Actuators IC 20, IC 40

Technical Information · GB
3.1.6.4 Edition 10.07

- IC 20 for basic applications with continuous or three-point step control and automatic/manual mode changeover for easy commissioning, IC 20..E with electronic positioning function and adjustable behaviour in the event of cable break
- IC 40 for complex applications with programmable functions for flexible adjustment to the process, with statistics and error history to support service personnel
- A position indicator that can be read externally
- Spacious connection chamber for ease of installation
- Actuator can be mounted directly onto the butterfly valves BVG, BVA or BVH

Contents

= To be continued

IC 20

Application

The actuators IC 20 and IC 40 are designed for all applications that require precise, controlled rotary movement between 0° and 90°. They can be mounted directly onto the butterfly valves BVG, BVA or BVH in order to control the gas and air flow rates on gas burners. They are designed for control ratios up to 1:10.

An optional integrated feedback potentiometer offers the option of monitoring the current position of the actuator. This scan function can be used in automation processes.

IC 20

IC 20 is used for basic applications. It is controlled by a continuous signal or three-point step signal. The automatic/manual mode changeover and the position indicator that can be read externally assist in the setting of the infinitely adjustable switching cams upon commissioning. This enables precise settings even in the low-fire rate range.

IC 40

IC 40

The IC 40 offers additional functions. It can be used in continuously-controlled burners and in step-by-step-controlled burners.

Settings on the actuator IC 40 can be made using a PC with the parameterisation software BCSoft. All the relevant settings for the process are made using the software via an optical interface. Various operating modes, which may be modified, are stored in the unit. In addition the control type (two-point signal, three-point step signal or continuous control), running times, adjustment angles and intermediate positions can be programmed.

The actuator can also be controlled "by hand" using the software.

Once set, all the parameters can be saved on the PC and copied from there into other actuators, thus saving time during the commissioning process.

Service technicians can call up statistical data using BCSoft, such as hours of operation, actuating cycles and an error history. Some values can also be set to zero, for example to record data over a specific period of time.

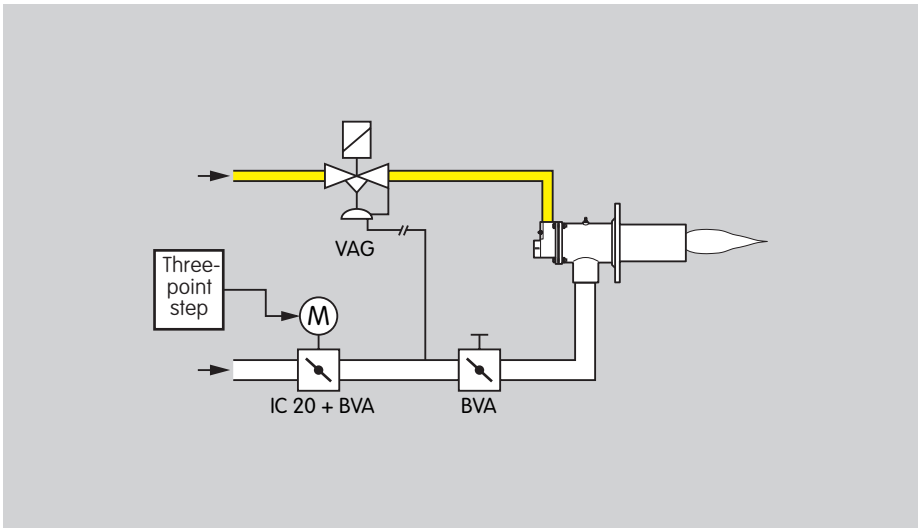
IC 20 with BVG 80

Application examples

The actuator can be mounted directly onto the butterfly valves BVG, BVA or BVH.

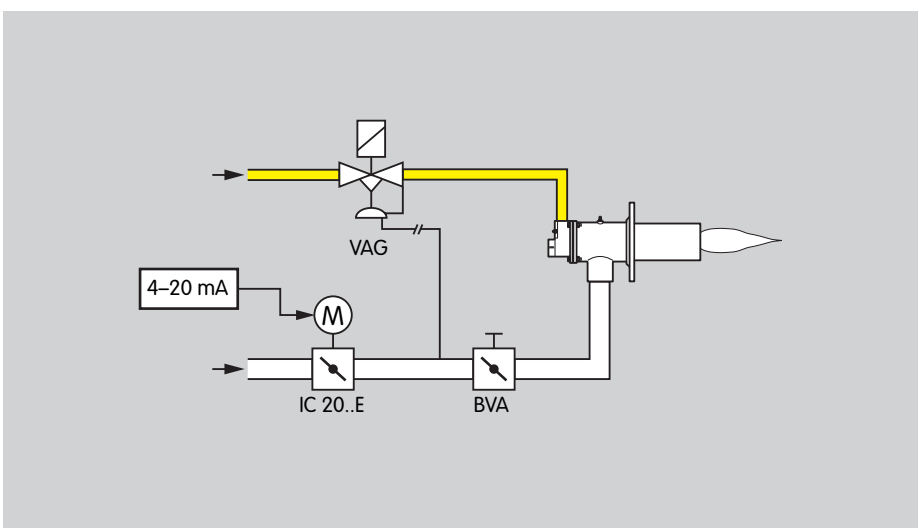
Roller hearth kiln in the ceramics industry

Forging furnace



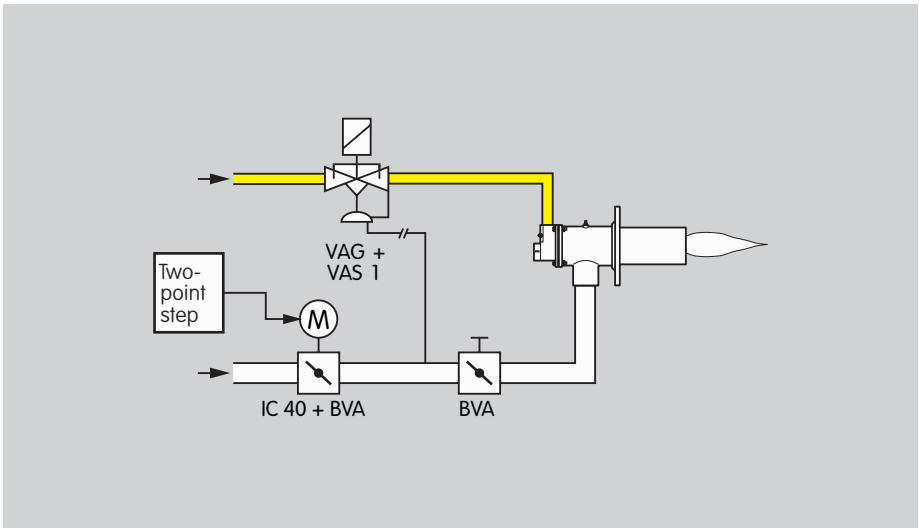
IC 20, continuous control

For processes that require high temperature accuracy and low circulation in the furnace. The actuator IC 20 is controlled by a three-point step controller.



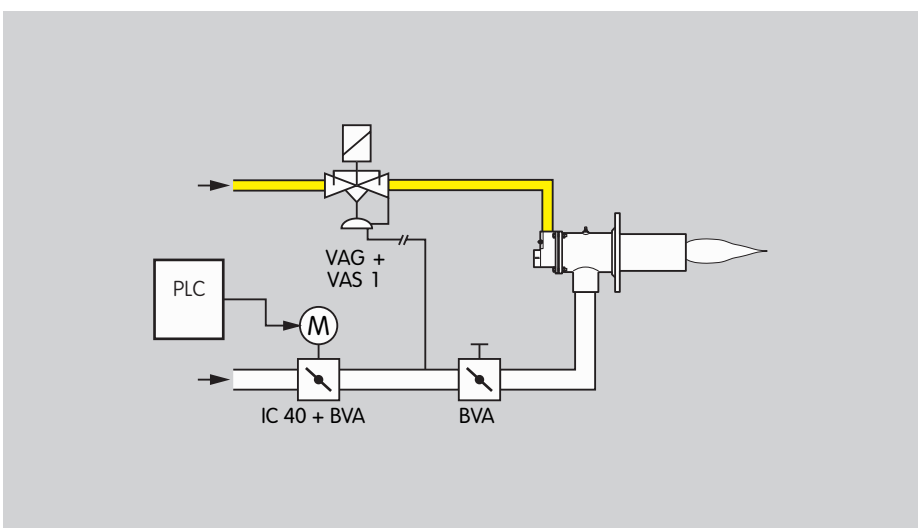
IC 20..E, continuous control

For processes that require high temperature accuracy and low circulation in the furnace. The actuator IC 20..E is controlled by a 4 – 20 mA, 0 – 20 mA or 0 – 10 V signal.



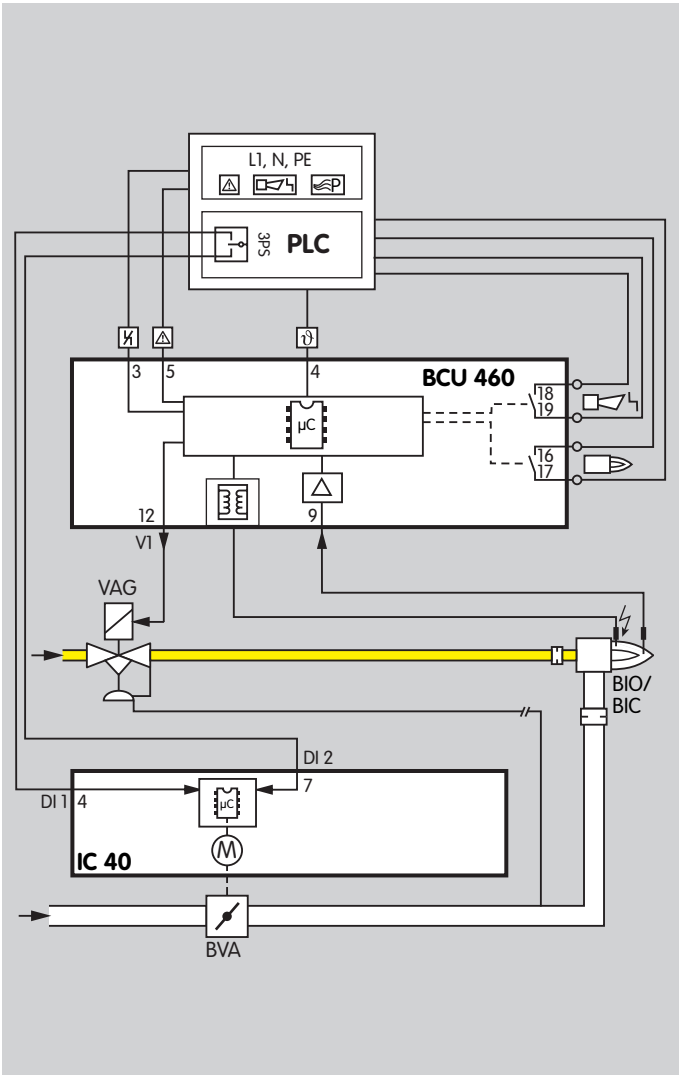
IC 40, staged control

For processes that require a homogeneous temperature distribution in the furnace. The actuator IC 40 is controlled by a two-point controller and operates in On/Off or High/Low intermittent mode. The actuator closes when the voltage supply is interrupted. The running time can be adjusted between 5 and 25 seconds.



IC 40, staged control with three burner output levels

For processes that require a homogeneous temperature distribution in the furnace and three burner output levels. The actuator IC 40 is controlled by a programmable controller and works in High/Medium/Low or High/Medium/Low/Off intermittent operation. This allows the ignition stage to be started. The pressure switch provides fail-safe monitoring of the maximum pilot air volume. The actuator running time can be adjusted between 5 and 50 (75) seconds.



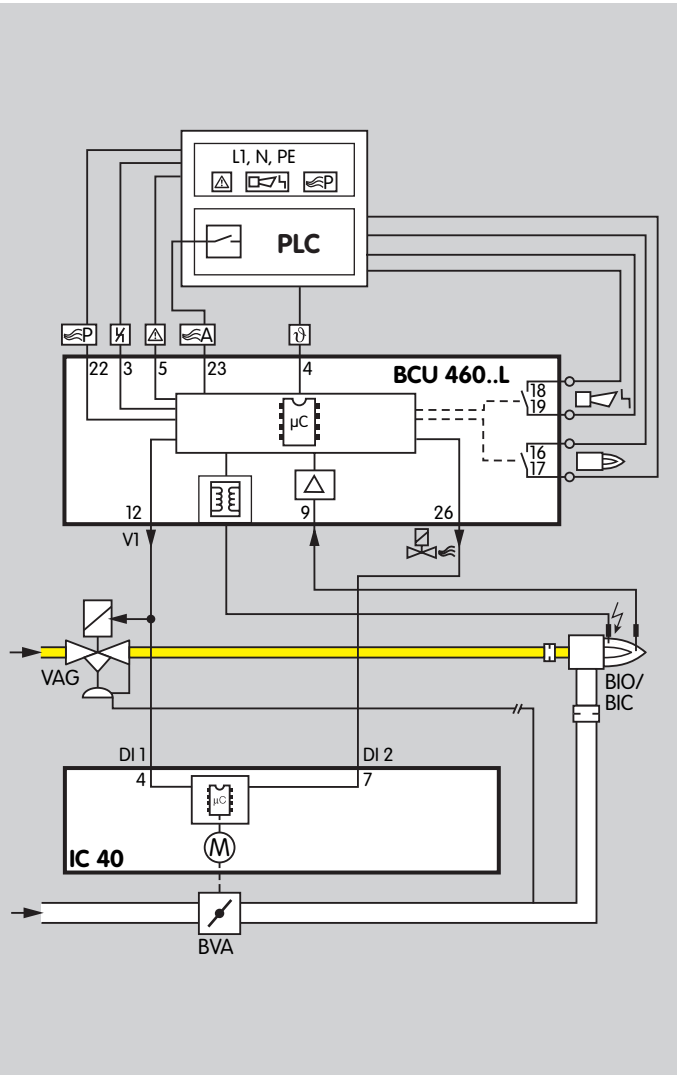
IC 40, continuous control by three-point step signal.

The actuator IC 40 is controlled by the three-point step controller 3PS and moves the butterfly valve BVA to the ignition position. The burner starts.

Once the burner is operating, the operation signalling contact of the burner control unit BCU 460 closes. The BCU issues the Controller enable signal to the temperature controller. The butterfly valve opens or closes between the low-fire and high-fire rate positions depending on the capacity demand of the burner. When the three-point step signal is disconnected, the butterfly valve stops at its current position.

If both inputs on the IC 40 (DI 1 and DI 2) are actuated after the burner has been shut down, the butterfly valve closes further than the low-fire rate position (see Operating mode 12, 3-point step operation with low position)

DI 1	DI 2	IC 40 position	Valve Position
Off	Off	Idle/Stop	Idle
On	Off	Open to high position	Open to high-fire rate
Off	On	Close to middle position	Close to low-fire rate
On	On	low	Valve closes further



IC 40, staged control with pre-purge

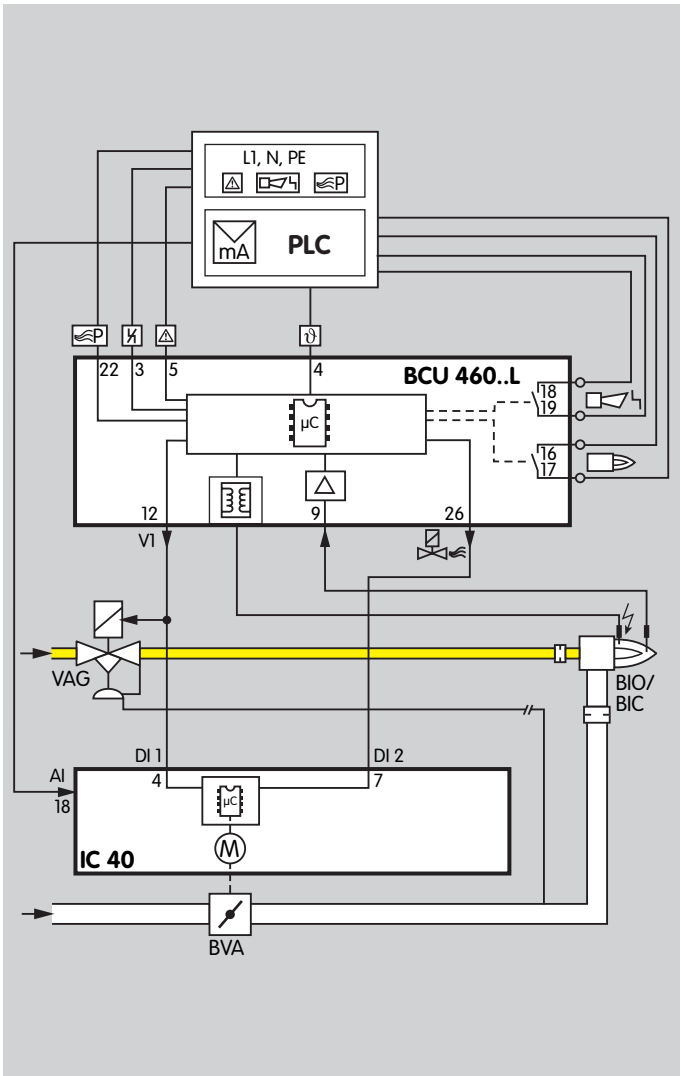
The central control system starts the pre-purge. Input DI 2 is actuated via the air valve output of the BCU and moves the butterfly valve BVA to the pre-purge position.

In the event of a temperature demand, the burner control unit BCU actuates input DI 1 via the valve output V1 and moves the butterfly valve to the ignition position. (Precondition: the IC 40 must have reached the ignition position on the instant of ignition.) The burner starts.

To activate the high-fire rate, DI 2 is actuated via the air valve output on terminal 26 of the BCU.

The butterfly valve moves cyclically between the high-fire rate position and the low-fire rate position (see Operating mode 11, 2-step operation with two digital inputs).

DI 1/ V1	DI 2/ air Valve	IC 40 position	Valve Position
Off	Off	closed	Closed
On	Off	low	Ignition position/low-fire rate
On	On	middle	High-fire rate
Off	On	high	Pre-purge



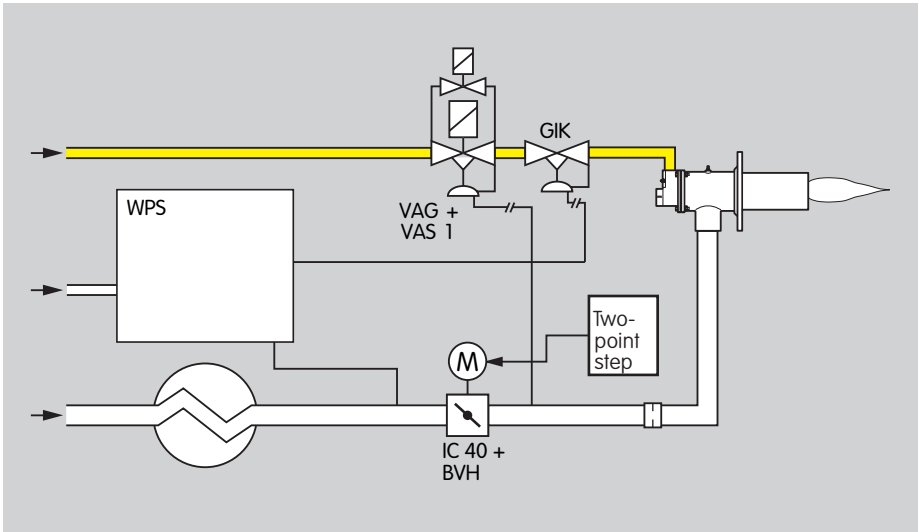
IC 40, continuous control with defined ignition position

The central control system starts the pre-purge. Input DI 2 is actuated via the air valve output of the BCU and moves the butterfly valve BVA to the pre-purge position.

In the event of a temperature demand, the burner control unit BCU actuates input DI 1 via the valve output V1 and moves the butterfly valve to the ignition position. (Precondition: the IC 40 must have reached the ignition position on the instant of ignition.) The burner starts.

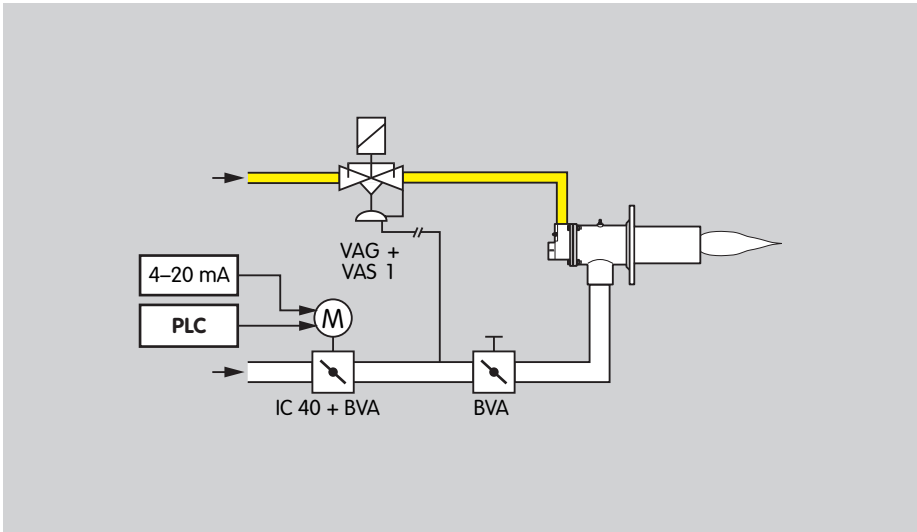
The BCU actuates DI 2 via the air valve output. This enables the analogue input AI on the actuator IC 40. Depending on the capacity demand of the temperature controller, the butterfly valve BVA moves steplessly to the position between the low-fire rate and the high-fire rate as specified by the analogue input AI (see Operating mode 27, 2-step operation with two digital inputs and variable adjustment angle).

DI 1/ V1	DI 2/ air valve	IC 40 position	Valve position
Off	Off	closed	Closed
On	Off	low	Ignition position/low-fire rate
On	On	AI	Any position between ignition position and pre-purge
Off	On	high	Pre-purge/high-fire rate



IC 40, hot air compensation

For processes in which preheated combustion air at a temperature of up to 450°C must be controlled. In this example, the actuator IC 40 is regulated by a two-point controller to adjust the burner firing capacity. It runs in High/Low intermittent operation. The running time can be adjusted between 5 and 25 seconds.



IC 40, staged control with online adjustment of the burner firing capacity

For processes that require a homogeneous temperature distribution and high temperature accuracy in the furnace.

If only a low heat output is required, for example to maintain the temperature in the furnace, the burner can continue to run in intermittent operation. The adjustment angle of the valve is reduced by the analogue input (4 – 20 mA) of the actuator and the burner output is therefore lowered. This ensures uniform temperature distribution even with a low burner output.

The functions of the actuator IC 40 can also be used in the ceramics industry to correct the lambda value or for temperature compensation purposes in hot air applications.

Certification

Elster Kromschröder certifies that the actuators IC 20 and IC 40 conforms to the following EU Directives:

– Low Voltage Directive (73/23/EEC) on the basis of EN 60730-1,
– Electromagnetic Compatibility Directive (89/336/EEC) on the basis of EN 50082-2 and EN 50081-1.

UL approval for actuator IC 40 is listed.

IC 20 function

The actuator IC 20 moves towards 0° or 90° if it is energised electrically at the related terminal. If the voltage is disconnected, the actuator stops at the current position. A high holding torque when energised renders additional braking elements superfluous. Two infinitely adjustable switching cams limit the angle of rotation so as to allow low and high fire to be set individually.

The actuator IC 20 is optimally tailored to the Kromschröder butterfly valves BVG, BVA or BVH.

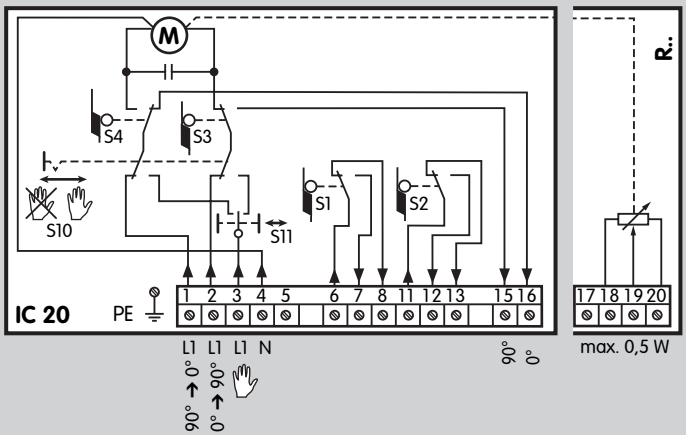
Automatic/Manual mode

Switchover between Automatic and Manual mode facilitates setting of the infinitely adjustable switching cams during commissioning. This enables precise settings even in the low-fire rate range.

The switching point is set directly on the cams with a screwdriver.

Two infinitely adjustable switching cams limit the angle of rotation so as to allow low and high fire to be set individually.

External devices can be activated or intermediate positions can be scanned via two additional, floating, infinitely adjustable switches. An optional integrated feedback potentiometer offers the option of monitoring the current position of the actuator. This scan function can be used in a fail-safe system.



Connection diagram

See Project planning information.

See Technical data.

IC 20..E

In normal operation, input "OK" is supplied with voltage. The setpoint device issues an actuating signal (0 (4) – 20 mA, 0 – 10 V). The current signal corresponds to the adjustment angle to be approached (e.g. with a 0 – 20 mA signal, 10 mA correspond to a valve angle of 45°). The minimum and maximum adjustment angles can be set using the keys. The hysteresis can be adjusted on a potentiometer to suppress interference in the input signal.

Display

Normal operation

Blue LED	Red LED	Operating state
On	Off	Manual mode
Flashing	Flashing	Calibration (in Manual mode only)

Low-fire/High-fire rate adjustment (in Manual mode only)

Blue LED	Red LED	Operating state
On	On for 0.5 s	Min. value ≥ max. value*
Off for ≤ 0.5 s	Off	Min. or max. setting accepted

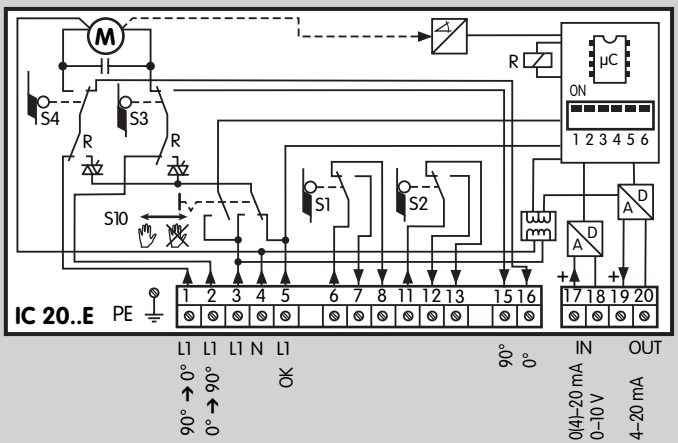
* Value will only be accepted, if the Min. or Max. button is pressed for another three seconds.

Warnings and faults

Blue LED	Red LED	Warning*/fault**	Description	Cause
Off	Flashing light (1×)	Warning*	The device is in 4 – 20 mA mode, the input signal is < 3 mA	- Cable break on the 4 – 20 mA setpoint input
Off	Flashing light (2×)	Warning*	Many changes of direction, input signal oscillates	- Hysteresis set too small
Off	Flashing light (3×)	Warning*	Control range < 1°	- Device programming error (min. and max. setting)
Flashing light (1×)	Permanent light	Fault**	Calibration not successful	- Control range < 1° (cams overlapping), motor defective, gear defective, potentiometer defective
Flashing light (2×)	Permanent light	Fault**	Internal error	- Unit defective

* The unit continues to function. The warning is not displayed in Manual mode.

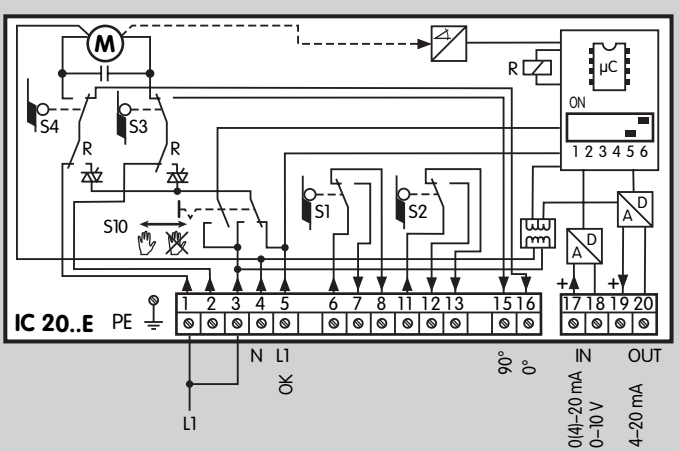
** Fault: The unit does not continue to function normally.



Connection diagram

See Project planning information.

See Technical data.

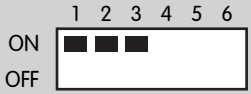


2-point step control

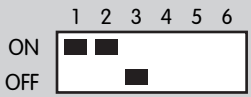
Connect bridge between terminals 1 and 3. Set the DIP switch to 2-point step control.

If an input signal is applied to terminal 5 (OK), the actuator opens. If no input signal is applied to terminal 5, the actuator closes.

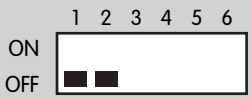
Input selection



4 – 20 mA

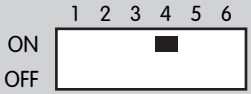


0 – 20 mA

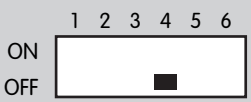


0 – 10 V

Load impedance of the current input

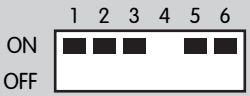


50 Ω

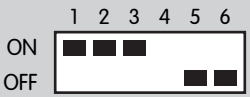


250 Ω

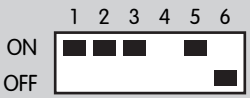
Behaviour in the event of cable break (4 – 20 mA)



Closed position

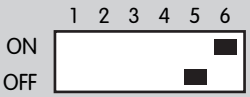


Open position



Stop

2-point step control



Burner control: On/Off or High/Low

■ = Switch position

DIP switch

The setpoint device input, the load impedance of the current input, the behaviour in the event of cable break (4 – 20 mA) or the 2-point step control are set by means of a DIP switch on the actuator.

IC 40 function

The actuator IC 40 moves the butterfly valve towards 0° or 90°. There are 4 possible positions which the actuator can approach in steps. Any intermediate position is possible in continuous three-point step mode. Optionally, the actuator can also approach any intermediate position via an additional control input.

The slow flashing blue LED indicates that the motor of actuator IC 40 is moving. The position indicator on the housing indicates the opening angle. Further visualisation and operation are performed on a PC using the Kromschröder BCSoft® software.

BCSoft

The sequence of opening and closing is programmed using the BCSoft software and can be adapted individually to any application.

All settings for the actuator IC 40 are made using BCSoft. Commissioning and calibration of the "Closed" position are performed conveniently using the software.

BCSoft offers the option of moving and setting the butterfly valve in Manual mode via the actuator – see Manual mode.

A detailed manual is available for the BCSoft® software:

http://www.kromschroeder.com
▶ Products ▶ 03 Valves and butterfly valves
▶ Actuators IC 20, IC 40.

Operating modes

The operating mode is responsible for the setting properties of the IC 40.

The running times and dwell positions of the actuator are stored in the various operating modes but can be reprogrammed at any time using BCSoft (if mounted on BVA, BVG or BVH).

The actuator operates in continuous and intermittent mode with various adjustment angles for the "open" position. The adjustment angles for the "open" position indicate the approach position of the actuator in the case of intermittent operation. They can be changed in BCSoft.

The corresponding operating modes are displayed in BCSoft® as flowcharts by way of example to visualise the opening/closing behaviour of the actuator.

Standard and analogue operating modes

In the **standard operating modes**, two digital inputs (DI 1 and DI 2) of the actuator are pre-assigned at the works as universal inputs. If a voltage of 24 V DC or 100 – 230 V AC is applied to the input, this is recognised as "On" signal (positive logic). It is not necessary to set or readjust the voltage magnitude or voltage type.

In the **analogue operating modes**, an additional input (AI) is assigned for the actuator. If an actuator IC 40..A with 4 – 20 mA analogue input is connected (option), further operating modes are available in addition to the standard operating modes. The actuator can approach corresponding intermediate positions via a current signal to the additional input – see Priority and running time in operating modes 1 – 0.

Closed, Low-fire rate, Intermediate and Open position

Depending on the set operating mode, there are 4 positions which the actuator can approach:
Closed = 0° = 0%,
Low = Low-fire rate position,
Middle = Intermediate position,
High = Open position.

The positions not used by the operating mode are barred in this case.

The "closed position" is always the calibrated zero position of the device and cannot be readjusted. The other positions can be defined on site.

Basically, the following parameter limits must be noted.

Ascending sequence of positions:
0% = closed –>
low –>
middle –>
high ≤ 100%

The "High position" may not be selected less than 10%.

If the positions have been changed in the software, BCSoft checks the new values for compliance with the limits and adapts the positions.

Running times

Up to 6 running times (t_1 to t_6), each between 0 and max. 25.5 seconds, can be set dependent on the operating mode.

A minimum running time is required for each change in position.

Minimum actuator running time t_{min}:

$$t_{min} = \frac{4.5\ s \times \text{change in position } \%}{100\%}$$

Times which are too short are automatically corrected by the IC 40 to the minimum possible value. If the actuator is to operate as fast as possible, a time of 0 seconds can be pre-set.

After they have been entered, the valid parameters are automatically read out and displayed in BCSoft.

We recommend switching to Manual mode when commissioning in order to establish the right positions and running times for the application – see Manual mode.

Outputs

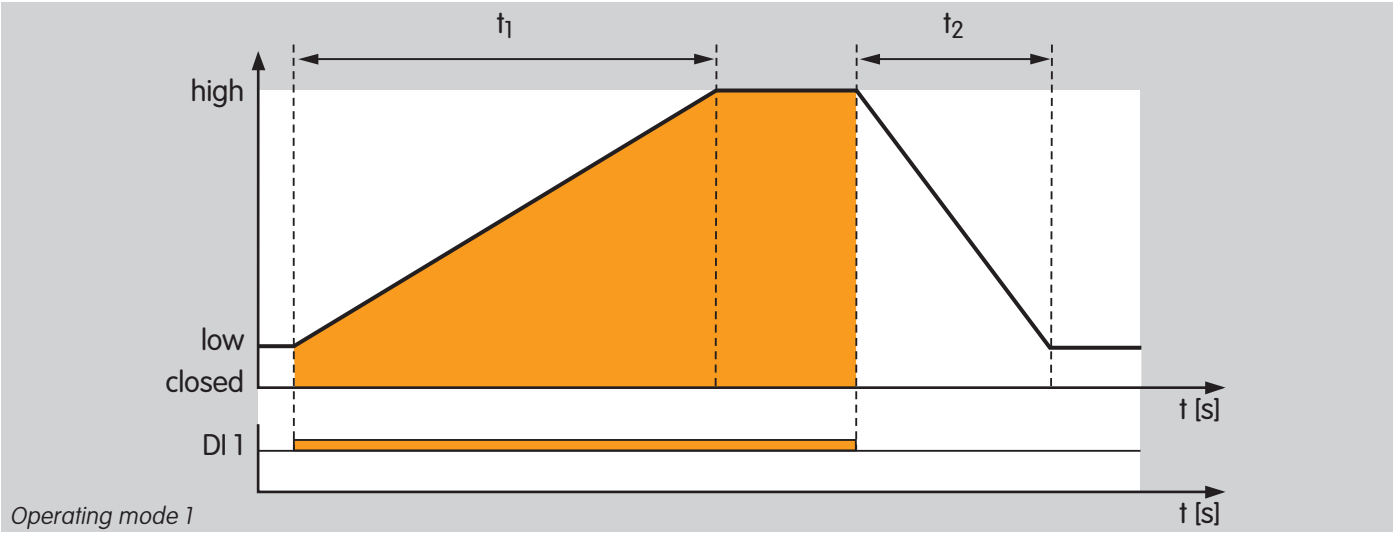
In addition to feedback signals, it is also possible to apply freely adjustable position ranges to the two outputs, RO 1 and RO 2 – see Outputs.

Statistics

The statistical data stored in the unit, such as faults which have occurred, various counter readings and measured values, are displayed and read out in BCSoft® – see Statistics.

Safety closing function

A pre-tensioned spiral spring moves the drive shaft with valve disc against the mechanical stop of the butterfly valve to closed position in the event of faults or if the continuous supply voltage is interrupted, within the closing time < 1 s – see Safety closing function.



Operating mode 1

Standard operating modes 1–12

General description – see Operating modes.

2-point operation

Operating mode 1

In idle state (DI 1 with no signal), the actuator is in "low" position ("low" position may also be 0° = "closed" position).

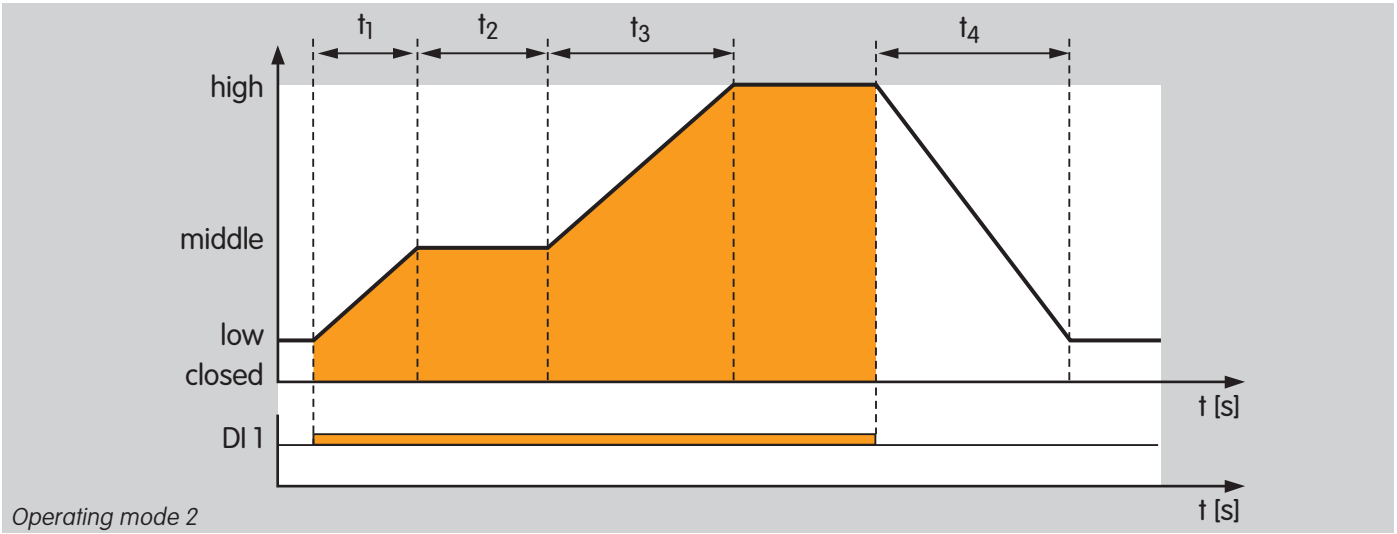
If a signal is applied to digital input DI 1, the actuator moves to "high" position in running time t_1. As the signal at digital input IN dig. 1 drops, the actuator moves back to "low" position in running time t_2.

DI 1	Position
Off	low/closed
On	high

If the signal at digital input DI 1 is deactivated before "high" position is reached, the actuator moves directly to "low" position in the percentage time of t_2.

The actuator operates in intermittent mode high/low (high/closed).

Possible parameter sets for this operating mode: P 68017, P 68018 and P 68019.



Operating mode 2

2-point operation with flame proving period

Operating mode 2

In idle state (DI 1 with no signal), the actuator is in "low" position ("low" position may also be 0° = "closed" position).

If digital input DI 1 is activated, the actuator moves in running time t_1 to "middle" position.

After the waiting time t_2, the actuator automatically moves back to "high" position in running time t_3.

As the voltage at digital input DI 1 drops, the actuator closes in running time t_4 to the "low" position.

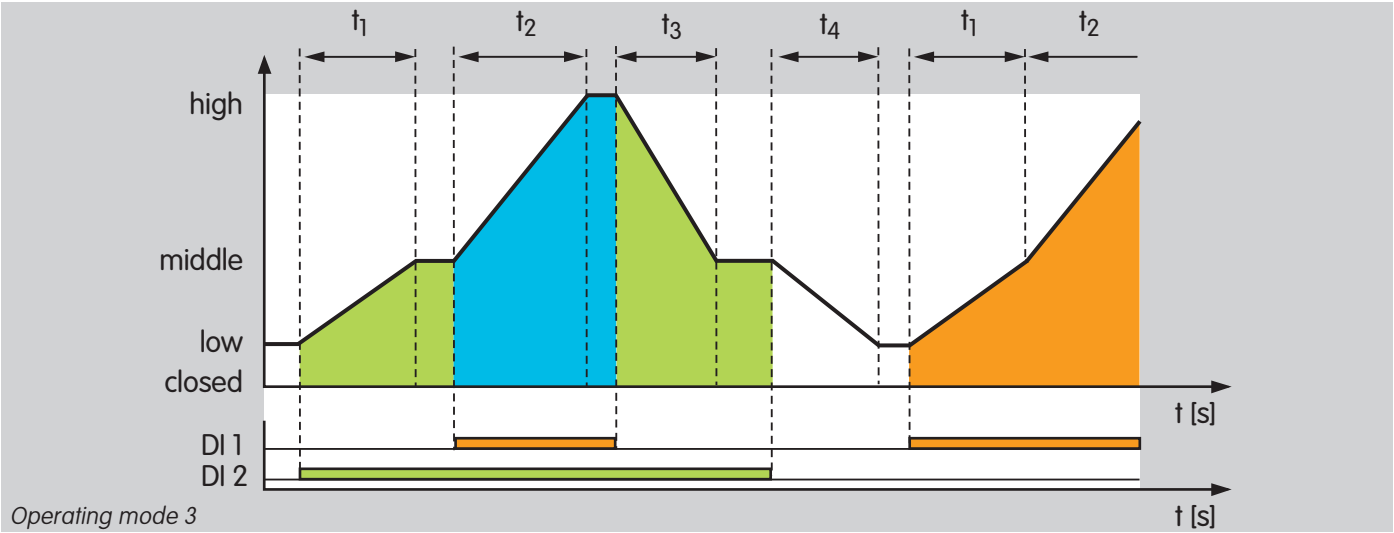
DI 1	Position
Off	low/closed
On	high

If the signal at digital input DI 1 is deactivated before "high" position is reached, the actuator moves directly in the percentage time of t_4 to "low" position.

The actuator operates in intermittent mode high/middle/low (high/middle/closed).

On burners which must ignite during opening of the butterfly valve, the waiting time t_2 is appropriate for flame proving.

Possible parameter set for this operating mode: P 68021.



Operating mode 3

2-step operation with one or two digital inputs

Operating mode 3

In idle state (DI 1 and DI 2 with no signal), the actuator is in "low" position ("low" position may also be 0° = "closed" position).

Control via two digital inputs

If digital input DI 2 is activated, the actuator moves in running time t_1 from "low" position to "middle" position.

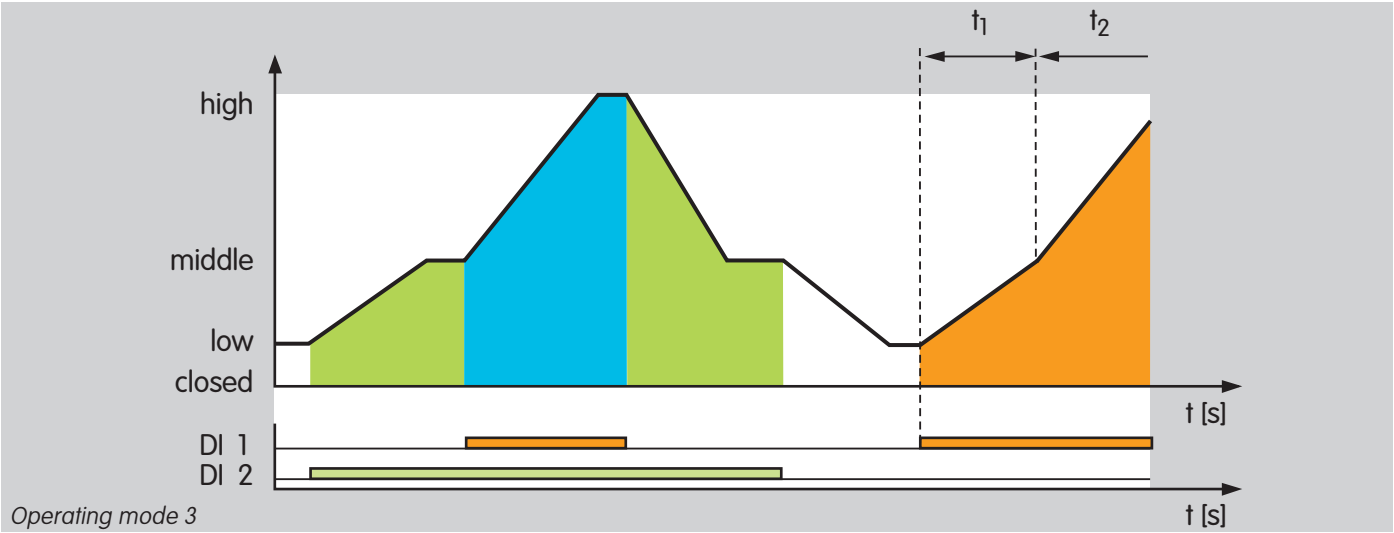
If, in addition, digital input DI 1 is activated, the actuator approaches "high" position in running time t_2.

When the signal DI 1 drops, the actuator moves back in running time t_3 to "middle" position and closes the control element to the "low" position in running time t_4 if the signal is also disconnected from DI 2.

The actuator operates in intermittent mode high/middle/low (high/middle/closed).

DI 1	DI 2	Position
Off	Off	low/closed
On	Off	high (DI 1 has priority)
Off	On	middle
On	On	high

In this operating mode, digital input DI 1 has priority and its signal always leads to opening of the actuator to the "high" position.



Operating mode 3

This may prove to be practical in order, for instance, to purge a furnace or kiln via DI 1 (independently of IN dig. 2). It is then possible to operating with both inputs in intermittent mode high/middle/low.

Possible parameter sets for this operating mode: P 68015, P 68016.

Control via one digital input

If digital input DI 1 is activated (DI 2 with no signal), the actuator moves to "high" position. The running times t_1 and t_2 run directly in succession.

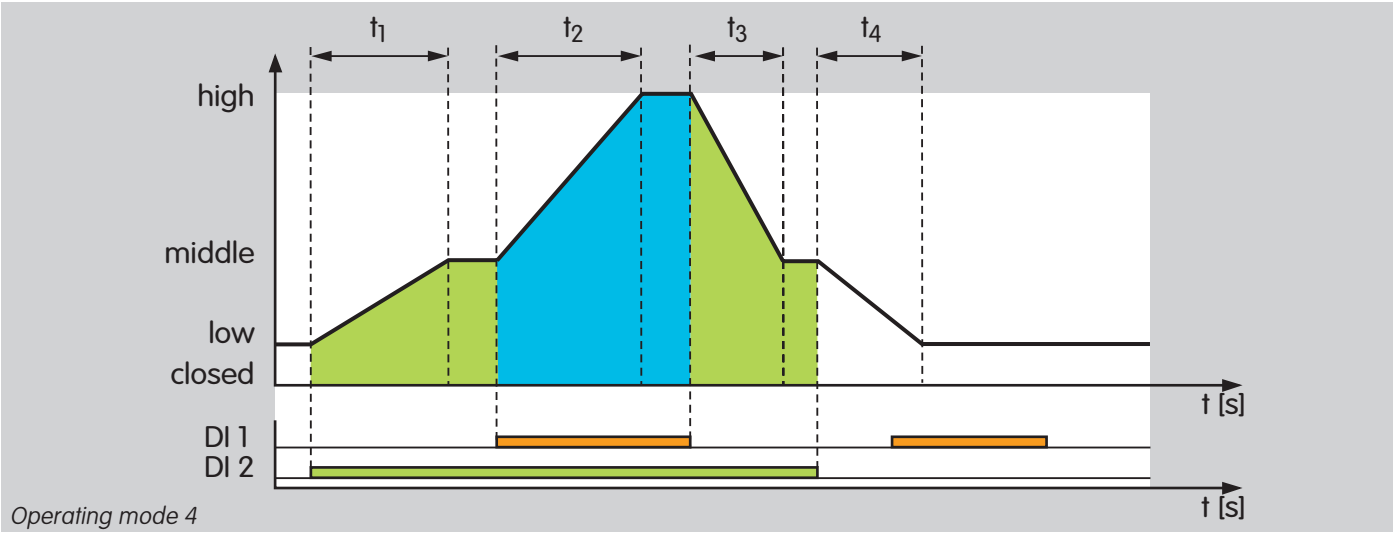
Likewise, the actuator closes in the successive running times t_3 and t_4 if signal DI 1 drops. The "middle" position serves as an interpolation point and can be freely programmed.

Owing to the two successive running times, the opening characteristic of the butterfly valve can be changed. For example, the characteristic of the air side can be adapted to that of the gas side.

Running times up to 51 s (2 x 25.5 s) are possible in this operating mode. If the signal at digital input IN dig. 1 is deactivated before "high" position is reached, the actuator moves directly to "low" position in the percentage times of t_3 and t_4.

The actuator operates in intermittent mode high/low (high/closed).

DI 1	DI 2	Position
Off	Off	low/closed
On	Off	high



Operating mode 4

2-step operation with two digital inputs

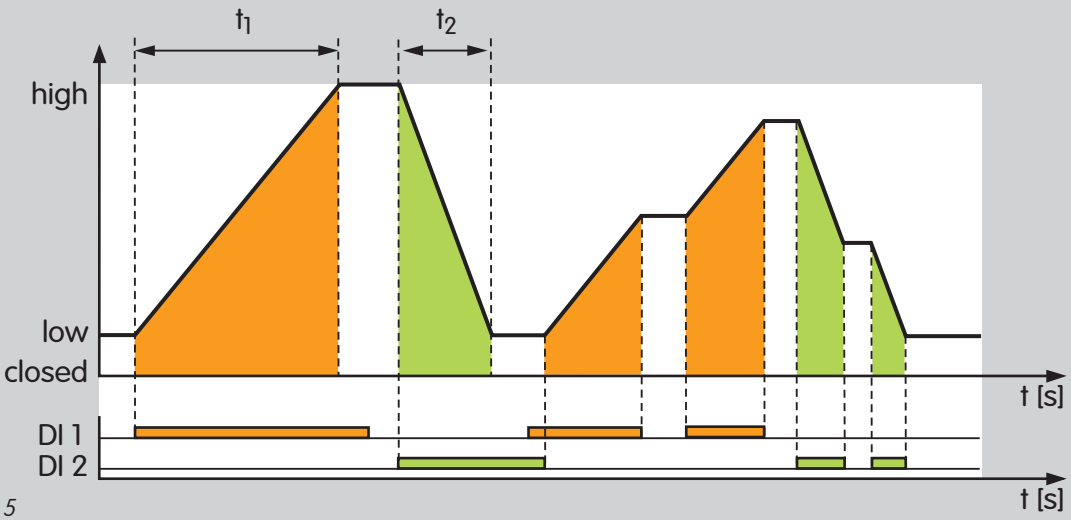
Operating mode 4

The function corresponds to operating mode 3 with different priority of the digital inputs.

Digital input DI 2 has priority over DI 1. This means that a signal at DI 1 has no effect unless a signal is also applied to DI 2.

DI 1	DI 2	Position
Off	Off	low/closed
On	Off	low/closed (DI 2 has priority))
Off	On	middle
On	On	high

Possible parameter set for this operating mode: P 68022.



Operating mode 5

3-point step operation

Operating mode 5

If only digital input DI 1 is active, the actuator opens. If only digital input DI 2 is active, the actuator closes.

If none of the two digital inputs or both digital inputs is or are active simultaneously, the actuator stops in its position. This means that it can stop at any position.

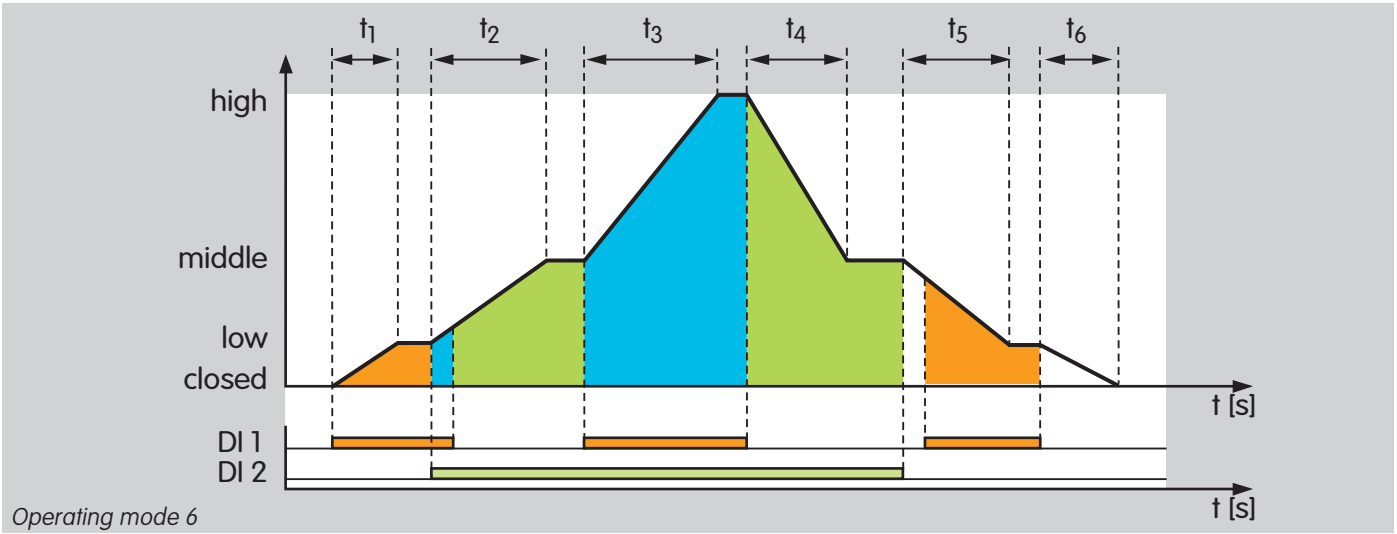
The actuator operates in continuous mode and is controlled via a 3-point step signal. The actuating function is limited by the "low" and "high" positions ("low" position may also be 0° = "closed" position).

The opening speed is pre-set via the time t_1 for the entire actuating travel "low" to "high". Accordingly, the closing speed is set with t_2 for the entire actuating travel "high" to "low".

Possible parameter sets for this operating mode: P 68012, P 68013, P 68014.

DI 1	DI 2	Reaction
Off	Off	Idle/Stop
On	Off	Open to "high" position at max.
Off	On	Close to "low" position ("closed" position) at min.
On	On	Idle/Stop

This method of control is frequently used on furnaces and kilns in the sector of ceramics, steel and aluminium.



Operating mode 6

3-step operation with one or two digital inputs

Operating mode 6

Each of the 4 circuit combinations resulting from IN dig. 1 and DI 2 determines precisely one actuator position:

DI 1	DI 2	Position
Off	Off	closed
On	Off	low
Off	On	middle
On	On	high

Each signal change results in a new position setpoint for the actuator. If the signals overlap (see t_2), the actuator moves towards "high". If the signals do not overlap (see t_5), the actuator moves towards "closed".

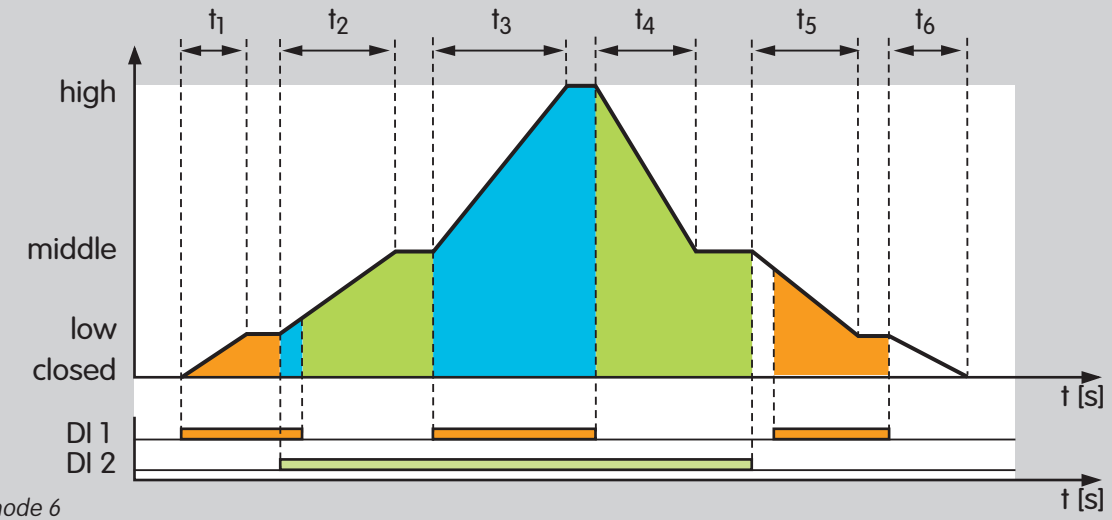
Various modes of operation can be implemented with this operating mode.

Control via one digital input

DI 2 with no signal:

The actuator operates in intermittent mode low/closed via digital input DI 1.

DI 1 with no signal:
The actuator operates in intermittent mode middle/low via digital input DI 2.



Operating mode 6

DI 1 with continuous signal, for instance resulting from inversion of the logic – see Switching logic:

The actuator operates in intermittent mode high/low (high/closed) via digital input DI 2 with two successive running times up to 51 s (2 x 25.5 s).

DI 1 and DI 2 are connected in parallel:

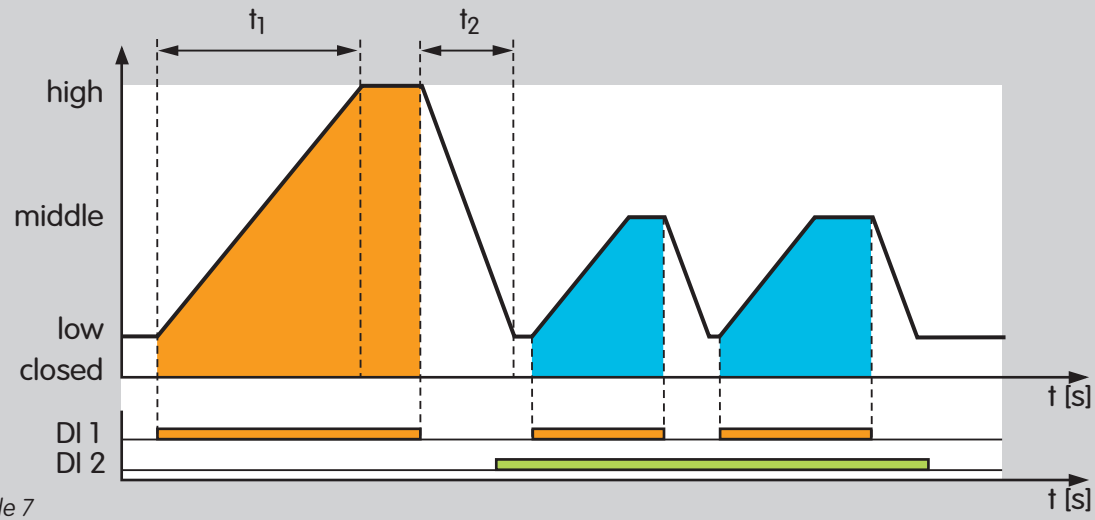
The actuator operates with one signal in intermittent mode high/closed with three successive running times up to 76.5 s (3 x 25.5 s).

With three successive running times via interpolation points, it is possible to change the opening characteristic of the butterfly valve. For example, the characteristic of the air side can be adapted to that of the gas side.

Control via two digital inputs

If all possible combinations of the two inputs are used, for instance by a PLC control system, it is possible to implement intermittent mode high/middle/low/closed (3 steps plus the "closed" position).

Possible parameter set for this operating mode: P 68001.



Operating mode 7

2-point operation with switchover of the adjustment angle for the "open" position

Operating mode 7

In idle state (DI 1 and DI 2 with no signal), the actuator is in "low" position ("low" position may also be 0° = "closed" position).

Digital input DI 1 functions as a pulse input.

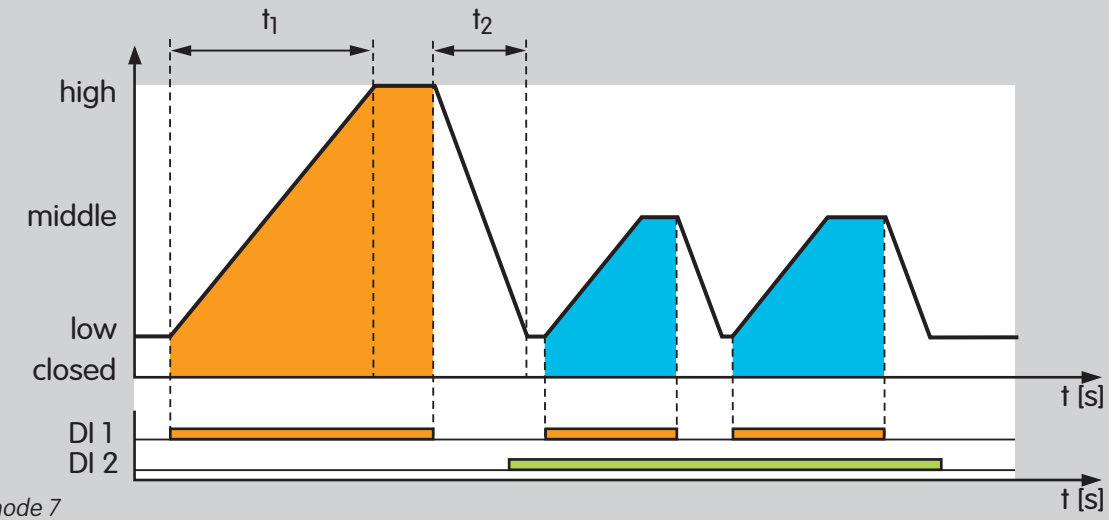
DI 2 has no signal:
The actuator operates in intermittent mode high/low (high/closed) via digital input DI 1.

Signal at DI 2:
The actuator can switch over its intermittent mode between high/low (high/closed) and middle/low (middle/closed) during ongoing operation. The adjustment angle for the "open" position is then approached with signal at DI 1 and switched over via DI 2.

The actuator now operates in intermittent mode middle/low (middle/closed) via digital input DI 1.

The heat output can now be reduced and it is nevertheless possible to continue operation in intermittent mode so as to ensure a uniform temperature distribution. High/low may also be used for purging and middle/low may also be used for heating mode in order, for instance, to reduce the pre-purging time.

DI 1	DI 2	Position
Off	Off	low/closed
On	Off	high
Off	On	low/closed (DI 1 has priority)
On	On	middle



Operating mode 7

The opening speed is pre-set via the running time t_1 for the entire actuating travel "low" to "high". Accordingly, the closing speed is set with t_2 for the entire actuating travel "high" to "low". The speeds are retained when switching with reduced output (signal at DI 2). The running time is shortened in accordance with the reduced position.

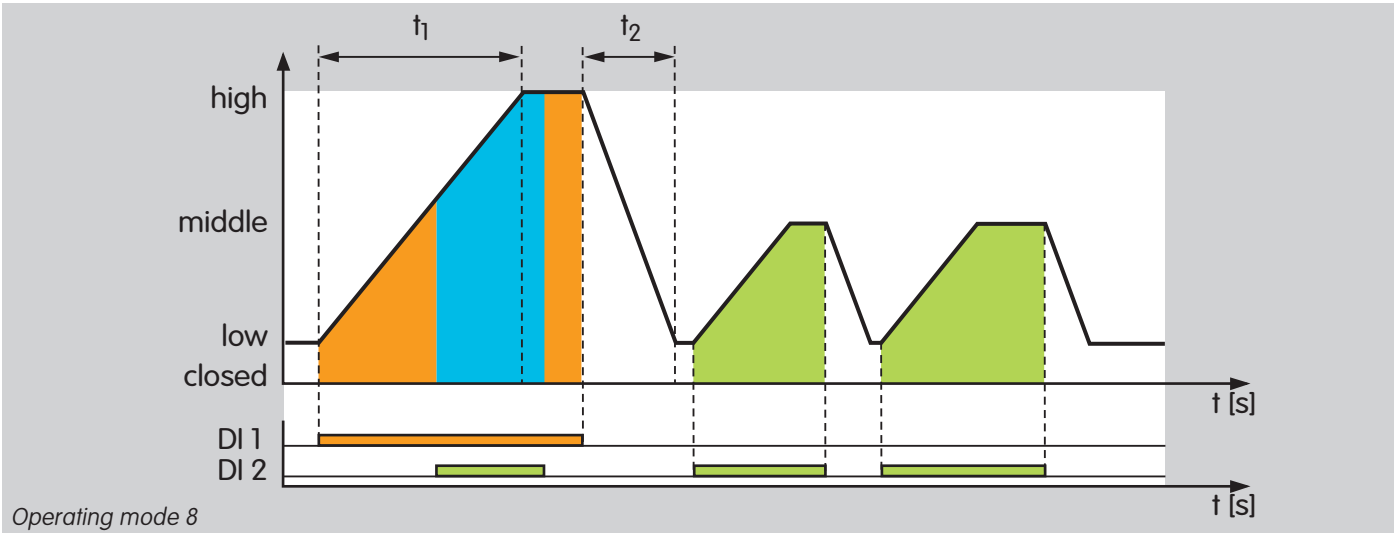
Alternative function (2-step operation with constant speed):

DI 1	DI 2	Position
Off	Off	low/closed
On	Off	high
Off	On	low/closed (DI 1 has priority)
On	On	middle

For as long as a signal is applied to DI 1, DI 2 switches to and fro between "high" and "middle" position. In this case, it may be practical to invert the logic of digital input DI 2 – see Switching logic.

This mode of operation ensures that the actuator always opens or closes at constant speed.

Possible parameter set for this operating mode: P 68023.



Operating mode 8

2-point operation with input-dependent adjustment angle for the "open" position

Operating mode 8

The function corresponds to operating mode 7 apart from the fact that both digital inputs function as pulse inputs.

The actuator operates in intermittent mode high/low (high/closed) via digital input DI 1 and operates in middle/low (middle/closed) mode via DI 2.

A signal at DI 1 (priority) always leads to an approach to "high" position which, for instance, can be used to purge the furnace or kiln.

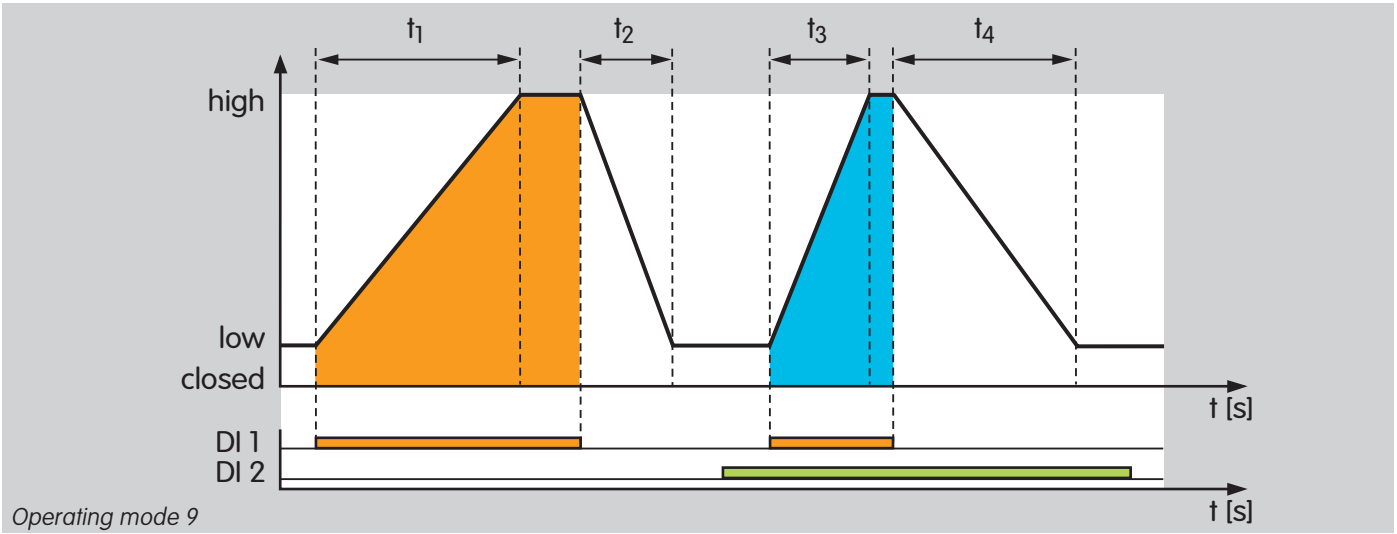
DI 1	DI 2	Position
Off	Off	low/closed
On	Off	high
Off	On	middle
On	On	high (DI 1 has priority)

Alternative function: 2-step operation with constant speed.

For as long as a signal is applied to DI 2, DI 1 switches to and fro between "high" and "middle" position.

This mode of operation ensures that the actuator always opens or closes at constant speed.

Possible parameter set for this operating mode: P 68024.



Operating mode 9

2-point operation with switchover of the running times

Operating mode 9

Digital input DI 1 functions as a pulse input.

The actuator operates in intermittent mode high/low (high/closed) via digital input DI 1.

In idle state (DI 1 with no signal), the actuator is in "low" position ("low" position may also be 0° = "closed" position).

DI 1	Position
Off	low/closed
On	high

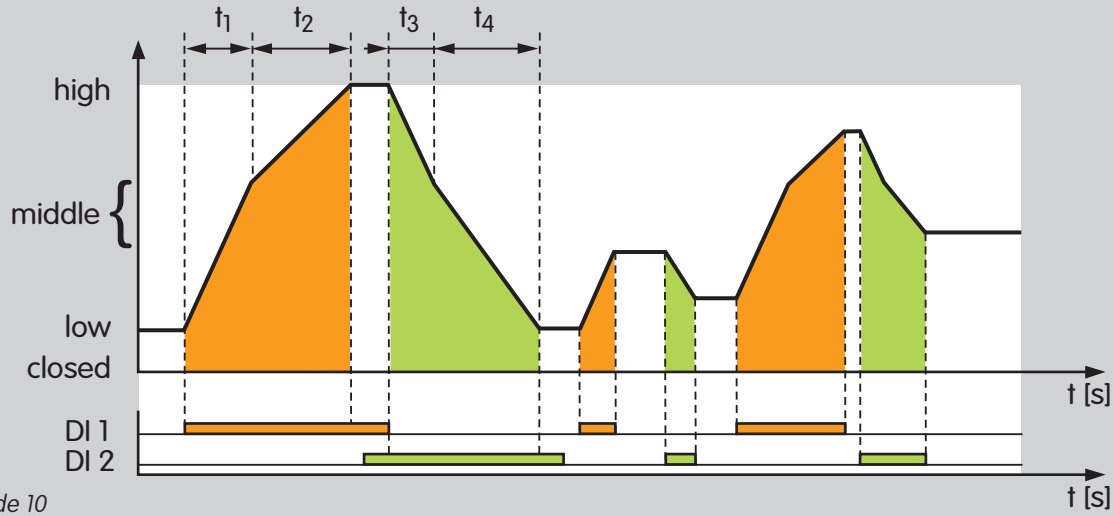
The running times are switched over via DI 2.

DI 2	Opening time	Closing time
Off	t_1	t_2
On	t_3	t_4

Switchover of the running times may also occur during movement of the actuator.

This function can also, for instance, be used for fast movement to the pre-purging position, with correspondingly slow running time for burner operation.

Possible parameter set for this operating mode: P 68025.



Operating mode 10

3-point step operation with running time fractions

Operating mode 10

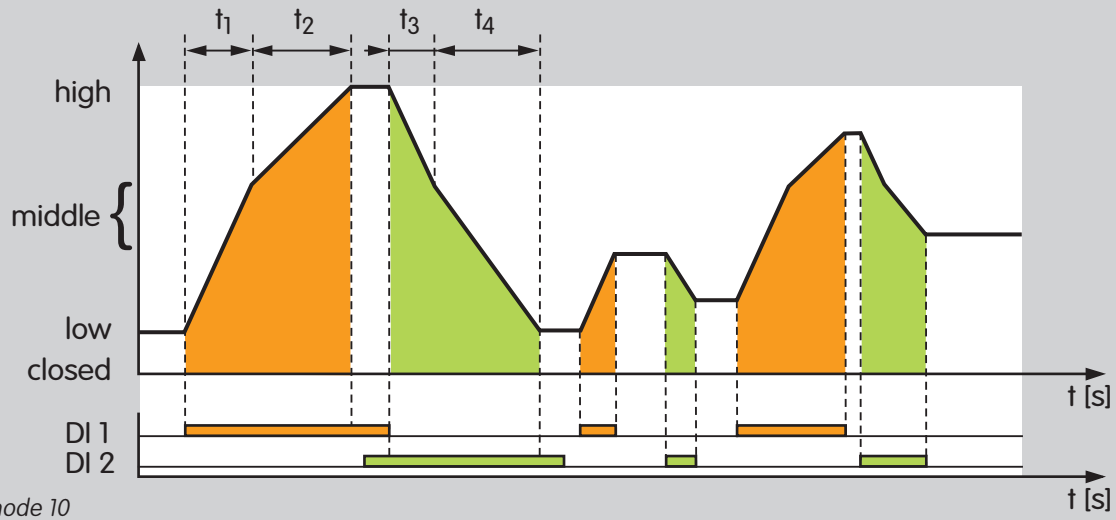
If only digital input DI 1 is active, the actuator opens. If only digital input DI 2 is active, the actuator closes.

If none of the two digital inputs or both digital inputs is or are active simultaneously, the actuator stops in its position. The actuator can be stopped in any position.

The actuator operates in continuous mode and is controlled via a 3-point step signal.

The actuating function is limited by the "low" and "high" positions ("low" position may also be 0° = "closed" position).

DI 1	DI 2	Reaction
Off	Off	Idle/Stop
Ein	Off	Open to "high" position at max.
Off	Ein	Close to "low" position ("closed" position) at min.
Ein	Ein	Idle/Stop



Operating mode 10

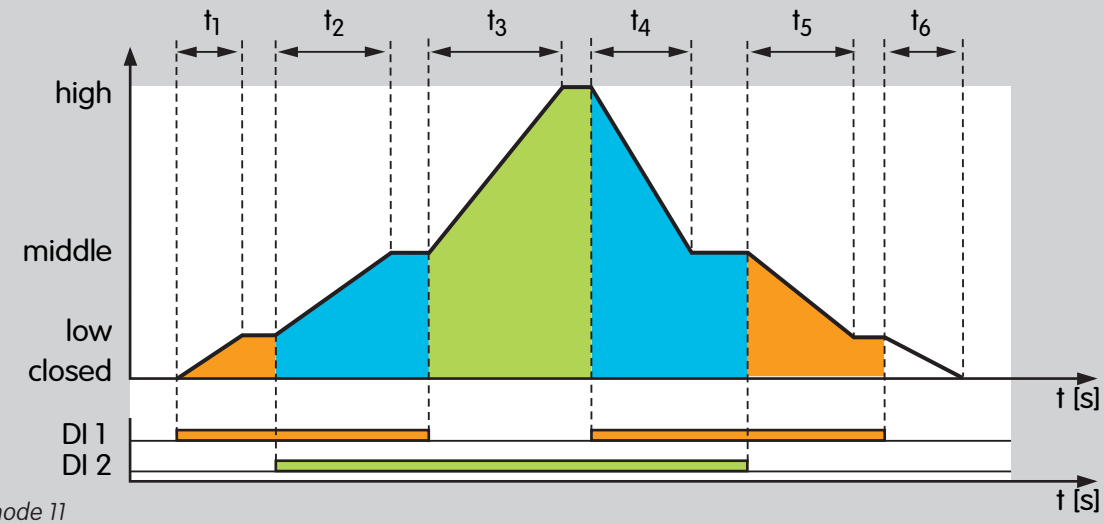
The opening time results from the two successive running times t_1 and t_2.

The closing time results accordingly from running times t_3 and t_4. "Middle" position is used as an interpolation point. This can be defined individually.

Owing to the two successive running times, the opening characteristic of the butterfly valve can be changed. For example, the characteristic of the air side can be adapted to that of the gas side.

Running times up to 51 s (2 x 25.5 s) are possible in this operating mode.

Possible parameter sets for this operating mode: P 68010, P 68011 and P 68020.



Operating mode 11

3-step operation with two digital inputs

Operating mode 11

In idle state (DI 1 and DI 2 with no signal), the actuator is in "closed" position and the butterfly valve is closed.

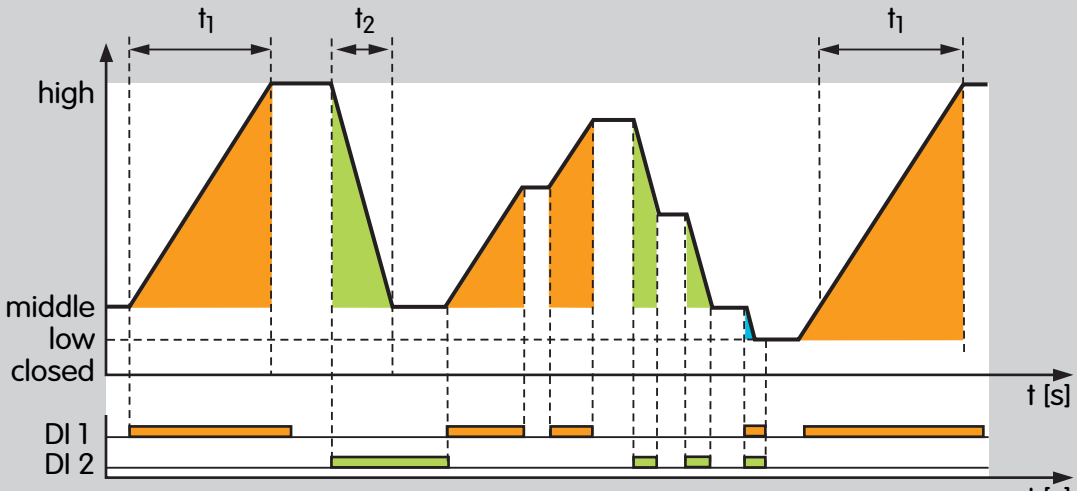
If a signal is applied to DI 1 (DI 2 with no signal), the butterfly valve moves to "low" position (ignition position and low-fire rate position).

If a signal is applied to DI 2 (DI 1 with no signal), the butterfly valve moves to "high" position for pre-purge.

If a signal is applied to DI 1 and DI 2, the butterfly valve moves to "middle" position (high-fire rate).

DI 1/V1	DI 2/ air valve	Position IC 40	Valve Position
Off	Off	closed	Closed
On	Off	low	igniting position/low-fire rate
On	On	middle	High-fire rate
Off	On	high	Pre-purge

(see Example of application: IC 40, staged control with pre-purge)



Operating mode 12

3-point step operation with low position

Operating mode 12

If a three-point step signal is applied to DI 1 (DI 2 with no signal), the butterfly valve moves to "high" position.

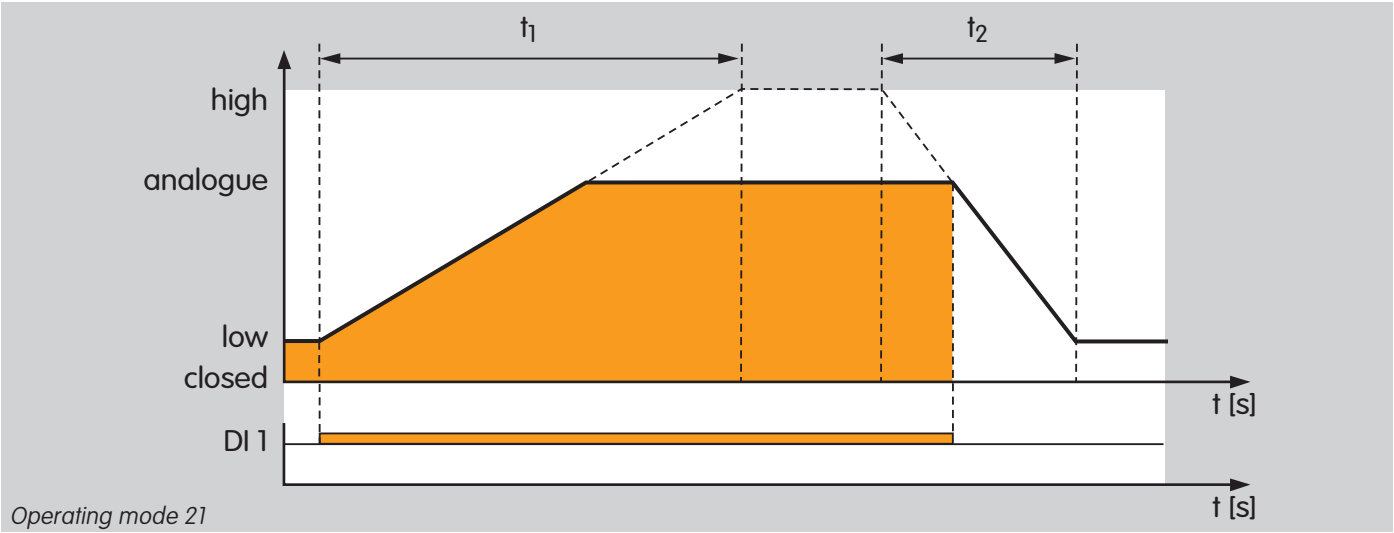
If a three-point step signal is applied to DI 2 (DI 1 with no signal), the butterfly valve moves to "middle" position.

If no three-point step signal is applied to the inputs (DI 1 and DI 2 with no signal), the actuator stops and the butterfly valve remains in its current position.

If a three-point step signal is applied to inputs DI 1 and DI 2, the actuator moves from the low-fire rate position to "low" position.

DI 1	DI 2	IC 40 position	Valve position
Off	Off	Idle/Stop	Idle
On	Off	Open to high position	Open to high-fire rate
Off	On	Close to middle position	Close to low-fire rate
On	On	low	Valve closes further

(see Example of application: IC 40, continuous control by three-point step signal)



Operating mode 21

Analogue operating modes 21 – 27

General description – see Operating modes.

2-point operation

Operating mode 21

In idle state (DI 1 with no signal), the actuator is in "low" position ("low" position may also be 0° = "closed" position).

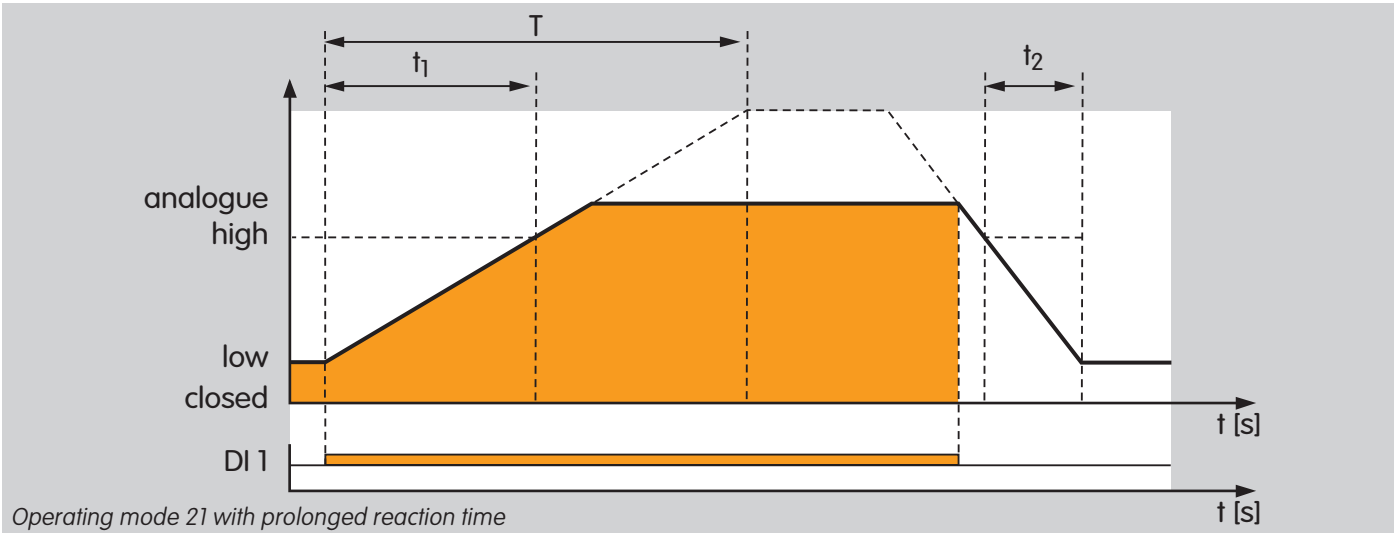
If a signal is applied to digital input DI 1, the actuator moves to the position pre-set via analogue input 4 – 20 mA. When the signal at DI 1 drops, the actuator moves back to "low" position.

The actuator operates in intermittent mode analogue/low (analogue/closed), whereby the analogue signal determines the adjustment angle for the "open" position (= setpoint). The adjustment angle for the "open" position which can be varied via the analogue signal is set in BCSoft.

Example: 4 mA for 60% opening and 20 mA for 100% opening. If no analogue value is pre-set, the actuator remains in "low" position ("closed" position).

DI 1	Position
Off	low/closed
On	analogue

The opening speed is pre-set via the time t_1 for the entire actuating travel "low" to "high". Accordingly, the closing speed is set with t_2 for the entire actuating travel "high" to "low" position.



Operating mode 21 with prolonged reaction time

The "high" position can be selected correspondingly lower in order to obtain longer running times (> 25.5 s).

The "high" position does not limit the adjustment angle for the "open" position but defines only the speeds here.

Consequently, the "high" position may also be lower than the "analogue" position. The magnitude of the current signal is crucial as regards the "analogue" position.

Example for double running time T:
The "high" position is set to 50%.

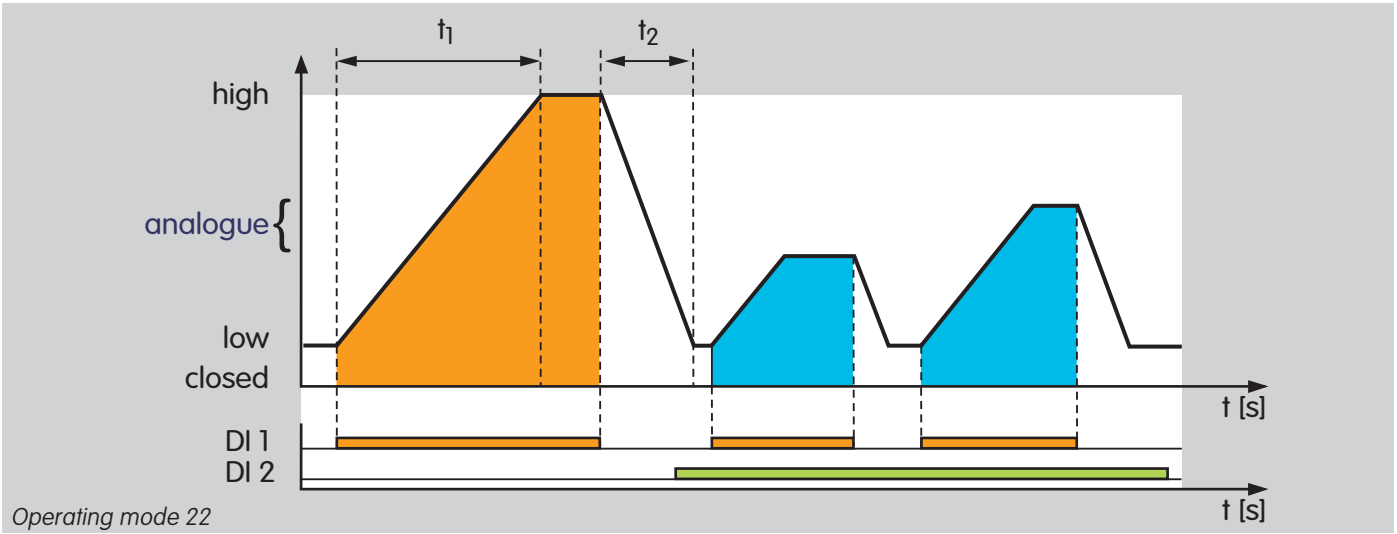
$$T = t_1 \frac{100\%}{\text{high}}$$

$$T = 25{,}5\ \text{s} \frac{100\%}{50\%}$$

$$T = 51\text{s}$$

Possible parameter set for this operating mode:
P 68026.

Note:
The running time can be prolonged up to max. 150 s for the full adjustment range 0–90°. Running times outside of this permitted range are adapted automatically by BCSoft.



Operating mode 22

2-point operation with switchover of the adjustment angle for the "open" position

Operating mode 22

In idle state (DI 1 and DI 2 with no signal), the actuator is in "low" position independently of the analogue signal ("low" position may also be 0° = "closed" position).

Signal at DI 1, DI 2 with no signal:
The actuator operates in intermittent mode high/low (high/closed) via digital input DI 1.

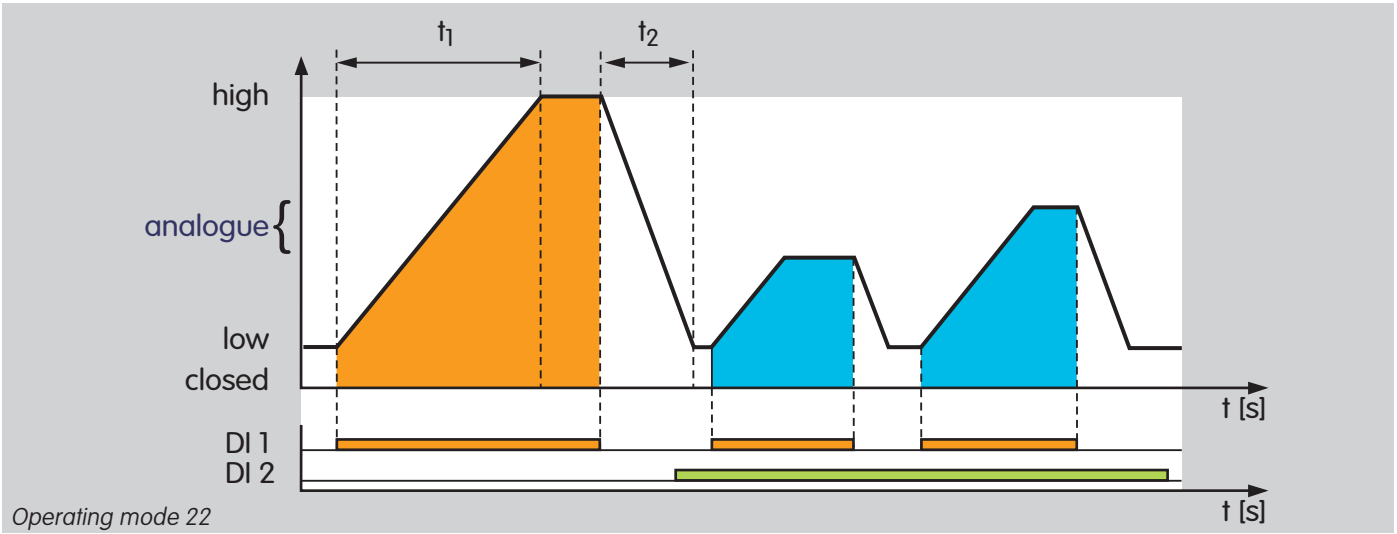
Digital input DI 1 functions as a pulse input.

Signal at DI 2:
Intermittent mode can switch over in ongoing operation between high/low (high/closed) and analogue/low (analogue/closed). The adjustment angle for the "open" position is then approached with signal at DI 1 and switched over via DI 2. The actuator now operates in intermittent mode analogue/low (analogue/closed) via digital input DI 1.

The adjustment angle for the "open" position which can be varied via the analogue signal (position setpoint) is set in BCSoft.

Example: 4 mA for 60% opening and
20 mA for 100% opening.

Depending on adjustment angle for the "open" position, the heat output can be reduced and a uniform temperature distribution in the furnace or kiln can be achieved nevertheless owing to intermittent operation of the burner.



Operating mode 22

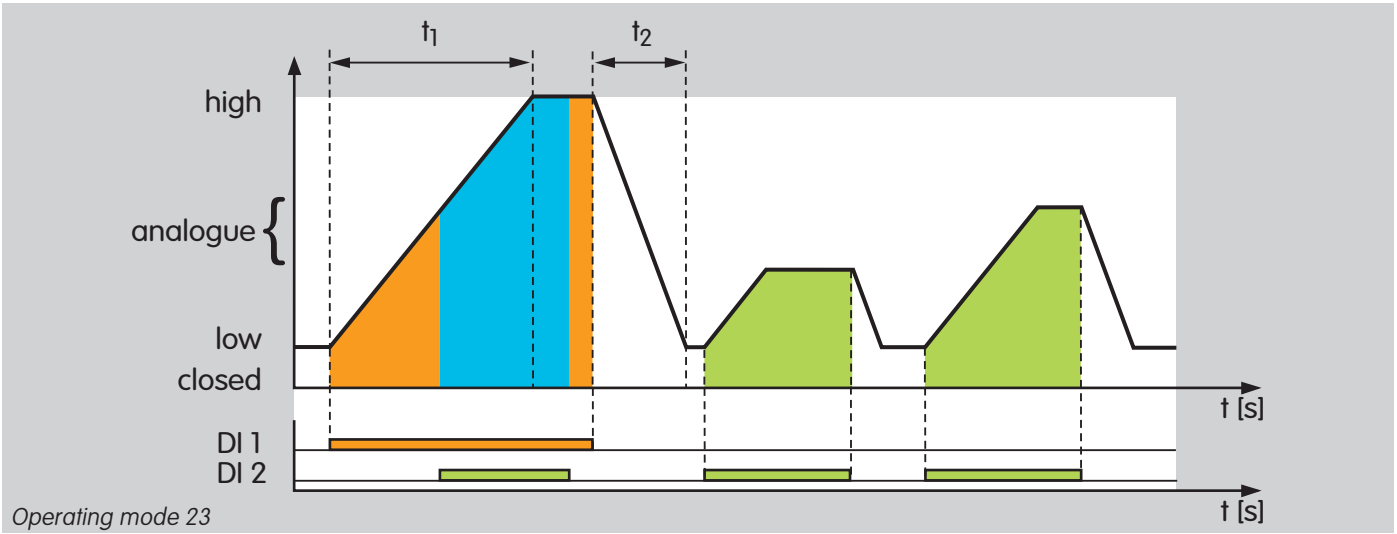
DI 1	DI 2	Position
Off	Off	low/closed
On	Off	high
Off	On	low/closed
On	On	analogue

The opening speed is pre-set via the time t_1 for the entire actuating travel "low" to "high".

Accordingly, the closing speed is set with t_2 for the entire actuating travel "high" to "low".

The speeds are retained in both intermittent modes. The running times are changed accordingly if the "analogue" position (current signal) is moved. The "analogue" position may also be higher than the "high" position in this operating mode.

Possible parameter set for this operating mode: P 68027.



Operating mode 23

2-point operation with input-dependent adjustment angle for the "open" position

Operating mode 23

The function corresponds to operating mode 22 apart from the fact that both digital inputs function as pulse inputs.

The actuator operates in intermittent mode high/low (high/closed) via digital input DI 1.

The actuator operates in intermittent mode analogue/low (analogue/closed) via digital input DI 2.

A signal at DI 1 (priority) always leads to approach to "high" position. This application can be used, for instance, for purging a furnace or kiln.

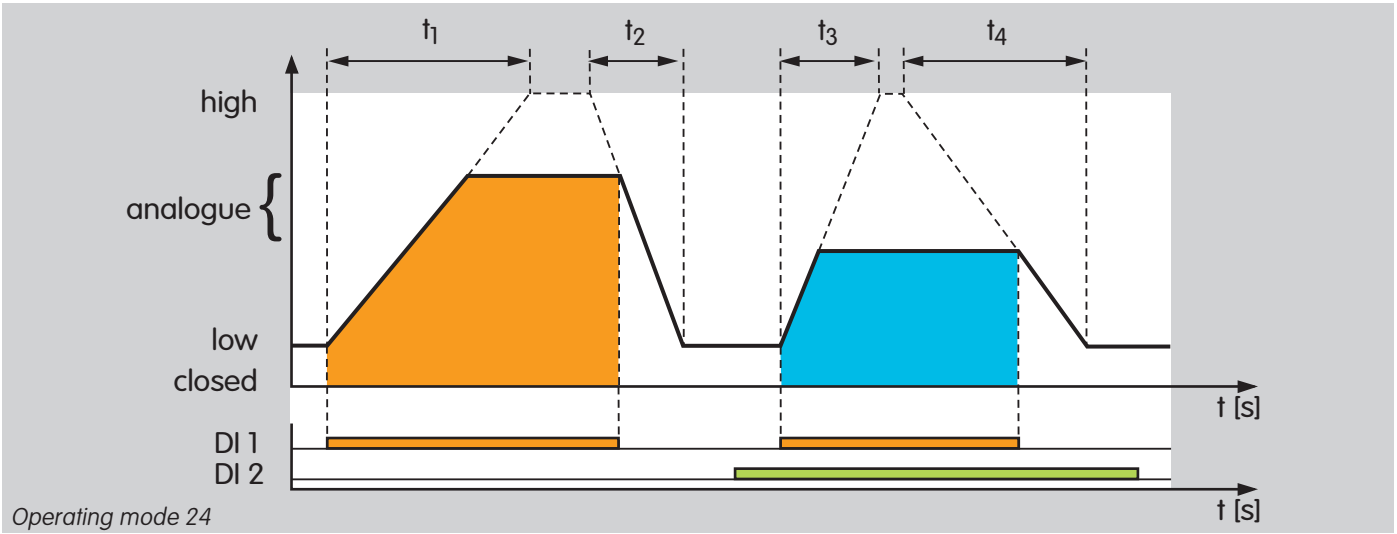
The adjustment angle for the "open" position which can be varied via the analogue signal is set in BCSoft. Example: 4 mA for 60% opening and 20 mA for 100% opening.

Depending on adjustment angle for the "open" position, the heat output can be reduced and a uniform temperature distribution in the furnace or kiln can be achieved nevertheless owing to intermittent operation of the burner.

The "high" position may also be lower than the "analogue" position in this case.

DI 1	DI 2	Position
Off	Off	low/closed
On	Off	high
Off	On	analogue
On	On	high (DI 1 has priority)

Possible parameter set for this operating mode: P 68028.



Operating mode 24

2-point operation with switchover of the running times

Operating mode 24

Digital input DI 1 functions as a pulse input. The actuator operates in intermittent mode analogue/low (analogue/closed) via DI 1.

In idle state (DI 1 with no signal), the actuator is in "low" position.

("Low" position may also be 0° = "closed" position).

The adjustment angle for the "open" position which can be varied via the analogue signal is set in BCSoft. Example: 4 mA for 60% opening and 20 mA for 100% opening.

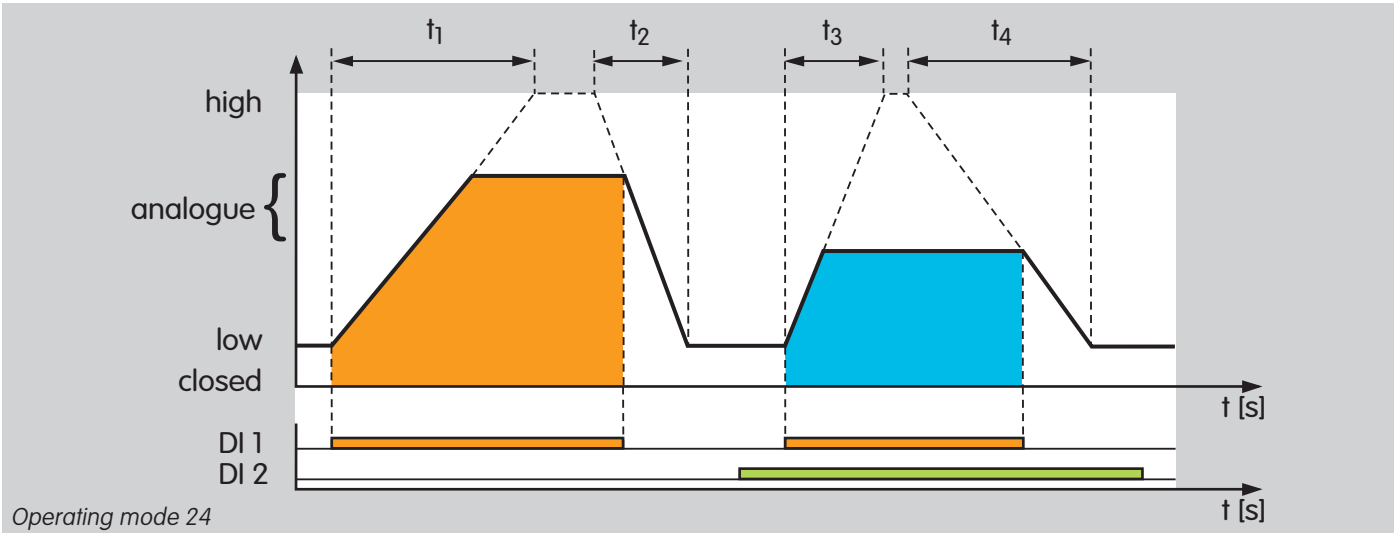
Depending on adjustment angle for the "open" position, the heat output can be reduced and a uniform temperature distribution in the furnace or kiln can be achieved nevertheless owing to intermittent operation of the burner.

DI 1	Position
Off	low/closed
On	analogue

The running times are switched over via DI 2.

DI 2	Opening time	Closing time
Off	t_1	t_2
On	t_3	t_4

The running times can also be switched over in ongoing operation.



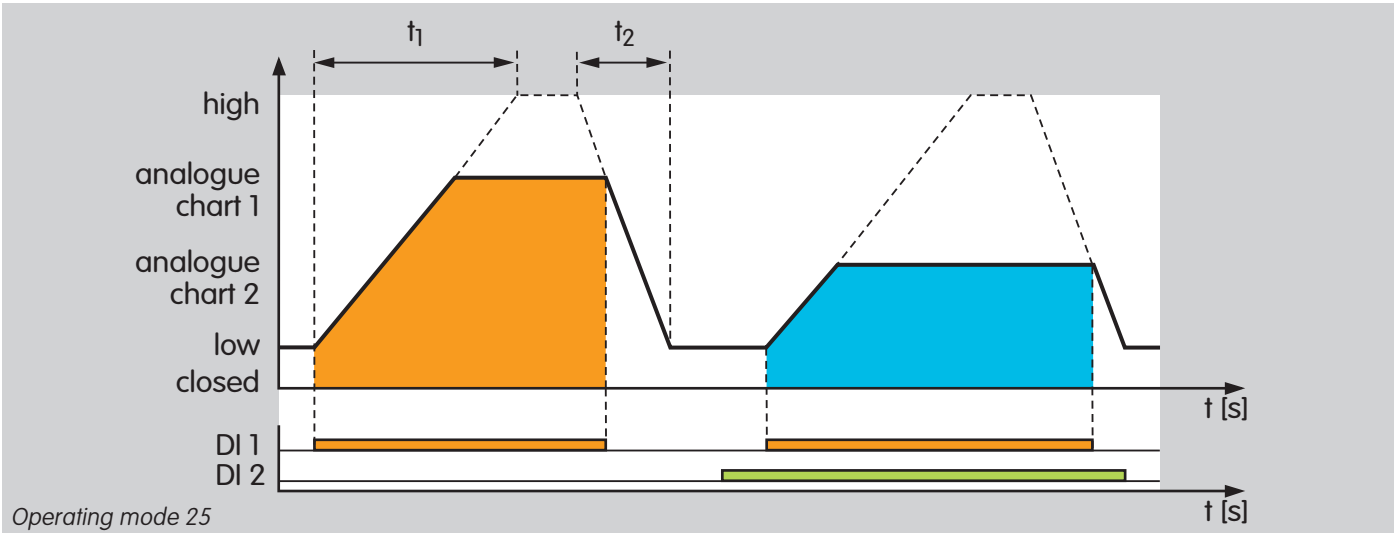
Operating mode 24

The "high" position can be selected correspondingly lower in order to obtain longer running times (> 25.5 s). Example of double running time – see Operating mode 21, Prolonged running time.

The "high" position does not limit the adjustment angle for the "open" position but only defines the speeds.

Consequently, the "high" position may also be lower than the "analogue" position. The magnitude of the current signal is crucial as regards the "analogue" position.

Possible parameter set for this operating mode: P 68029.



Operating mode 25

2-point operation with characteristic curve switchover I

Operating mode 25

In idle state (DI 1 and DI 2 with no signal), the actuator is in "low" position ("low" position may also be 0° = "closed" position).

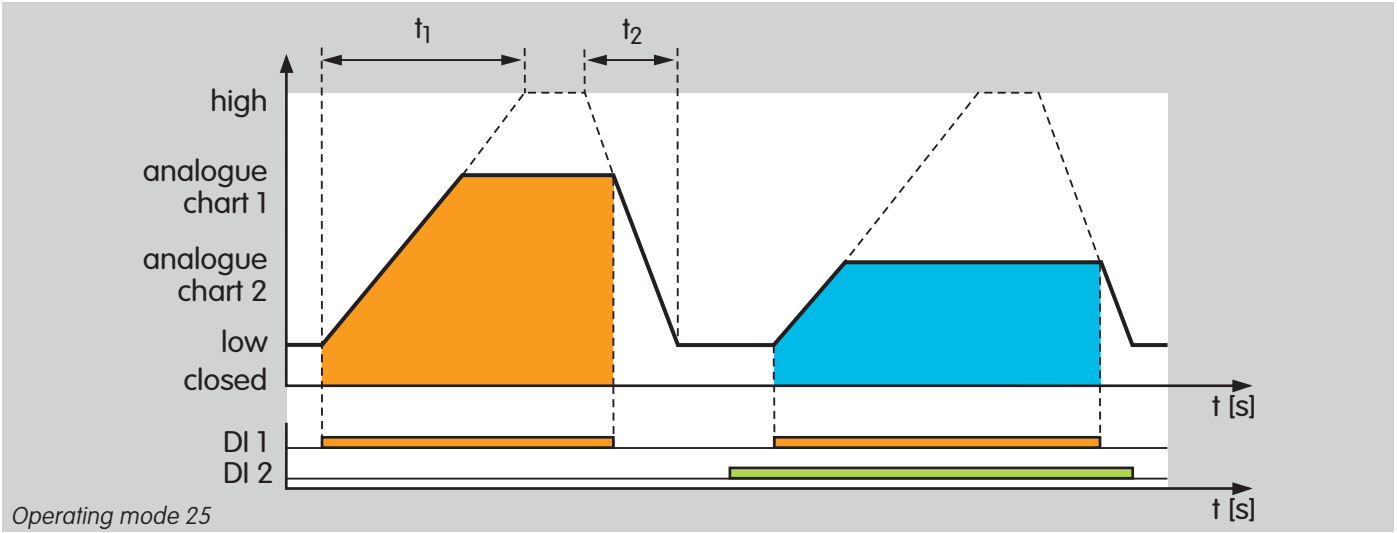
DI 1 functions as a pulse input. The analogue characteristic curve (analogue chart 1/analogue chart 2) is switched over via DI 2 and the adjustment angle for the "open" position is pre-set by this. This angle is approached with signal at DI 1.

DI 2 with no signal:
The actuator operates in intermittent mode analogue chart 1/low (analogue chart 1/closed) via digital input DI 1.

Signal at DI 2:
The actuator operates in intermittent mode analogue chart 2/low (analogue chart 2/closed) via digital input DI 1.

This function allows the actuator to switch over its intermittent mode in ongoing operation. The adjustment angle for the "open" position is pre-set via two characteristic curves (charts), each with 5 interpolation points – see Analogue input. This allows the same current signal to be used for running through two different output ranges, for example for lambda adjustment or for hot air compensation.

The adjustment angles for the "open" position of the characteristic curves chart 1 and chart 2 can be set mutually independently. The adjustment angle for the "open" position of chart 2 may thus also be higher than that of chart 1.



Operating mode 25

The burner continues to be operated in intermittent mode so as to ensure a uniform temperature distribution even with low heat output.

DI 1	DI 2	Position
Off	Off	low/closed
On	Off	analogue chart 1
Off	On	low/closed
On	On	analogue chart 2

The opening speed is pre-set via the time t_1 for the entire actuating travel "low" to "high".

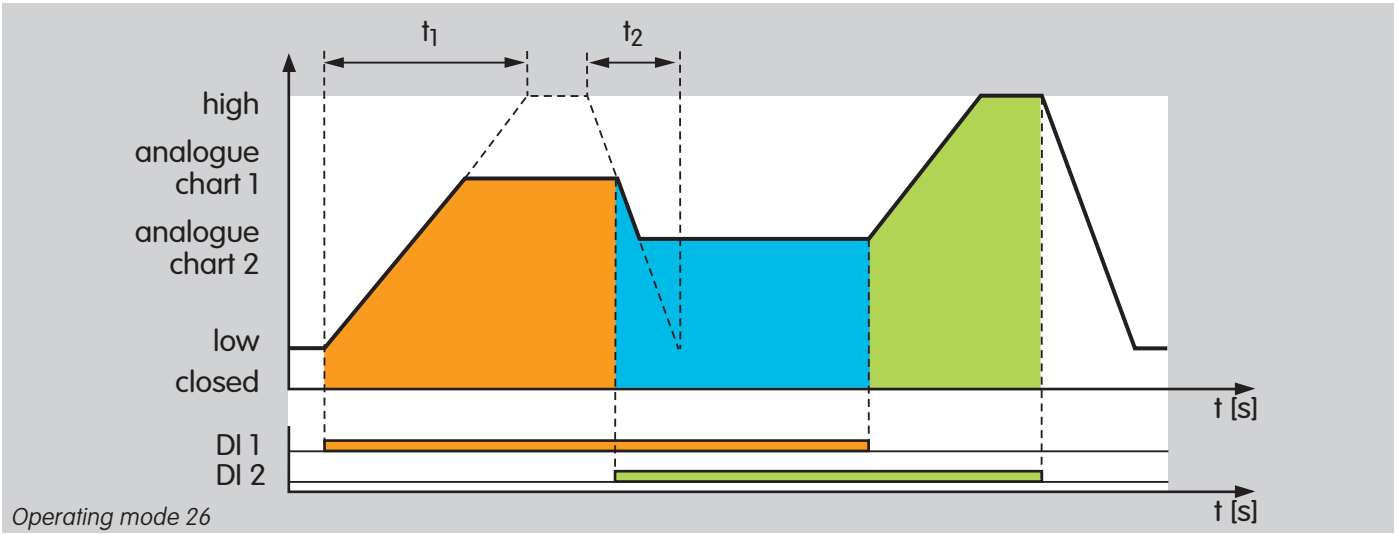
Accordingly, the closing speed is set with t_2 for the entire actuating travel "high" to "low".

The speeds are retained in both intermittent modes.

The "high" position can be selected correspondingly lower in order to obtain longer running times (> 25.5 s). Example of double running time – see Operating mode 21, Prolonged running time. The "high" position does not limit the adjustment angle for the "open" position but only defines the speeds. The adjustment angles for the "open" position are pre-set by the current signal.

Consequently, "high" position may also be lower than the "analogue chart" positions. If no analogue value is pre-set, the actuator remains in "low" position ("closed" position).

Possible parameter set for this operating mode:
P 68030.



Operating mode 26

2-point operation with characteristic curve switchover II

Operating mode 26

In idle state (DI 1 with no signal), the actuator is in "low" position ("low" position may also be 0° = "closed" position).

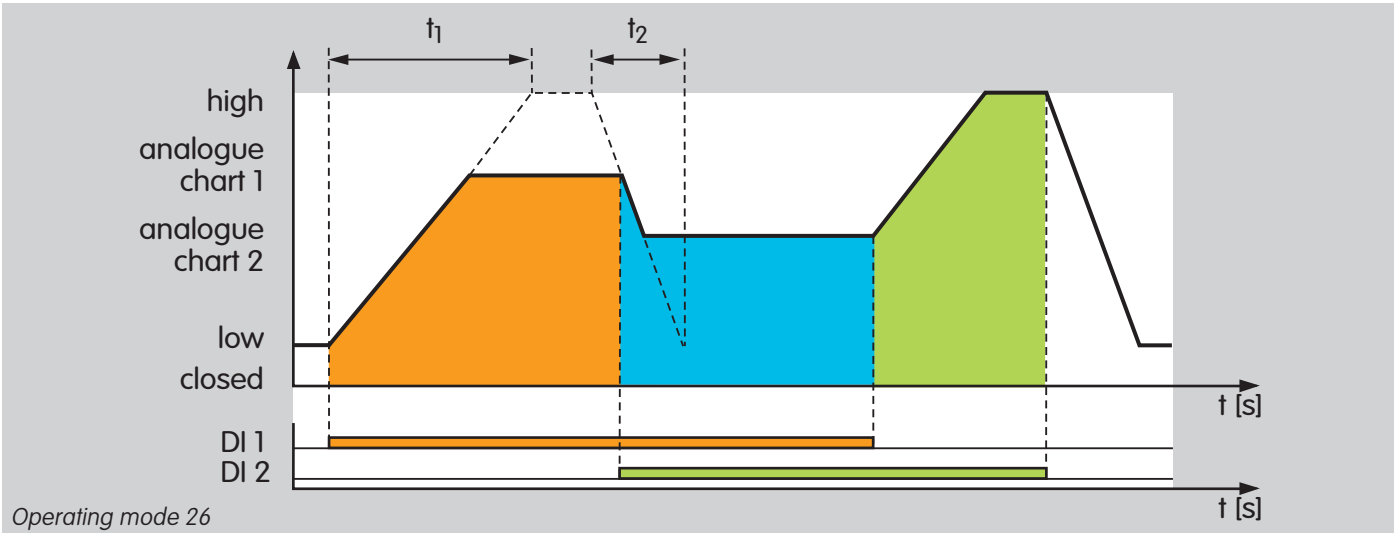
Each circuit combination of DI 1 and DI 2 determines precisely one actuator position:

DI 1	DI 2	Position
Off	Off	low/closed
Ein	Off	analogue chart 1
Off	Ein	high
Ein	Ein	analogue chart 2

A change in the circuit combination directly triggers approach to the new position.

"High" position may also be lower than the "analogue chart" positions in this case. The opening speed is pre-set via the running time t1 for the entire actuating travel "low" to "high". Accordingly, the closing speed is set with t_2 for the entire actuating travel "high" to "low". The speeds are independent of the digital inputs and the analogue input in this case.

Two characteristic curves, each with 5 interpolation points, are available – see Analogue input.



Operating mode 26

This allows the same current signal to be used for running through two different output ranges, for example for lambda adjustment or for hot air compensation.

Intermittent operation

DI 2 with no signal:
The actuator operates in intermittent mode analogue chart 1/low (analogue chart 1/closed) via digital input DI 1.

DI 1 with no signal:
The actuator operates in intermittent mode high/low (high/closed) via digital input DI 2.

DI 1 and DI 2 simultaneously with ON or OFF signal:
The actuator operates in intermittent mode analogue chart 2/low (analogue chart 2/closed).

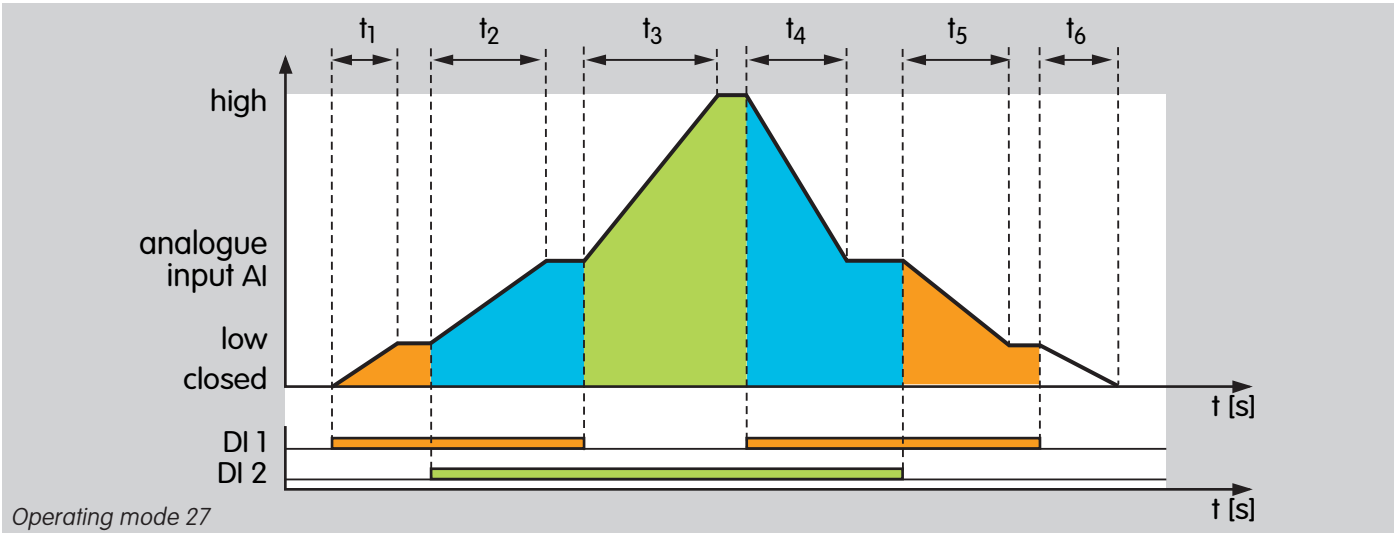
If all possible combinations of the two inputs are used, for instance by a PLC control system, this allows intermittent mode high/analogue chart 1/analogue chart 2/low (closed) to be implemented.

Continuous operation

The actuator may also operate in continuous mode via current input 4 – 20 mA. In this case, it is possible to switch over between two characteristic curves via the digital inputs – see Analogue input.

As with operating mode 25, this allows lambda adjustment or hot air compensation to be implemented.

Possible parameter set for this operating mode:
P 68031.



Operating mode 27

2-step operation with two digital inputs and variable adjustment angle

Operating mode 27

In idle state (DI 1 and DI 2 with no signal), the actuator is in "closed" position and the butterfly valve is closed.

If a signal is applied to DI 1 (DI 2 with no signal), the butterfly valve moves to "low" position (ignition position and low-fire rate position).

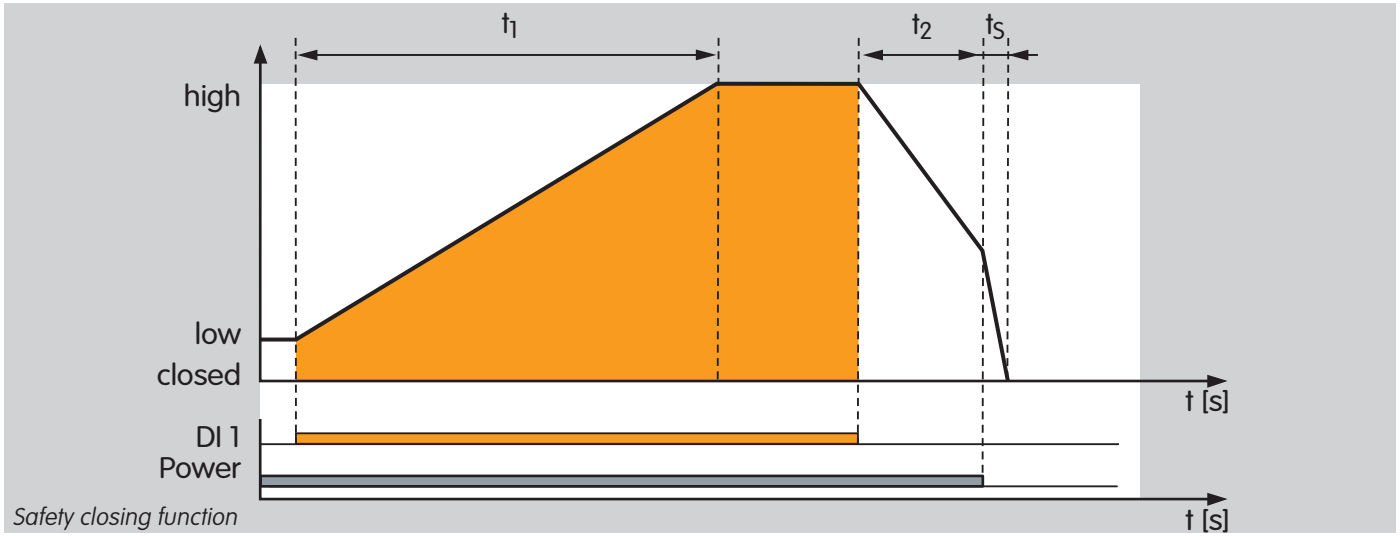
If a signal is applied to DI 2 (DI 1 with no signal), the butterfly valve moves to "high" position for pre-purge (high-fire rate).

If a signal is applied to DI 1 and DI 2, the butterfly valve can be moved steplessly between the low-fire position and the high-fire rate position via the analogue input AI. The adjustment angle for the "open" position which can be varied via the analogue signal is set in BCSoft.

Example: 4 mA for 60% opening and 20 mA for 100% opening.

DI 1	DI 2	IC 40 position	Valve Position
Off	Off	closed	Closed
On	Off	low	Ignition position/low-fire rate
On	On	AI	Any position between ignition position and pre-purge
Off	On	high	Pre-purge/high-fire rate

(see application example: IC 40, continuous control with defined ignition position)



Safety closing function

Safety closing function

The safety closing function cuts in in the event of a fault or interruption of the continuous supply voltage (power) or, for instance, in the event of a motor defect.

A pre-tensioned spiral spring turns the drive shaft with valve disc against the mechanical stop of the butterfly valve to the "closed" position within the closing time $t_S < 1$ s.

Fast and reliable closing prevents air being able to flow into the furnace or kiln chamber in uncontrolled manner if the installation is disconnected from the electrical power supply or in the event of a device defect. The penetration of air may also lead to damage to the material in the furnace or kiln in extreme cases, besides changing the furnace or kiln atmosphere.

In order to maximise the service life of the parts subject to wear in the actuator and in the butterfly valve, the safety closing function should be used only for the scheduled closing function and not for normal shutdown or for intermittent switching of the burner.

The safety closing function is available as an option on the actuator IC 40S and can be implemented only in combination with the butterfly valve BVHS. Both actuator and butterfly valve must feature this function – see Selection/type designation.

Parameters

Various parameter sets are saved in the BCSoft software to assist programming. Selecting a parameter set pre-selects the corresponding operating mode and assigns practical values to all parameters which can be set. Each parameter can be tailored to the individual requirements of the installation

Parameter sets

Parameter set	Operating mode	Function
P68001	6	3-step operation with one or two digital inputs, running time: 6 s
P68010	10	3-point step operation with running time fractions, running time: 51 s
P68011	10	3-point step operation with running time fractions, running time: 30 s
P68012	5	3-point step operation, running time: 15 s
P68013	5	3-point step operation, running time: 7.5 s
P68014	5	3-point step operation, running time: 4.5 s
P68015	3	2-step operation with one or two digital inputs, running time: 51 s
P68016	3	2-step operation with one or two digital inputs, running time: 30 s
P68017	1	2-point operation, running time: 15 s
P68018	1	2-point operation, running time: 7.5 s
P68019	1	2-point operation, running time: 4.5 s
P68020	10	3-point step operation with running time fractions, running time: 15 s
P68021	2	2-point operation with flame proving period, running time: 4.5 s
P68022	4	2-step operation with two digital inputs, running time: 5 s
P68023	7	2-point operation with switchover of the adjustment angle for the "open" position, running time: 4.5 s
P68024	8	2-point operation with input-dependent adjustment angle for the "open" position, running time: 4.5 s

Parameter set	Operating mode	Function
P68025	9	2-point operation with switchover of the running times, running time: 4.5 s/15 s
P68026	21	2-point operation, running time: 7.5 s
P68027	22	2-point operation with switchover of the adjustment angle for the "open" position, running time: 7.5 s
P68028	23	2-point operation with input-dependent adjustment angle for the "open" position, running time: 7.5 s
P68029	24	2-point operation with switchover of the running times, running time: 4.5 s/ 15 s
P68030	25	2-point operation with characteristic curve switchover I, running time: 7.5 s
P68031	26	2-point operation with characteristic curve switchover II, running time: 7.5 s

Factory default parameters

Factory default parameters are data saved permanently in the unit and which can be viewed in BC-Soft. This includes motor data and calibration data.

In addition, information on which parameter set was entered in the condition as delivered is also saved in the factory default parameters.

Certain special functions can be programmed with this, changing the behaviour of the digital inputs – see Switching logic.

Digital inputs

In the basic setting, the two digital inputs operate as universal inputs. If a voltage of 24 V DC or 100 – 230 V AC is applied to the input, this is recognised as "On" signal (positive logic).

Switching logic

The switching logic can be inverted here for each individual digital input. An applied voltage is then recognised as "Off" signal while no voltage results in an "On" signal (negative logic). Inversion of the input switching logic in conjunction with the operating modes provides new options for defining the behaviour of the actuator.

Signal source

If a digital input operates only with 100 – 230 V AC, the universal AC/DC input can be switched over to AC. In this setting (AC), an applied DC voltage is interpreted as a fault and this results in a fault signal. The red LED blinks and a message is displayed in BCSoft. The fault signal is saved in the statistics. The signal source can be defined individually for each digital input.

Analogue input

The actuator can approach corresponding intermediate positions via a current signal to the additional input. This function can be used only if an actuator IC 40 with analogue input 4 – 20 mA is connected (option). The switch-on and switch-off threshold of the analogue input is defined at approx. 3 mA.

The assignment of current value to position can be freely defined via 5 pairs of values (interpolation points).

One position which the actuator approaches when the corresponding current signal is applied can be assigned to each of the interpolation points at 4, 8, 12, 16 and 20 mA. The position is interpolated on the basis of a linear function in each case between the interpolation points.

In the case of operating modes 25 and 26, 2 characteristic curves, each with 5 interpolation points, can be defined. In this case, the digital inputs define which characteristic curve currently applies. This allows the same current signal to be used to run through two different output ranges, for example for lambda adjustment or for hot air compensation – see Operating mode 25 and Operating mode 26.

Filtering and hysteresis of the current signal

In order to suppress noise of the current signal, the analogue input is sampled equidistantly every millisecond and a mean value is generated over 0.1 s. This filtering can be prolonged up to 1 s in the case of a very poor input signal. However, this also prolongs the response time to a change at the analogue input.

The current input (4 – 20 mA) operates internally with a resolution of 10 bit (corresponding to 0.1% of the actuator). This allows the analogue input to detect a change of 0.02 mA (hysteresis).

If the input signal fluctuates too greatly (owing to noise for instance), this high resolution results in constant corrections of the actuator and butterfly valve (if mounted on BVA, BVG or BVH).

Consequently, the hysteresis may be increased to up to 0.2 mA. The resolution in this case is reduced down to 1% of the actuator accordingly. The maximum resolution is always set in each case as the basic setting.

Priority and running time in operating modes 1 – 10

In operating modes 1 to 10, the actuator is positioned (0 – 100%) by both digital inputs DI 1 and IN dig. 2. Alternatively, on the IC 40A..A, there is the option of positioning the actuator with a 4 – 20 mA current signal. Simultaneous presets via the analogue input and via the digital inputs necessitate defining a priority in BCSoft. The digital inputs have priority by default.

Opening speeds and closing speeds between 0 and 25.5 s can be set for analogue mode. The time always relates to the distance between the positions at 4 and 20 mA. If the current signal changes more slowly than the set running time, the actuator follows more slowly accordingly through to step-by-step movement – see Running times.

Outputs

Various, independent signalling functions can be assigned to the two outputs RO 1 and RO 2: closed position, low position, middle position and high position, fault signals and freely programmable positions.

2 relays with change-over contacts are available for signalling. The contacts are floating and are thus referred to as dry contacts. They can be integrated in automation processes.

For instance, reaching the pre-set position can be signalled back as a signal function. The range in which the output switches can be defined in BCSoft using the relational operator. The range may be =, ≥ or ≤ of the set position. Thus, for instance, the behaviour of a cam disk can be simulated.

Example for output 1 (RO 1): if the condition is met, the output relay is energised. Terminals 10 and 12 are connected – see IC 40 connection diagram.

The switching range can also be set individually via one minimum value and one maximum value. These settings are independent of the selected low position, middle position or high position.

A feedback signal can also be used as a fault signal. In BCSoft, it is possible to select what status is to lead to setting of the output (relay energised).

Device defective:
An internal fault, such as a fault in the memory chip, leads to failure of the device.

Internal warning (reference switch):
Internal monitoring of the motor position has detected a fault. Recalibrate!

Internal temperature > 90°C:
Warning! Attach heat deflectors.

Service note:
Number of cycles, changes of direction or relay switching operations greater than limit.

"Fault signals" also covers a "Device in Manual mode" signal even though the signal is not actually a fault signal.

The precise cause of the signal is displayed in the BCSoft and saved in the statistics – see Statistics.

The feedback signal of the IC 40 may not be used on its own for fail-safe signalling of a status or a fail-safe position – see Project planning information.

Manual mode

For simplified commissioning, the actuator can be operated "by hand" via the BCSoft software. Manual mode is activated via BCSoft.

A distinction is made between two types of manual mode: **Direct position preset** and **Simulate inputs**. The related setting options are enabled after the required Manual mode is selected.

The exterior, applied input signals have no effect on the control element in both Manual operating modes. Instead, the device responds to the presets from the software.

Fast blinking of the blue LED indicates that the actuator is in Manual mode.

Only one Manual mode may be activated at any one time. If the Manual mode is to be changed, the existing Manual mode must first be deactivated before the other Manual mode can be activated.

Direct position preset

This Manual mode serves to determine the operating positions for the process, such as the low fire (low) position, the middle (ignition) and the high fire (high) position.

For this purpose, the actuator can be moved to any position, regardless of the input signal. The position can be entered or changed directly in BCSoft. The resolution is defined in ranges fine/medium/coarse, whereby "fine" allows any step of the step motor (< 0.05%).

After transfer of the values from BCSoft to the actuator, the actuator responds accordingly to the new presets. The new position is always approached at maximum speed in this case.

The operating position determined can be assigned in BCSoft to a position, for example ignition position.

Simulate inputs

When this Manual mode is activated, the external inputs are deactivated. Instead, the signals of the two digital inputs can be pre-set "manually". If the actuator has a 4 – 20 mA analogue input (option), this can also be simulated.

Switching the inputs allows the behaviour of the actuator to be tested. This allows the set running times to be checked and optimised in BCSoft.

Statistics

The statistical data stored in the unit, such as fault signals which have occurred, various counter readings and measured values, is displayed in statistics in BCSoft.

The **counters** and **measured** values ranges are each split into overall data and customer data. The customer data is used for recording information over a specific period.

Counters

Actuating cycles (0 – 100 – 0%), changes of direction (Open/Closed), switching of the output relays, "Power On" switching operations and mains operating hours are added in the statistics. Besides the total counters, there are customer counters for recording information over a specific period.

Measured values

The minimum and maximum internal housing temperatures are saved in statistics. In addition, the current internal temperature is displayed. Here as well, there is a customer memory for viewing a period.

Resetting statistics

All signals and customer data can be reset. The reset date is saved automatically and displayed together with the customer data.

Counters and measured values cannot be reset or deleted.

Resetting a signal

A fault signal is signalled by the red LED on the actuator. The detailed cause of the signal is displayed in BCSoft. The cause must be remedied. The signal can then be acknowledged and reset with BCSoft.

Display

Normal operation

Blue LED	Red LED	Operating state
Moderately flashing**	Off	Zero position
Slow flashing***	Slow flashing***	Calibration
On	Off	Device in Standby mode
Moderately flashing**	Off	Device in motion
Fast flashing	Off	Manual mode
Fast flashing	Off	Moving in Manual mode
Permanent light	see Fault signal	Fault

* Fast: 5 times per second, ** moderately: 3 times per second, *** slow: once per second

Warnings and faults

Blue LED	Red LED	BCSoft error code	Warning*/fault**	Description	Cause
According to operating state	Flashing light (1×)	1	Warning	Internal temperature > 90°C	- High ambient temperature
According to operating state	Flashing light (2×)	4	Warning	Drift reference switch > 5%	- Mechanical valve offset - Valve moving against its stop
According to operating state	Flashing light (3×)	7	Warning	Drift reference switch > 10%	- Mechanical valve offset - Valve moving against its stop
According to operating state	Flashing light (4×)	8	Warning	Reference switch does not open	- Valve blocked - Large mechanical offset - Internal error - Actuator offset
According to operating state	Flashing light (5×)	9	Warning	Reference switch does not close	- Valve blocked - Internal error - Actuator offset, mechanical offset
According to operating state	Flashing light (6×)	10	Warning	Analogue input AI < 4 mA	- Signal interrupted - Signal not connected - Input defective

Blue LED	Red LED	BCSoft error code	Warning*/fault**	Description	Cause
According to operating state	Flashing light (7×)	21	Warning	Service note: Number of OPEN/ CLOSE cycles > limit value	
According to operating state	Flashing light (8×)	22	Warning	Service note: Number of changes of direction > limit value	
According to operating state	Flashing light (9×)	23	Warning	Service note: Number of relay output RO 1 or RO 2 switching operations > limit value	
Flashing light (1×)	Permanent light	5	Fault	Internal fault	- e.g. EEPROM reading or writing error
Flashing light (2×)	Permanent light	11	Fault	Zero position: Reference switch does not close	- Valve blocked - Internal error - Actuator offset - Valve not closed (BVHS)
Flashing light (3×)	Permanent light	12	Fault	Zero position: Reference switch does not open	- Valve blocked - Internal error - Actuator offset
Flashing light (4×)	Permanent light	13	Fault	Zero position: Reference opens too early (BVHS)	- Spring defective/not strong enough - Valve not closed tightly - Cam maladjusted
Flashing light (5×)	Permanent light	14	Fault	Zero position: Reference opens too late (BVHS)	- Motor or gear defective - Cam maladjusted
Flashing light (6×)	Permanent light	30	Fault	Saving error for adjustable parameters etc.	
Flashing light (7×)	Permanent light	31	Fault	Saving error: factory default parameters	
Flashing light (8×)	Permanent light	32	Fault	Saving error: user calibration	
Flashing light (9×)	Permanent light	33	Fault	Saving error: analogue parameters	

* Warning: The flashing of the LED on the unit is activated by selecting the corresponding option in BCSoft. The unit continues to function.

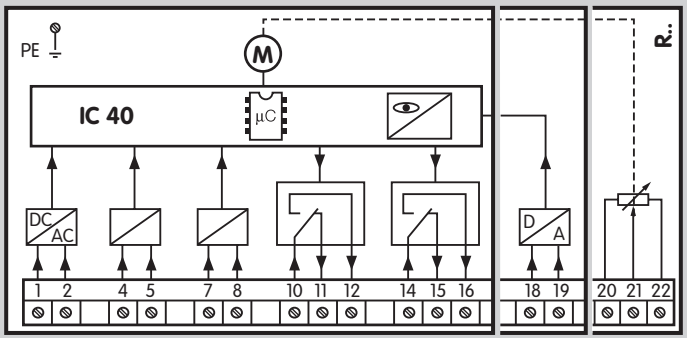
** Fault: The LED on the unit flashes whenever there is a fault. The unit no longer functions.

Relay outputs RO 1 and RO 2 function

The function of digital outputs RO 1 and RO 2 can be adjusted using BCSoft.

Signal at RO 1 or RO 2	Further setting options	Remarks
CLOSED position	equal to = greater than or equal to > = equal to or less than < =	
Low-fire rate position (low)		
Intermediate position (middle)		
OPEN position (high)		
Freely programmable position	Minimum and maximum value [°, %]	Relay switches when valve between min. and max. position
Faults and warnings	Drift reference switch > 5%* Drift reference switch > 10%* Reference switch does not open* Reference switch does not close* Internal temperature > 90°C Analogue input AI < 4 mA Service note	Faults are always signalled, warnings are signalled depending on the selection in BCSoft (see Inputs/ Outputs, Display of warnings)
Fault		Only faults are displayed
Manual mode		Device is in Manual mode
Ready		Relay drops out in the event of: faults (not in the event of warning), manual operation, zero position, calibration, no mains voltage
None		Relay output has no function

* These warnings are displayed as positioning errors in BCSoft.



	Power	DI 1 / DI 2	RO 1 / RO 2	IN Analog	Potentiometer
IC 40	100..230 VAC 50..60 Hz	100..230 VAC 24 VDC	max. 230 VAC max. 2 A	4..20 mA	max. 0,25 W
IC 40T **UL listed**	120 VAC 60 Hz	120 VAC 24 VDC	max. 120 VAC max. 2 A	4..20 mA Class 2	max. 0,25 W Class 2

Connection diagram

See Project planning information.

See Technical data.

Replacement possibility for actuators

GT 31 is to be replaced by IC 20

GT 31	Actuator	Actuator	IC 20
03			
07			07
15	Running time [s/90°]	Running time [s/90°]	15
30			**30**
60			60
H	Mains voltage: 24 V AC	Mains voltage: 100 – 230 V AC, ±10%	
M	120 V AC	120 V AC, -15/+10%	Q
T	220/240 V AC	230 V AC, -15/+10%	**W**
1	Torque 1.2 Nm	–	–
2	Torque 2.5 Nm	Torque 2.5 Nm*	2
3	Torque 3.0 Nm	Torque 3.0 Nm*	**3**
●	Three-point step control	Three-point step control	**●**
R	Two-point control	Two-point control	–
E	Continuous control	Continuous control	–
G	Additional switches with gold contacts	–	–
P	Feedback potentiometer 1000 Ω	Feedback potentiometer 1000 Ω	R10
GT 31-30T3	Example	Example	**IC 20-30W3**

● standard, ○ available

* IC 20-07: 2.5 Nm, IC 20-15/-30/-60: 3.0 Nm.

GT 31 is to be replaced by IC 40

GT 31	Actuator	Actuator	IC 40
03			
07			
15	Running time [s/90°]	Running time [s/90°]	●
30			
60			
H	Mains voltage: 24 V AC		
M	120 V AC	Mains voltage***: 100 – 230 V AC, ±10%	A
T	220/240 V AC		
1	Torque 1.2 Nm	–	–
2	Torque 2.5 Nm	Torque 2.5 Nm*	2
3	Torque 3.0 Nm	Torque 3.0 Nm*	3
●	Three-point step control	Three-point step control**	●
R	Two-point control	Two-point control**	●
E	Continuous control	Analogue input 4 – 20 mA	A
G	Additional switches with gold contacts	–	–
P	Feedback potentiometer 1000 Ω	Feedback potentiometer 1000 Ω	R10
GT 31-07T2E	Example	Example	IC 40A2A

with parameter set P 68013**

● standard, ○ available

* IC 40: 2.5 Nm, IC 40S: 3.0 Nm.

** Various parameter sets can be pre-set ex-works.

*** Supply the IC 40 permanently with voltage.

M5/M6 is to be replaced by IC 40

M	Solenoid actuator	Actuator	IC 40
●	Closed when de-energised	Safety closing function	S
5	Actuator size 5 for DN 40 – 80	–	–
6	Actuator size 6 for DN 100	–	–
R	Slow opening, slow closing		
L	Slow opening, quick closing	Running time 4.5 – 76.5 [s/90°]**	●
N	Quick opening, quick closing		
T	Mains voltage: 220/240 V AC	Mains voltage***: 100 – 230 V AC, ±10%	A
	110 V AC	–	–
	24 V DC	–	–
●	Two-point control	Two-point control**	●
3	Terminal connection box, IP 54	IP 65	●
6	... Standard plug	–	–
M 6RT3	Example	Example	IC 40SA

with parameter set P 68019**

● standard, ○ available

* IC 40: 2.5 Nm, IC 40S hat 3,0 Nm.

** Various parameter sets can be pre-set ex-works.

*** Supply the IC 40 permanently with voltage.

Selection

IC 20: Actuator for basic applications
IC 40: Intelligent actuator for complex applications

	S	-07	-15	-30	-60		W	Q	A	2[1]	3[1]	E[3]	A[3]	R10[3]
IC 20		●	●	●	●		●	●		●	●			○
IC 40[2]	○					●			●	●	●		○	○[4]

Type = IC

Safety closing function = S
(with butterfly valve BVHS only)

Running time (at 50 Hz)
7.5 s = -07
15 s = -15
30 s = -30
60 s = -60
4.5 – 76.5 s programmable

Mains voltage
230 V AC, -15/+10%, 50/60 Hz = W
120 V AC, -15/+10%, 50/60 Hz = Q
100 – 230 V AC, ±10%, 50/60 Hz = A

Torque
2.5 Nm = 2
3.0 Nm = 3

Continuous control 0 (4) – 20 mA, 0 – 10 V = E

Analogue input 4 – 20 mA = A

Feedback potentiometer
0 – 1000 Ω = R10

[1] IC 20-07: 2.5 Nm, IC 20-15/-30/-60: 3.0 Nm. IC 40: 2.5 Nm, IC 40S: 3.0 Nm.

[2] Various parameter sets can be pre-set ex-works. Please quote the parameter set in your order.

[3] If "none", this specification is omitted.

[4] Cannot be retrofitted.

Order example **IC 40A2R10**

Project planning information

Cable selection

Install supply and signal lines separately.

Cables should be installed well away from high-voltage lines of other devices.

Observe EMC Directive for installation of signal lines.

Use cables with wire end ferrules.

Cable cross-section:
IC 20: max. 2.5 mm^2,
IC 40: max. 2.5 mm^2.

See Technical data.

Wiring

See IC 20 connection diagram,
see IC 20..E connection diagram,

see IC 40 connection diagram.

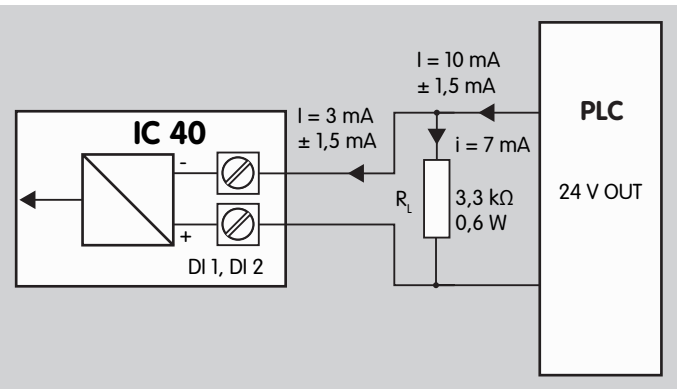
If the power supply is susceptible to frequent voltage peaks we recommend that an electric filter be used.

IC 40 digital inputs

The digital inputs require a current of 3 mA ±1.5 mA. To avoid interference, it may be necessary to increase the output current by using an additional load resistor on the signal sensor.

Load resistors may not be fitted inside the IC 40 for reasons relating to heat dissipation.

Example for 24 V DC and 10 mA:
Load resistor = 3.3 kΩ, 0.6 W.



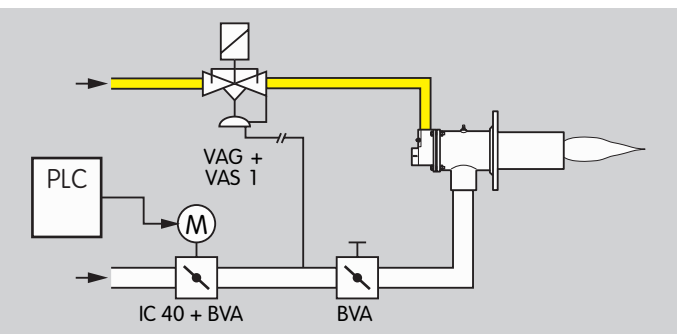
IC 40 feedback signalling

The feedback signal function (relay contact) possible with the outputs may not be used on its own for fail-safe signalling of the status or of the position.

Please refer to the relevant Directives and Standards as to whether and when a fail-safe signal is required.

As defined in European Standard EN 746-2 for instance, gating of two non-fail-safe sensors (signals) must be considered as a fail-safe equivalent array if the two sensors detect different physical variables.

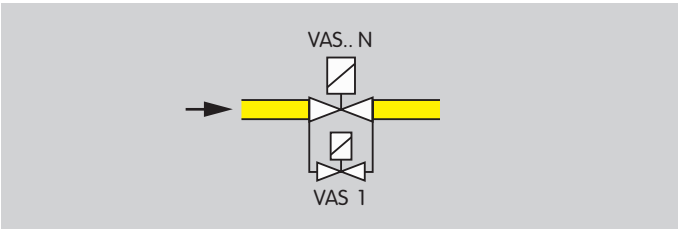
Example 1:



A fail-safe equivalent array for the ignition position of the butterfly valve for air may be series connection of a pressure switch signal with the feedback signal of the IC 40.

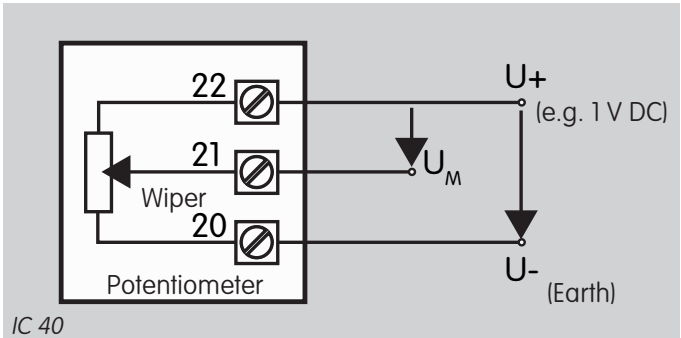
In this application, the pressure switch monitors the maximum permitted air pressure so as to restrict the maximum permitted start fuel flow rate using the air/gas ratio control GIK.

Example 2

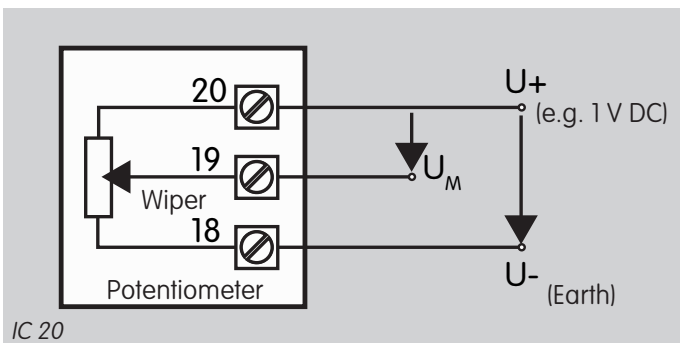


One other option of fail-safe limitation of the start fuel flow rate is utilisation of a bypass at the gas side. A bypass valve can limit the amount of gas in fail-safe manner owing to its nominal cross-section. The maximum possible gas pressure must be allowed for when selecting the nominal cross-section.

At all events, the plant user is responsible for assessing installation safety. Elster Kromschröder GmbH can, in this case, only provide its own estimates and resultant recommendations which do not reflect the individual situation of the particular installation.



IC 40



IC 20

IC 20/IC 40 feedback potentiometer

The feedback potentiometer offers the option of monitoring the current position of the actuator.

It must be utilised as a voltage divider. The change in position of the potentiometer wiper (which corresponds to the actuator position) can be measured as a changing voltage between U_+ and U_M.

Other circuit layouts produce measurement results that are inaccurate and do not remain stable over a long period of time or are non-reproducible. They also reduce the service life of the feedback potentiometer.

The feedback potentiometer can be retrofitted on actuator IC 20 – see Accessories.

IC 40 cannot be retrofitted with a potentiometer. As an option, the actuator is available with fitted potentiometer.

Installation

Installation position of actuators IC 20, IC 40: vertical or horizontal, not upside down.

If the actuator is used with hot air, the pipeline should be adequately insulated so as to reduce the ambient temperature.

Important! In order to avoid over-heating the flanges and butterfly valve must not be insulated.

In conjunction with butterfly valves BVH, BVHS, the actuator can be used in temperatures of up to 250°C, with additional heat deflectors it can be used in temperatures of up to 450°C – see Accessories.

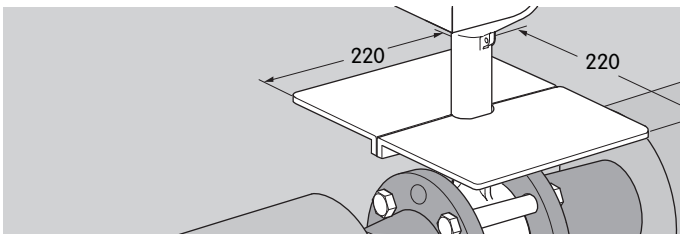
If the actuator is mounted onto butterfly valves other than DKL, DKG, BVA, BVG or BVH, the attachment set for "single application" is required – see Accessories.

IC 40 commissioning

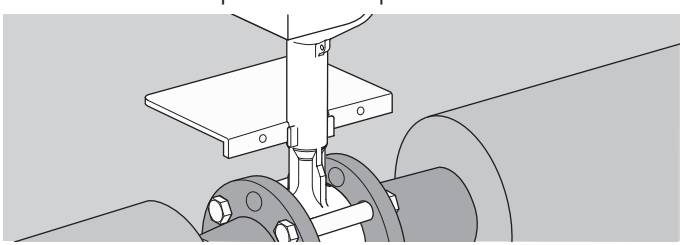
When mains power is connected, the actuator IC 40 conducts a zero position check. To do this, the actuator opens the control element to approx. 30°. Then the actuator moves to the position specified by the operating mode and input signals.

Accessories

IC 20, IC 40
Heat deflectors



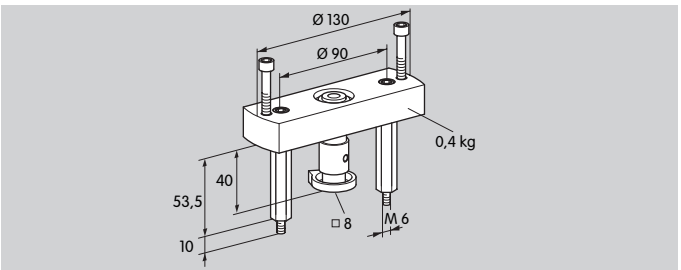
In conjunction with butterfly valves BVH, BVHS for hot air, the actuator can be used in temperatures of up to 250°C, with additional heat deflectors it can be used in temperatures of up to 450°C.



Order number: 74921670

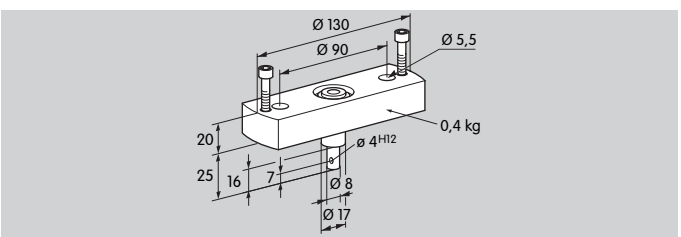
If you are using an insulated pipeline ensure that there is sufficient installation space to access the heat deflectors and the screw connectors near the valve.

Adapter set for mounting an actuator IC 20, IC 40 onto a butterfly valve DKL, DKG



Order number: 74921672

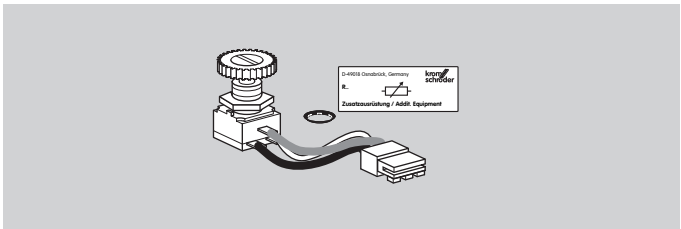
IC 20, IC 40 "single application" attachment set



Order number: 74921671

This attachment set is required if the actuator is mounted onto butterfly valves other than DKL, DKG, BVA, BVG or BVH.

IC 20 potentiometer installation set



Feedback potentiometer 1000 Ω. The power consumption of the potentiometer is max. 0.5 W.

Order number: 74921144

IC 40 BCSoft

Opto-adapter including BCSoft CD-ROM

Order No.: 74960437

The current software can be downloaded from our Internet site at

http://www.kromschroeder.com
▶ Products ▶ 03 Valves and butterfly valves
▶ Actuators IC 20, IC 40.

Technical data

IC 20

Mains voltage:

120 V AC, -15/+10%, 50/60 Hz,
230 V AC, -15/+10%, 50/60 Hz.

Power consumption:
4.9 VA at 50 Hz, 5.8 VA at 60 Hz.

Screw terminals using the elevator principles for cables up to 4 mm2 (single core cables) and for cables up to 2.5 mm2 with wire end ferrules.

Angle of rotation: 0 – 90°, adjustable.

Holding torque = Torque.

Switching power of the position switches:

Voltage	Resistive load	Incand. lamp load	Inductive load
125 V AC	2 A	0,5 A	2 A
250 V AC	2 A	0,5 A	2 A
<30 V DC	2 A	2 A	2 A
<50 V DC	1 A	0,4 A	1 A
<75 V DC	0,75 A	0,3 A	0,75 A
<125 V DC	0,5 A	0,2 A	0,03 A
<250 V DC	0,25 A	0,1 A	0,03 A
12 – 30 V AC/DC	10 – 100 mA	–	10 – 100 mA

IC 20..E

Power consumption:
Terminals 1, 2 and 5:
4.9 VA at 50 Hz, 5.8 VA at 60 Hz,
Terminal 3:
8.4 VA at 50 Hz, 9.5 VA at 60 Hz,
in total not exceeding:
8.4 VA at 50 Hz, 9,5 VA at 60 Hz.

Feedback output:
galvanically isolated, load impedance max. 500 Ω.

Input: galvanically isolated,
4 (0) – 20 mA: load impedance
switchable from 50 Ω to 250 Ω,
0 – 0 V: 100 kΩ input resistance.

IC 40

Mains voltage:
IC 40: 100 – 230 V AC, ±10%, 50/60 Hz, the actuator automatically adjusts to the respective mains voltage;
IC 40T: 120 V AC, ±10%, 60 Hz.

Power consumption: 8.4 W,
Switch-on peak current: max. 8 A for max. 10 ms.

Screw terminals using the elevator principles for cables up to 4 mm^2 (single core cables) and for cables up to 2.5 mm^2 with wire end ferrules.

Angle of rotation: 0 – 90°.

Holding torque = Torque as long as permanent supply voltage is applied.

2 digital inputs:
IC 40: 24 V DC or 100 – 230 V AC each,
IC 40T: 24 V DC or 120 V AC each.

Current requirement of digital inputs: 3 mA ± 1.5 mA.

1 analogue input (optional): 4 – 20 mA (IC 40T: Class 2) (internal load impedance max. 500 Ω at 20 mA).

Potentiometer (optional):
1000 Ohm +/- 20%,
linearity tolerance +/- 2%,
max. capacity 0.25 W (IC 40T: Class 2),
conductive plastic element.

Important: Tap wiper at high resistance
– see Project planning information.

2 digital outputs:
signalling contacts designed as relay change-over contacts.

Contact current of digital outputs:
min. 5 mA (resistive) and max. 2 A.

The relay contacts can be connected to 100 – 230 V AC or 24 V DC (IC 40T: 120 V or 24 V). If the contacts have been connected with a voltage > 24 V and a current > 0.1 A once, the gold plating on the contacts will have been burnt through. This contact can then only be connected with this power rating or higher power rating.

2 LED status displays:

– Blue LED for operation "ON",
  Drive in motion = Slow flashing light;
  Manual operation = Fast flashing light;
  Drive stopped = Permanent light.
– Red LED for warnings and faults,
  Warning = Permanent light;
  Fault = Flashing light.
– Red and blue LED simultaneously,
  Calibration in progress = Flashing light.

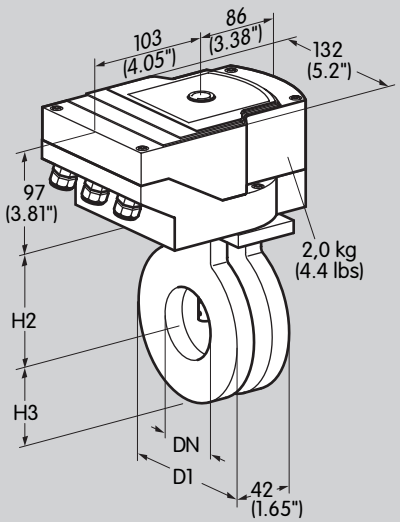
IC 20, IC 40

IC 20, IC 40: Enclosure: IP 65 pursuant to IEC 529,
IC 40T: NEMA 4 (Indoor Use Only).

Protection class: I pursuant to EN 60335.

Electrical connection:
Line entrance: 3 × M20 plastic screw connectors.

Ambient temperature:
-20 – 60°C, no condensation permitted.



IC 20/IC 40 + BVA/BVG

Running times and torques

Type	Running time [s/90°]		Torque [Nm]	
	50 Hz	60 Hz	50 Hz	60 Hz
IC 20-07	7.5	6.25	2.5	2
IC 20-15	15	12.5	3	3
IC 20-30	30	25	3	3
IC 20-60	60	50	3	3
IC 40	4.5..76.5	4.5..76.5	2.5	2.5
IC 40S	4.5..76.5	4.5..76.5	3	3

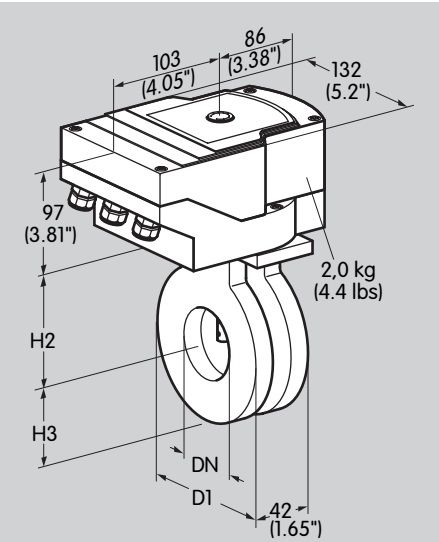
IC 20:
The running time per 90° depends on the required torque.

The running time is reduced by a factor of 0.83 at 60 Hz.

IC 40:
On the IC 40, the running time and torque are independent of the mains frequency. The running time can be freely programmed between the limits of 4.5 – 76.5 s.

Dimensions IC 20/IC 40 + BVA/BVG

Type	DN	H2 mm	H3 mm	D1 mm	Weight kg
IC 20/IC 40 + BVA/BVG 40	40	96	51	92	2.8
IC 20/IC 40 + BVA/BVG 50	50	100	59	107	3.0
IC 20/IC 40 + BVA/BVG 65	65	108	69	127	3.3
IC 20/IC 40 + BVA/BVG 80	80	115	76	142	3.5
IC 20/IC 40 + BVA/BVG 100	100	125	86	162	3.8
IC 20/IC 40 + BVA/BVG 125	125	138	101	192	4.2
IC 20/IC 40 + BVA/BVG 150	150	150	114	218	4.5



IC 20/IC 40 + BVA/BVG

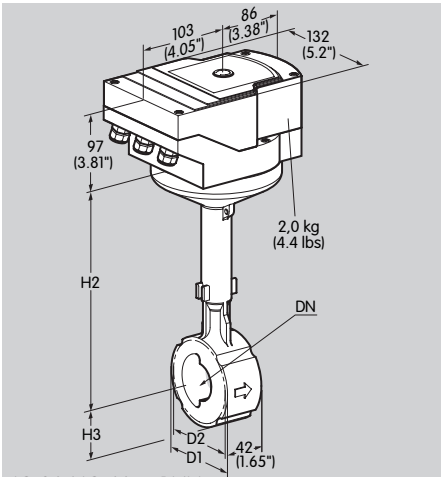
Dimensions IC 20/IC 40 + butterfly valves BVA/BVG with reduced bore

With 1x reduced bore

Typ	DN	H2 mm	H3 mm	D1 mm	Weight kg
IC 20/IC 40 + BVA / BVG 40/32	32	96	51	92	2.9
IC 20/IC 40 + BVA / BVG 50/40	40	100	59	107	3.1
IC 20/IC 40 + BVA / BVG 65/50	50	108	69	127	3.4
IC 20/IC 40 + BVA / BVG 80/65	65	115	76	142	3.7
IC 20/IC 40 + BVA / BVG 100/80	80	125	86	162	4.0
IC 20/IC 40 + BVA / BVG 125/100	100	138	101	192	4.6
IC 20/IC 40 + BVA / BVG 150/125	125	150	114	218	5.0

With 2x reduced bore

Typ	DN	H2 mm	H3 mm	D1 mm	Weight kg
IC 20/IC 40 + BVA / BVG 40/25	25	96	51	92	3.0
IC 20/IC 40 + BVA / BVG 50/32	32	100	59	107	3.2
IC 20/IC 40 + BVA / BVG 65/40	40	108	69	127	3.5
IC 20/IC 40 + BVA / BVG 80/50	50	115	76	142	3.8
IC 20/IC 40 + BVA / BVG 100/65	65	125	86	162	4.2
IC 20/IC 40 + BVA / BVG 125/80	80	138	101	192	4.9
IC 20/IC 40 + BVA / BVG 150/100	100	150	114	218	5.5



IC 20/ IC 40 + BVH

Dimensions IC 20/IC 40 + BVH

Type	DN	H2 mm	H3 mm	D1 mm	D2 mm	Weight kg
IC 20/IC 40 + BVH 40	40	234	46	92	–	5.4
IC 20/IC 40 + BVH 50	50	239	54	107	–	5.9
IC 20/IC 40 + BVH 65	60	243	64	127	–	6.8
IC 20/IC 40 + BVH 80	80	254	71	142	–	7.3
IC 20/IC 40 + BVH 100	100	265	88	175	162	8.5

Maintenance cycles

The actuators IC 20, IC 40 suffer little wear and require little servicing.

We recommend a function check once a year.

IC 40

A service note is issued after
3 million cycles (0 – 90 – 0°/0 – 100 – 0 %),
3 million relay switching operations,
5 million changes of direction.

Glossary

Start fuel flow rate

The start fuel flow rate is the quantity of fuel ignited by the ignition device on start-up of the burner.

Positions

Position is the angle (0 – 90° or 0 – 100%), which the actuator approaches. There are 4 positions, depending on the set operating mode:

Closed = 0° = 0%

Low = Low-fire rate

Middle = Intermediate

High = Open.

Adjustment angle for the "open" position

The adjustment angle for the "open" position indicates the approached position of the actuator and thus determines the maximum quantity in intermittent mode.

Legend

	Manual operation
	Safety interlocks (Limits)
	Start-up signal
DI	High temperature operation
	Ignition transformer
	Gas valve
	Air valve
P	Purge
A	Ext. air valve control
	Flame signal
	Operating signal
1, 2	Pilot and main burner
	Fault signal
	Reset
t_S	Closing time
	Air pressure switch

Feedback

Finally, we are offering you the opportunity to assess this "Technical Information (TI)" and to give us your opinion, so that we can improve our documents further and suit them to your needs.

Clarity

- ○ Found information quickly
- ○ Searched for a long time
- ○ Didn't find information

  What is missing?
- ○ No answer

Comprehension

- ○ Coherent
- ○ Too complicated
- ○ No answer

Scope

- ○ Too little
- ○ Sufficient
- ○ Too wide
- ○ No answer

Use

- ☐ To get to know the product
- ☐ To choose a product
- ☐ Planning
- ☐ To look for information

Navigation

- ○ I can find my way around
- ○ I got "lost"
- ○ No answer

My scope of functions

- ○ Technical department
- ○ Sales
- ○ No answer

Remarks

(Adobe Reader 7 or higher required)

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