] and controller [2] is performed.

- **Controller [1] active when DI2 = off/Controller [2] active when DI2 = on**
  See (Controller [1] active when DI1 = off/Controller [2] active when DI1 = on)
- **Controller [1] active when DI3 = off/Controller [2] active when DI3 = on**
  See (Controller [1] active when DI1 = off/Controller [2] active when DI1 = on)
- **Controller [1] active when DI4 = off/Controller [2] active when DI4 = on**
  See (Controller [1] active when DI1 = off/Controller [2] active when DI1 = on)
- **Cascade control**
  In the cascade control, the output of the master controller (controller [2]) is the set point of the slave controller (controller [1]). The C1.SP.MAX and C1.SP.MIN parameters limit the range of the master signal (C1.SP.MIN corresponds to 0 % of Y [2]; C1.SP.MAX corresponds to 100 % of Y [2]).
  After selecting the control mode, controller [1] and controller [2] are configured separately from one another. To parameterize the slave controller (controller [1]), the cascade must be opened. In this case, the set point C1.SP must be assigned to the slave controller instead of the output of controller [2]. The output of controller [1] acts on the actuator. As a result, the position of the actuator stem is controlled.

CO/PA	Designation	Value range
M1	Control mode	0: Fixed set point/follow-up 1: Override (MIN selection) 2: Override (MAX selection) 3: Controller [1] active when LIM1 = off / Controller [2] active when LIM1 = on 4: Controller [1] active when LIM2 = off / Controller [2] active when LIM2 = on 5: Controller [1] active when DI1 = off / Controller [2] active when DI1 = on 6: Controller [1] active when DI2 = off / Controller [2] active when DI2 = on 7: Controller [1] active when DI3 = off / Controller [2] active when DI3 = on 8: Controller [1] active when DI4 = off / Controller [2] active when DI4 = on 9: Cascade
C1.SP.MIN, C1.SP.MAX		See section 2.3.2

2.2.3 Operating direction

The operating direction of the actuator can be changed with this setting.

Increasing/increasing

- Actual value < Set point: actuator stem retracts
- Actual value > Set point: actuator stem extends

Increasing/decreasing

- Actual value < Set point: actuator stem extends
- Actual value > Set point: actuator stem retracts

Actuator stem extended

- With globe valves: Valve closed
- With three-way mixing valves: Port A -> AB open, B -> AB closed (see Fig. 1)
- With three-way diverting valves: Port AB -> A closed, AB -> B open

Actuator stem retracted

With globe valves: Valve open
With three-way mixing valves: Port A -> AB closed, B -> AB open (see Fig. 1)
With three-way diverting valves: Port AB -> A open, AB -> B closed

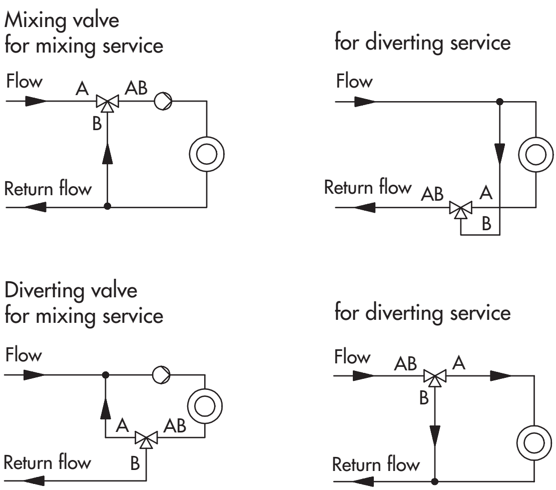


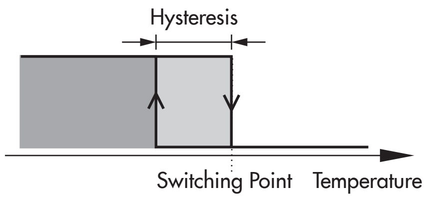
Fig. 1: *Flow of media in three-way mixing and diverting valves*

CA/PA	Designation	Value range
M2	Direction of action	0: >> (increasing/increasing) 1: <> (increasing/decreasing)

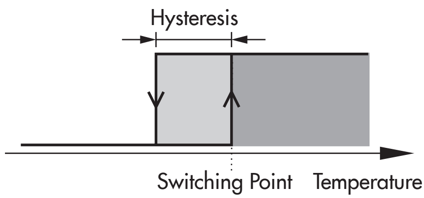
2.2.4 Internal limits LIM1 and LIM2

A wide range of measured values, process variables or set points can be assigned as the temperature limit (LIM1.S). The LIM1.F parameter allows you to determine whether the limit takes effect when the temperature falls below or exceeds the switching point.

The setting 'Source (signal) ≤ LIM1/LIM2' causes the LIM1/LIM2 limit function to be deactivated again when the temperature has reached the value 'Switching point' + 'Hysteresis'.



The setting 'Source (signal) ≥ LIM1/LIM2' causes the LIM1/LIM2 limit function to be deactivated again when the temperature has reached the value 'Switching point' – 'Hysteresis'.



When LIM1 = 0, the internal limit has no function.

CO/PA	Designation	Value range
LIM1.S LIM2.S	Internal limit LIM1 Internal limit LIM2 Source	1: Measured value AI1 2: Measured value AI1 after function generation 3: Measured value AI2 4: Measured value AI2 after function generation 5: Measured value AI3 6: Measured value AI3 after function generation 7: Measured value AI4 8: Measured value AI4 after function generation 9: Actual value [1] before comparator 10: Set point [1] before comparator 11: Set point deviation [1] before comparator 12: Actual value [2] before comparator 13: Set point [2] before comparator 14: Set point deviation [2] before comparator 15: Set point from program controller
LIM1.F LIM2.F	Internal limit LIM1 Internal limit LIM2 Function	0: None 1: Source (signal) ≤ LIM1/LIM2 2: Source (signal) ≥ LIM1/LIM2
LIM1.P LIM2.P	Internal limit LIM1 Internal limit LIM2 Switching point	–50 to +150 °C –50 to +150 °C
LIM1.H LIM2.H	Internal limit LIM1 Internal limit LIM2 Hysteresis	0.5 to 10.0 °C 0.5 to 10.0 °C

2.3 Controller [1]

2.3.1 Actual value (process variable)

The input signal of single analog input on which a function generation has been performed or a combination of input signals from various analog inputs (using a formula to link them) can be assigned to controller [1] as the source.

To perform complex control tasks, the actual value can be calculated with or without weighting taking the analog inputs into account by calculating their sum, difference or mean value.

CA/PA	Designation	Value range
C1.1	Source	0: Actual value = $\frac{C1.a * AI1 + C1.b * AI2 + C1.c * AI3 + C1.d * AI4}{C1.z}$ 1: Process variable (actual value) = AI1 after function generation 2: Process variable (actual value) = AI2 after function generation 3: Process variable (actual value) = AI3 after function generation 4: Process variable (actual value) = AI4 after function generation
C1.a	Factor AI1	–9.0 to +99.0
C1.b	Factor AI2	–9.0 to +99.0
C1.c	Factor AI3	–9.0 to +99.0
C1.d	Factor AI4	–9.0 to +99.0
C1.z	Divisor	1.0 to 99.0

2.3.2 Adjusting the set point

The set point may be an input value after function generation, a fixed value, the positioning value of controller [2] or a value from the program controller. The set point can also be achieved by calculating the sum or difference of a fixed set point and the input values at the analog inputs. The difference or sum calculation is also possible in combination with the program controller.

The set point can be raised or lowered by a constant amount using the 'Set point offset' parameter. This function, for example, can be used for day/night set-back.
If the set point is above or under the adjusted limits, the effective set point is limited to the maximum or minimum value.

CA/PA	Designation	Value range
C1.2	Source	0: Set point = C1.SP + C1.e * AI1 + C1.f * AI2 + C1.g * AI3 + C1.h * AI4 1: Set point = AI1 after function generation

CA/PA	Designation	Value range
	A different rule applies to controller [2] for C2.2 = 7: Set point = C1.SP + C2.e *AI1 + C2.f * AI2 + C2.g * AI3 + C2.h * AI4	2: Set point = AI2 after function generation 3: Set point = AI3 after function generation 4: Set point = AI4 after function generation 5: Set point = C1.SP 6: Set point = C2.SP 7: Set point = Output of controller [2] 8: Set point = Program controller 9: Set point = Program controller (C1.SP + C1.e * AI1 + C1.f * AI2 + C1.g * AI3 + C1.h * AI4)
C1.SP	Set point	–50.0 to +150.0 °C
C1.SP.DIF	Set point offset	–50.0 to +150.0 °C
C1.SP.MIN	Lower adjustment limit	–50 to +150 °C
C1.SP.MAX	Upper adjustment limit	–50 to +150 °C
C1.e	Factor AI1	–9.0 to +99.0
C1.f	Factor AI2	–9.0 to +99.0
C1.g	Factor AI2	–9.0 to +99.0
C1.h	Factor AI2	–9.0 to +99.0

Program controller

The program controller allows you to define the set point over time (max. 1 week = 10080 min). To do this, eleven pairs of values (set point and time) need to be entered. Additionally, it is possible to define the behavior after the program has run.

CA/PA	Designation	Value range
A0.1	Behavior when program has elapsed	1: Control active, last set point is retained 2: Control active, program is repeated cyclically 3: Control inactive, actuator positioning value is 0 % 4: Control inactive, actuator positioning value is 100 %

2.3.3 Set point deviation

The set point deviation can be inverted by one of the four digital inputs or by an internal limit.

- **Inverted by DI1/DI2/DI3/DI4**
  The set point deviation is inverted when the digital input is closed ('1' signal).
- **Inverted by LIM1/LIM2**

The set point deviation is inverted when the internal temperature limit is reached (see section 2.2.1).

CA/PA	Designation	Value range	
C1.3	Set point deviation function	0:	Not inverted
		1:	Inverted by DI1
		2:	Inverted by DI2
		3:	Inverted by DI3
		4:	Inverted by DI4
		5:	Inverted by LIM1
		6:	Inverted by LIM2
		7	Inverted

❗ *NOTICE*

The set point deviation can be also be reversed using the C1.2 function.

2.3.4 PID controller

The control algorithm can be set over the control parameters 'Proportional-action coefficient', 'Reset time', 'Derivative-action time' and 'Operating point'. The actuator is set by default to act with PI action (C1.TV = 0 s).

- **Proportional-action coefficient C1.KP**
  The proportional-action coefficient acts on the P, I and D terms. Increasing the proportional-action coefficient makes the output amplitude increase in a P controller. The proportional-action coefficient C1.KP is based on the measuring span of 100 °C. For example, a set point deviation of 5 °C and a proportional-action coefficient of 2 results in a travel of 10 %.
- **Reset time C1.TN**
  The reset time is the parameter of the I term. The reset time is the time it takes for the integral term during a step response in a PI controller to produce the same change in output as the P term. Increasing the reset time causes a reduction in the rate of change in the output when the error is constant.
- **Derivative-action time C1.TV**
  The derivative-action time is the parameter of the D term. The derivative-action time is the time it takes the rise response of a PD controller to reach a certain output earlier than it

would with just its P term. Increasing the derivative-action time causes an increase in output amplitude when the error rate of change is constant. After ramped error changes, a larger derivative-action time causes the D term to continue to have a longer effect.

– **Operating point C1.Y0**
  The operating point of the P or PD controller determines the positioning value, which is fed to the controlled system when the process variable is the same as the set point. The operating point is normally only important for P and PD controllers, but it can also be set for control strategies PI, PID and I due to the possible limitation of the integral-action component. For control strategies with integral-action component, the operating point can also be used as the initial value for a restart.

CA/PA	Designation	Value range
C1.KP	Proportional-action coefficient	0.1 to 999.9
C1.TN	Reset time	0 to 999 s
C1.TV	Derivative-action time	0 to 999 s
C1.Y0	Operating point	0.0 to 100.0 %

2.3.5 Manipulated variable

The manipulated variable determined in closed-loop operation can be deactivated by one of the four digital inputs or depending on an internal limit. In this case, the actuator issues a fixed positioning value.

– **Fixed actuator positioning value with DI1/DI2/DI3/DI4**
  The actuator moves the stem to the position defined in C1.YP when the digital input is closed ('1' signal).
– **Fixed actuator positioning value with LIM1/LIM2**
  The actuator moves the stem to the position defined in C1.YP when the internal temperature limit is reached (see section 2.2.1).

CA/PA	Designation	Value range	
C1.4	Manipulated variable function	0:	Controller positioning value
		1:	Fixed actuator positioning value with DI1
		2:	Fixed actuator positioning value with DI2
		3:	Fixed actuator positioning value with DI3
		4:	Fixed actuator positioning value with DI4
		5:	Fixed actuator positioning value with LIM1

CA/PA	Designation	Value range
		6: Fixed actuator positioning value with LIM2
C1.YP	Fixed actuator positioning value	0.0 to 100.0 %

2.4 Controller [2]

The functions of controller [2] are mainly the same as the functions of controller [1] (see section 2.3).
Merely the parameter setting C1.2 = 7 is not the same as for controller [1]. In this case, a different rule applies compared to section 2.3.2: Set point = C1.SP + C2.e * AI1 + C2.f * AI2 + C2.g * AI3 + C2.h * AI3

2.5 Actuator functions

2.5.1 Actuator parameters

End position guiding

The actuator stem moves to the end positions early if the end position guiding function is active:

– **End position guiding (stem extends)**
  If the set point reaches the value entered in 'End position guiding (stem extends)', the actuator stem moves to the lower end position after the time entered in 'Idle time during end position guiding' has elapsed.
– **End position guiding (stem retracts)**
  If the set point reaches the value entered in 'End position guiding (stem retracts)', the actuator stem moves to the top end position after the time entered in 'Idle time during end position guiding' has elapsed.

❗ NOTICE

When 'End position guiding (stem extends)' = 0.0 % and 'End position guiding (stem retracts)' = 100.0 %, the end positioning guiding function is deactivated.

CA/PA	Designation	Value range
MY.EA	End position guiding (stem extends)	0.0 to 100.0 %
MY.EE	End position guiding (stem retracts)	0.0 to 100.0 %
MY.TE	Idle time during end position guiding	0 to 99 s

Dead band (switching range)

The dead band determines how sensitive the actuator reacts. A change in the positioning value by the adjusted value first causes a minimally small change in the stem position.

CA/PA	Designation	Value range
MY.TZ	Dead band (switching range)	0.5 to 5.0 %

2.5.2 Behavior in the event of a signal failure

The actuator monitors the signals at the analog inputs AI1 to AI3 during closed-loop operation. The action to be performed by the actuator in the event of signal failure can be defined:

– **Last travel value**
  The actuator keeps the valve at the last positioning value as long as the signal failure exists.
– **Fixed positioning value**
  The actuator moves the valve to the fixed positioning value A7.YP.ERR as long as the signal failure exists.

CA/PA	Designation	Value range
A7.1	Signal failure	0: Last travel value 1: Fixed positioning value
A7.YP.ERR	Fixed positioning value	0.0 to 100.0 %

2.5.3 Zero calibration

This function determines the end position (stem retracted or stem extended) for zero calibration.

NOTICE

The zero calibration starts automatically after the electric actuator starts or restarts. It is started manually with the TROVIS-VIEW software. Open the [Service] folder and select [Functions]. Click on 'Start zero calibration' parameter and execute the command.

CA/PA	Designation	Value range
A8.1	Zero calibration	0: Extend actuator stem 1: Retract actuator stem

2.5.4 Restart condition

After a power supply failure, the controller starts according to the restart condition.

CA/PA	Designation	Value range
A8.2	Restart conditions	0: Start with last operating state 1: Start with operating function [O] 2: Start with operating function [I]

2.5.5 Blocking protection

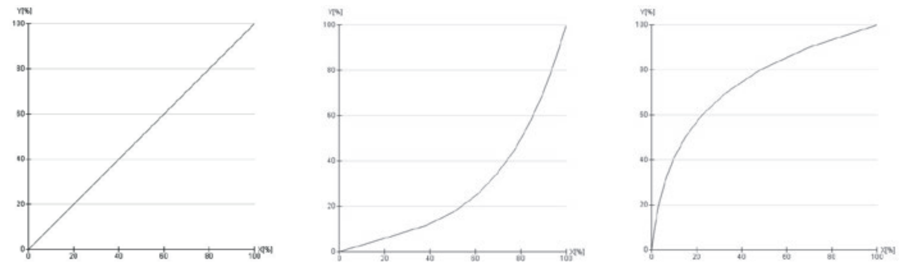
The blocking protection prevents the valve from seizing up. If the actuator stem is in the closed position (0 %), it is extended slightly and then moved back to the closed position by up to 2 mm 24 hours after it last moved.

CA/PA	Designation	Value range
A8.3	Blocking protection	0: No 1: Yes

2.5.6 Positioning value characteristic

The characteristic expresses the relation between the positioning value and the actuator travel. It can be adjusted to be linear or user-defined.

- **Linear**
  The travel is proportional to the positioning value.
- **Equal percentage**
  The travel is exponential to the positioning value.
- **Reverse equal percentage**
  The travel is reverse exponential to the positioning value.



Linear | Equal percentage | Reverse equal percentage

Fig. 2: *Characteristics*

– **User-defined**
  A new characteristic based on the last characteristic used can be defined over eleven points.

CA/PA	Designation	Value range	
M6	Characteristic type	0:	Linear
		1:	Equal percentage
		2:	Reverse equal percentage
		3:	User-defined

#	1	2	3	4	5	6	7	8	9	10	11
X	0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
Y	0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0

2.6 Operation

2.6.1 [I]/[O] settings

Various functions can be assigned to the [I] and [O] keys as well as the individual digital inputs separately or in combination with one of the four digital inputs:

– **[I] Start control sequence / [O] Stop control sequence**

[I] Start closed-loop operation. Readings: 'on' while start-up is being performed. Afterwards, the value resulting from the A3.1 function (see section 2.7.1).	[O] End closed-loop operation. Readings: '-' blinks in alternating sequence on the left and right while the lag time is running '--' while closed-loop operation is interrupted
The duration of start-up is set in the A1.T.ON parameter. During start-up, the actuator stem moves to the defined positioning value A1.YP.ON.	The lag time is set in the A1.T.OFF parameter. While the lag time is running, the actuator stem moves to the defined positioning value A1.YP.OFF.
The parameter settings can be changed in TROVIS-VIEW.	

– **[I] Set point / [O] Set point increase/decrease**

[I] Control to set point	[O] Increase/decrease set point. The level of the set point increase/decrease is set in the C1.SP.DIF or C2.SP.DIF parameter. See section 2.3.2.

– **[I] External set point / [O] Internal set point**

[I] Activate external set point.	[O] Activate internal set point.

– **[I] Start/halt program controller / [O] Cancel program controller**

[I] Start and stop program controller. Restarting the stopped program controller (see section 2.3.2) causes the program to continue running.	[O] Cancel program controller. Restarting the stopped program controller (see section 2.3.2) after it has been canceled causes the program to start from the beginning.

CA/PA	Designation	Value range
A1.1	[I]/[O] keys function	0: No function 1: [I] Start control sequence / [O] Stop control sequence 2: [I] Set point / [O] Set point increase/decrease 3: [I] External set point / [O] Internal set point 4: [I] Start/halt program controller / [O] Cancel program controller
A1.5	Open loop control	0: [I]/[O] keys 1: [I]/[O] keys or DI1 2: [I]/[O] keys or DI2 3: [I]/[O] keys or DI3 4: [I]/[O] keys or DI4 5: DI1 6: DI2 7: DI3 8: DI4
A1.T.ON	Start-up time after start	0 to 999 s
A1.YP.ON	Positioning value during start-up function	0.0 to 100.0 %
A1.T.OFF	Lag time after stop	0 to 999 s
A1.YP.OFF	Positioning value after lag time	0.0 to 100.0 %

! NOTICE

The setting A1.1 = 2 or 3 and A1.5 = 1, 2, 3 or 4 allows the operating function to be controlled by the digital input and over the [I]/[O] keys (automatic level, 'Au' reading in the display). Changing to the functional level ('Fu' reading) is performed only using the [I]/[O] keys.
Press the [I] or [O] key once to change from the automatic to the function level. To change from the function to the automatic level, keep the [O] key pressed for three seconds.

2.7 [Up]/[Down] settings

[Up] key function

Press the △ key to display and/or adjust the set points depending on the configuration.

– **Displaying and adjusting set point C1.SP/C2.SP:**

  △ Set point reading

  △ Start set point adjustment.

  △/▽ Raise/lower set point.

  After five seconds the reading changes back to the reading determined in A3.1. See section 2.7.1. The actuator uses the newly adjusted set point for closed-loop control.
  If '==' is selected instead of the value, the set point limit is reached. In this case, the set point adjustment is canceled without changing the set point.
  Canceling set point adjustment
  △ or ▽ until '==' appears.
  After five seconds the reading changes back to the reading determined in A3.1 without a change in the set point. See section 2.7.1.

– **Displaying set point C1.SP/C2.SP/before comparator of controller [1]/before comparator of controller [2]:**

  Keep △ pressed down to show set point reading.

CA/PA	Designation	Value range
A2.1	[Up] key function	1: Display and adjust set point C1.SP 2: Display and adjust set point C2.SP 3: Display set point C1.SP 4: Display set point C2.SP 5: Display set point before comparator of controller [1] 6: Display set point before comparator of controller [2]

[Down] key function

Press the ▽ key to display the measured value, process variable (actual value), set point or set point deviation depending on the configuration.

Keep ▽ pressed down to show reading.

CA/PA	Designation	Value range
A2.2	[Down] key function	1: Display measured value AI1
		2: Display measured value AI1 after function generation
		3: Display measured value AI2
		4: Display measured value AI2 after function generation
		5: Display measured value AI3
		6: Display measured value AI3 after function generation
		7: Display measured value AI4
		8: Display measured value AI4 after function generation
		9: Display actual value before comparator of controller [1]
		10: Display set point before comparator of controller [1]
		11: Display set point deviation of controller [1]
		12: Display actual value before comparator of controller [2]
		13: Display set point before comparator of controller [2]
		14: Display set point deviation of controller [2]
		15: Set point from program controller

2.7.1 Display

The process variable (actual value) before the comparator of controller [1] or process variable (actual value) before the comparator of controller [2] can be displayed depending on the configuration.

CA/PA	Designation	Value range
A3.1	Function	1: Actual value before comparator of controller [1]
		2: Actual value before comparator of controller [2]

3 Additional readings and functions in the TROVIS-VIEW software

3.1 Operating values

The actual value is shown on the display in °C during closed-loop operation.

Other operating values, such as information on the inputs, actual value, set point or set point deviation, can be read in TROVIS-VIEW.

3.2 Service

Functions

The following actions/tests can be performed using the executable parameters of the [Functions] folder:

- Start initialization
- Start zero calibration
- Perform reset
- Loading default settings
- Display and key test
- Find device
- Start transit time measurement
- Activate the long-term test

Manual level

The actuator goes to the manual level.

In the hand level, the actuator can be moved by entering values in TROVIS-VIEW.

Status messages

The [Status messages] folder contains information on operation (operating hours, temperature inside device etc.) as well as on the actuator and valve travel.

Statistics

The [Statistics] folder contains a list on how many times device malfunctions, errors, actions, key activation and executed functions have taken place.

3.3 Default setting

! *NOTICE*

Malfunction due to a configuration that does not meet the requirements of the application!
After loading the default settings, the actuator is configured for the application Fixed set point control for heating with one sensor.
Adapt configuration items and parameters to the application after a reset to default settings.

4 Modbus list

The firmware version 2.1x of TROVIS 5724-8 and TROVIS 5725-8 Electric Actuators with Process Controllers have an integrated RS-485 interface to use the Modbus-RTU protocol, which is a master/slave protocol (in which the control station acts as the master and the electric actuator as the slave).

The following Modbus functions are supported:

Code	Modbus function	Application
1	Read Coils	Read state of several digital outputs in bit format
3	Read Holding Registers	Read several parameters
5	Write Single Coil	Write a single digital output in bit format
6	Write Single Register	Write a value into a single holding register
15	Write Multiple Coils	Write several digital outputs in bit format
16	Write Multiple Registers	Write a value into several holding registers

The electric actuator can issue the following Modbus error responses:

Error code	Error	Cause
1	Illegal function	The function code is not supported.
2	Illegal data address	A register address is invalid or write-protected.
3	Illegal data value	A value contained in the data is not allowed or not plausible.
4	Slave device failure	An unrecoverable error occurred during an action.
6	Slave device busy	The slave is busy and cannot accept the query.

Several important data points from the Modbus data point list are listed below. The entire data point list is available on request.

❗ NOTICE

Data are saved in a non-volatile EEPROM. This type of memory has a limited life of at least 100,000 write operations per memory address. It is almost impossible to exceed this limitation if configurations and data are only changed manually using TROVIS-VIEW or the keys on the device. If parameters are changed automatically (e.g. by Modbus communication), make sure to observe the maximum number of write operations and take appropriate action to prevent that parameters are written too frequently.

HR	Designation	Access	Transmission range		Indicating range	
			Start	End	Start	End
Device ID data						
1	Device type	R	5724	5725	5724	5725
2	Version	R	8	8	8	8
3	Revision (e.g. rev. 2.00)	R	100	9999	1.00	99.99
4	Serial number, part 1 (four high-order digits)	R	0	9999	0	9999
5	Serial number, part 2 (four low-order digits)	R	0	9999	0	9999
6	Firmware version	R	100	9999	1.00	99.99
7	Released firmware version	R	100	9999	1.00	99.99
8	Station address (release "W" via CL 008)	R	0	255	0	255
Control function						
9	System code number M0	R	0	99	0	99
10	Control mode M1	R/W	0	9	0	9
11	Direction of action M2	R/W	0	1	0	1
Operating values (analog inputs)						
12	Measured value (analog input I1)	R	–500	1500	–50.0	150.0
13	Analog input I1 after function generation	R	–500	1500	–50.0	150.0
14	Measured value (analog input I2)	R	–500	1500	–50.0	150.0
15	Analog input I2 after function generation	R	–500	1500	–50.0	150.0
16	Measured value (analog input I3)	R	–500	1500	–50.0	150.0
17	Analog input I3 after function generation	R	–500	1500	–50.0	150.0
18	Measured value (analog input I4)	R	0	1000	0.0	100.0
19	Analog input I4 after function generation	R	–500	1500	–50.0	150.0
Operating values (analog inputs)						
20	Source of positioning value (controller [...])	R	0	9	0	9
21	YP Actuator positioning value	R	0	1000	0.0	100.0
22	AT Calculated actuator travel	R	0	1000	0.0	100.0
23	Travel status	R	0	4	0	4
24	Set point deviation of positioning value	R	0	1000	0.0	100.0
Manual level						
25	Manual positioning value (external)	R/W	0	1000	0.0	100.0

HR	Designation	Access	Transmission range		Indicating range	
			Start	End	Start	End
26	Set point deviation of the external manual level	R	0	1000	0.0	100.0
Operating values (operating function)						
27	Operating function status	R	0	11	0	11
28	Operating function cause	R	0	3	0	3
29	Program controller set point	R	–500	1500	–50.0	150.0
30	Program controller time elapsed	R	0	10080	0	10080
31	Reserved (time elapsed for start function)	R	0	65535	0	65535
32	Reserved (time elapsed for end function)	R	0	65535	0	65535
33	Reserved (time elapsed for switching output)	R	0	65535	0	65535
Operating values and settings of controller [1]						
34	Actual value before comparator of controller [1] (PV[1])	R	–500	1500	–50.0	150.0
35	Set point before comparator of controller [1] (SP[1])	R	–500	1500	–50.0	150.0
36	Set point deviation of controller [1] (SP[1] – PV[1])	R	–9999	9999	–999.9	999.9
37	Positioning value of controller [1] before characteristic Y[1]	R	0	1000	0.0	100.0
38	Positioning value of controller [1] after characteristic YP[1]	R	0	1000	0.0	100.0
39	Set point deviation of controller [1]	R	0	1	0	1
40	Active controller set point [1]	R	0	9	0	9
41	Set point C1.SP	R/W	–500	1500	–50.0	150.0
42	Reserved	R	0	65535	0	65535
43	Reserved	R	0	65535	0	65535
44	Reserved	R	0	65535	0	65535
45	Reserved	R	0	65535	0	65535
Operating values and settings of controller [2]						
46	Actual value before comparator of controller [2] (PV[2])	R	–500	1500	–50.0	150.0
47	Set point before comparator of controller [2] (SP[2])	R	–500	1500	–50.0	150.0

HR	Designation	Access	Transmission range		Indicating range	
			Start	End	Start	End
48	Set point deviation of controller [2] (SP[2] – PV[2])	R	–9999	9999	–999.9	999.9
49	Positioning value of controller [2] before characteristic Y[2]	R	0	1000	0.0	100.0
50	Positioning value of controller [2] after characteristic YP[2]	R	0	1000	0.0	100.0
51	Set point deviation of controller [2]	R	0	1	0	1
52	Active controller set point [2]	R	0	9	0	9
53	Set point C2.SP	R/W	–500	1500	–50.0	150.0
54	Reserved	R	0	65535	0	65535
55	Reserved	R	0	65535	0	65535
56	Reserved	R	0	65535	0	65535
57	Reserved	R	0	65535	0	65535
Universal input I1						
100	Function of universal input I1	R/W	0	3	0	3
Function generation AI1						
101	Input signal AI1, point 1 (AI1.I1)	R/W	–500	1500	–50.0	150.0
102	Output signal AI1, point 1 (AI1.O1)	R/W	–500	1500	–50.0	150.0
103	Input signal AI1, point 2 (AI1.I2)	R/W	–500	1500	–50.0	150.0
104	Output signal AI1, point 2 (AI1.O2)	R/W	–500	1500	–50.0	150.0
Universal input I2						
105	Function of universal input I2	R/W	0	3	0	3
Function generation AI2						
106	Input signal AI2, point 1 (AI2.I1)	R/W	–500	1500	–50.0	150.0
107	Output signal AI2, point 1 (AI2.O1)	R/W	–500	1500	–50.0	150.0
108	Input signal AI2, point 2 (AI2.I2)	R/W	–500	1500	–50.0	150.0
109	Output signal AI2, point 2 (AI2.O2)	R/W	–500	1500	–50.0	150.0
Universal input I3						
110	Function of universal input I3	R/W	0	3	0	3

HR	Designation	Access	Transmission range		Indicating range	
			Start	End	Start	End
Function generation AI3						
111	Input signal AI3, point 1 (AI3.I1)	R/W	–500	1500	–50.0	150.0
112	Output signal AI3, point 1 (AI3.O1)	R/W	–500	1500	–50.0	150.0
113	Input signal AI3, point 2 (AI3.I2)	R/W	–500	1500	–50.0	150.0
114	Output signal AI3, point 2 (AI3.O2)	R/W	–500	1500	–50.0	150.0
Universal input I4						
115	Function of universal input I4	R/W	0	4	0	4
Function generation AI4						
116	Input signal AI4, point 1 (AI4.I1)	R/W	0	1000	0.0	100.0
117	Output signal AI4, point 1 (AI4.O1)	R/W	–500	1500	–50.0	150.0
118	Input signal AI4, point 2 (AI4.I2)	R/W	0	1000	0.0	100.0
119	Output signal AI4, point 2 (AI4.O2)	R/W	–500	1500	–50.0	150.0
Switching output						
120	Function of switching output M4	R/W	0	8	0	8
121	Lag time of switching output M4.T	R/W	0	999	0	999
122	Logic of switching output M5	R/W	0	1	0	1
Control function						
123	System code number M0	R	0	99	0	99
124	Control mode M1	R/W	0	9	0	9
125	Direction of action M2	R/W	0	1	0	1
Internal limit LIM1						
126	Source of internal limit LIM1.S	R/W	1	15	1	15
127	Function of internal limit LIM1.F	R/W	0	2	0	2
128	Switching point LIM1.P	R/W	–50	150	–50	150
129	Hysteresis LIM1.H	R/W	5	100	0.5	10.0
Internal limit LIM2						
130	Source of internal limit LIM2.S	R/W	1	15	1	15
131	Function of internal limit LIM2.F	R/W	0	2	0	2
132	Switching point LIM2.P	R/W	–50	150	–50	150
133	Hysteresis LIM2.H	R/W	5	100	0.5	10.0

HR	Designation	Access	Transmission range		Indicating range	
			Start	End	Start	End
Program controller						
134	Behavior when program has elapsed A0.1	R/W	0	5	0	5
Actuator configuration						
135	End position guiding (stem extends)	R/W	0	499	0	49
136	End position guiding (stem retracts)	R/W	500	1000	50	100
137	Idle time during end position guiding	R/W	0	99	0	99
138	Rated travel in mm	R	0	999	0.0	99.9
139	Transit time in s	R	0	999	0	99.9
140	Dead band (switching range)	R/W	5	50	0.5	5.0
141	Signal failure function A7.1	R/W	0	1	0	1
142	Fixed actuator positioning value A7.YP.ERR	R/W	0	1000	0.0	100.0
143	Zero calibration A8.1	R/W	0	1	0	1
144	Restart conditions A8.2	R/W	0	2	0	2
145	Blocking protection A8.3	R/W	0	1	0	1
146	Characteristic type M6	R/W	0	3	0	3
Settings of operating function						
147	Function A1.1	R/W	0	4	0	4
148	Trigger A1.5	R/W	0	8	0	8
149	Start-up time after start	R/W	0	999	0	999
150	Fixed actuator positioning value A1.YP.ON	R/W	0	1000	0.0	100.0
151	Lag time after stop A1.T.OFF	R/W	0	999	0	999
152	Fixed actuator positioning value A1.YP.OFF	R/W	0	1000	0.0	100.0
153	[Up] key function A2.1	R/W	1	6	1	6
154	[Down] key function A2.2	R/W	1	15	1	15
155	Display function [XX] A3.1	R/W	1	2	1	2
Configuration of controller [1]						
156	Source of actual value (process variable) C1.1	R/W	0	4	0	4
157	Formula parameter C1.a	R/W	–90	990	–9.0	99.0
158	Formula parameter C1.b	R/W	–90	990	–9.0	99.0
159	Formula parameter C1.c	R/W	–90	990	–9.0	99.0

HR	Designation	Access	Transmission range		Indicating range	
			Start	End	Start	End
160	Formula parameter C1.d	R/W	–90	990	–9.0	99.0
161	Formula parameter C1.z	R/W	10	990	1.0	99.0
162	Source of set point (reference variable) C1.2	R/W	0	9	0	9
163	Set point C1.SP	R/W	–500	1500	–50.0	150.0
164	Set point offset C1.SP.DIF	R/W	–500	1500	–50.0	150.0
165	Lower adjustment limit C1.SP.MIN	R/W	–500	1500	–50.0	150.0
166	Upper adjustment limit C1.SP.MAX	R/W	–500	1500	–50.0	150.0
167	Formula parameter C1.e	R/W	–90	990	–9.0	99.0
168	Formula parameter C1.f	R/W	–90	990	–9.0	99.0
169	Formula parameter C1.g	R/W	–90	990	–9.0	99.0
170	Formula parameter C1.h	R/W	–90	990	–9.0	99.0
171	Set point deviation function C1.3	R/W	0	7	0	7
172	Control parameter of controller [1] C1.KP	R/W	1	9999	0.1	999.9
173	Control parameter of controller [1] C1.TN	R/W	0	999	0	999
174	Control parameter of controller [1] C1.TV	R/W	0	999	0	999
175	Control parameter of controller [1] C1.Y0	R/W	0	1000	0.0	100.0
176	Positioning value function C1.4	R/W	0	6	0	6
177	Fixed positioning value C1.YP	R/W	0	1000	0	100.0
Configuration of controller [2]						
178	Source of actual value (process variable) C2.1	R/W	0	4	0	4
179	Formula parameter C2.a	R/W	–90	990	–9.0	99.0
180	Formula parameter C2.b	R/W	–90	990	–9.0	99.0
181	Formula parameter C2.c	R/W	–90	990	–9.0	99.0
182	Formula parameter C2.d	R/W	–90	990	–9.0	99.0
183	Formula parameter C2.z	R/W	10	990	1.0	99.0
184	Source of set point (reference variable) C2.2	R/W	0	9	0	9
185	Set point C2.SP	R/W	–500	1500	–50.0	150.0
186	Set point offset C2.SP.DIF	R/W	–500	1500	–50.0	150.0
187	Lower adjustment limit C2.SP.MIN	R/W	–500	1500	–50.0	150.0
188	Upper adjustment limit C2.SP.MAX	R/W	–500	1500	–50.0	150.0

HR	Designation	Access	Transmission range		Indicating range	
			Start	End	Start	End
189	Formula parameter C2.e	R/W	–90	990	–9.0	99.0
190	Formula parameter C2.f	R/W	–90	990	–9.0	99.0
191	Formula parameter C2.g	R/W	–90	990	–9.0	99.0
192	Formula parameter C2.h	R/W	–90	990	–9.0	99.0
193	Set point deviation function C2.3	R/W	0	7	0	7
194	Control parameter of controller [2] C2.KP	R/W	1	9999	0.1	999.9
195	Control parameter of controller [2] C2.TN	R/W	0	999	0	999
196	Control parameter of controller [2] C2.TV	R/W	0	999	0	999
197	Control parameter of controller [2] C2.Y0	R/W	0	1000	0.0	100.0
198	Positioning value function C2.4	R/W	0	6	0	6
199	Fixed positioning value C2.YP	R/W	0	1000	0.0	100.0

Class	Designation COILS (1-bit)	Access	Status 0	Status 1
Operating states				
1	Error during operation	R	No	Yes
2	Internal manual level on the actuator activated	R	No	Yes
3	Enable external manual level (travel adjustment)	R/W	No	Yes
Digital inputs				
4	State of digital input 1	R	Off	On
5	State of digital input 2	R	Off	On
6	State of digital input 3	R	Off	On
7	State of digital input 4	R	Off	On
Limits				
8	State of internal limit 1	R	Off	On
9	State of internal limit 2	R	Off	On
Limit switches				
10	State of limit switch "stem retracted"	R	Off	On
11	State of limit switch "stem extended"	R	Off	On

Class	Designation COILS (1-bit)	Access	Status 0	Status 1
Switching output				
12	Logical state of switching output	R	Off	On
13	Switching contact of switching output	R	Off	On
14	Enable manual level for switching output	R/W	Off	On
15	Logical state (manual level for switching output)	R/W	Off	On
Fatal errors				
16	Signal failure at analog input 1	R	No	Yes
17	Signal failure at analog input 2	R	No	Yes
18	Signal failure at analog input 3	R	No	Yes
19	Both limit switches active	R	No	Yes
20	Canceled while retracting stem	R	No	Yes
21	Canceled while extending stem	R	No	Yes
22	Excessive temperature inside the actuator	R	No	Yes
23	No initialization performed	R	No	Yes
EEPROM errors				
24	EE-Error basic settings state	R	No	Yes
25	EE-Error basic settings cause	R	No	Yes
26	EE-Error configuration state	R	No	Yes
27	EE-Error configuration cause	R	No	Yes
28	EE-Error offset state	R	No	Yes
29	EE-Error offset cause	R	No	Yes
30	EE-Error calibration state	R	No	Yes
31	EE-Error calibration cause	R	No	Yes
32	EE-Error serial number state	R	No	Yes
33	EE-Error serial number cause	R	No	Yes
34	EE-Error manufacturing parameters state	R	No	Yes
35	EE-Error manufacturing parameters cause	R	No	Yes
36	EE-Error manufacturing parameters state	R	No	Yes
37	EE-Error manufacturing parameters cause	R	No	Yes
38	EE-Error status messages state	R	No	Yes
39	EE-Error status messages cause	R	No	Yes

Class	Designation COILS (1-bit)	Access	Status 0	Status 1
40	EE-Error statistics state	R	No	Yes
41	EE-Error statistics cause	R	No	Yes
Actions				
42	Zero calibration active	R	No	Yes
43	Initialization active	R	No	Yes
44	Blocking protection active	R	No	Yes
45	Long-term test active	R	No	Yes

5 Abbreviations

AI	Analog input
DI	Digital input
SP	Set point before comparator
C1.SP	Set point of controller [1]
C2.SP	Set point of controller [2]
C1.SP.DIF	Set point offset of controller [1]
C2.SP.DIF	Set point offset of controller [2]
C1.SP.MAX	Maximum set point of controller [1]
C2.SP.MAX	Maximum set point of controller [2]
C1.SP.MIN	Minimum set point of controller [2]
C2.SP.MIN	Minimum set point of controller [2]
PV	Actual value (process variable) before comparator
e	Set point deviation
Y	Positioning value
YP	Actuator positioning value
C1.YP	Fixed actuator positioning value 1
C2.YP	Fixed actuator positioning value 2
LIM1	Internal limit 1
LIM2	Internal limit 2
KP	Proportional-action coefficient
TN	Reset time
TV	Derivative-action time
Y0	Operating point
HA	Manual level

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main, Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
samson@samson.de · www.samson.de

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