Burner control units BCU 570

Technical Information · GB
6 Edition 01.15

- For monitoring and controlling modulating individual burners and forced draught burners of unlimited capacity
- For directly ignited burners or burners ignited by a pilot burner in intermittent or continuous operation
- Perform safety functions in accordance with EN 746-2 and EN 676
- With optional valve proving system
- Flexible range of applications due to parameterization possibilities
- Optional bus module for fieldbus connection
- EC type-tested and certified
- Safety functions up to SIL 3 (DIN EN 62061) corresponding to PL e (ISO EN 13849)
- AGA approval in preparation

Contents

▼ = To be continued

1 Application

BCU 570 with plug-in spring-force connection terminals

Burner control unit BCU 570 controls, ignites and monitors industrial individual burners and forced draught burners of unlimited capacity in intermittent or continuous operation. It can be used for directly ignited burners or burners ignited by a pilot burner.

The BCU 570 has an interface for control elements for burner capacity control. Both actuators (IC 20, IC 40, 3-point step and RBW) and frequency converters can be controlled. A valve proving system can be integrated as an option.

The BCU 570 activates the fan and sets a connected actuator or frequency converter to pre-purge and ignition position. If the centrally checked safety requirements, e.g. pre-purge, flow detector and pressure switch check, have been met, the BCU 570 starts the burner. An enable signal is then issued to an external temperature controller which controls the actuator or frequency converter in accordance with the capacity demand.

The burner control unit BCU 570 monitors the gas and air pressure. The optionally integrated valve proving system checks the valves by checking an external gas pressure switch or by checking whether the gas valve on the inlet side is closed.

Using the BCSoft program, the parameters, analysis and diagnostic information can be read from the BCU via the optionally available opto-adapter. All valid parameters are saved on the integrated parameter chip card. The parameter chip card can be removed easily, for example when the unit is replaced, and inserted into a new BCU to transfer the parameters.

An integrated Manual mode allows the manual activation of the burner control units and adjustment of the butterfly valves.

The fan output and the actuator and valve outputs which are checked for faults are accommodated in a plug-in power module. This can simply be replaced if necessary.

Once the plug-in power module has been removed, the parameter chip card and fuses are accessible.

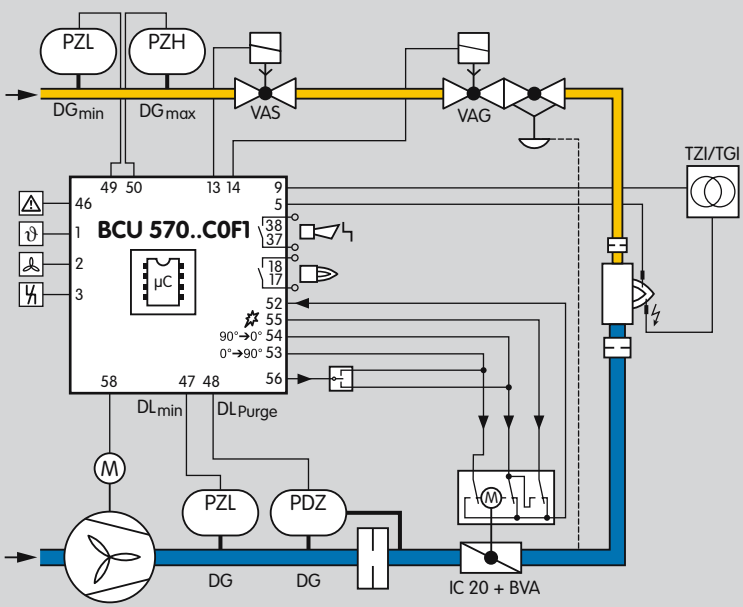
The BCU can be installed on a DIN rail in the control cabinet. The plug-in connection terminal strips make it easier to install and remove.

The external operator-control unit OCU is available as an option for the BCU. The OCU can be installed in the control cabinet door instead of standard control units. The program step/status or fault messages can be read on the OCU. For burner adjustment, the operating points can be approached conveniently in Manual mode using the operator-control unit.

Thanks to the operator-control unit OCU, display functions and operation of the BCU can be relocated to the control cabinet door.

Using the bus module BCM 500, the BCU can be networked with a fieldbus system. Networking in a fieldbus system enables the burner control unit BCU 570 to be controlled and monitored by an automation system (e.g. PLC). This also opens up a wide range of process visualization possibilities.

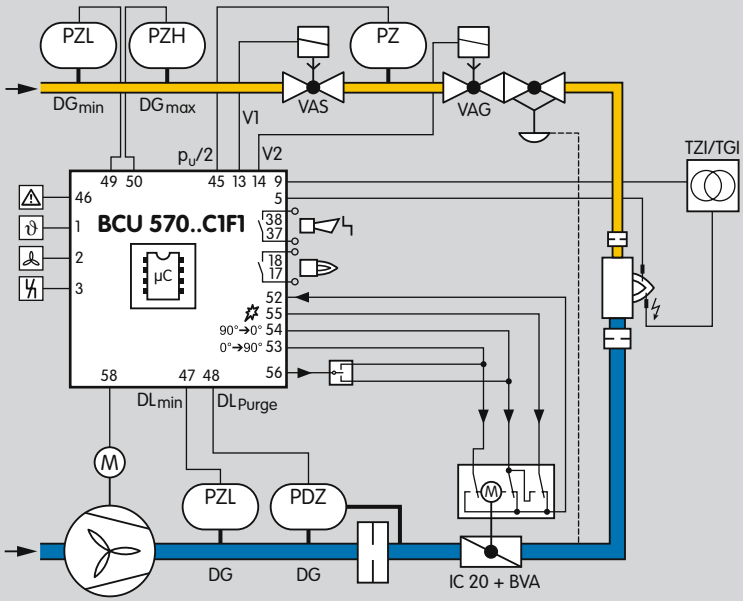
Bus module BCM 500 for DIN rail installation for lateral connection to the BCU



1.1 Examples of application

1.1.1 Modulating-controlled forced draught burner

The BCU 570 controls the fan, monitors the combustion media air and gas, controls pre-purge and moves the butterfly valve to pre-purge and ignition position. Once the BCU 570 has started the burner, it issues the enable signal to the external temperature controller which then assumes the control task.

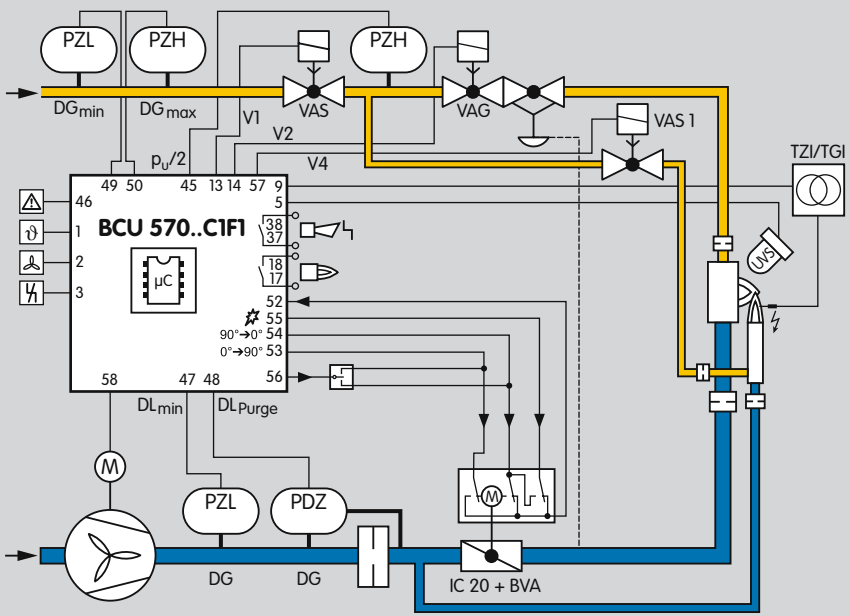


1.1.2 Modulating-controlled forced draught burner with valve proving system

The BCU 570..C1 is fitted with an integrated valve proving system. This allows the tightness of two gas solenoid valves and the pipework to be checked. Optionally, the closed position of a gas solenoid valve can also be checked using a POC switch.

The tightness control function satisfies the requirements of EN 1643 (Valve proving systems for automatic shut-off valves for gas burners and gas appliances).

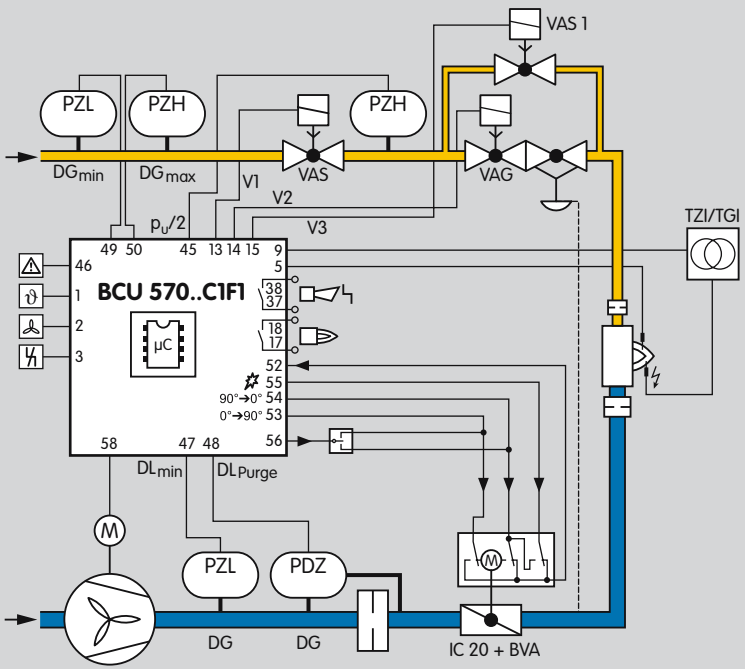
By checking the closed position using the proof of closure function, the BCU complies with the requirements of NFPA 85 (Boiler and Combustion Systems Hazards Code) and NFPA 86 (Standard for Ovens and Furnaces).



1.1.3 Modulating-controlled forced draught burner with pilot burner and valve proving system

The burner is ignited by a pilot burner. The integrated valve proving system checks the tightness of all gas valves and the pipework between the gas solenoid valves with the aid of the pressure switch.

Parameters may be used to decide whether the pilot burner should be operated permanently or is switched off during the main burner's safety time.

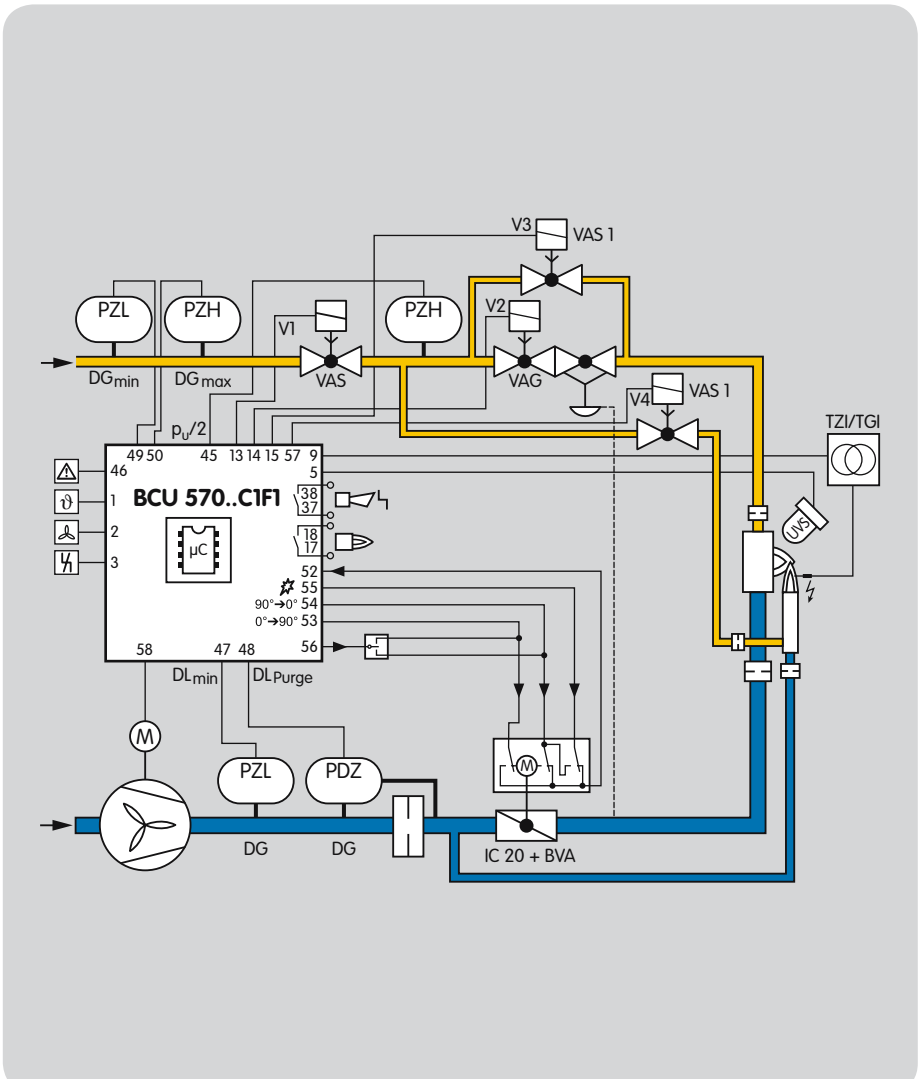


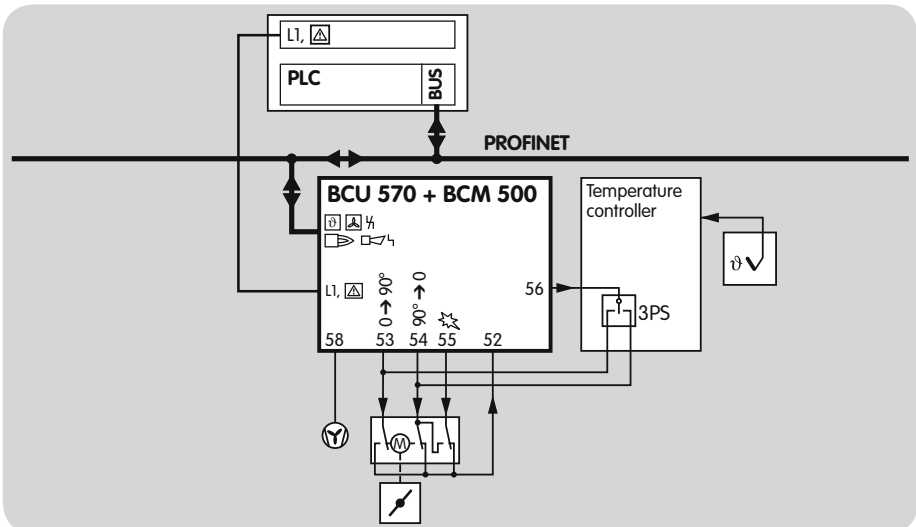
1.1.4 Limitation of the ignition rate in accordance with SIL/PL

The burner can be started with a defined ignition rate using the connected gas valve V3. Once the BCU has been informed that the burner is in operation, gas valve V2 opens. Gas valve V3 closes.

It is thus possible to limit the ignition rate in accordance with the valid SIL/PL safety requirements.

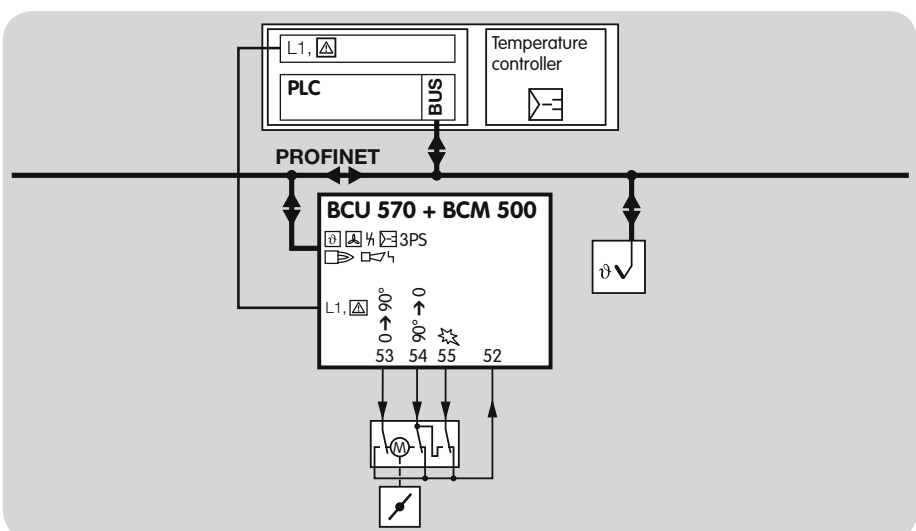
The safe limitation of the ignition rate can be used for both applications with a single burner and burners with pilot burners.


V3
VAS 1
PZL
PZH
V1
PZH
V2
DGmin
DGmax
VAS
VAG
V4
VAS 1
TZI/TGI
pU/2
49 50 45 13 14 15 57 9
46
1
2
3
BCU 570..C1F1
µC
38
37
18
17
5
52
55
90°→0° 54
0°→90° 53
56
58
47 48
DLmin
DLPurge
UVS
M
PZL
PDZ
DG
DG
IC 20 + BVA



1.1.5 Controlling the BCU via Profinet

The BCU issues the Enable signal to the temperature controller for capacity control. The temperature controller then controls the butterfly valve directly.



1.1.6 Controlling the BCU and the butterfly valve via Profinet

The BCU receives positioning information for the butterfly valve from the temperature controller via Profinet and activates the butterfly valve following controller enable.

2 Certification

Certified to SIL and PL

For systems up to SIL 3 pursuant to EN 61508 and PL e pursuant to ISO 13849

EU certified

pursuant to

- Gas Appliances Directive (2009/142/EC) in conjunction with EN 298, EN 1643
- Low Voltage Directive (2006/95/EC) in conjunction with EN 60730
- Electromagnetic Compatibility Directive (2004/108/EC) in conjunction with the relevant standards relating to radiation

CSA approved

Certified to CAN/CSA–22.2 No. 199-M89 (R 2004), Canadian Standards Association Class: 3335-01 and 3335-81 "Systems (Gas)-Automatic Ignition and Components"

For more details, see http://directories.csa-international.org

FM approved

The BCU 570 is FM approved,
Factory Mutual Research Class: 7610 "Combustion Safeguards and Flame Sensing Systems".

Suitable for applications pursuant to NFPA 86.

For more details, see www.fmglobal.com ➔ Products and Services ➔ Product Certification ➔ Approval Guide

UL listed

Underwriters Laboratories – UL 353 "Standard for Limit Controls". www.ul.com ➔ (at the bottom of the page) "Online Certifications Directory"

Eurasian Customs Union

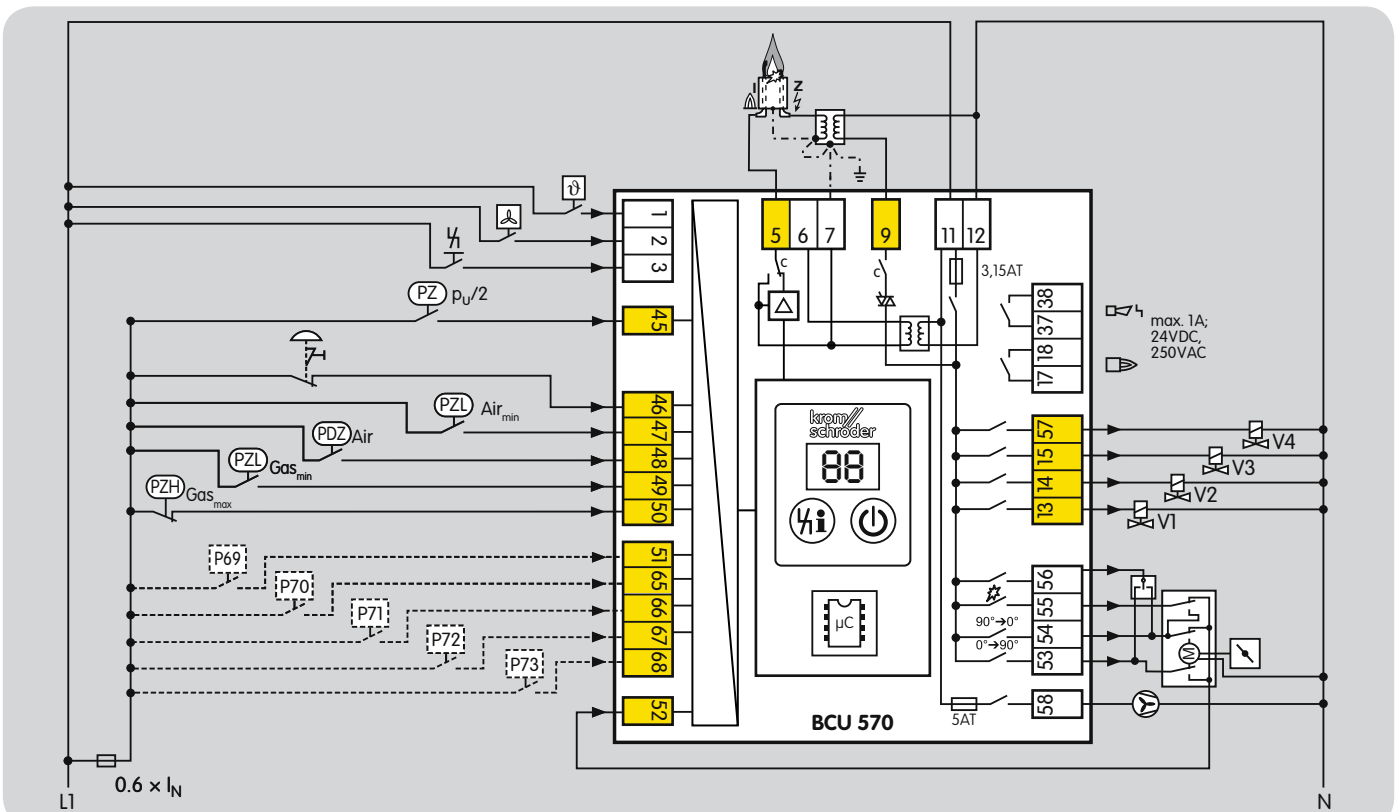
The product BCU 570 meets the technical specifications of the Eurasian Customs Union (the Russian Federation, Belarus, Kazakhstan).

3 Function

3.1 Connection diagram

3.1.1 BCU 570 with ionization control in double-electrode operation

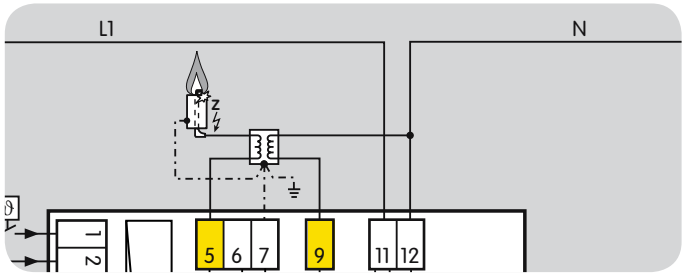
Connection diagrams for actuators and frequency converters, see from page 20 (Capacity control)



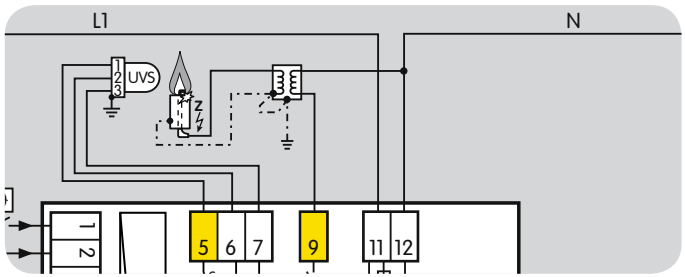
Electrical connection, see page 86 (Project planning information)

Explanation of symbols, see page 103 (Legend)

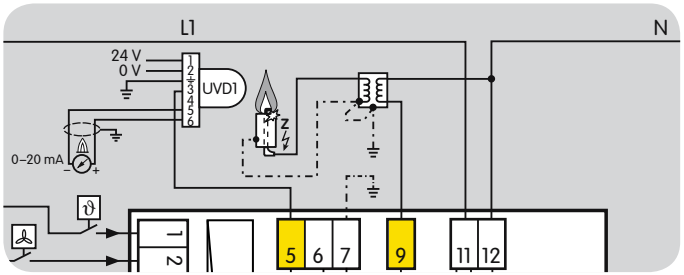
3.1.2 With ionization control in single-electrode operation



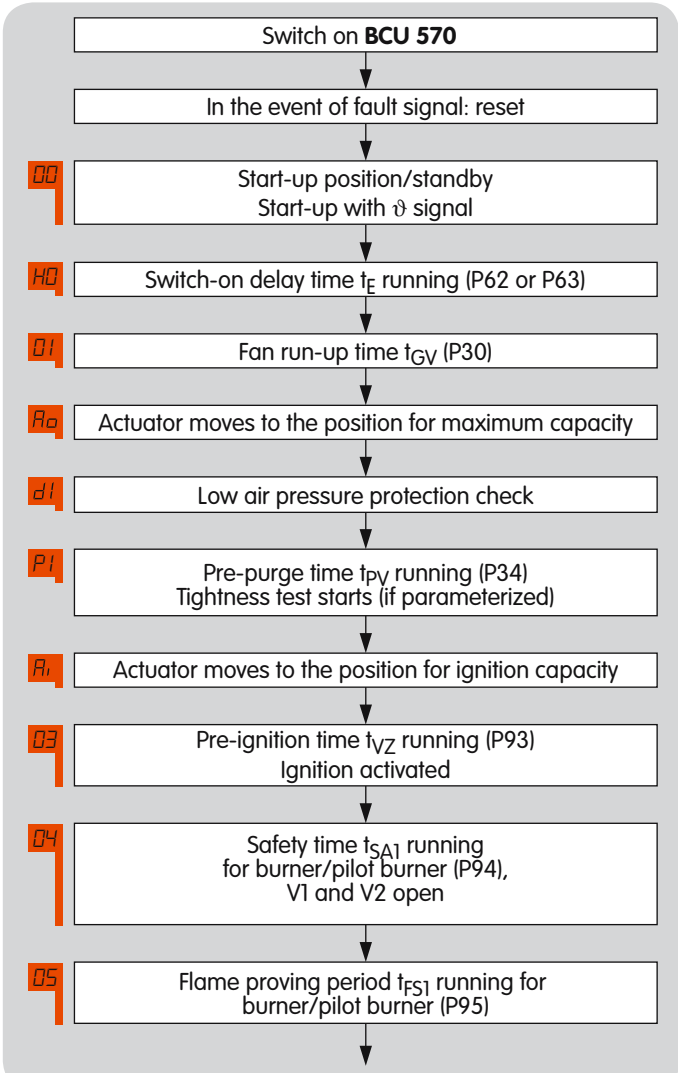
3.1.3 With UVS control



3.1.4 With UVD control



An additional voltage supply of 24 V DC is required to operate the UV sensor for continuous operation UVD 1 in conjunction with burner control unit BCU 570. The 24 V DC voltage supply and the 0 – 20 mA current output of the UV sensor must be wired separately.



3.2 Program sequence

3.2.1 Normal start-up

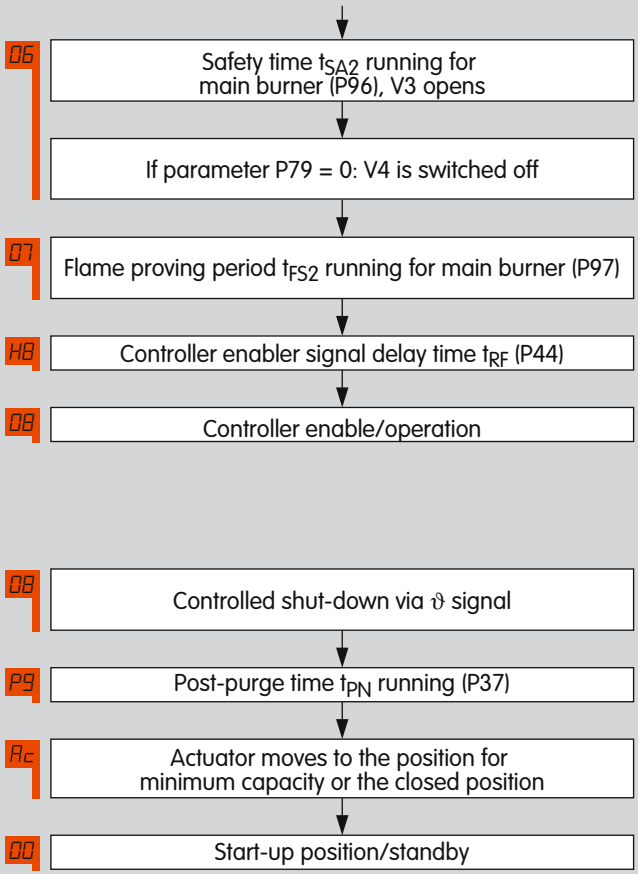
If a fault from the preceding operating cycle is still being signalled after switching on, it will be necessary to reset this first. The BCU 570..C1 has an integrated valve proving system which starts the tightness test or proof of closure function after the BCU has been switched on.

Once the start-up signal (ϑ) has been applied, the switch-on delay t_E starts to elapse (display H0).

During the fan run-up time t_{GV} (display 01) which follows, the fan starts with the butterfly valve being closed. Afterwards, the actuator moves from the position for minimum capacity to the position for maximum capacity. The air pressure is checked using the differential pressure switch (display dI). The pre-purge time t_{PV} (display PI) starts if the air flow is sufficient.

After the pre-purge time has elapsed and the valve check has been successfully completed (if parameterized on the BCU 570..C1), the actuator moves to the position for ignition capacity (display AI). The running times depend on the connected actuator. The BCU waits for actuator feedback before continuing the program sequence.

Now the BCU starts the pre-ignition time t_{VZ} (display 03) and then opens valves V1 and V2 for the pilot burner (display 04). The ignition time t_Z starts. After the first flame proving period t_{FS1} (for the pilot burner, display 05), the BCU opens valve V3 to start the burner (main burner).



If parameter 79 = 0, V4 closes shortly before the second safety time t_{SA2} for the main burner has elapsed (display 06). The pilot burner is switched off.

This is followed by the flame proving period t_{FS2} for the main burner (display 07) and the controller enable signal delay time t_{RF}. The BCU then issues the controller enable signal for the actuator (display 08). The BCU is in operation.

If there is no pilot burner, program steps 06 and 07 will be omitted.

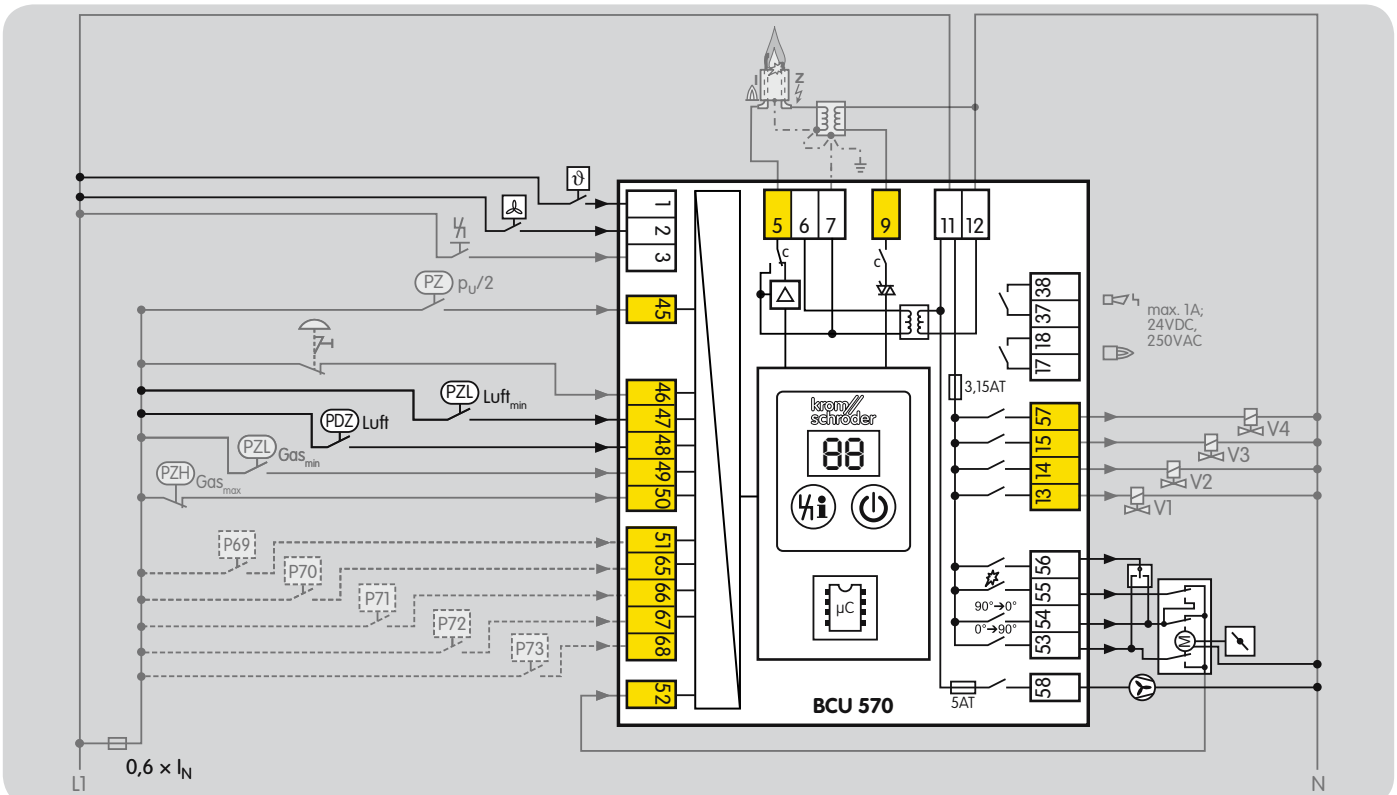
As soon as the start-up signal (ϑ) is switched off, the post-purge time starts to elapse (display P9). During this, the butterfly valve moves to the position for the ignition capacity and then to the position for minimum capacity or the closed position (display Ac). Next, the BCU rests in the start-up position/standby (display 00).

4 Air control

The BCU 570 takes over the air control as it is the central protective system. It controls and monitors the required air volume for start-up and after the burner has been shut down. The capacity control is enabled while the burner is in operation.

The BCU 570 activates the fan. The static air pressure and the air volume for pre-purge are monitored by pressure switches.

3-point step actuators (for example IC 20, IC 20E) or IC 40 actuators can be controlled and monitored via the interfaces on the BCU 570..F1. RBW actuators or frequency-controlled fans can be controlled and monitored via the interfaces on the BCU..F2. The actuator or fan is controlled by an external temperature controller.



4.1 Controlled air flow

If the controlled air flow input (terminal 2) is actuated in standby (without a start-up signal), the BCU will start the fan to provide air to cool the combustion chamber for example.

The fan is started depending on the functions defined by parameters, see page 61 (Low air pressure protection), page 80 (Switch-on delay time t_E), page 62 (Fan run-up time t_{GV}) and page 62 (Air flow monitoring during controlled air flow).

As soon as a start-up signal ϑ is received at terminal 1, the controlled air flow function is stopped and a burner start is initiated.

4.2 Capacity control

The BCU 570 activates a control element via the outputs for capacity control (terminals 53 to 56) for controlled air flow, pre- and post-purge or to start the burner. This control element (butterfly valve or frequency converter) is used to set the air volume required for the relevant operation situation.

As soon as a start-up signal is received by the BCU 570 (terminal 1), the fan is started after the switch-on delay time has elapsed. The air volume for pre-purge is set using the control element via the outputs for capacity control (terminals 53 to 56). If the fan is switched on, the minimum air pressure is ensured using an air pressure switch connected to terminal 47. The pre-purge time starts if there is adequate air flow.

After the elapse of the pre-purge time, the air volume for ignition is set using the control element. If the air volume has been set and the valve check (BCU 570..C1) completed, the burner will be ignited. After the operating signal has been received from the burner and after expiry of the delay time for the controller enable signal (P44), the BCU issues the controller enable signal. Access to the control element is thus transferred to an external temperature controller. The temperature controller controls the burner capacity (air volume) on the basis of the required temperature. Depending on the wiring for the output signals of the temperature controller (3-point step), the actuator may be adjusted between maximum capacity and ignition capacity or minimum capacity.

Depending on parameter 40, actuators IC 20 and IC 40, an actuator with an RBW interface or a fan controlled by a frequency converter can be actuated via the outputs for capacity control.

For more detailed information about capacity control with actuators IC 20 and IC 40, RBW interface or frequency converter, see from page 65 (Capacity control).

5 Valve proving system

The BCU 570..C1 is fitted with an integrated valve proving system. This tests the tightness of the gas solenoid valves including the pipework between these valves, see page 21 (Tightness control).

Alternatively, the valve proving system may be parameterized so that a proof of closure switch checks the closed position of a gas solenoid valve, see page 31 (Proof of closure function).

Once the test has been carried out successfully, the burner is enabled.

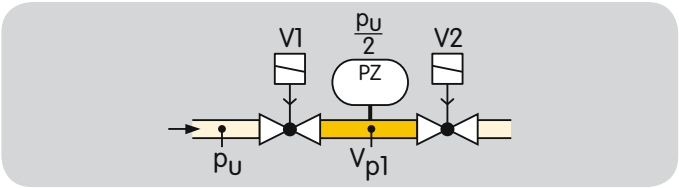
The valve proving system function satisfies the requirements of EN 1643 (Valve proving systems for automatic shut-off valves for gas burners and gas appliances).

By checking the closed position using the proof of closure function, the BCU complies with the requirements of NFPA 85 (Boiler and Combustion Systems Hazards Code) and NFPA 86 (Standard for Ovens and Furnaces).

5.1 Tightness control

The aim of the tightness control is to identify an inadmissible leak on one of the gas solenoid valves and to prevent burner start. European standards EN 746-2 and EN 676 stipulate tightness controls for capacities over 1200 kW (NFPA 86: from 117 kW or 400,000 Btu/h).

Gas solenoid valves V1 and V2 are tested as is the pipework between the valves.



5.1.1 Test instant

Depending on the parameter setting, the tightness control checks the tightness of the pipework and the gas solenoid valves before each start-up and/or after each shut-down of the burner, see page 78 (Valve proving system).

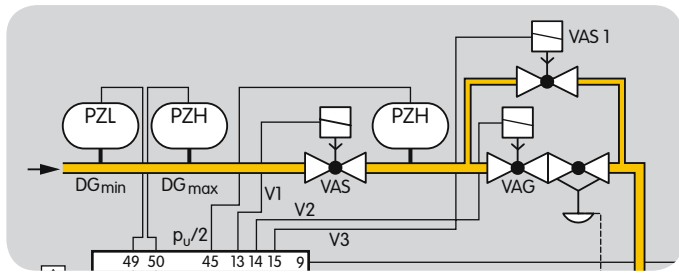
The gas line is always safeguarded by a gas solenoid valve during this check.

Before burner start-up

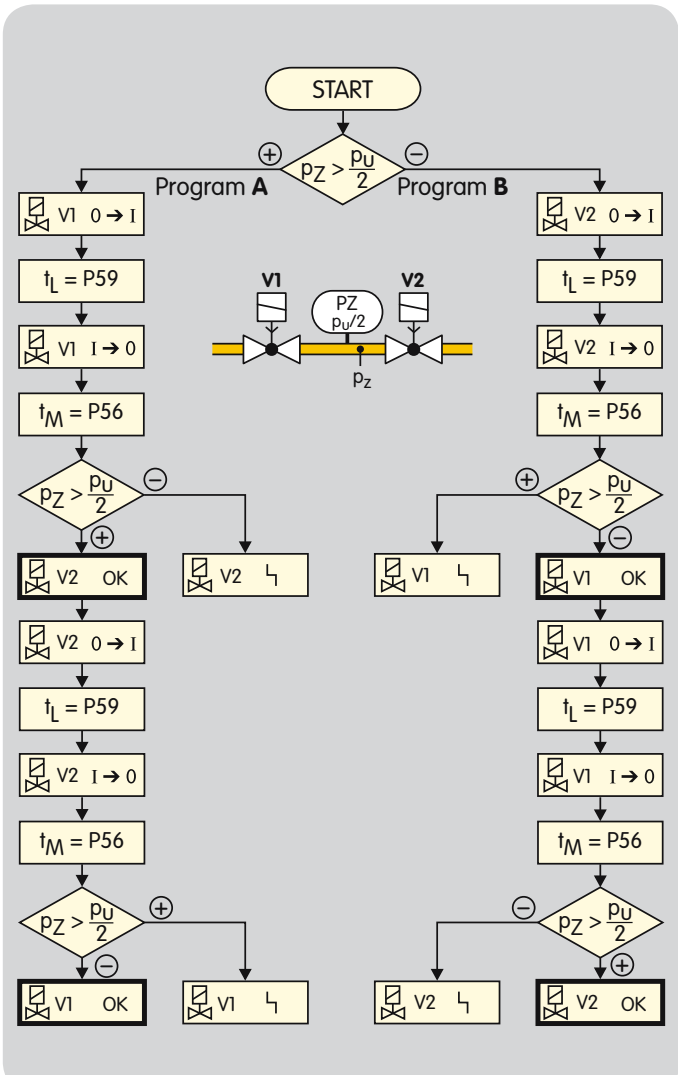
The valve check is started when the start-up signal ϑ is present at terminal 1. The BCU checks the tightness of the gas solenoid valves and the pipework between the valves. The gas line is always safeguarded by a gas solenoid valve during this check. The burner is ignited when pre-purge is ended and the tightness has been checked successfully.

After burner shut-down

After the burner has been shut down, the BCU checks the tightness of the gas solenoid valves and the pipework between them. Once the test has been carried out successfully, the next burner start is enabled. The BCU immediately conducts a tightness test if mains voltage is available or if it is reset after a fault lock-out.



An additional bypass/relief valve must be installed in gas sections with an air/gas ratio control. This ensures that a closed air/gas ratio control is bypassed during the tightness test.



5.1.2 Program sequence

The tightness test starts by checking the external pressure switch. If pressure $p_Z > p_u/2$, program A starts.

If pressure $p_Z < p_u/2$, program B starts, see page 24 (Program B).

Program A

Valve V1 opens for the opening time t_L set in parameter 59. V1 closes again. During the measurement time t_M, the tightness control checks the pressure p_Z between the valves.

If pressure p_Z is less than half the inlet pressure $p_u/2$, valve V2 is leaking.

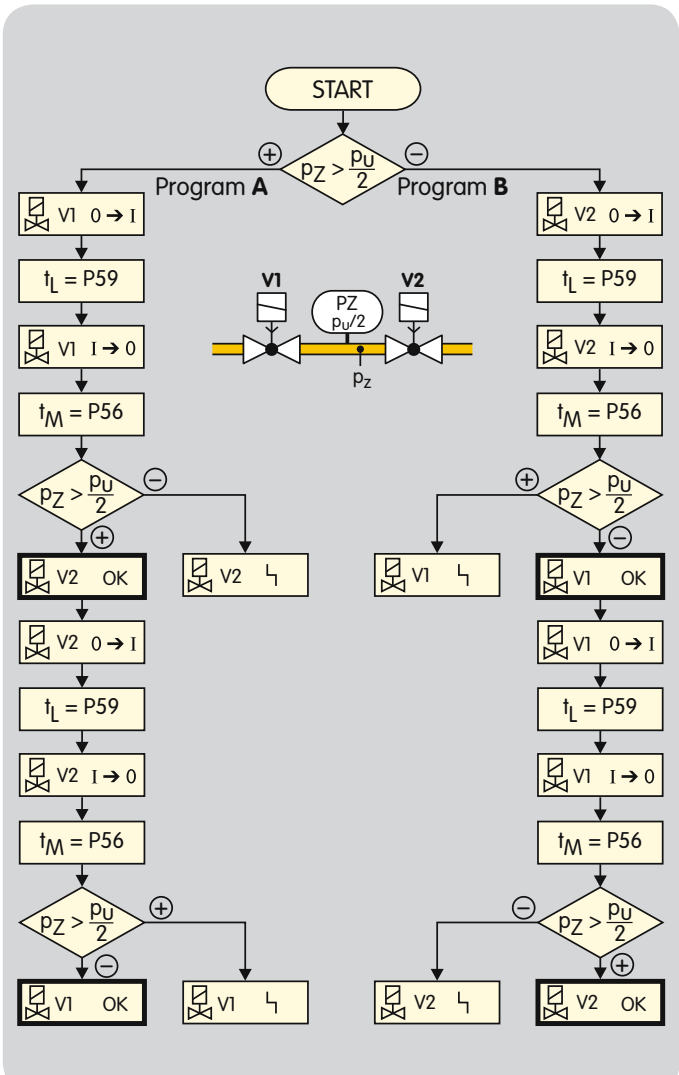
If pressure p_Z is greater than half the inlet pressure $p_u/2$, valve V2 is tight. Valve V2 is opened for the set opening time t_L. V2 closes again.

During the measurement time t_M, the tightness control checks the pressure p_Z between the valves.

If pressure p_Z is greater than half the inlet pressure $p_u/2$, valve V1 is leaking.

If pressure p_Z is less than half the inlet pressure $p_u/2$, valve V1 is tight.

The tightness test can only be performed if pressure p_d downstream of V2 is around atmospheric pressure.



Program B

Valve V2 opens for the set opening time t_L. V2 closes again. During the measurement time t_M, the tightness control checks the pressure p_Z between the valves.

If pressure $p_Z > p_u/2$, valve V1 is leaking.

If pressure $p_Z < p_u/2$, valve V1 is tight. Valve V1 is opened for the set opening time t_L. V1 closes again.

During the measurement time t_M, the tightness control checks the pressure p_Z between the valves.

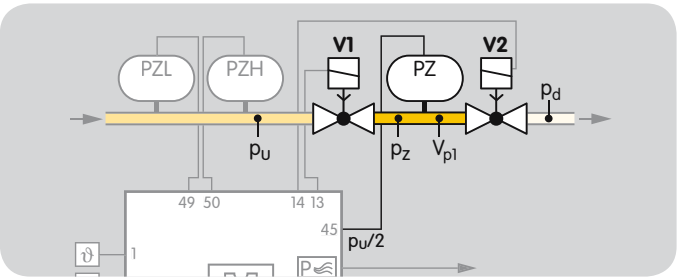
If pressure $p_Z < p_u/2$, valve V2 is leaking.

If pressure $p_Z > p_u/2$, valve V2 is tight.

The tightness test can only be performed if pressure p_d downstream of V2 is around atmospheric pressure.

5.2 Test period t_P

Depending on the burner capacity, the tightness of the gas solenoid valves must be checked in accordance with the relevant application standard, e.g. EN 676, EN 746, NFPA 85 and NFPA 86.



The test period t_P is calculated from:

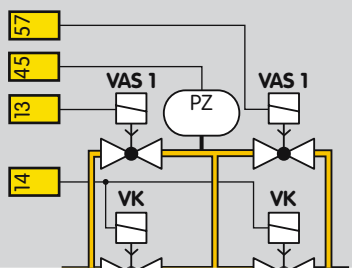
– Opening times t_L for V1 and V2,
– Measurement times t_M for V1 and V2.

$$t_P\,[s] = 2 \times t_L + 2 \times t_M$$

5.2.1 Extended opening time t_L

Standard EN 1643:2000 allows a maximum opening time of 3 s for the tightness test if the main gas valves are actuated directly. If gas can flow into the combustion chamber when a valve is opened, the gas volume must not exceed 0.05% of the maximum flow rate.

If the pre-set opening time t_L = 3 s is inadequate (e.g. if slow opening motorized valves VK are used) to build up or reduce the test volume pressure, bypass valves with an extended opening time may be used (e.g. VAS 1 or bypass valves with an additional orifice). Parameter 52 = 4 must be selected for this.



Calculation example

Nominal flow rate $Q_{(N)}$:

P (kW): capacity = 1000 kW
H_U (kWh/m³): lower calorific value of gas type = 10 kW/m³

$$Q_{(N)}\ (m^3/h) = \frac{P\ (kW)}{H_U\ (kWh/m^3)}$$

$$\mathbf{Q_{(N)}\ (m^3/h)} = \frac{1000\ kW}{10\ kWh/m^3} \mathbf{= 100\ m^3/h}$$

Max. gas volume in combustion chamber V_O:

$$V_O\ (l/h) = Q_{(N)} \times 0.05\%$$

$Q_{(N)}$ (m³/h): nominal flow rate = 100 m³/h (100,000 l/h)

$$\mathbf{V_O\ (l/h)} = 100{,}000\ l/h \times 0.05\% \mathbf{= 50\ l/h}$$

Required opening time t_L:

$$t_L\ (s) = \frac{400 \times V_O}{\pi \times d^2 \times 0.7} \times \sqrt{\frac{\rho}{2 \times p_U}}$$

V_O (l/h): max. gas volume in combustion chamber = 50 l/h,
d (mm): orifice diameter of bypass valve = 9.45 mm,
flow factor = 0.7,
p_U (mbar): inlet pressure = 20 mbar,
ρ (kg/m³): density of gas = 0.8 kg/m³

$$\mathbf{t_L\ (s)} = \frac{400 \times 50\ l/h}{3.14 \times 9.45^2 \times 0.7} \times \sqrt{\frac{0.8\ kg/m^3}{2 \times 20\ mbar}} \mathbf{= 14.26\ s}$$

Enter the next lowest value for parameter 59 (P59 = 14) to set the opening time, see page 79 (Valve opening time t_{L1}).

Calculation module for calculating the opening time t_L, see page 27 (Calculating the extended opening time)

Calculating the extended opening time

(•) Metric ( ) Imperial

Gas type	Natural gas H	
Lower calorific value	10.0	kWh/m3
Density ρ	0.79	kg/m3
Capacity P	1000	kW
Inlet pressure p_u	100	mbar
Nominal flow rate $Q_{(N)}$	100	m3/h
Max. gas volume in combustion chamber V_O	50.0	Liter
VAS 1 on main valve or orifice diameter d	VAS 1 to 3	
	9.45	mm
Opening time t_L	6	s

The calculation module can be used to calculate the opening time t_L for the two bypass valves (e.g. VAS 1 or bypass valves with additional orifice) by entering the gas type, calorific value, density, burner heat load, inlet pressure and orifice diameter.

Set the next lowest value for parameter 59 to set the opening time, see page 79 (Valve opening time t_{L1}).

5.2.2 Measurement time t_M

The sensitivity of the tightness control in the BCU can be adjusted for each individual system by adapting the measurement time t_M. The longer the measurement time t_M, the greater the sensitivity of the tightness control. The measurement time is set using parameter 56 and 57 to a value between 3 and 3600 s – see page 79 (Measurement time V_{p1}).

The required measurement time t_M is calculated from:
inlet pressure p_U [mbar]
leakage rate Q_L [l/h]
test volume V_{p1} [l]
Calculation of the test volume – see page 29 (Test volume V_{p1})

For one test volume V_p between 2 gas solenoid valves

Adjustable using parameter 56

$$t_M\,[s] = \left(\frac{2 \times p_U \times V_{p1}}{Q_L} \right)$$

For a large test volume V_{p1} with reduced testing time

Adjustable using parameter 56

$$t_M\,[s] = \left(\frac{0.9 \times p_U \times V_{p1}}{Q_L} \right)$$

Conversion into US units – see page 101 (Conversion factors)

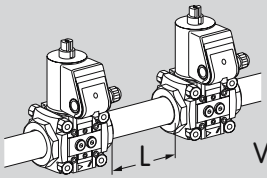
Leakage rate

The BCU tightness control makes it possible to check a specific leakage rate Q_L. The maximum leakage rate in the territory governed by the European Union is Q_L = 0.1% of the maximum flow rate $Q_{(N)max.}$ [m^3/h].

$$\text{Leakage rate } Q_L\,[l/h] = \frac{Q_{(N)max.}\,[m^3/h] \times 1000\,[l/h]}{1000 \times 1\,[m^3/h]}$$

Test volume V_{p1}

Test volume V_p is calculated from the valve volume V_V, added to the volume of the pipe V_R for each additional metre in length L.



$$V_{p1} = V_V + L \times V_R$$

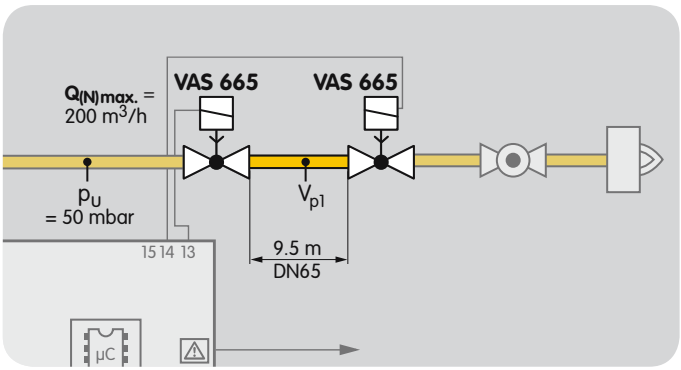
Valves		Pipework	
Type	Volume V_V [l]	DN	Volume per metre V_R [l/m]
VAS 1	0.25	10	0.1
VAS 2	0.82	15	0.2
VAS 3	1.8	20	0.3
VAS 6	1.1	25	0.5
VAS 7	1.4	40	1.3
VAS 8	2.3	50	2
VAS 9	4.3	65	3.3
VG 10	0.01	80	5
VG 15	0.07	100	7.9
VG 20	0.12	125	12.3
VG 25	0.2	150	17.7
VG 40/VK 40	0.7	200	31.4
VG 50/VK 50	1.2	250	49
VG 65/VK 65	2		
VG 80/VK 80	4		
VK 100	8.3		
VK 125	13.6		
VK 150	20		
VK 200	42		
VK 250	66		

The measurement time required for the test volume V_{p1} must be set on the basis of the calculation using parameter 56.

For the calculation, see page 30 (Calculation examples).

Calculation examples

2 valves VAS 665,
distance L = 9.5 m,
inlet pressure p_u = 50 mbar,
max. flow rate $Q_{(N)max.}$ = 200 m³/h.



Leakage rate Q_L = $\frac{200\ m^3/h \times 1000\ l/h}{1000 \times 1\ m^3/h}$ = 200 l/h

Test volume V_{p1} = 1.1 l + 9.5 m x 3.3 l/m = 32.45 l,
see page 29 (Test volume V_{p1})

Measurement time for one test volume V_{p1}

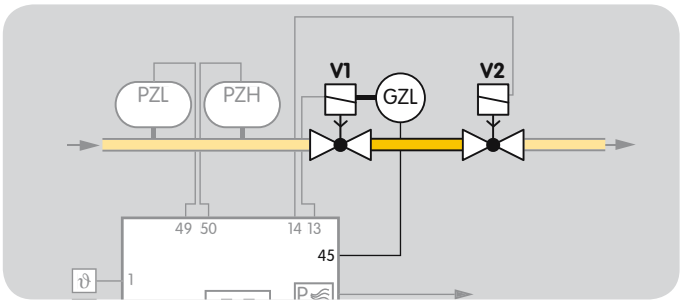
$$t_M\ [s] = \frac{2 \times 50\ mbar \times 32.45\ l}{200\ l/h} = 16.23\ s$$

Set the next highest value (17 s) using parameter 56, see page 79 (Measurement time V_{p1}).

The measurement time can be set to a value between 3 and 3600 s in steps of 1 s.

5.3 Proof of closure function

For applications in the territory covered by NFPA 85 and 86.



The proof of closure function monitors the function of the gas solenoid valve V1. The proof of closure function can be activated using parameter 51 = 4, see page 78 (Valve proving system).

A limit switch on gas solenoid valve V1 signals the closed position of the valve to the BCU (terminal 45).

5.3.1 Program sequence

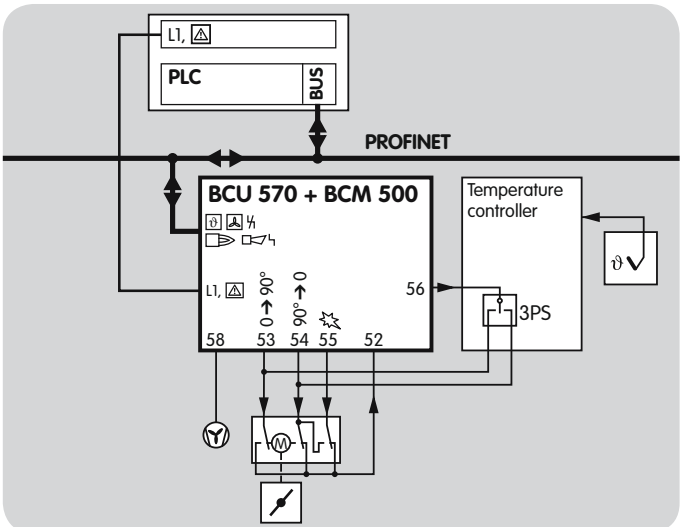
When the start-up signal ϑ is received at terminal 1, the BCU checks that valve V1 is in its closed position using the POC switch. If a signal is not received at terminal 45 from the POC switch after a timeout time of 10 s (valve V1 is closed), the BCU performs a fault lock-out with fault message c1.

As soon as the BCU has opened valve V1, it queries the open position of the valve via the POC switch. If a signal is still received at terminal 45 from the POC switch after a timeout time of 10 s, the BCU performs a fault lock-out with fault message c8.

6 BCSoft

The BCSoft engineering tool provides extended access to the device parameters, individual statistics, logging functions and line recorders for the burner control unit via the optical interface. Using this engineering tool on PCs with a Windows operating system, the device parameters can be adjusted to the specific application.

7 Profinet



Profinet is a manufacturer-independent, open standard for industrial Ethernet. It covers the requirements for automation technology (manufacturing automation, process automation, drive applications with or without functional safety).

Profinet is a bus variant for communication between automation systems (PLCs) and distributed peripherals at the field level, optimized for speed and low connection costs.

The individual bus stations are connected to Profinet using network components which are certified for Profinet use.

The bus system transfers the control signals for starting, resetting and for controlling the air valve to purge the furnace or kiln or for cooling in start-up position and heating during operation from the automation system (PLC) to the BCU/BCM. In the opposite direction, it sends operating status, the level of the flame signal and the current program step.

7.1 Safety-related control signals

Safety-related signals and interlocks (e.g. safety interlock) must be wired independently of the bus communication direct to the BCU/FCU.

Pre-ventilation or purging of the furnace chamber can also be activated if certain conditions are met via bus communication or alternatively via terminal 2 (controlled air flow). It must be taken into consideration here that the safety-relevant function of pre-ventilation is monitored by other external measures (e.g. flow monitoring).

7.2 Controller – device function

The Profinet communication of the FCU/BCU 500 product family is designed for the fast transfer of I/O data. Control signals, signal states of the device inputs and outputs and information about the device status, warnings and faults are transferred simultaneously.

For Profinet communication, there are essentially two device types depending on their tasks:

– IO controller
  The IO controller assumes the master function for the input/output data of the distributed field devices (IO devices, e.g.) in the role of automation system (PLC).
– IO device
  The IO devices (e.g. BCU 570, BCU 56x, FCU 50x) send input information from the peripherals to the master and output information from the master to the peripherals.

7.2.1 Controller – device communication

Profinet communication between the automation system (controller) and the BCUs/FCUs (devices) takes place using industrial Ethernet. Two types of transmission are supported:

Cyclic communication

For cyclic communication, I/O data and information about the device status are transferred between the controller and the device. The various modules for cyclic I/O data are defined in the GSD file for BCU/FCU, see page 36 (Cyclic I/O data exchange). They can be parameterized individually. BCUs/FCUs are controlled and visualized as part of cyclic communication.

Acyclic communication

With acyclic data communication via "Record Data CR", the data is exchanged on an event basis and separate from cyclic communication. Using acyclic communication, all the parameters can be read from devices in the BCU/FCU 500 product family. In addition, the device statistics and the fault history can be opened. The distinction between and division of the various data records takes place using an index, see also page 41 (Structure of acyclic communication).

7.3 Network technology

Bus module BCM 500 has two RJ45 connection sockets for connection to the fieldbus on its front. The connection sockets are combined with an internal switch. This allows the BCM 500 together with the control unit (BCU/FCU) to be integrated in various network topologies (star, tree or line topology). Requirements such as Auto Negotiation and Auto Crossover are satisfied.

For information on planning and the structure of a Profibus network and the components to be used (e.g. cables, lines and switches), see Profinet Installation Guide at www.profibus.com.

7.4 Configuration and GSD file

Before commissioning, the Profinet system must be configured for data communication using an engineering tool for automation systems.

The standardized device master data file (GSD) is used to integrate the Profinet devices (BCU/FCU) into the configuration of the automation system. The GSD file contains a description of the interface of the Profinet device. Communication with the Profinet controller (PLC) is configured using this file.

The GSD file can be ordered at www.docuthek.com. The steps required to integrate the file are described in the instructions for the engineering tool for your automation system.

For further measures for integrating BCU/FCU, see page 84 (Fieldbus communication).

7.5 Cyclic I/O data exchange

As part of cyclic communication, I/O data is continuously transferred between the IO controller (PLC) and the IO devices (BCU/FCU). These I/O data is used to control the devices from the BCU/FCU 500 series and visualize the processes. The modules for the cyclic I/O data are defined in the GSD file for the device family BCU/FCU 500. In some cases, these modules can be selected.

7.5.1 Modules for cyclic data communication

Assembly	Module	Input address	Output address
BCU 570	0		
Inputs/outputs	1	n...n+1	n
Flame signal	2	n	
Status signal	3	n	
Fault and warning signals	4	n...n+1	
Remaining times	5	n...n+1	
TC remaining times	6	n...n+1	
PLC output information	7	n	
BCU input terminal information	8	n...n+1	
BCU output terminal information	9	n...n+1	

7.5.2 Module 1 – Inputs/Outputs

Input bytes (device ➔ controller)

The input bytes describe the digital signals which are transferred from the burner control unit BCU 570 to the digital inputs of the PLC. The digital signals take up 2 bytes (16 bits).

Bit	Byte n	Byte n+1	Format
0	Operating signal	Min. capacity reached[1)]	BOOL
1	Free	Max. capacity reached[1)]	BOOL
2	BCU system fault	Free	BOOL
3	Fault lock-out	Free	BOOL
4	Safety shut-down	Free	BOOL
5	Warning	Free	BOOL
6	ON	Free	BOOL
7	Manual mode	Flame signal	BOOL

[1)] Only with three-point step control via bus.

Output bytes (controller ➔ device)

The output byte describes the digital signals which are output by the PLC (controller) to the BCU 570 (device). The digital signals to control the burner control unit BCU 570 occupy 1 byte (8 bits).

Parallel to the bus communication, terminals 1 to 3 of the BCU 570 can be wired. This allows the BCU to be controlled using the digital signals (bit 0, 1, 2) or the inputs at terminals 1 to 3.

In the event that the bus communication is faulty or interrupted and during the initialization of the bus communication after switching on, the digital signals are interpreted as "0".

If the BCU is controlled using the inputs at terminals 1 to 3, the normal program runs even if the bus communication is faulty or invalid.

Bit	Byte n	Format
0	Reset[1)]	BOOL
1	Start[1)]	BOOL
2	Ventilation[1)]	BOOL
3	Free	BOOL
4	Free	BOOL
5	Free	BOOL
6	Open control element, three-point step Open[2)]	BOOL
7	Close control element, three-point step Close[2)]	BOOL

[1)] Parallel to the bus communication, terminals 1 to 3 can be wired.

[2)] Only with three-point step control via bus.

7.5.3 Module 2 – Flame signal (device ➔ controller)

Module 2 transfers the flame signal from the burner control unit BCU 570 to the PLC as an analogue value. The flame signal occupies one byte with values from 0 to 255 (= flame signal from 0 to 25.5 µA).

Bit	Byte n	Data type	Format	Value
0 1 2 3 4 5 6 7	Flame signal	Byte	DEC	0 – 255 (0 to 25.5 µA)

7.5.4 Module 3 – Status signal (device ➔ controller)

In module 3, the status signals are transferred from the BCU 570 to the PLC. The status signals occupy one byte (0 to 255). Every status signal is allocated a code. The allocation is described in the code table "BCU570_GSD_Codetabelle.xlsx".

Bit	Byte n	Data type	Format	Value
0 1 2 3 4 5 6 7	Status signals	Byte	DEC	0 – 255 (see code table "BCU570_GSD_Codetabelle.xlsx" at www.docuthek.com)

7.5.5 Module 4 – Fault and warning signals (device ➔ controller)

In module 4, the fault and warning signals are transferred from the BCU 570 to the PLC. The fault and warning signals occupy one byte each (0 to 255). The allocation of the output codes to the fault and warning signals is described in code table "BCU570_GSD_Codetabelle.xlsx". The same allocation table applies to the fault messages and the warning signals.

Bit	Byte n	Data type	Format	Value
0 1 2 3 4 5 6 7	Fault signals	Byte	DEC	0 – 255 (see code table "BCU570_GSD_Codetabelle.xlsx" at www.docuthek.com)

Bit	Byte n+1	Data type	Format	Value
0 1 2 3 4 5 6 7	Warning signals	Byte	DEC	0 – 255 (see code table "BCU570_GSD_Codetabelle.xlsxÆ at www.docuthek.com)

7.5.6 Module 5 – Remaining times

In module 5 of the GSD file, remaining times are transferred from the burner control unit BCU 570 to the PLC. The remaining time occupies two bytes.

Bit	Byte n+1	Data type	Format	Value
0 1 2 3 4 5 6 7	Remaining times	Word	DEC	0 – 6554 (0 to 6554 s)

7.5.7 Module 6 – Remaining time of the valve proving system (device ➔ controller)

Only on BCU 570..C1. Module 6 in BCU 570..C0 contains no information.

In module 6, the remaining times of the value proving system are transferred from the BCU 570 to the PLC. The remaining time occupies two bytes. The valve check runs parallel to other time-related processes, e.g. pre-purge. To display the remaining time of the valve proving system separately, it is transferred separately.

Bit	Byte n+1	Data type	Format	Value
0 1 2 3 4 5 6 7	Remaining times of the valve proving system	Word	DEC	0 – 6554 (0 to 6554 s)

7.5.8 Module 7 – PLC output information (device ➔ controller)

In module 7, the signals used by the PLC to control the BCU 570 are transferred back to the PLC. This allows the signal transfer from the PLC to the BCU 570 to be checked.

Bit	Byte n	Format
0	Reset	BOOL
1	Start	BOOL
2	Controlled air flow	BOOL
3	Free	BOOL
4	Free	BOOL
5	Free	BOOL
6	Open control element, three-point step Open[1)]	BOOL
7	Close control element, three-point step Close[1)]	BOOL

1) Only on BCU 507 with three-point step control via bus.

7.5.9 Module 8 – BCU input terminal information (device ➔ controller)

In module 8, the signal states of the digital inputs on the BCU 570 (input terminals) are transferred to the PLC.

Bit	Byte n	Byte n+1	Format
0	Terminal 1	Terminal 50	BOOL
1	Terminal 2	Terminal 51	BOOL
2	Terminal 3	Terminal 52	BOOL
3	Terminal 45	Terminal 65	BOOL
4	Terminal 46	Terminal 66	BOOL
5	Terminal 47	Terminal 67	BOOL
6	Terminal 48	Terminal 68	BOOL
7	Terminal 49	Free	BOOL

7.5.10 Module 9 – BCU output terminal information (device ➔ controller)

In module 9, the signal states of the digital outputs on the BCU 570 (output terminals) are transferred to the PLC.

Bit	Byte n	Byte n+1	Format
0	Terminal 9	Terminal 55	BOOL
1	Terminal 13	Terminal 56	BOOL
2	Terminal 14	Terminal 57	BOOL
3	Terminal 15	Terminal 58	BOOL
4	Terminal 17/18	Free	BOOL
5	Terminal 37/38	Free	BOOL
6	Terminal 53[1)]	Free	BOOL
7	Terminal 54	Free	BOOL

1) Only for BCU 570..F2: bit 6 has no function. Terminal 53 is used as an input.

7.6 Structure of acyclic communication

With the help of acyclic communication between the automation system (controller) and BCU/FCU (devices), it is possible to read information on parameters, statistics and fault history on an event basis (e.g. using system function block Siemens FSB 52 RDREC). This form of communication is known as "Record Data CR".

The available data records differ in terms of their indexes. The contents and description of the indexes are described in code table "GSD Codes BCU 570" (download from www.docuthek.com).

8 Program step/status

DISPLAY	Program step/status
00	Start-up position/standby
H0	Delay
01	Fan run-up time t_{GV}
d0	"No flow" state check
d1	Low air pressure protection check
Ac	Approaching minimum capacity/closed position
Ao	Approaching maximum capacity
P1	Pre-purge
Ai	Approaching ignition capacity
H2	Delay
tc	Valve check
03	Pre-ignition time t_{VZ}
04	Safety time 1 t_{SA1}
05	Flame proving period 1 t_{FS1}
06	Safety time 2 t_{SA2}
07	Flame proving period 2 t_{FS2}
H8	Delay
08	Operation/controller enable
09	Over-run up to minimum capacity
P9	Post-purge
C1	Controlled air flow
U1	Remote control with OCU
Pr	Data transfer (programming mode)
--	Device Off

In Manual mode, two dots blink on the display.

9 Fault signalling

Fault message (blinking)	DISPLAY	Description
Flame simulation	01	Flame signal before ignition
No flame after safety time 1	04	No flame formation to end of 1st safety time
Flame failure during flame proving period 1 t_{FS1}	05	
Flame failure during safety time 2 t_{SA2}	06	No flame formation to end of 2nd safety time
Flame failure during flame proving period 2 t_{FS2}	07	
Flame failure during operation	08	
Too many remote resets	10	Remote reset activated > 5 × in 15 min.
Too many restarts	11	> 5 restarts in 15 minutes
Controller enable output at terminal 56 supplied with power from an external source	20	Controller enable output incorrectly connected
Simultaneous activation of inputs at terminals 51 and 52	21	"Maximum capacity" and "Ignition capacity" position feedback from butterfly valve set simultaneously
The actuator is incorrectly wired	22	Faulty wiring of terminals 52 to 55
Feedback from actuator/frequency converter	23	Maximum or ignition capacity is not constantly signalled back to terminal 52
Bus control	24	"Open actuator" and "Close actuator" bus signals set simultaneously
Non-fail-safe parameters (NFS) inconsistent	30	NFS parameter range is inconsistent
Fail-safe parameters (FS) inconsistent	31	FS parameter range is inconsistent
Over-/Undervoltage	32	Operating voltage too high/low
Faulty parameterization	33	Parameter set contains illegal settings
Incompatible bus module	35	
Power module defective	36	Relay contact error
Inlet valve(s) leaking	40	Leak found on inlet valve
Outlet valve(s) leaking	41	Leak found on outlet valve

Fault message (blinking)	DISPLAY	Description
Controller enable/emergency stop	50	No signal at the controller enable/emergency stop input
Fuse defective	51	Device fuse F1 is defective
Permanent remote reset	52	Remote reset input activated > 25 s
Timing cycle too short	53	Minimum timing cycle not observed
Flame amplifier error	80	Device error
Internal error	89	Error in processing internal data
Internal error	94	Error at digital inputs
Internal error	95	Error at digital outputs
Internal error	96	Error when checking the SFR
Internal error	97	Error when reading the EEProm
Internal error	98	Error when writing to the EEProm
emBoss	99	Shut-down without application error
Position for minimum capacity is not reached	Ac	Position for minimum capacity has not been reached after 255 s
Position for maximum capacity is not reached	Ao	Position for maximum capacity has not been reached after 255 s
Position for ignition capacity is not reached	A,	Position for ignition capacity has not been reached after 255 s
Bus module	bE	Bus module fault
Parameter chip card (PCC)	bc	Incorrect or defective PCC
POC valve open	c1	Valve not closed
POC valve closed	c8	Valve not open
Air monitor "no flow" state check	d0	Fault Air monitor "no flow" state check

Fault message (blinking)	DISPLAY	Description
Low air pressure during a program step (display d1 d2, d3, d4, d5, d6, d7, d8 or d9)	d1, d2, d3, d4, d5, d6, d7, d8, d9	Fault Air supply during program step 1, 2, 3, 4, 5, 6, 7, 8 or 9
Air flow during pre-purge	dP	Air flow failure during pre-purge
BCU – controller connection error	n0	BCU waiting for connection to controller
Invalid address on bus module	n1	Invalid or incorrect address set on bus module
Incorrect controller configuration for bus module	n2	The bus module has received an incorrect configuration from the controller
Invalid network name	n3	Invalid or no address allocated in the network name
Controller in STOP position	n4	Controller in STOP position
High gas pressure during a program step (display o0, o1, o2, o3, o4, o5, o6, o7, o8 or o9)	o0, o1, o2, o3, o4, o5, o6, o7, o8, o9	Fault $DG_{max.}$ during program step 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9
Low gas pressure during a program step (display u1, u2, u3, u4, u5, u6, u7, u8 or u9)	u1, u2, u3, u4, u5, u6, u7, u8, u9	Fault $DG_{min.}$ during program step 1, 2, 3, 4, 5, 6, 7, 8 or 9

10 Parameters

Any changes to parameters will be saved to the parameter chip card.

Name	Parameter	Value range	Description	Factory default settings
Switch-off threshold 1	01	0 – 20	Burner 1 flame signal switch-off threshold in µA	2 (5 when P04 = 1)
Flame control	04	0 1 2	Ionization electrode UVS sensor UVD sensor	0
Burner 1 start-up attempts	07	1 2 3	1 start-up attempt 2 start-up attempts 3 start-up attempts	1
Restart	09	0 1 4	No Burner Max. 5 × restart of pilot burner in 15 min.	0
Emergency stop	10	0 1 2	OFF With safety shut-down With fault lock-out	2
High gas pressure protection	12	0 1 2	OFF With safety shut-down With fault lock-out	2
Low gas pressure protection	13	0 1 2	OFF With safety shut-down With fault lock-out	2
Low air pressure protection	15	0 1 2	OFF With safety shut-down With fault lock-out	2
Safety time during operation t_{SB}	19	1; 2	Time in seconds	1
Fan run-up time t_{GV}	30	0 – 6000	Time in seconds	0

Name	Parameter	Value range	Description	Factory default settings
Air flow monitoring during controlled air flow	32	0 1 2	OFF; maximum capacity ON; maximum capacity OFF; controller enable	1
Start-up with pre-purge	33	0 1 2 3 4	Yes (depending on P34 Pre-purge time t_{PV}) No; no air control No; start from position for ignition capacity No; start from minimum capacity/closed position No; start from position for minimum capacity	1
Pre-purge time t_{PV}	34	0 – 6000	Time in seconds	6000
Air flow monitoring during pre-purge	35	0 1 2	OFF With safety shut-down With fault lock-out	2
Post-purge time t_{PN}	37	0 – 6000	Time in seconds	6000
Air flow monitoring during post-purge	38	0 1 2 3	ON; control element to maximum capacity OFF; control element to maximum capacity OFF; control element to ignition capacity OFF; control element controller enable	1
Capacity control	40	0 1 2 3 4	Off With IC 20 With IC 40 With RBW With frequency converter	BCU..F1 = 1 BCU..F2 = 3
Running time selection	41	0 1 2 3	Off; checking the positions for minimum/maximum capacity On; for approaching the position for minimum/maximum capacity On; for approaching the position for maximum capacity On; for approaching the positions for minimum capacity	0

Name	Parameter	Value range	Description	Factory default settings
Running time	42	0 – 250	Running time in seconds if parameter 41 = 1, 2 or 3	30
Low fire over-run	43	0 1	OFF Up to minimum capacity	1
Controller enable signal delay time t_{RF}	44	0 – 250	Time in seconds	0
Valve proving system	51	0 1 2 3 4	OFF Tightness test before start-up Tightness test after shut-down Tightness test before start-up and after shut-down Proof of closure function	0
Relief valve (VPS)	52	2 3 4	V2 V3 V4	2
Measurement time V_{p1}	56	3 5 – 25 30 – 3600	Time in seconds (in 5 s steps) (in 10 s steps)	10
Valve opening time t_{L1}	59	2 – 25	Time in seconds	2
Minimum operating time t_B	61	0 – 250	Time in seconds	0
Minimum pause time t_{BP}	62	0 – 3600	Time in seconds	0
Switch-on delay time t_E	63	0 – 250	Time in seconds	0
Operating time in Manual mode	67	0 1	Unlimited 5 minutes	1

Name	Parameter	Value range	Description	Factory default settings
Function of terminal 51	69	0 8 9 10 11 12 13	OFF AND with emergency stop (trm. 46) AND with $air_{min.}$ (trm. 47) AND with air flow monitoring (trm. 48) AND with $gas_{max.}$ (trm. 50) AND with $gas_{min.}$ (trm. 49) Max. capacity position feedback (IC 40/ RBW)	0
Function of terminal 65	70	0 8 9 10 11 12	OFF AND with emergency stop (trm. 46) AND with $air_{min.}$ (trm. 47) AND with air flow monitoring (trm. 48) AND with $gas_{max.}$ (trm. 50) AND with $gas_{min.}$ (trm. 49)	0
Function of terminal 66	71	0 8 9 10 11 12	OFF AND with emergency stop (trm. 46) AND with $air_{min.}$ (trm. 47) AND with air flow monitoring (trm. 48) AND with $gas_{max.}$ (trm. 50) AND with $gas_{min.}$ (trm. 49)	0
Function of terminal 67	72	0 8 9 10 11 12	OFF AND with emergency stop (trm. 46) AND with $air_{min.}$ (trm. 47) AND with air flow monitoring (trm. 48) AND with $gas_{max.}$ (trm. 50) AND with $gas_{min.}$ (trm. 49)	2

Name	Parameter	Value range	Description	Factory default settings
Function of terminal 68	73	0 8 9 10 11 12	OFF AND with emergency stop (trm. 46) AND with $air_{min.}$ (trm. 47) AND with air flow monitoring (trm. 48) AND with $gas_{max.}$ (trm. 50) AND with $gas_{min.}$ (trm. 49)	0
Capacity control (bus)	75	0 1 2 3 4 5	OFF MIN-MAX/MIN MIN-MAX/CLOSED IGNITION-MAX/CLOSED MIN-MAX/MIN + quick start IGNITION-MAX/CLOSED + quick start	0
Password	77	0000 – 9999	Four-digit number code	1234
Burner application	78	0 1 2 3	Burner 1 Burner 1 with pilot gas Burner 1 and burner 2 Burner 1 and burner 2 with pilot gas	1
Pilot burner	79	0 1	With shut-down Continuous operation	0
Fieldbus communication	80	0 1 2	OFF With address check Without address check	1
Pre-ignition time	93	0 – 5	Time in seconds	1
Safety time 1 t_{SA1}	94	2, 3, 5, 10	Time in seconds	5
Flame proving period 1 t_{FS1}	95	0 – 20	Time in seconds	2
Safety time 2 t_{SA2}	96	2, 3, 5, 10	Time in seconds	3
Flame proving period 2 t_{FS2}	97	0 – 20	Time in seconds	2

10.1 Scanning the parameters

During operation, the 7-segment display shows the program step/status.

All the parameters of the BCU can be scanned in numerical order by repeatedly pressing the Reset/Information button (for 1 s).

The parameter display is ended 60 seconds after the last time the button is pressed or by switching off the BCU.

The BCU indicates [--] when the mains switch has been switched off. The parameters cannot be scanned when the BCU is switched off or when a fault or warning is displayed.

10.2 Flame control

The BCU is fitted with a flame amplifier which evaluates whether an adequate flame signal is supplied by the burner using an ionization electrode or UV sensor.

10.2.1 Burner 1 flame signal switch-off threshold FS1

Parameter 01

The sensitivity at which the burner control unit detects a flame can be set using parameter 01.

As soon as the measured flame signal falls below the set value (2 to 20 µA), the BCU performs a fault lock-out during start-up after the elapse of the safety time or during operation after the elapse of the safety time during operation (parameter 19).

In the case of UV control, this value can be increased, should the burner to be monitored be influenced by other burners for example.

10.2.2 Flame control

Parameter 04

Parameter 04 = 0: flame control is performed with an ionization electrode.

Parameter 04 = 1: the flame is controlled by a UV sensor for intermittent operation (UVS).

To meet the requirement for intermittent operation, the burner is shut down automatically after 24 hours operating time. This shut-down and subsequent restart are performed in the same way as a normal controlled shut-down. Depending on the parameterization, the burner may be started with or without a pre-purge.

This process is controlled by the BCU and therefore it must be checked whether the industrial process permits the pause in heat supply it creates.

Parameter 04 = 2: the flame is controlled with a UV sensor for continuous operation (UVD).

The reaction times of the BCU and UV sensor for continuous operation (UVD) are coordinated so that the set safety times during operation are not extended.

10.3 Behaviour during start-up

10.3.1 Burner 1 start-up attempts

Parameter 07

This parameter defines the maximum number of possible start-up attempts of the burner.

If the safety of the system is not adversely affected, up to three start-up attempts are possible in certain conditions.

If no flame is detected during start-up, an immediate fault lock-out (P07 = 1) or up to two additional start-up attempts (P07 = 2, 3) are performed depending on parameter 07.

Parameter 07 = 1: one start-up attempt. If no flame is formed during the start-up so that at the end of the safety time t_{SA} no flame signal is detected, this will result in a BCU fault lock-out. The fault message 04 or 06, depending on the burner operating mode, will flash in the BCU display.

Parameter 07 = 2, 3: two or three start-up attempts. If no flame is formed during the start-up so that at the end of the safety time t_{SA} no flame signal is detected, the BCU closes the gas valves, switches off the fan and repeats the start-up. Each start-up attempt begins with the fan being switched on and the parameterized start-up behaviour (pre-purge, valve check).

If the safety time t_{SA} elapses without a flame signal, having been detected even after the last parameterized start-up attempt, this will result in a BCU fault lock-out. The fault message 04 or 06, depending on the burner operating mode, will flash in the BCU display.

If the parameters for the limits of High gas pressure protection, Low gas pressure protection, Low air pressure protection or Air flow monitoring during pre-purge are set to safety shut-down (P12, P13, P15 or P35 = 1) and there is no signal at the input for the relevant limit (terminal 47, 48, 49 or 50), depending on parameter 07 an immediate fault lock-out (P07 = 1) or up to two additional start-up attempts (P07 = 2, 3) will take place.

10.3.2 Start-up with pre-purge after controlled shut-down within 24 hours

Parameter 33

Parameter 33 determines whether the BCU activates pre-purge after a controlled shut-down before a fresh burner start and in what position the actuator stays during standby. The requirement for this is that the last controlled shut-down took place within the last 24 hours.

If parameter 33 = 1, 2 or 3, pre-purge is not required for a start-up after a controlled shut-down within the last 24 hours. After switching on the BCU (mains on) and after a safety shut-down or fault lock-out and after a controlled shut-down more than 24 hours previously, the BCU will always perform a pre-purge.

Parameter 33 = 0: yes (depending on P34 Pre-purge time t_{PV}). The BCU starts a pre-purge for every start-up for the time fixed in parameter 34.

Parameter 33 = 1: no; no air control. No control element is connected to the BCU (parameter 40 = 0). Pre-purge is deactivated.

Parameter 33 = 2: no; standby with pilot air volume. If the start-up takes place within 24 hours of the last controlled shut-down, pre-purge is suppressed. The actuator is in the position for ignition capacity during standby (after a controlled shut-down).

Parameter 33 = 3: no; start from closed position. If the start-up takes place within 24 hours of the last controlled shut-down, pre-purge is suppressed. The actuator is in the position for minimum capacity during standby (after a controlled shut-down).

Starting up without pre-purge (quick start, P33 = 1, 2, 3) prevents air flowing into the combustion chamber unnecessarily. This accelerates the burner start-up.

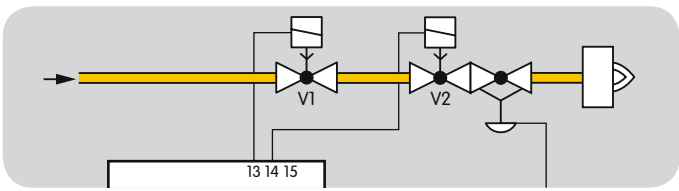
Taking into account the national standards and requirements, it must be clarified whether the quick start option without pre-purge may be used.

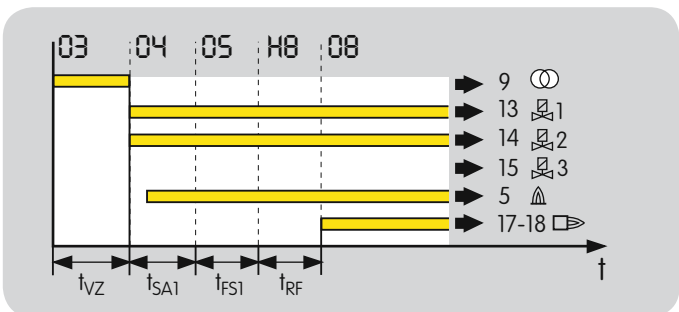
10.3.3 Burner application

Parameter 78

This parameter enables the BCU to be adjusted to various burner applications. In principle, a distinction is made between applications with a burner (P78 = 0) and burners with a pilot burner (P78 = 2). In both applications, an optional pilot gas valve (V3) can be parameterized via which the burner is started with a defined ignition capacity.

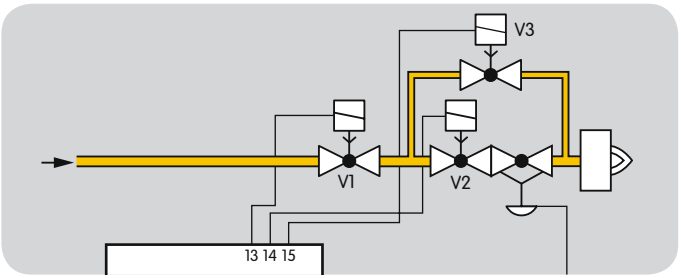
Parameter 78 = 0: burner 1. Two valves (V1, V2) are included for a modulating burner. These are connected to the valve outputs (terminals 13 and 14). Valves V1 and V2 are opened in parallel to start the burner in order to release the gas supply to the burner.

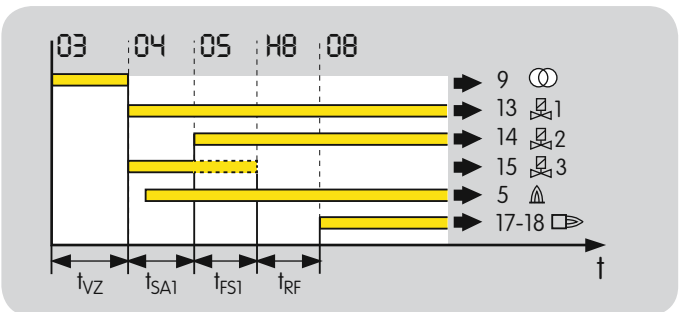




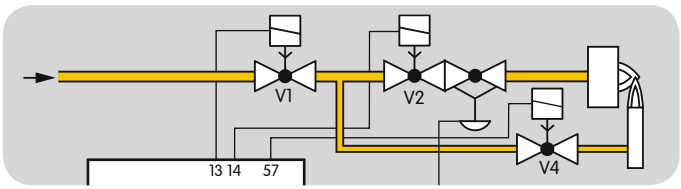
Parameter 78 = 1: burner 1 with pilot gas. Three valves (V1, V2 and V3) are included for a modulating burner with a pilot gas valve. These are connected to the valve outputs (terminals 13, 14 and 15). Valves V1 and V3 open to start the burner. The burner is started with a defined ignition capacity using valve V3. After the elapse of the safety time t_{SA1} (program step 04), valve V2 opens. Valve V3 limits the ignition capacity. After the elapse of the flame proving period t_{FS1} (program step 05), it is closed again.

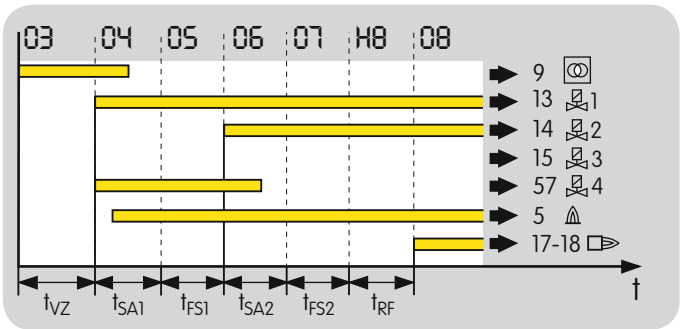
For this application, it must be ensured that the flame proving period (P95) is set to a value ≥ 2 s.





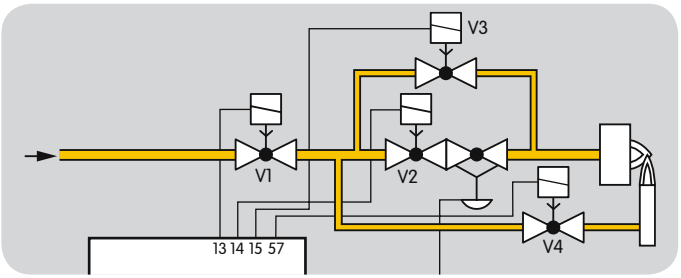
Parameter 78 = 2: burner 1 with pilot burner. Three valves (V1, V2 and V4) are included for a modulating burner with a pilot burner. These are connected to the valve outputs (terminals 13, 14 and 57). Valves V1 and V4 open to start the pilot burner. Gas valve V2 releases the gas supply to the main burner.

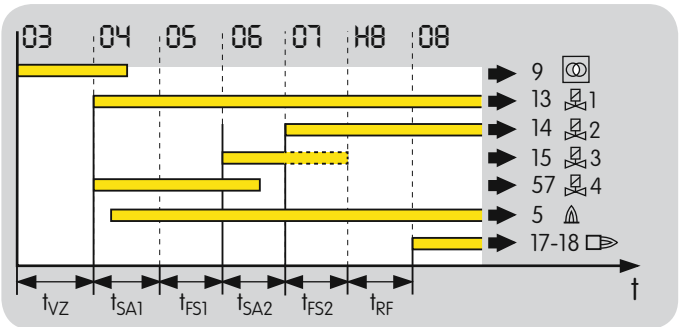




Parameter 78 = 3: Burner 1 and burner 2 with pilot gas. In this application the burner has an additional pilot gas valve V3. The valves are connected to the valve outputs (terminals 13, 14, 15 and 57). Valves V1 and V4 open to start the pilot burner. The burner is started with a limited ignition capacity using gas valve V3. After the elapse of the safety time t_{SA2} (program step 06), valve V2 opens (terminal 14). Pilot gas valve V3 is closed again after the elapse of the flame proving period t_{FS2} (program step 07).

For this application, it must be ensured that the flame proving period (P97) is set to a value ≥ 2 s.





10.3.4 Pre-ignition time t_{VZ}

Parameter 93

The ignition is activated at the start of the pre-ignition time (0 to 5 s). The valves are closed during the pre-ignition time. The ignition spark can stabilize in the air flow. Only after the pre-ignition time has ended will the valves be opened to ignite the flame. The safety time on start-up is then started after the end of the pre-ignition time.

10.3.5 Safety time 1 t_{SA1}

Parameter 94

Safety time 1 is the time in which the flame (pilot flame) is ignited. It can be set to 2, 3, 5 or 10 s.

Safety time 1 runs when starting burner 1 (pilot burner). The valves open at the start of safety time 1. The fuel supply to burner 1 (pilot burner) is released so that a flame can form. If no flame is detected at the end of safety time 1, the valves are closed again. Depending on parameter 07 (Burner 1 start-up attempts), the BCU reacts either with an immediate safety shut-down with fault lock-out (P07 = 1) or with one or two additional start-up attempts (P07 = 2 or 3). The BCU will complete a maximum of three start-up attempts.

Safety time 1 must be determined on the basis of current national standards and regulations. The burner application and the burner capacity are the main criteria for this.

If signals ϑ (terminal 1) or $Gas_{min.}$ (terminal 49) drop out during safety time 1, the valves will not be switched off until the end of safety time 1.

See also program flow charts from page 54 (Burner application).

10.3.6 Flame proving period 1 t_{FS1}

Parameter 95

Flame proving period 1 can be parameterized to enable the flame on burner 1 (pilot burner) to stabilize after the elapse of safety time 1. Only when the flame proving period has elapsed will the next program steps be initiated by the BCU. The first flame proving period can be set between 0 and 20 s.

See also program flow charts from page 54 (Burner application).

10.3.7 Safety time 2 t_{SA2}

Parameter 96

Safety time 2 is the time in which the flame on burner 2 (main flame) is ignited. It can be set to 2, 3, 5 or 10 s.

Safety time 2 runs when starting burner 2 (main burner). The valves open at the start of safety time 2. The fuel supply to burner 2 (main burner) is released so that a flame can form. If no flame is detected at the end of safety time 2, the valves are closed again. Depending on parameter 07 (Burner 1 start-up attempts), the BCU reacts either with an immediate safety shut-down with fault lock-out (P07 = 1) or with one or two additional start-up attempts (P07 = 2 or 3). The BCU will complete a maximum of three start-up attempts.

Safety time 2 must be determined on the basis of current national standards and regulations. The burner application and the burner capacity are the main criteria for this.

If signals ϑ (terminal 1) or $gas_{min.}$ (terminal 49) drop out during safety time 2, the valves will not be switched off until the end of safety time 2.

See also program flow charts from page 54 (Burner application).

10.3.8 Flame providing period 2 t_{FS2}

Parameter 97

Flame proving period 2 can be parameterized to enable the flame on burner 2 (main burner) to stabilize after the elapse of safety time 2. The operating signal is not issued until after the flame proving period has ended. The second flame proving period can be set between 0 and 20 s.

See also program flow charts from page 54 (Burner application).

10.4 Behaviour during operation

10.4.1 Restart

Parameter 09

This parameter determines whether the BCU initiates an immediate fault lock-out or restart after a flame failure during operation. Excessive restarts (max. 5) can also be detected.

In accordance with EN 746-2, a restart may be conducted only if the safety of the installation is not impaired. Restart is recommended for burners which occasionally display unstable behaviour during operation.

The precondition for an automatic restart is that the burner can restart (as intended in all operating phases). In this case, it must be ensured that the program sequence started by the BCU matches the application.

Parameter 09 = 0: no. Fault lock-out in the event of flame failure during operation.

Parameter 09 = 1: burner. The restart function is active. If a flame failure occurs during operation (minimum operating time of 2 s), the valves are closed and the operation signalling contact is opened within the safety time during operation t_{SB}. The burner control unit then attempts to restart the burner once. If the burner does not function, a fault lock-out occurs. The display blinks and shows the fault message.

Parameter 09 = 4: max. 5 × for burner 1 in 15 min. The restart function is active and is also monitored. In certain conditions, it is possible that the restart function is repeated continuously without a fault lock-out being performed. The BCU has a fault lock-out option if more than 5 restarts are performed within a period of 15 minutes.

Taking into account the national standards and requirements, it must be clarified whether the quick start option without pre-purge may be used.

10.4.2 Minimum operating time t_B

Parameter 61

A minimum operating time (0 to 250 s) may be defined to ensure that the heating equipment operates stably.

If the minimum operating time is active, burner operation will be maintained until the set time has elapsed even if the start-up signal fails.

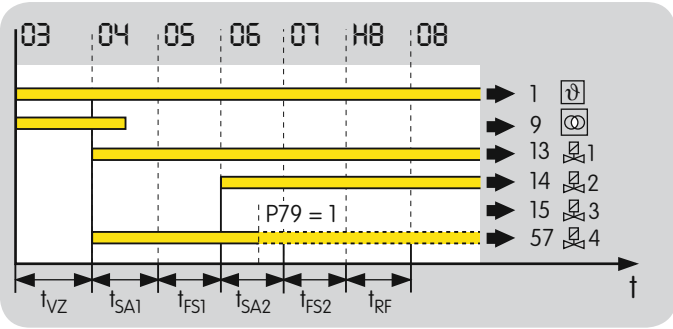
The minimum operating time starts as soon as program status Delayed controller enable (display *HB*) or program step Operation (display *08*) has been reached.

If the start-up signal drops out before the start of the delayed controller enable, e.g. during pre-purge, the burner control unit reverts directly to standby and the burner is not ignited.

The minimum operating time can be cancelled by switching off the BCU or if a safety shut-down occurs.

10.4.3 Pilot burner

Parameter 79



If a burner with a pilot burner is used, this parameter can be used to define whether the pilot burner is shut down 1 second before the end of the second safety time t_{SA2} or operates continuously.

Parameter 79 = 0: with shut-down.

Parameter 79 = 1: continuous operation.

Taking national standards and requirements into consideration, it must be clarified whether the pilot burner can remain in operation permanently. Special requirements for the type of burner must be satisfied for this purpose.

10.5 Safety limits

Parameters 10, 12, 13, 15 and 19 can be used to adjust the safety limits (emergency stop, high gas pressure protection, low gas pressure protection, low air pressure protection and safety time during operation) to the system requirements.

10.5.1 Emergency stop

Parameter 10

Function and properties of the controller enable/emergency stop input (terminal 46)

This input is the safety interlock input of the BCU. Activation of this input and the shut-down properties can be set using parameter 10. If the signal is interrupted when the safety interlock input on terminal 46 is active, the BCU initiates a function depending on parameter 10.

Parameter 10 = 0: OFF; the function of the safety interlock input is deactivated.

Parameter 10 = 1: ON; a safety shut-down will be performed if there is no signal at the controller enable/emergency stop input (terminal 46).

Parameter 10 = 2: ON; a fault lock-out will be performed if there is no signal at the controller enable/emergency stop input (terminal 46).

10.5.2 High gas pressure protection

Parameter 12

Function of the $gas_{max.}$ input (terminal 50)

The maximum gas pressure is monitored permanently using the $gas_{max.}$ gas pressure switch connected to terminal 50. Activation of the high gas pressure protection device and the shut-down properties can be set using parameter 12. If the gas pressure exceeds the value set on the $gas_{max.}$ pressure switch, the signal to terminal 50 is interrupted and the BCU initiates a function depending on parameter 12.

Parameter 12 = 0: OFF; the high gas pressure protection function is deactivated.

Parameter 12 = 1: ON; a safety shut-down will be performed if there is no signal at the $gas_{max.}$ input (terminal 50).

Parameter 12 = 2: ON; a fault lock-out will be performed if there is no signal at the $gas_{max.}$ input (terminal 50).

10.5.3 Low gas pressure protection

Parameter 13

Function of the $gas_{min.}$ input (terminal 49)

The minimum admissible gas pressure is ensured by the $gas_{min.}$ gas pressure switch connected to terminal 49 when the start-up signal ϑ (terminal 1) is applied. Activation of the low gas pressure protection device and the shut-down properties can be set using parameter 13. If the gas pressure falls below the value set on the $gas_{min.}$ pressure switch, the signal to terminal 49 is interrupted and the BCU initiates a function depending on parameter 13.

Parameter 13 = 0: OFF; the low gas pressure protection function is deactivated.

Parameter 13 = 1: ON; a safety shut-down will be performed if there is no signal at the $gas_{min.}$ input (terminal 49).

Parameter 13 = 2: ON; a fault lock-out will be performed if there is no signal at the $gas_{min.}$ input (terminal 49).

10.5.4 Low air pressure protection

Parameter 15

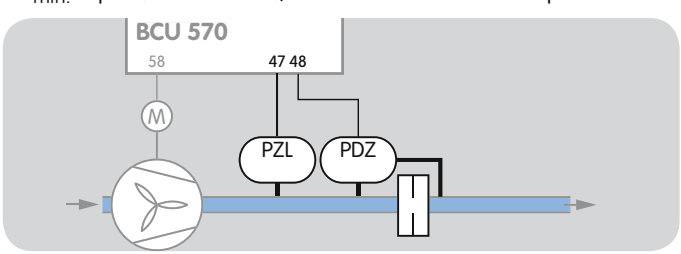
The minimum air pressure is ensured using the $air_{min.}$ air pressure switch connected to terminal 47 while the fan for the combustion air is switched on. Activation of the low air pressure protection device and the shut-down properties can be set using parameter 15. If the air pressure falls below the value set on the $air_{min.}$ air pressure switch, the signal to terminal 47 is interrupted and the BCU initiates a function depending on parameter 15.

When the fan is switched off, the "no flow" state (default position) of the air pressure switch (PZL) is checked. To bypass switching off the fan, the air supply to the pressure switch can be interrupted by a 2/3-way valve. The 2/3-way valve is actuated by terminal 58.

Parameter 15 = 0: OFF; the low air pressure protection function is deactivated.

Parameter 15 = 1: with safety shut-down. If there is no signal at the $air_{min.}$ input (terminal 47), a safety shut-down will be performed.

Parameter 15 = 2: with fault lock-out. If there is no signal at the $air_{min.}$ input (terminal 47), a fault lock-out will be performed.



If air flow monitoring during pre-purge is active (P35 = 1 or 2), the "no flow" state of the air flow monitoring pressure switch (PDZ) is also checked.

For further information on the low air pressure protection function ($air_{min.}$, terminal 47, and air flow, terminal 48) during pre-purge, see page 63 (Air flow monitoring during pre-purge).

10.5.5 Safety time during operation

Parameter 19

Parameter 19 = 1; 2: time in seconds

The safety time during operation is the time that the BCU needs to stop the fuel supply after a flame failure during operation or an interruption at the safety current inputs (terminals 45 to 51 and 65 to 68). The safety time can be set to 1 or 2 seconds. Prolonging the safety time during operation increases the installation availability in the case of brief-duration signal fades (e.g. fades of the flame signal).

In accordance with EN 298, the maximum reaction time to a flame failure must not exceed 1 s. In accordance with EN 746-2, the safety time of the installation during operation (total closing time) may not exceed 3 s.

The requirements of national standards and regulations must be satisfied.

10.6 Air control

10.6.1 Fan run-up time t_{GV}

Parameter 30

This parameter defines the time between the activation of the fan (terminal 58) and the start of the BCU program sequence (display 01).

The fan run-up time can be parameterized in a range between 0 and 6000 s.

10.6.2 Air flow monitoring during controlled air flow

Parameter 32

Controlled air flow is activated by actuating the input (terminal 2). The connected fan (terminal 58) is switched on. Parameter 32 can be used to adjust the behaviour of the actuator during controlled air flow. It also decides whether the low air pressure protection device (PZL) and the air flow (PDZ) should be monitored during controlled air flow.

Parameter 32 = 0: OFF; maximum capacity.

The actuator is moved to the position for maximum capacity during controlled air flow. Monitoring of the low air pressure protection device (PZL) and the air flow (PDZ) is not active.

Parameter 32 = 1: ON; maximum capacity.

The actuator is moved to the position for maximum capacity during controlled air flow. Monitoring of the low air pressure protection device (PZL) and the air flow (PDZ) is active. The display on the BCU shows P1 (Pre-purge). The controlled air flow time is subtracted from the pre-purge time of a subsequent burner start.

Parameter 32 = 2: OFF; controller enable.

The controller enable signal (terminal 56) is issued. The position of the actuator can be changed using an external temperature controller (controlled cooling). Monitoring of the low air pressure protection device (PZL) and the air flow (PDZ) is not active.

10.6.3 Pre-purge time t_{PV}

Parameter 34

A burner start may only occur if it has been ensured that the concentration of inflammable components in all sections of the combustion chamber and the connected areas and the flue gas ducts is less than 25% of the lower flammability limit of the fuel gas. A pre-purge is generally performed to ensure compliance with these requirements.

Parameter 34 is used to parameterize the pre-purge time in a range between 0 and 6000 s.

The pre-purge time t_{PV} is to be set on the basis of the relevant application standard (e.g. EN 676, EN 746-2, NFPA 85 or NFPA 86).

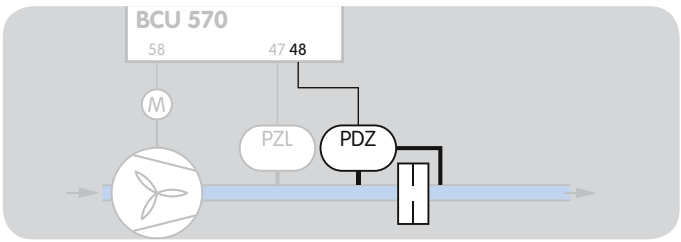
If air monitoring has been activated in parameter 15 or 35, the pre-purge time t_{PV} starts as soon as the air monitor detects an adequate flow for purging, see page 61 (Low air pressure protection) and page 9 (Modulating-controlled forced draught burner with pilot burner and valve proving system).

10.6.4 Air flow monitoring during pre-purge

Parameter 35

Function of the Air $flow_{min.}$ input (terminal 48)

The air flow is monitored during pre-purge by the differential pressure switch connected to terminal 48. If the air volume and therefore the differential pressure on the air pressure switch falls below the set value, the BCU will perform a safety shut-down or fault lock-out.



When the fan is switched off, the "no flow" state (default position) of the differential pressure switch is also checked if air flow monitoring has been activated. Activation of the air flow monitoring and the shut-down properties can be set using parameter 35.

Parameter 35 = 0: OFF; the air flow monitoring function is deactivated.

Parameter 35 = 1: with safety shut-down. If there is no signal at the input (terminal 48), a safety shut-down will be performed.

Parameter 35 = 2: with fault lock-out. If there is no signal at the input (terminal 48), a fault lock-out will be performed.

Air flow monitoring is to be set on the basis of the relevant application standard (e.g. EN 676, EN 746-2, NFPA 85 or NFPA 86).

10.6.5 Post-purge time t_{PN}

Parameter 37

If a post-purge time has been set, this will start immediately after the end of the burner operation. This allows the combustion chamber and the flue gas routes to be ventilated to remove fuel gas residues. Parameter 37 is used to parameterize the post-purge time in a range between 0 and 6000 s.

If the post-purge time has been activated, other settings are required for the low air pressure protection device, see also page 9 (Modulating-controlled forced draught burner with pilot burner and valve proving system).

10.6.6 Air flow monitoring during post-purge

Parameter 38

Parameter 38 is used to define whether the air flow is monitored and which position the actuator assumes during post-purge. Air flow monitoring can only be selected if low air pressure protection (parameter 15 = 1, 2) is active.

Parameter 38 = 0: ON; control element to maximum capacity. The actuator is moved to the position for maximum capacity during the post-purge time. The air flow is monitored.

Parameter 38 = 1: OFF; control element to maximum capacity. The actuator is moved to the position for maximum capacity during the post-purge time. The air flow is not monitored.

Parameter 38 = 2: OFF; control element to ignition capacity. The actuator is moved to the position for ignition capacity during the post-purge time. If the position of the actuator at this time is less than the position for ignition capacity, this position is not changed. The air flow is not monitored.

Parameter 38 = 3: OFF; control element controller enable. The controller enable signal (terminal 56) is issued. The position of the actuator can be changed using an external temperature controller (controlled cooling). The air flow is not monitored.

10.6.7 Capacity control

Parameter 40

The BCU 570 has an interface for connecting actuators or a frequency converter. Using parameter 40, you can set which actuator is used for capacity control (actuators IC 20, IC 40, RBW or frequency converter).

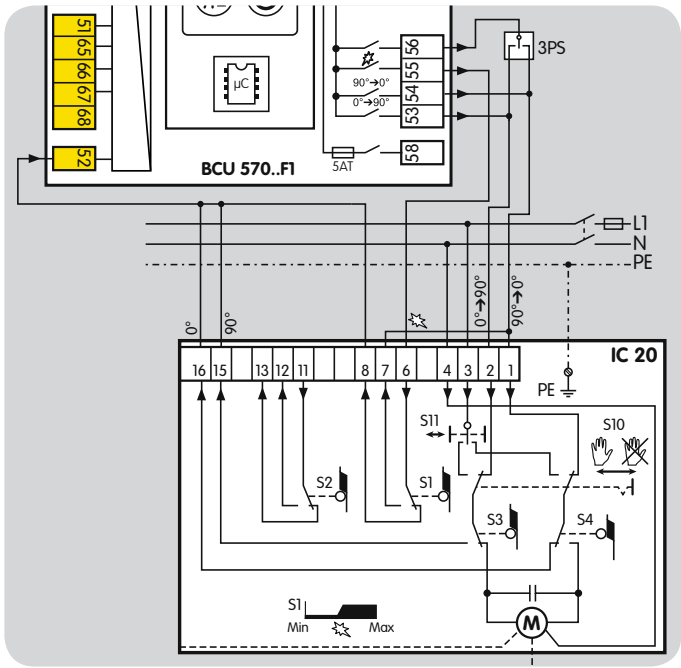
Parameter 40 = 0: OFF; no capacity control (no actuator).

Parameter 40 = 1: with IC 20.

The interface is configured to the requirements of actuators IC 20 or IC 20..E.

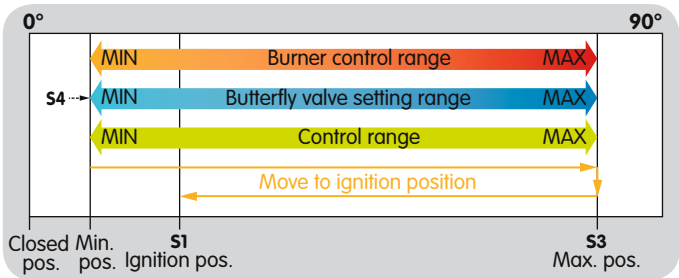
Alternatively, comparable three-point step actuators may be used.

IC 20



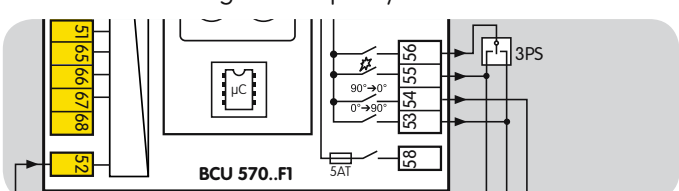
The positions for maximum capacity, ignition capacity and minimum capacity can be set using the actuator. It is checked whether the relevant position has been reached using terminal 52. If the position is not reached within the timeout time of 255 s, the BCU will display fault message A_C, A_0 oder A_1 (maximum, ignition or minimum capacity not reached), see page 43 (Fault signalling).

In the event of a fault, the actuator is moved to the position set via cam S4 for minimum capacity via the output at terminal 54.

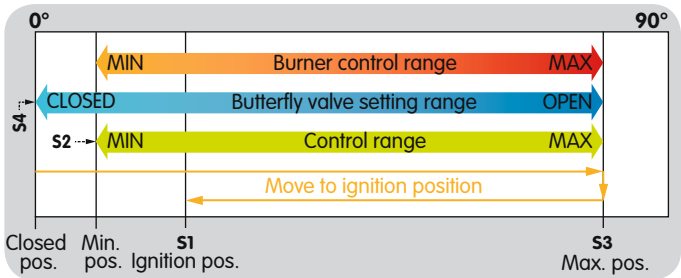


The control system is enabled for operation via the controller enable output (terminal 56). During the controller enable procedure, the actuator can be adjusted infinitely between the positions for maximum and minimum capacity by an external three-point step controller or using bus signals. There is no timeout active in this case.

If bus control is active (parameter 75), the controller enable output (terminal 56) has a different function. The wiring between the BCU and the 3-point step controller can be adjusted so that the control range of the actuator is between the positions for maximum and ignition capacity.



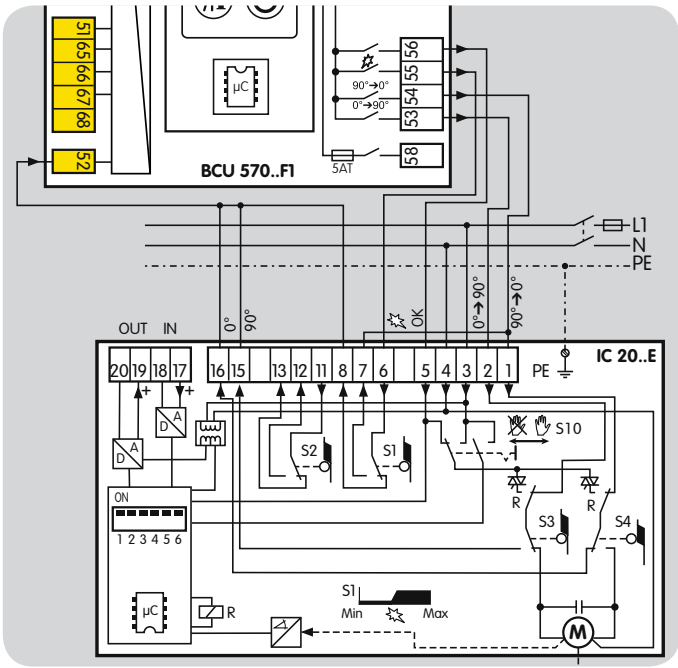
The minimum position which can be reached is the closed position.



Manual mode

In Manual mode, the actuator can be moved between the positions for maximum and minimum capacity in 3-point step operation. No timeout is active when approaching these positions. The controller enable output (terminal 56) is not active and not checked.

IC 20..E



The positions for minimum capacity, maximum capacity and ignition capacity can be set using the actuator. When the appropriate position has been reached, this information is signalled back via terminal 52. If no signal is received that the position has been reached within the timeout time of 255 s, a safety shut-down of the BCU will be performed and a fault message (Ac, Ao or Ai) will be displayed, see page 43 (Fault signalling). In addition, the actuator will be moved to the set position for minimum capacity using the output at terminal 54.

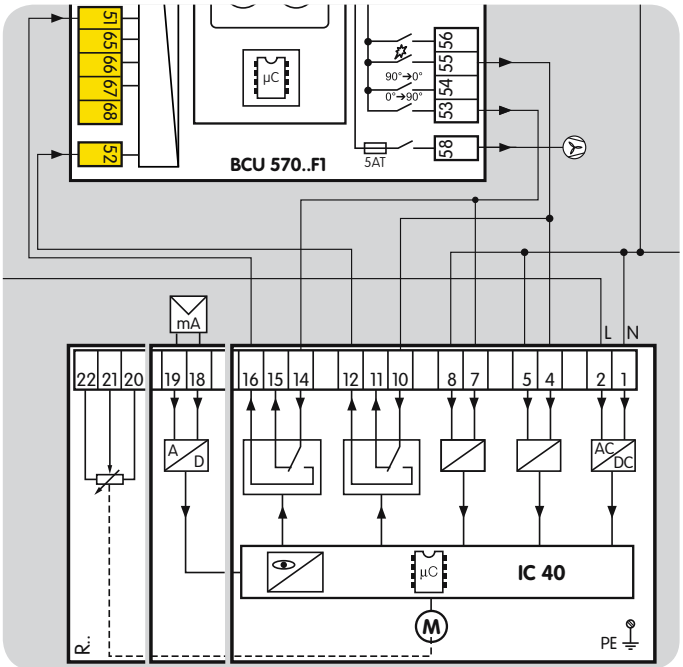
The control system is enabled during operation via the controller enable output (terminal 56). During the controller enable procedure, the actuator can be adjusted infinitely between the positions for maximum and minimum capacity by a controller (0(4) – 20 mA, 0 – 10 V) using the setpoint generator on terminals 17 and 18 or the bus signal. There is no timeout active in this case. If bus control is active, the controller enable output (terminal 56) has a different function.

Manual mode

In Manual mode, the actuator can be moved between the positions for maximum and minimum capacity in 3-point step operation. No timeout is active when approaching these positions. The controller enable output (terminal 56) is not active and not checked.

Parameter 40 = 2: with IC 40.

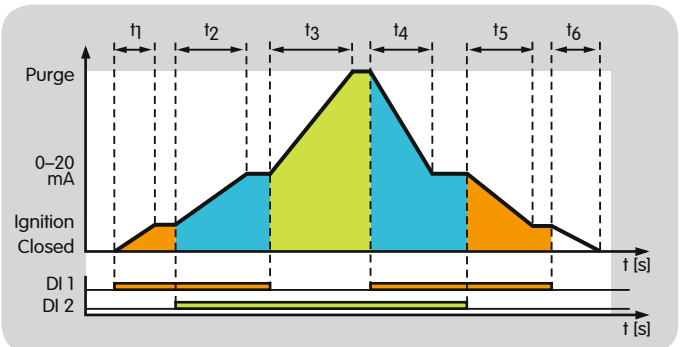
To ensure that the actuator IC 40 can be operated on the BCU..F1, P40 = 2 (capacity control) must be set. The operating mode of control element IC 40 must be parameterized to 27.



The positions for maximum capacity and ignition capacity can be set using the actuator. Terminal 51 checks whether the position for maximum capacity has been reached. Terminal 52 checks the position for ignition capacity. If the position is not reached within the timeout time of 255 s, a safety shut-down of the BCU will be performed. A fault message (*Ac*, *Ao* or *Ai*) will be displayed, see page 43 (Fault signalling).

If a controller enable is active, the control system is enabled for operation via the outputs at terminals 53 and 55.

During the controller enable procedure, the actuator IC 40 can be adjusted infinitely between the positions for maximum and minimum capacity using its analogue input (terminals 18 and 19). There is no timeout active in this case.



BCU		IC 40	
Signal at terminal		Position	Butterfly valve position
55	53		
OFF	OFF	Closed	Closed
ON	OFF	Ignition	Minimum/Ignition capacity
ON	ON	0 – 20 mA	Any position between minimum and maximum capacity
OFF	ON	Purge	Maximum capacity

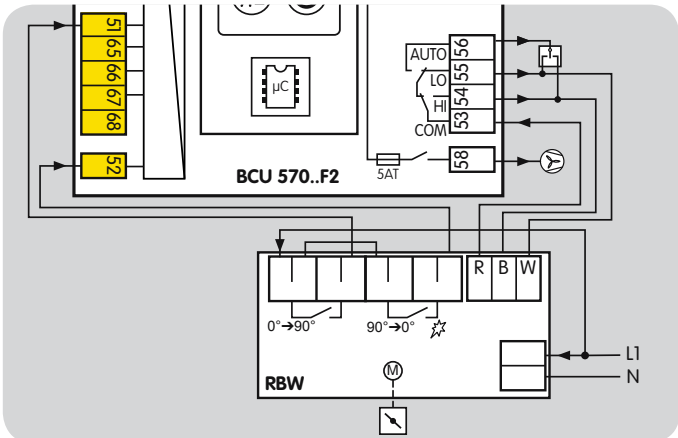
In the event of a fault and in standby, there will be no signal at terminals 53 and 55 so that the actuator moves to the closed position. When approaching the closed position, no timeout of 255 s is active since no feedback input is checks. This may result in a situation where the program is continued in the case of a request for the closed position, without the butterfly valve being closed. The outputs at terminals 56 (controller enable) and 54 (closed position) on the BCU are non-functional and are not activated.

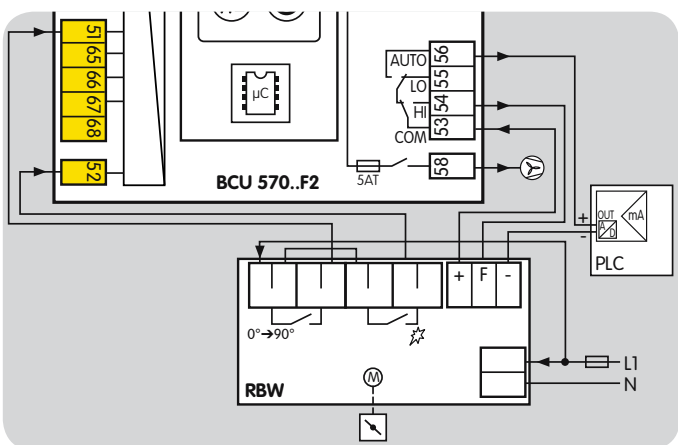
Manual mode

In Manual mode, no external controller is enabled. The actuator can be moved to the positions for maximum capacity or ignition capacity by the user. 3-point step operation is not possible. No timeout is active when approaching these positions.

Parameter 40 = 3: with RBW.

The actuator can be moved to the positions for maximum capacity (contact COM to HI) and minimum capacity (contact COM to LO) using the interface and by closing the various contacts.





The RBW actuator reports that it has reached the position for maximum capacity via a signal to terminal 51. The actuator reports that it has reached the position for minimum capacity via a signal to terminal 52. The simultaneous activation of terminals 51 and 52 results in a fault lock-out of the BCU.

If parameter 41 = 0, the system monitors the movement to the positions for maximum and minimum capacity with a timeout time of 255 s. Reaching the relevant position immediately triggers the program continue switch conditions. If reaching the position is not signalled within the timeout time of 255 s, a safety shut-down of the BCU will be performed. A fault message (*Fc* or *Fo*) will be displayed, see page 43 (Fault signalling).

If parameter 41 = 1, the system does not monitor whether the positions for minimum and maximum capacity are reached. In this case, a running time of up to 250 s must be defined using parameter 42, see page 72 (Running time). The program continue switch conditions are then controlled dependent on this time.

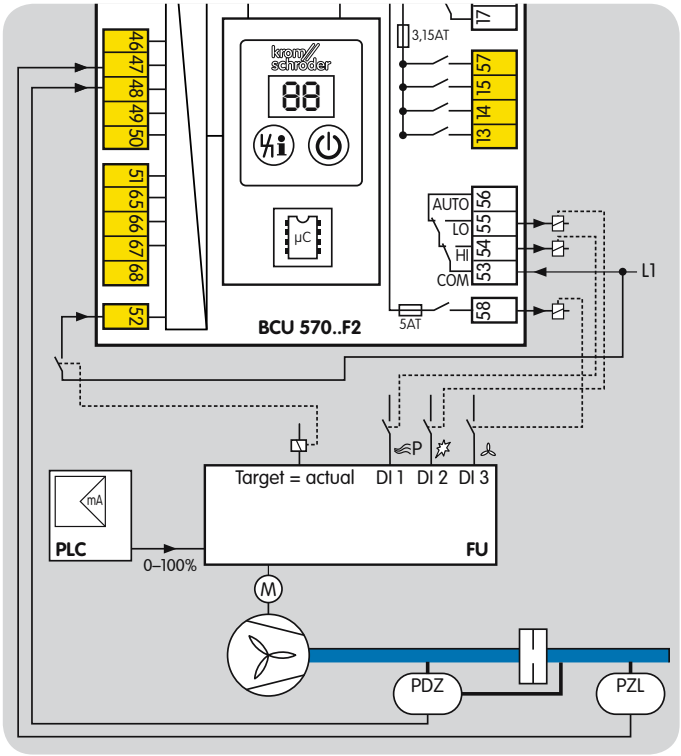
If a fault occurs, the actuator is moved to the position for minimum capacity.

Manual mode

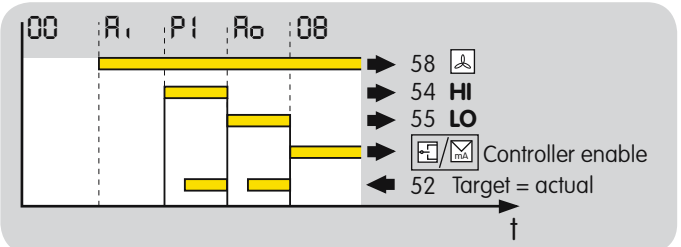
In Manual mode, no external controller is enabled during the controller enable procedure. The actuator can be moved to the positions for maximum capacity or ignition capacity by the user. 3-point step operation is not possible. No timeout is active when approaching these positions.

Parameter 40 = 4: with frequency converter.

The interface is configured according to the requirements of a fan controlled by a frequency converter.



The speeds for maximum capacity and ignition capacity are set using the frequency converter depending on the outputs at terminals 54 and 55. The frequency converter reports that the relevant speeds have been reached by a signal (target = actual) to the BCU via terminal 52. If reaching the speeds is not signalled within the timeout time of 255 s, a safety shut-down of the BCU will be performed. A fault message (*Ao* or *A1*) will be displayed, see page 43 (Fault signalling). The frequency converter is switched off in the event of a fault.



In Manual mode, the frequency converter can be set to the speed for maximum capacity or ignition capacity. Adjustment by the control system is not possible. No timeout is active when accelerating to these speeds.

10.6.8 Running time selection

Parameter 41

This parameter can only be set on the BCU 570..F2 version in conjunction with an actuator with an RBW interface.

Parameter 41 = 0: a signal that the positions for minimum and maximum capacity have been reached is returned and monitored with a timeout time of max. 255 s. When the position has been reached, the BCU will initiate the next program step.

Parameter 41 = 1: no signal is returned that the positions for minimum and maximum capacity have been reached. The running time set in parameter 42 is activated for approaching these positions, see page 72 (Running time). After this time has elapsed, the BCU will initiate the next program step.

Parameter 41 = 2: only approaching the position for minimum capacity is signalled and monitored. No signal is returned that the position for maximum capacity has been reached. The running time set in parameter 42 is activated for approaching the position for maximum capacity. After this time has elapsed, the BCU will initiate the next program step.

Parameter 41 = 3: only approaching the position for maximum capacity is signalled and monitored. No signal is returned that the position for minimum capacity has been reached. The running time set in parameter 42 is activated for approaching the position for minimum capacity. After this time has elapsed, the BCU will initiate the next program step.

10.6.9 Running time

Parameter 42

Parameter 42 is only active if parameter 40 = 3 and parameter 41 = 1, 2 or 3.

This parameter is used to define the running time of the RBW actuator if it only signals one position or no positions (parameter 41 = 1, 2 or 3).

10.6.10 Low fire over-run

Parameter 43

This parameter can only be set on the BCU 570..F1 version in conjunction with an actuator IC 20 (P40 = 1).

Low fire over-run (P43 = 1) means that the burner is not immediately switched off after the start-up signal ϑ (terminal 1) is removed. During low fire over-run, the control element is moved to the position for minimum capacity and the fan and gas valves remain switched on until either the flame fails or the position for minimum capacity is reached. If the flame is extinguished, this does not result in a fault. If a post-purge has been parameterized, it will be started following the over-run.

Parameter 43 = 0: OFF. No low fire over-run is performed.

Parameter 43 = 1: up to minimum capacity. Low fire over-run is performed after a controlled shut-down (ϑ signal off).

10.6.11 Controller enable signal delay time t_{RF}

Parameter 44

Parameter 44 can be used to delay the controller enable signal from 0 to 250 s in 1 s steps.

If the BCU has successfully started the burner, after the elapse of the safety time and the flame proving period, if parameterized, the controller enable signal to the external temperature controller is delayed. The BCU shows program status H8. After the elapse of the delay time t_{RF}, the burner operation signalling contact (terminals 17, 18) is closed and the controller enable output (terminal 56) activated. The display changes to 08.

10.6.12 Capacity control (bus)

Parameter 75

Controlling the burner capacity using the fieldbus is only possible with bus module BCM 500 connected and enabled (P80 = 1 or 2).

Output terminal 56 is no longer available for controller enable if bus control is active.

Parameter 75 = 0: OFF. No capacity control possible using the fieldbus.

Parameter 75 = 1: MIN. to MAX. capacity; standby in position for MIN. capacity. The control range while the burner is operating is between the positions for minimum capacity (S4) and maximum capacity (S3). The burner is ignited in the position for ignition capacity (S1). When the burner is switched off, the actuator is moved to the position for minimum capacity (S4).

This operating mode can be achieved with an actuator IC 20, RBW or alternatively with a comparable three-point step actuator.

NOTE:
If the air supply is stopped on a heated furnace with the burner switched off, the controls may be damaged by the hot furnace atmosphere as a result of the lowest possible position of the butterfly valve, limited by S4.

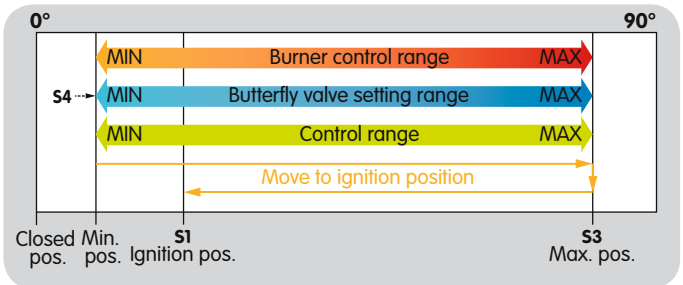
IC 20

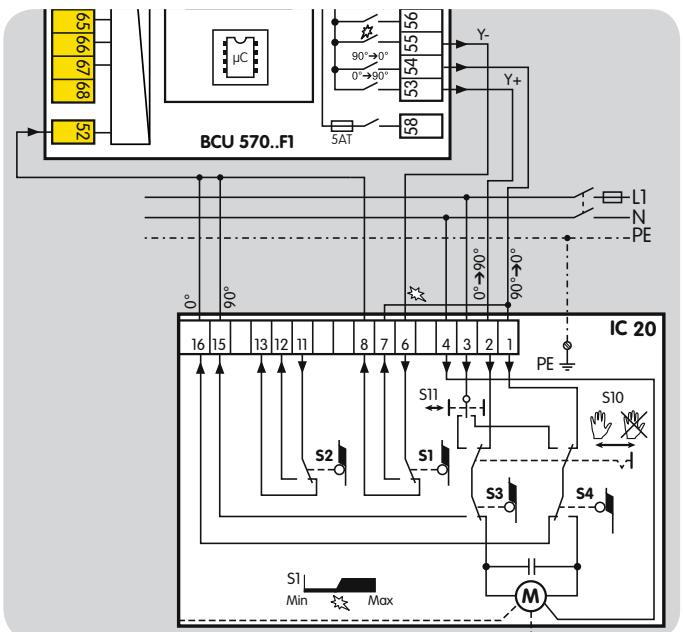
Switching cam setting for ignition capacity, minimum and maximum capacity as well as pre-purge and standby:

S1: for ignition capacity of the burner.

S3: for maximum capacity of the burner and pre-purge.

S4: for minimum capacity of the burner and standby.
If the air supply is stopped on a heated furnace with the burner switched off, the controls may be damaged by the hot furnace atmosphere as a result of the lowest possible position of the butterfly valve, limited by S4.





Parameter 75 = 2: MIN. to MAX. capacity; standby in CLOSED position. The control range while the burner is operating is between the positions for minimum capacity (S2) and maximum capacity (S3). The burner is ignited in the position for ignition capacity (S1). When the burner is switched off, the actuator is moved to the closed position (S4).

This operating mode can be achieved with an actuator IC 20 or alternatively with a comparable three-point step actuator.

NOTE:
If the air supply is stopped on a heated furnace with the burner switched off, the controls are protected from the hot furnace atmosphere as a result of the butterfly valve being in the closed position (limited by S4). Check whether the burner can cope without cooling in this situation.

IC 20

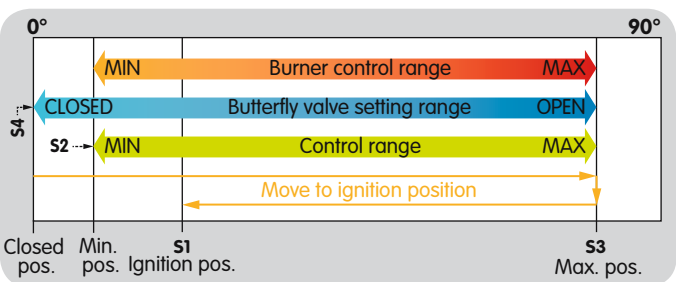
Switching cam setting for ignition capacity, minimum and maximum capacity as well as pre-purge and standby:

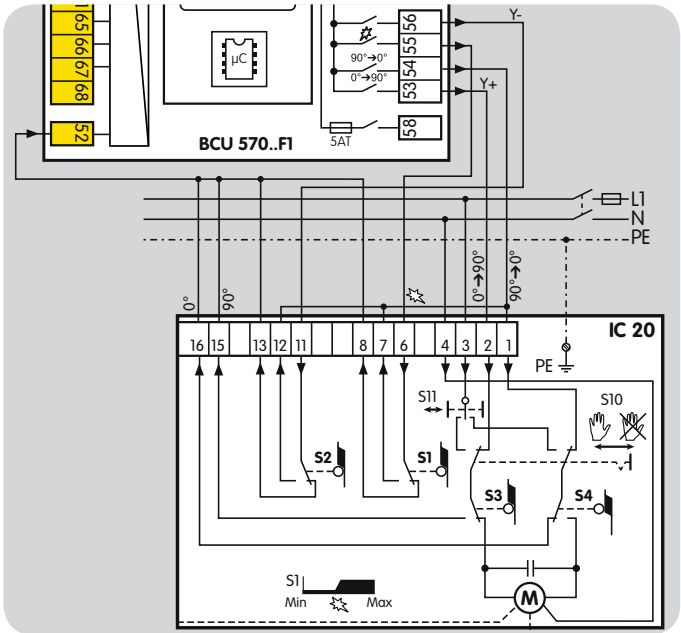
S1: for ignition capacity of the burner.

S2: for minimum capacity of the burner.

S3: for maximum capacity of the burner and pre-purge.

S4: for the closed position of the butterfly valve and standby.





Parameter 75 = 3: IGNITION to MAX. capacity; standby in CLOSED position.

The control range while the burner is operating is between the positions for minimum capacity (S1) and maximum capacity (S3). The burner is ignited in the position for minimum capacity (S1). When the burner is switched off, the actuator is moved to the closed position (S4).

This operating mode can be achieved with an actuator IC 20 or alternatively with a comparable three-point step actuator.

NOTE:
If the air supply is stopped on a heated furnace with the burner switched off, the controls are protected from the hot furnace atmosphere as a result of the butterfly valve being in the closed position (limited by S4). Check whether the burner can cope without cooling in this situation.

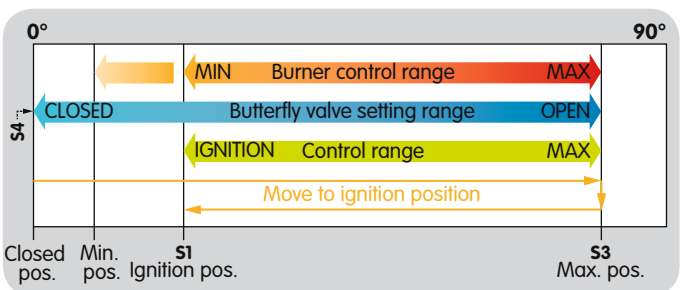
IC 20

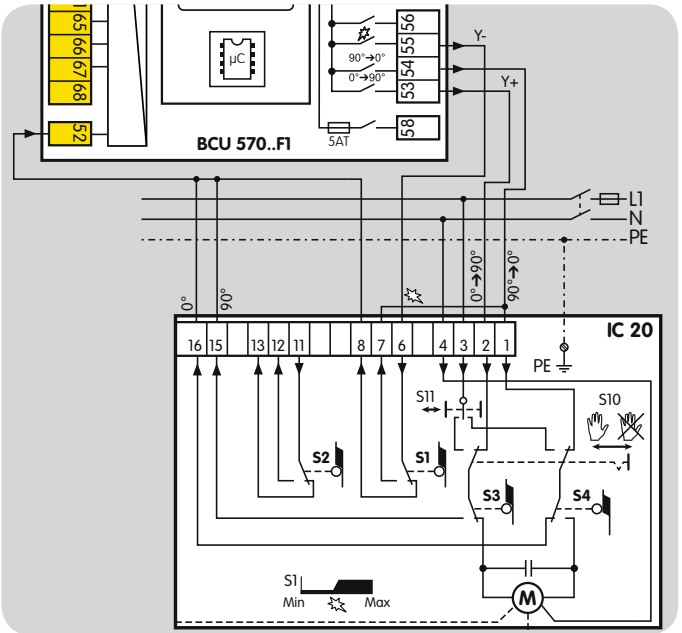
Switching cam setting for ignition capacity, minimum and maximum capacity as well as pre-purge and standby:

S1: for minimum capacity and ignition capacity of the burner.

S3: for maximum capacity of the burner and pre-purge.

S4: for the closed position of the butterfly valve and standby.





Parameter 75 = 4: MIN. to MAX. capacity; standby in position for MIN. capacity; burner quick start.

The control range while the burner is operating is between the positions for minimum capacity (S4) and maximum capacity (S3). The burner is ignited in the position for ignition capacity (S1). Switching cam S2 (reverse direction of rotation) ensures that the position for ignition capacity is approached without pre-purging first (quick start). When the burner is switched off, the actuator is moved to the position for minimum capacity (S4).

This operating mode can be achieved with an actuator IC 20 or alternatively with a comparable three-point step actuator.

NOTE:
If the air supply is stopped on a heated furnace with the burner switched off, the controls may be damaged by the hot furnace atmosphere as a result of the lowest possible position of the butterfly valve, limited by S4.

Remember that if pre-purge is active in this operating mode, purging will take place with considerably lower air capacity than the maximum air capacity.

IC 20

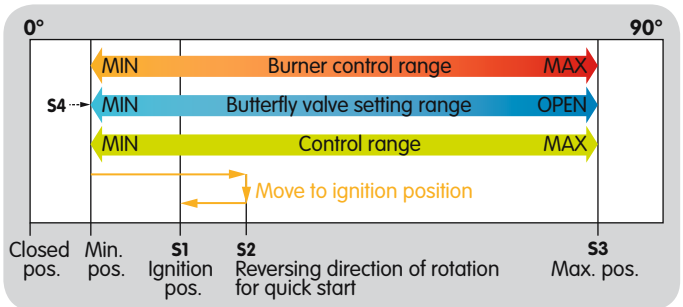
Switching cam setting for ignition capacity, minimum and maximum capacity and reverse direction of rotation to approach the position for ignition capacity:

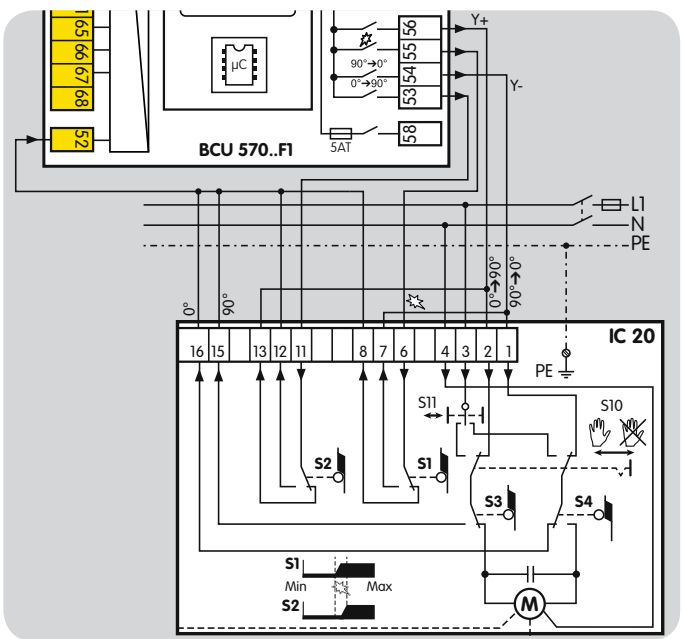
S1: for ignition capacity of the burner.

S2: for reversing the direction of rotation to approach the position for ignition capacity.

S3: for maximum capacity of the burner and pre-purge.

S4: for the closed position of the butterfly valve and standby.



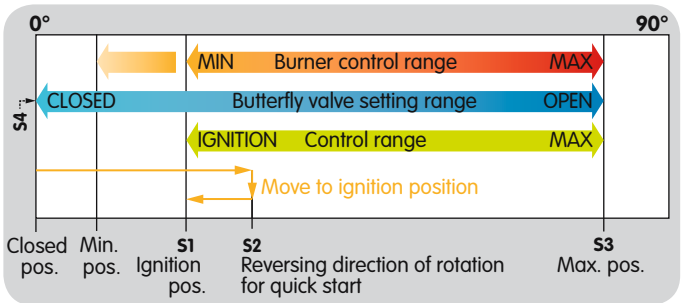


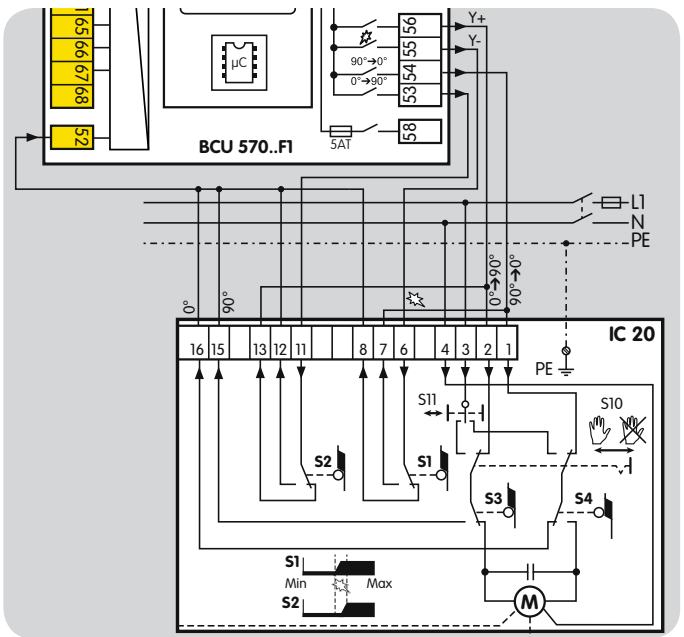
Parameter 75 = 5: IGNITION to MAX. capacity; standby in CLOSED position; burner quick start.

The control range while the burner is operating is between the positions for ignition capacity (S1) and maximum capacity (S3). The burner is ignited in the position for ignition capacity (S1). Switching cam S2 (reverse direction of rotation) ensures that the position for ignition capacity is approached without pre-purging first (quick start). When the burner is switched off, the actuator is moved to the closed position (S4).

This operating mode can be achieved with an actuator IC 20 or alternatively with a comparable three-point step actuator.

NOTE:
If the air supply is stopped on a heated furnace with the burner switched off, the controls are protected from the hot furnace atmosphere as a result of the butterfly valve being in the closed position (limited by S4). Check whether the burner can cope without cooling. If pre-purge is active, considerably lower air capacity than the maximum air capacity will be used for purging.





IC 20

The position for maximum capacity is achieved by the controller enable output (terminal 56).

Switching cam settings S1, S2, S3 and S4:

S1: for minimum capacity and ignition capacity of the burner.

S2: for reversing the direction of rotation to approach the position for ignition capacity. The actuator will move to the position for ignition capacity without reaching the position for maximum burner capacity.

S3: for maximum capacity of the burner and pre-purge.

S4: for the closed position of the butterfly valve and standby.

10.7 Valve check

10.7.1 Valve proving system

Parameter 51

Parameter 51 is used to define whether and at what time in the BCU 570 program sequence the valve check is activated. In addition, it is possible to select between the tightness control and proof of closure (POC) functions. If the proof of closure function is activated, the closed position of the gas solenoid valve at the inlet side is checked using a POC switch.

Parameter 51 = 0: OFF. No valve check is activated.

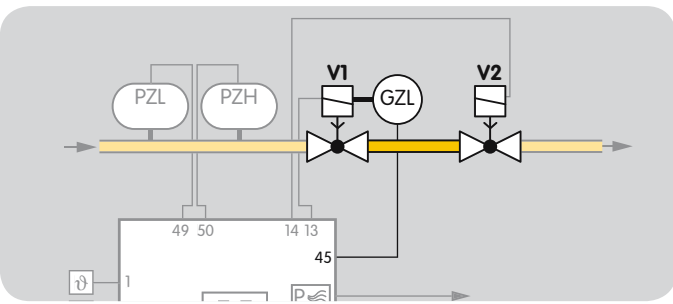
Parameter 51 = 1: tightness test before start-up.

Parameter 51 = 2: tightness test after shut-down. With this setting, a tightness test is also performed after a fault is reset and after mains ON.

Parameter 51 = 3: tightness test before start-up and after shut-down.

An additional bypass/relief valve must be fitted in gas sections with an air/gas ratio control, see also page 78 (Relief valve (VPS)). The valve allows the closed air/gas ratio control to be bypassed during the tightness test.

Parameter 51 = 4: proof of closure function (POC).



A signal is sent to the BCU via the POC switch on the gas solenoid valve on the inlet side before burner start-up stating that the valve is closed. After burner start-up, the signal must drop out to indicate to the BCU that the valve is open.

10.7.2 Relief valve (VPS)

Parameter 52

A valve can be selected at terminal 14, 15 or 57 to act as a relief valve during a tightness test.

Parameter 52 = 2: V2. The valve on terminal 14 acts as the relief valve.

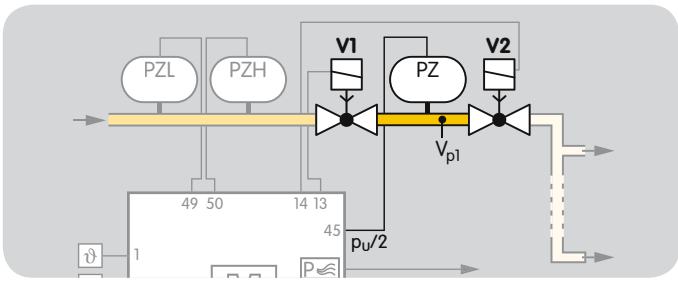
Parameter 52 = 3: V3. The valve on terminal 15 acts as the relief valve.

Parameter 52 = 4: V4. The valve on terminal 57 acts as the relief valve.

10.7.3 Measurement time V_{p1}

Parameter 56

The required measurement time must be determined according to the requirements of the appropriate application standards, e.g. EN 1643.



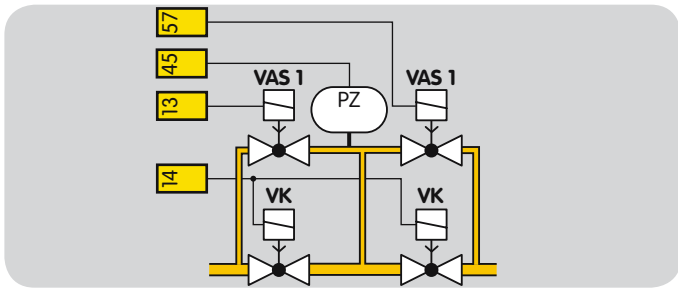
The required measurement time for the tightness test of V_{p1} can be set using parameter 56. The possible settings are 3 s, 5 to 25 s (in 5 s steps) or 30 to 3600 s (in 10 s steps).

See also page 28 (Measurement time t_M).

10.7.4 Valve opening time t_{L1}

Parameter 59

This parameter is used to define the opening time for the valves (2 to 25 s) which are opened to fill or discharge the test volume between the gas valves. If the preset opening time t_L = 2 s is inadequate (e.g. if slow opening valves are used) to fill the test volume or reduce the pressure between the valves, bypass valves can be used instead of the main valves.



On condition that the gas volume which flows into the combustion chamber is no larger than 0.05% of the maximum flow rate, the opening time of the bypass valves may be longer than the 3 s permitted by the standard (EN 1643:2000). The required volume limit can be achieved by fitting a restrictor or orifice, for example. The opening time to be set is then calculated on the basis of this restrictor or orifice.

Calculating the opening time, see page 27 (Calculating the extended opening time).

10.8 Behaviour during start-up

10.8.1 Minimum pause time t_{BP}

Parameter 62

A minimum pause time t_{BP} can be defined to achieve stable operation of the burners. If the post-purge time t_{PN} set using parameter 37 has elapsed and no signal (ϑ) is received at terminal 1 (burner shut-down), a restart is prevented for the duration of the minimum pause time t_{BP}. While the minimum pause time is active, it is not possible to activate controlled air flow (terminal 2).

If terminal 1 (burner start-up) or terminal 2 (controlled air flow) is activated during the minimum pause time, status display Delay HO will appear.

A minimum pause time in a range between 0 and 3600 s can be parameterized using parameter 62.

10.8.2 Switch-on delay time t_E

Parameter 63

Defines the time between applying the start-up signal (start or controlled air flow) and initiating the fan run-up time (0 to 25 s).

When several BCUs are activated simultaneously, setting different switch-on delay times t_E prevents the fans from starting at the same time and reduces the load on the power supply.

The switch-on delay also applies to the TC function. It is also active if the unit is switched on and the start-up signal was already present. If the switch-on delay is active, status display HO will appear. The switch-on delay can be set in the range from 0 to 250 s.

10.9 Manual mode

If the Reset/Information button is pressed for 2 s during switch-on, the BCU reverts to Manual mode. Two dots blink on the display. The BCU is now operating in Manual mode independently of the status of the inputs of the start-up signal (terminal 1), controlled air flow (terminal 2) and remote reset (terminal 3). The functions of the safety-relevant inputs/controller enable/emergency stop (terminal 46) are retained. The manual start-up of the BCU can be started in Manual mode by pressing the Reset/Information button. Each time the button is pressed again, the BCU moves to the next step of the program sequence and stops there, for example for adjusting an actuator or the gas/air mixture.

IC 20

Following controller enable (status display 08), a connected actuator can be opened and closed as required. By holding the button, the actuator is first opened further. The BCU indicates A.1. with blinking dots. Once the button has been released, the actuator stops in the relevant position. Pressing it again will result in closing the actuator to the position for minimum capacity. The BCU indicates A.0. with blinking dots. A change of direction takes place each time the button is released and pressed again. When the actuator has reached its final position, the dots disappear.

IC 40, RBW, frequency converter

With these actuator concepts for capacity control, it is only possible to set the actuator to the positions for maximum capacity and ignition capacity on a binary basis in Manual mode following controller enable (status display 08).

10.9.1 Operating time in Manual mode

Parameter 67

Parameter 67 decides whether the burner is operated for a limited time or not during Manual mode.

Parameter 67 = 0: Manual mode is not limited in time. If this function has been selected, operation of the burner may be continued manually in the event of failure of the control system or the bus activation.

Parameter 67 = 1: the BCU will terminate burner operation 5 minutes after the last time the button is pressed. It remains in Manual mode and returns to its start-up position/standby.

If the unit is switched off or a power failure occurs, Manual mode on the BCU will be terminated regardless of parameter 67.

10.10 Functions of terminals 51, 65, 66, 67 and 68

Terminals 51, 65, 66, 67 and 68 can each be assigned a logical AND gating with one of the inputs for the safety functions (terminals 46 – 50) using an appropriate parameter. If AND gating is not required, the input concerned can be disabled.

Terminal 51 can also be used as a feedback input for the maximum capacity position when operated with IC 40/RBW.

10.10.1 Function of terminal 51

Parameter 69

Parameter 69 = 0: function off

Parameter 69 = 8: AND with input at terminal 46 (emergency stop)

Parameter 69 = 9: AND with input at terminal 47 ($air_{min.}$ pressure switch)

Parameter 69 = 10: AND with input at terminal 48 (air flow pressure switch)

Parameter 69 = 11: AND with input at terminal 49 ($gas_{max.}$ pressure switch)

Parameter 69 = 12: AND with input at terminal 50 ($gas_{min.}$ pressure switch)

Parameter 69 = 13: IC 40/RBW feedback of position for maximum capacity, see page 70 (Parameter 40 = 3: with RBW.).

10.10.2 Function of terminal 65

Parameter 70

Parameter 70 = 0: function off

Parameter 70 = 8: AND with input at terminal 46 (emergency stop)

Parameter 70 = 9: AND with input at terminal 47 ($air_{min.}$ pressure switch)

Parameter 70 = 10: AND with input at terminal 48 (air flow pressure switch)

Parameter 70 = 11: AND with input at terminal 49 ($gas_{max.}$ pressure switch)

Parameter 70 = 12: AND with input at terminal 50 ($gas_{min.}$ pressure switch)

10.10.3 Function of terminal 66

Parameter 71

Parameter 71 = 0: function off

Parameter 71 = 8: AND with input at terminal 46 (emergency stop)

Parameter 71 = 9: AND with input at terminal 47 ($air_{min.}$ pressure switch)

Parameter 71 = 10: AND with input at terminal 48 (air flow pressure switch)

Parameter 71 = 11: AND with input at terminal 49 ($gas_{max.}$ pressure switch)

Parameter 71 = 12: AND with input at terminal 50 ($gas_{min.}$ pressure switch)

10.10.4 Function of terminal 67

Parameter 72

Parameter 72 = 0: function off

Parameter 72 = 8: AND with input at terminal 46 (emergency stop)

Parameter 72 = 9: AND with input at terminal 47 ($air_{min.}$ pressure switch)

Parameter 72 = 10: AND with input at terminal 48 (air flow pressure switch)

Parameter 72 = 11: AND with input at terminal 49 ($gas_{max.}$ pressure switch)

Parameter 72 = 12: AND with input at terminal 50 ($gas_{min.}$ pressure switch)

10.10.5 Function of terminal 68

Parameter 73

Parameter 73 = 0: function off

Parameter 73 = 8: AND with input at terminal 46 (emergency stop)

Parameter 73 = 9: AND with input at terminal 47 ($air_{min.}$ pressure switch)

Parameter 73 = 10: AND with input at terminal 48 (air flow pressure switch)

Parameter 73 = 11: AND with input at terminal 49 ($gas_{max.}$ pressure switch)

Parameter 73 = 12: AND with input at terminal 50 ($gas_{min.}$ pressure switch)

10.11 Password

Parameter 77

The password is designed to protect the parameter settings. To prevent unauthorized changes to parameter settings, a password is stored in parameter 77 (0000 to 9999). Changes to parameter settings can only be made once this number has been entered. The password can be changed using BCSoft. Note the effect of parameter settings on the safe functioning of your system.

10.12 Fieldbus communication

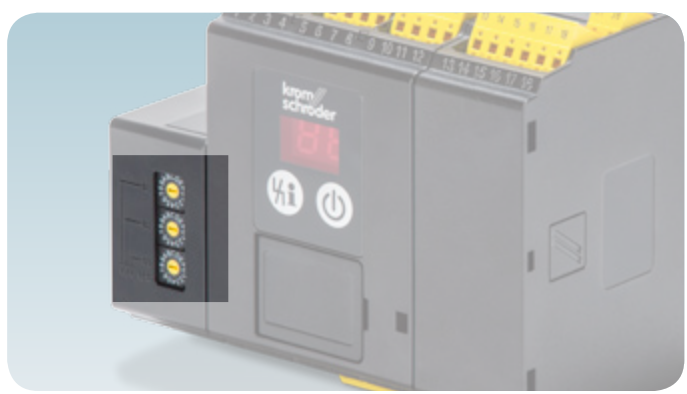
Parameter 80

Fieldbus communication can be activated using parameter 80 when bus module BCM 500 is connected.

A device name must be entered in the automation system for the unique identification of the control unit (BCU/FCU) in the Profinet IO system.

Parameter 80 = 0: OFF. Parameterization access using BCSoft via Ethernet is still possible.

Parameter 80 = 1: with address check. The device name on delivery is "not-assigned-bcu-570-xxx". The expression "not-assigned-" must be deleted or may be replaced with an individual name. The sequence xxx must be identical to the address set on the BCM 500 using the code switches (xxx = address in the range 001 to FEF).



Parameter 80 = 2: no address check. The device name can be selected as specified by the automation system.

11 Selection

	Q	W	CO	C1	F1	F2	U0	K0	K1	K2	E
BCU 570	●	●	●	○	●	○	○	○	●	○	●

● = *standard*, ○ = *available*

Order example

BCU 570WC1F1U0K1E

11.1 Type code

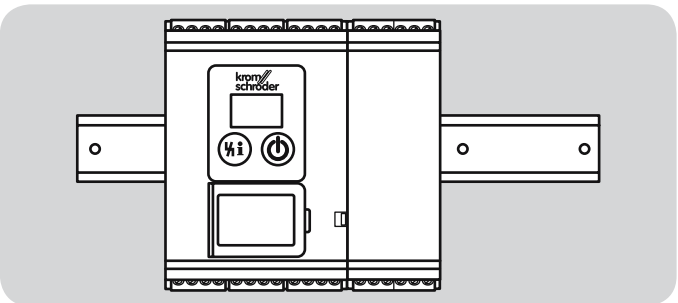
Code	Description
BCU	Burner control unit
570	Series 570
Q	Mains voltage: 120 V AC, 50/60 Hz
W	230 V AC, 50/60 Hz
C0	No valve proving system
C1	With valve proving system
	Capacity control:
F1	modulating with IC interface
F2	modulating with RBW interface
U0	Ionization or UV control in case of operation with gas
K0	No connection plug
K1	Connection plug with screw terminals
K2	Connection plug with spring force terminals
E	Individual packaging

12 Project planning information

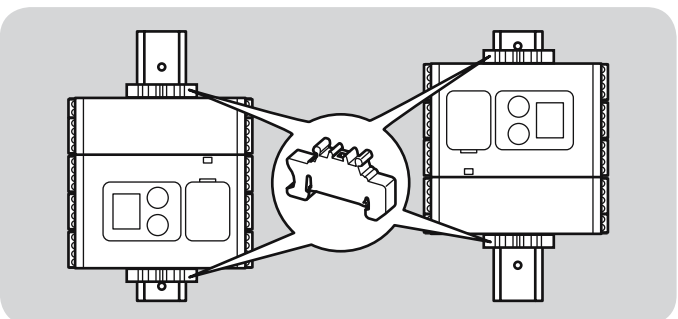
12.1 Installation

Installation position: any.

The BCU mounting is designed for horizontally aligned 35 × 7.5 mm DIN rails.



If the DIN rail is aligned vertically, end clamps are required (e.g. Clipfix 35 by Phoenix Contact) to prevent the BCU from slipping.



Environment

Install in a clean environment (e.g. a control cabinet) with an enclosure ≥ IP 54, whereby no condensation is permitted.

12.2 Commissioning

Do not start the BCU until the parameter settings and wiring are correct and the faultless processing of all input and output signals complies with the local standards.

12.3 Electrical connection

The BCU 570 is designed for connection to a 1-phase system. All inputs and outputs have a one-phase mains supply. Other connected burner control units must use the same phase of the mains supply.

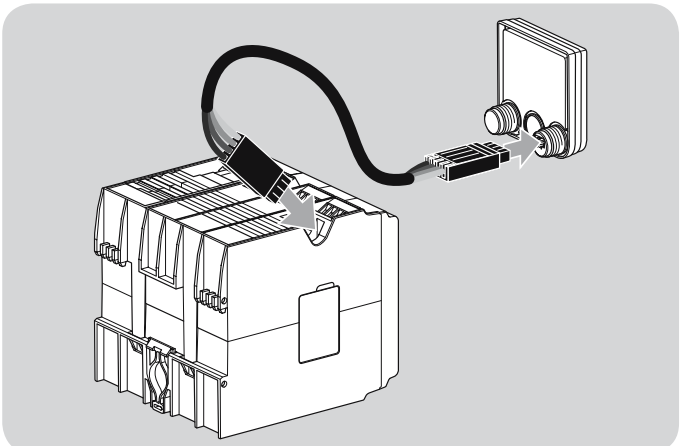
The national standards and safety requirements must be satisfied. If the BCU 570 is operated in ungrounded/IT systems, an insulation monitoring device must be provided to isolate it from the mains in the event of a fault. The cabling of the safety circuits (e.g. pressure switches, gas valves) outside enclosed installation spaces must be protected from mechanical damage and stress (e.g. vibration or bending) as well as short-circuits, short-circuits to ground and cross-circuits.

Signal and control line for screw terminals max. 2.5 mm^2 (AWG 12), for spring force terminals max. 1.5 mm^2 (AWG 16).

Do not route BCU cables in the same cable duct as frequency converter cables or cables emitting strong fields.

External electrical interference must be avoided.

12.3.1 OCU



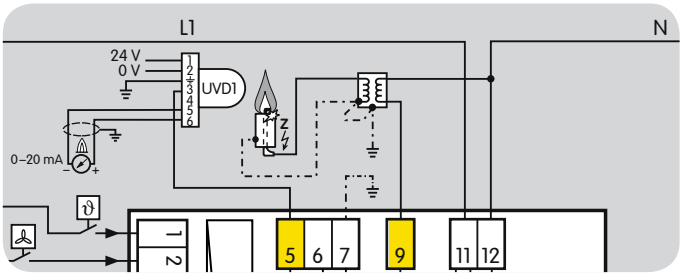
Cables for signalling and telecommunications systems are recommended for wiring the supplied plug connectors:

Cable length max. 10 m, 4-pin,

min. 0.25 mm^2 (AWG 24),

max. 0.34 mm^2 (AWG 22).

12.3.2 UVD sensor



An additional voltage supply of 24 V DC is required to operate the UV sensor for continuous operation UVD 1 in conjunction with the burner control unit BCU. The 24 V DC voltage supply and the 0 – 20 mA current output of the UV sensor must be wired separately.

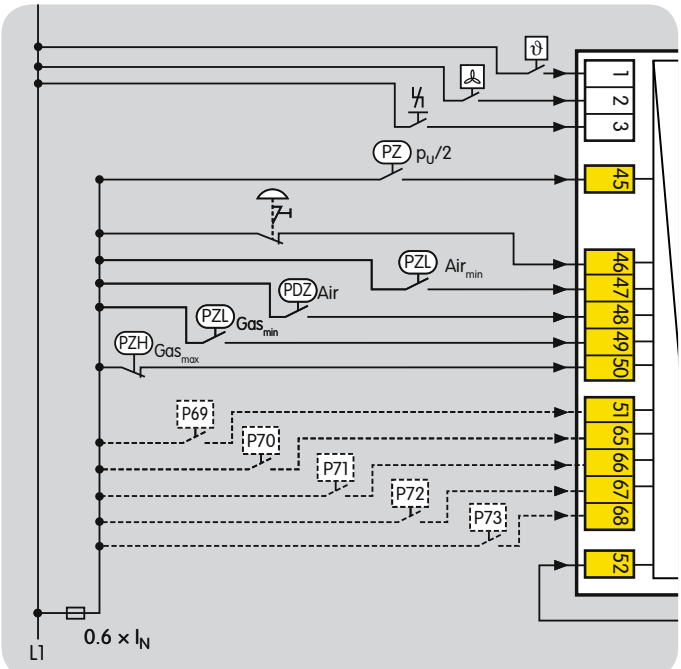
The 0 – 20 mA current output of the UVD can only be used to display the flame intensity (e.g. in a control room). If a distributor box is used, the cable from the distributor box to the control room must be screened. The length of the unscreened cable from UVD 1 to the distributor box may not exceed 5 m.

12.3.3 Safety current inputs

Actuation of the safety current inputs only with switchgear featuring mechanical contacts. If switchgear with semi-conductor contacts is used, the safety current inputs must be connected using relay contacts.

To safeguard the safety current inputs, the fuse must be designed so that the sensor with the lowest switching capacity is protected.

The cabling outside enclosed installation spaces must be protected from mechanical damage and stress (e.g. vibration or bending) as well as short-circuits, short-circuits to ground and cross-circuits.



Calculation

I_N = current of the sensor/contactor with the lowest switching capacity

Suitable fuse = 0.6 × I_N

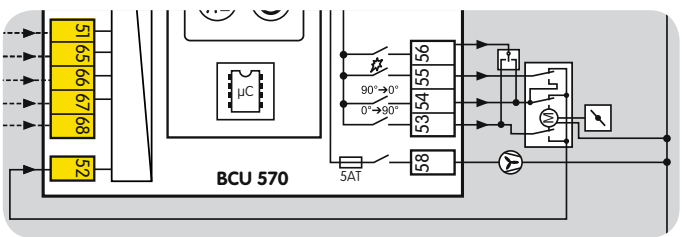
12.4 Actuators

If actuators are used, the start gas rate of the burners must be limited for SIL 3 applications in compliance with the standard.

12.4.1 IC 20

The BCU..F1 checks the position to which the actuator IC 20 has moved using terminal 52 (feedback) by lifting the signal to terminal 53, 54 or 55, see page 104 (Lifting).

To ensure this check is possible, BCU..F1 and actuator IC 20 or equivalent three-point step actuators must be wired as shown in the connection diagram.



12.5 Air control

Starting the fan with the butterfly valve closed reduces the start-up current of the fan motor.

12.6 Parameter chip card

The parameter chip card must be installed in the unit for the BCU to operate. The parameter chip card contains the valid parameters for the BCU. If a BCU is replaced, the parameter chip card can be removed from the old unit and inserted into the new BCU. The BCU must be disconnected from the electrical power supply for this purpose. The valid parameters are then adopted by the new BCU. The old device and the new BCU must have an identical type code.

13 Accessories

13.1 BCSoft

The current software can be downloaded from our Internet site at www.docuthek.com. To do so, you need to register in the DOCUTHEK.

13.1.1 Opto-adapter PCO 200

Including BCSoft CD-ROM,
Order No.: 74960625.

13.1.2 Bluetooth adapter PCO 300

Including BCSoft CD-ROM,
Order No.: 74960617.

13.2 OCU

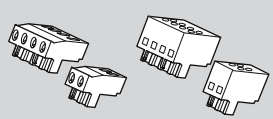
For installation in the control cabinet door in standard grid dimensions. The program step/status or fault messages can be read on the OCU. In Manual mode, the OCU can be used to proceed through the sequence of operating steps.

For details, see from page 92 (OCU).

OCU 500-1, Order No.: 84327030,
OCU 500-2, Order No.: 84327031.

13.3 Connection plug set

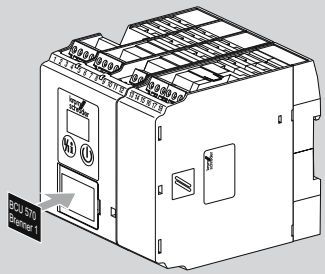
For wiring the BCU.



Connection plugs with screw terminals,
Order No.: 74923997.

Connection plugs with spring force terminals, 2 connection options per terminal,
Order No.: 74923999.

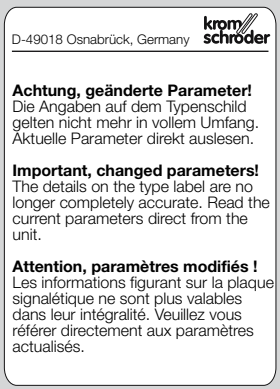
13.4 Stickers for labelling



For printing with laser printers, plotters or engraving machines, 27 × 18 mm or 28 × 17.5 mm.

Colour: silver.

13.5 "Changed parameters" stickers



Affix on the BCU following changes to unit parameters set at the factory.

100 pcs,
Order No.: 74921492.

14 OCU

14.1 Application

The OCU is an external operator-control unit which can be connected to a control unit of the FCU 500/BCU 500 series. The external operator-control unit OCU may be installed in the door of a control cabinet, for example. Thus, the control cabinet does not need to be opened to read out process values, statistics, flame signal intensities or parameter values, to change settings on the OCU or to control or adjust connected valves in Manual mode.

14.2 Function

The OCU features an illuminated plain-text display. The lighting is switched on when a control key is pressed and switches off automatically after 5 minutes. In case of a fault lock-out or safety shut-down of the control unit, the OCU light starts blinking.

You can choose between the indicating ranges status display and Service mode.
The status display shows the program step or a fault message which has occurred in text form with the appropriate code.
The Service mode allows you to read out process values, parameter settings, information on the OCU or the statistics. In addition, you can operate connected control units in Manual mode.

There are five control keys for the OCU and the control unit connected to it:

	**ON/OFF** Use the ON/OFF key to switch the control unit on or off.
	**Reset** Use the Reset key to reset the control unit to its starting position in the event of a fault.
	**OK** Press the OK key to confirm a selection or query. Starting from the status display, you can use the OK key to change to Service mode.
	**Back** In Service mode, you can use the Back key to switch from one setting level to the next higher one. By holding down the key for a certain time, you can change directly to the status display.
	**Navigation UP/DOWN** In Service mode, the navigation keys can be used to select individual functions on one level. In Manual mode, those keys can be used to open and close an activated valve.

14.2.1 Manual mode

In Manual mode, the control unit works with capacity control (FCU..F1/F2 or BCU..F1/F2) regardless of the status of its inputs. The inputs for start-up signal (terminal 1), controlled air flow (terminal 2) and remote reset (terminal 3) are ignored. The function of the controller enable/emergency stop input (terminal 46) is retained.

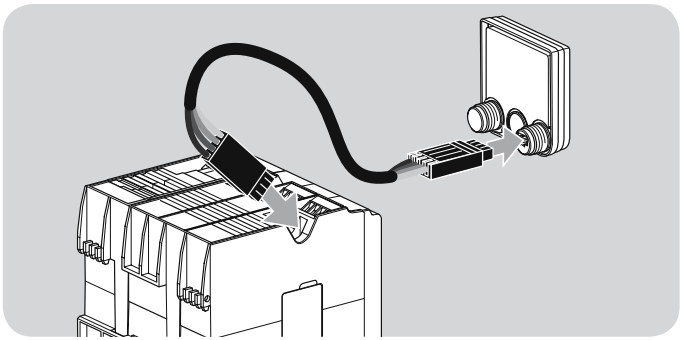
The positions for maximum capacity, minimum capacity and ignition capacity of an actuator can be adjusted using the OCU. The OCU supports the process by means of a cyclical, automatic repeat approach to the selected position. The actuator can be moved within the menu to make changes to the cam settings.

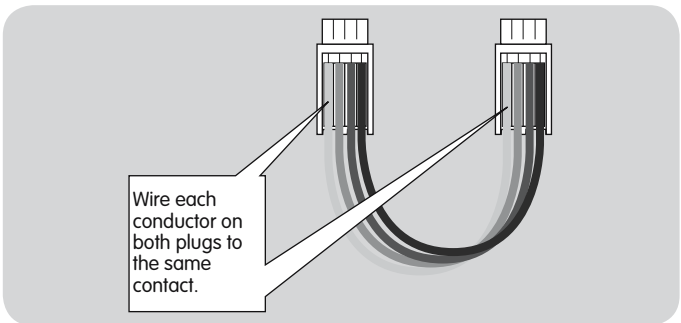
After start-up has been completed, the navigation keys can be used, for example, to open or close a valve in program step 08.

14.3 Electrical connection

The OCU is to be connected to the control unit using the two plugs provided.

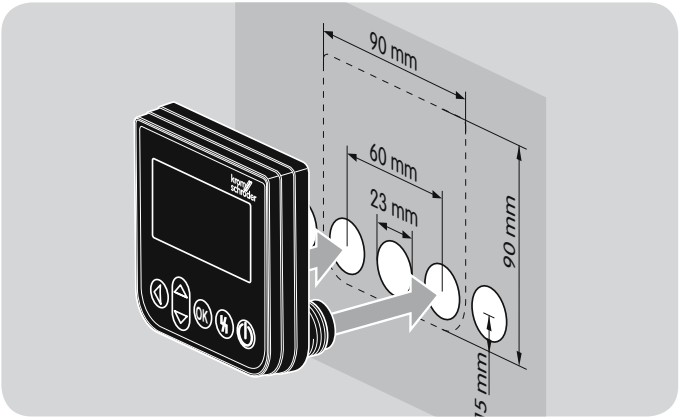
Required signal and control line:
cable length max. 10 m, 4-pin, min. 0.25 mm² (AWG 24), max. 0.34 mm² (AWG 22).





14.4 Installation

The threaded adapters of the OCU are suitable for 22 mm boreholes which are drilled at intervals of 30 mm.



14.5 Selection

The OCU can be supplied with various language kits.

Type	Languages	Order No.
OCU 500-1	German, English, French, Dutch, Spanish, Italian	84327030
OCU 500-2	English, Danish, Swedish, Norwegian, Turkish, Portuguese	84327031
OCU 500-3	English, US English, Spanish, Brazilian Portuguese, French	84327032
OCU 500-4	English, Russian, Polish, Hungarian, Romanian, Czech	84327033

14.6 Technical data

Ambient temperature: -20 to +60°C.

Relative humidity:
30% to 95% (no condensation permitted).

Enclosure: IP 65 when fitted (control cabinet door).

Dimensions of the operator-control unit:
90 x 90 x 18 mm (W x H x D).

Electrical connection

Connection data:
wire cross-section flexible min. 0.25 mm²,
wire cross-section flexible max. 0.34 mm²,
wire cross-section AWG/kcmil min. 24,
wire cross-section AWG/kcmil max. 22,
AWG to UL/CUL min. 24,
AWG to UL/CUL max. 22.

Cable length: inside control cabinet max. 10 m.

15 BCM

15.1 Application

The bus module BCM 500 is used as a communications interface for the protective system controls or furnace zone controls of the FCU 500 series or for the burner control units of the BCU 500 series for connecting to a fieldbus interface. Networking via the fieldbus enables the FCU or BCU to be controlled and monitored by an automation system (e.g. PLC).

15.2 Function

The bus system transfers the control signals for starting, resetting and for controlling the air valve to purge the furnace or kiln or for cooling in start-up position and heating during operation from the automation system (PLC) to the BCM. In the opposite direction, it sends operating status, the level of the flame signal and the current program step.

15.3 Electrical connection

Use only cable and plug components which comply with the appropriate fieldbus specifications.

Use shielded RJ45 plugs.

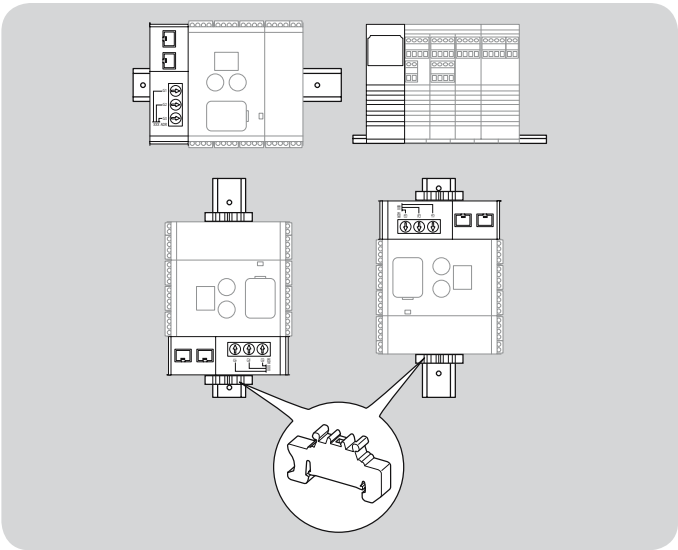
Cable length between 2 Profinet stations: max. 100 m

Profinet installation guidelines, see www.profibus.com.

15.4 Installation

Installation position: vertically upright, horizontal or tilted to the left or right.

The BCM mounting is designed for horizontally aligned 35 × 7.5 mm DIN rails.



If the DIN rail is aligned vertically, end clamps are required (e.g. Clipfix 35 by Phoenix Contact) to prevent the control unit from slipping.

Install in a clean environment (e.g. a control cabinet) with an enclosure ≥ IP 54, whereby no condensation is permitted.

15.5 Selection

Code	Description
BCM	Bus module
500	Series 500
S0	Standard communication
B2	Profinet
/3	2 RJ45 sockets
-3	Three-point step control via bus

Order No.: 74960663

15.6 Technical data

Electrical data

Power consumption: 1.2 VA.

Power loss: 0.7 W.

Mechanical data

Dimensions (W × H × D):
32.5 × 115 × 100 mm.

Weight: 0.3 kg.

Environment

Ambient temperature:
-20 to +60°C (-4 to +140°F).

Storage temperature:
-20 to +60°C (-4 to +140°F).

Climate: no condensation permitted.

Enclosure: IP 20 pursuant to IEC 529.

Installation location: min. IP 54 (for installation in a control cabinet).

16 Technical data

16.1 Electrical data

Mains voltage

BCU 570Q: 120 V AC, -15/+10%, 50/60 Hz, ±5%,
BCU 570W: 230 V AC, -15/+10%, 50/60 Hz, ±5%,
for grounded or ungrounded mains.

Power consumption

At 230 V AC approx. 6 W/11 VA plus power consumption per AC input of approx. 0.15 W/0.4 VA,
at 120 V AC approx. 3 W/5.5 VA plus power consumption per AC input of approx. 0.08 W/0.2 VA.

Flame control

With UV sensor or ionization sensor,
for continuous operation (intermittent operation with UVS).

Flame signal current: ionization control: 2 – 25 µA,
UV control: 5 – 25 µA.

Signal cable for flame signal current: max. 100 m (164 ft).

Contact rating

- Valve outputs V1, V2, V3 and V4 (terminals 13, 14, 15, 57):
  max. 1 A each, cos φ ≥ 1,
  0.625 $A_{peak-peak}$, 6.25 A inrush pilot duty 1.
- Actuator outputs (terminals 53, 54 and 55):
  max. 1 A each, cos φ ≥ 1.
- Ignition transformer (terminal 9):
  max. 2 A,
  2.5 A pilot duty (to UL approval).
- Total current for the simultaneous activation of the valve outputs (terminals 13, 14, 15, 57), of the actuator (terminals 53 – 56) and the ignition transformer:
  max. 2.5 A.
- Fan (terminal 58):
  max. 3 A (start-up current: 6 A < 1 s),
  3FLA, 18LRA (to UL approval).
- Signalling contact for operating and fault signals:
  max. 1 A (external fuse required).

Number of operating cycles

The fail-safe outputs (valve outputs V1, V2, V3 and V4) are monitored for correct functioning and are thus not subject to a max. number of operating cycles.
Actuator (terminals 53, 54 and 55): max. 250,000,
signalling contact for operating signals: max. 250,000,
signalling contact for fault signals: max. 10,000,
On/Off button: max. 10,000,
Reset/Information button: max. 10,000.

Input voltage of signal inputs:

Rated value	120 V AC	230 V AC
Signal "1"	80 – 132 V	160 – 253 V
Signal "0"	0 – 20 V	0 – 40 V

Signal input current:

Signal "1"	Max. 5 mA

Fuses, replaceable,
F1: T 3.15A H,
F2: T 5A H, pursuant to IEC 60127-2/5.

16.2 Mechanical data

Weight: 0.7 kg.

Connections:

– Screw terminals:
  nominal cross-section 2.5 mm²,
  wire cross-section (rigid) min. 0.2 mm²,
  wire cross-section (rigid) max. 2.5 mm²,
  wire cross-section AWG/kcmil min. 24,
  wire cross-section AWG/kcmil max. 12.
– Spring force terminals:
  nominal cross-section 2 x 1.5 mm²,
  wire cross-section min. 0.2 mm²,
  wire cross-section AWG min. 24,
  wire cross-section AWG max. 16,
  wire cross-section max. 1.5 mm²,
  rated current 10 A (8 A UL),
  to be observed in case of daisy chain.

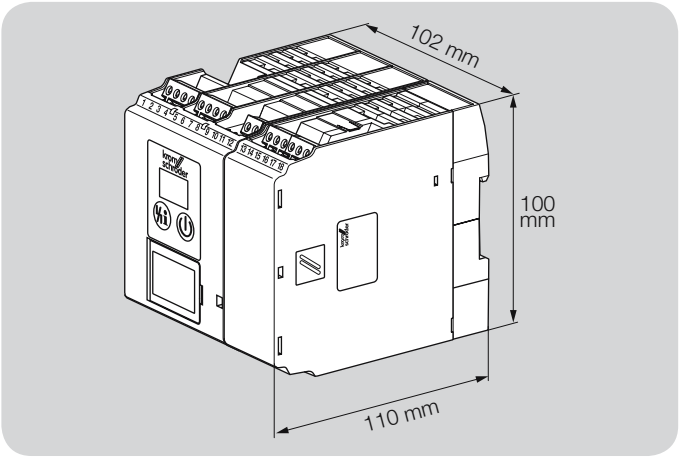
16.3 Environment

Ambient temperature:
-20 to +60°C (-4 to +140°F),
no condensation permitted.

Enclosure: IP 20 pursuant to IEC 529.

Installation location: min. IP 54 (for installation in a control cabinet).

16.4 Dimensions



16.5 Safety-specific characteristic values

Suitable for Safety Integrity Level	Up to SIL 3
Diagnostic coverage DC	98.8%
Type of subsystem	Type B to EN 61508-2:2010
Mode of operation	High demand mode pursuant to EN 61508-4:2010
Mean probability of dangerous failure PFH_D	14.6×10^{-9} 1/h on BCU 570..F1 13.2×10^{-9} 1/h on BCU 570..F2
Mean time to dangerous failure $MTTF_d$	$MTTF_d = 1/PFH_D$
Safe failure fraction SFF	99.8%

Mean probability of dangerous failure PFH_D of individual safety functions

Valve proving system	7.2×10^{-9} 1/h
Emergency stop	7.2×10^{-9} 1/h
Emergency stop with optional input	7.1×10^{-9} 1/h
Low air pressure protection	7.2×10^{-9} 1/h
Low air pressure protection with optional input	7.1×10^{-9} 1/h
Low gas pressure protection	7.2×10^{-9} 1/h
Low gas pressure protection with optional input	7.1×10^{-9} 1/h
High gas pressure protection	7.2×10^{-9} 1/h
High gas pressure protection with opt. input	7.1×10^{-9} 1/h
Air flow monitoring	7.2×10^{-9} 1/h
Air flow monitoring with optional input	7.1×10^{-9} 1/h
Flame control	8.7×10^{-9} 1/h
Approach position for ignition capacity with IC 20	8.0×10^{-9} 1/h
Approach position for ignition capacity with RBW	7.9×10^{-9} 1/h

SIL 3 is only achieved in conjunction with actuators IC 20 or RBW if a separate gas valve is used to limit the pilot gas rate, see page 54 (Burner application), parameter 78 = 1 or 3.

Relationship between the Performance Level (PL) and the Safety Integrity Level (SIL)

PL	SIL
a	–
b	1
c	1
d	2
e	3

Pursuant to EN ISO 13849-1:2006, Table 4, the BCU can be used up to PL e.

Max. service life under operating conditions:
20 years after date of production.

For a glossary of terms, see page 104 (Glossary).

For further information on SIL/PL, see www.k-sil.de

16.6 Conversion factors

SI unit ×	multiplier =	US unit
m^3/h	35.31	SCFH
bar	14.5	psi
mbar	0.0145	psi
mbar	0.39	"WC
mm	0.039	inch
kg	2.2	lbs
litres	0.26	gal

US unit ×	multiplier =	SI unit
SCFH	0.0283	m^3/h
psi	0.0689	bar
psi	68.89	mbar
"WC	2.54	mbar
inch	25.4	mm
lbs	0.45	kg
gal	3.79	litres

$°C = (°F - 32) \times {}^{5}/_{9}$

$°F = (°C \times {}^{9}/_{5}) + 32$

17 Maintenance

The fail-safe outputs (valve outputs V1, V2, V3 and V4) of the power module are monitored for correct functioning. In the event of a fault, the system is set to a safe status using a second shut-down method (isolation of the valve outputs from the mains). In the event of a defect (e.g. fault 36), the power module must be replaced.

See www.partdetective.de (optimized for smartphones) for a replacement/order option for the power module.

The device and user statistics can be displayed using the operator-control unit OCU or engineering tool BCSoft for further diagnostics and troubleshooting. The user statistics can be reset using engineering tool BCSoft.

18 Legend

	Ready for operation
	Safety interlocks (limits)
LDS	Safety limits (limits during start-up)
	Gas valve
	Air valve
	Air/gas ratio control valve
	Burner
	Purge
	Controlled air flow
	Operating signal
	Fault signal
	Start-up signal (BCU)
	Emergency stop
	Pressure switch for tightness control (TC)
	Pressure switch for maximum pressure
	Pressure switch for minimum pressure
	Differential pressure switch
Pxx	Input signal depending on parameter xx
	Control element with butterfly valve
TC	Tightness control
$p_u/2$	Half of the inlet pressure
p_u	Inlet pressure
p_d	Outlet pressure
V_{p1}	Test volume
	Valve with proof of closure switch
	Fan
	Three-point step switch
	Input/Output, safety circuit
I_N	Current consumption of sensor/contactor
t_L	Tightness control opening time
t_M	Measurement time during tightness test
t_P	Tightness control test period (= $2 \times t_L + 2 \times t_M$)
t_{FS}	Flame proving period
t_{PN}	Post-purge time
t_{GV}	Fan run-up time
t_E	Switch-on delay
t_{SA}	Safety time on start-up
t_{VZ}	Pre-ignition time
t_{PV}	Pre-purge time
t_{RF}	Controller enable signal delay time

19 Glossary

19.1 Safety shut-down

After an installation fault (e.g. flame or air pressure failure), the burner control unit performs a safety shut-down. The display blinks and displays the current program step, see page 43 (Fault signalling). This involves disconnecting the power from the gas valves and the ignition transformer. The operation signalling contact and the controller enable signal are deactivated.

After a safety shut-down, the BCU can restart, depending on the parameter settings.

19.2 Fault lock-out

In the event of a fault lock-out, the fault signalling contact closes, the display blinks and shows the current program step, see page 43 (Fault signalling). The gas valves are disconnected from the electrical power supply.

After a fault lock-out, the BCU must be reset manually using the button on the front panel, the OCU or the remote reset input (terminal 3).

The BCU cannot be reset by mains failure (non-volatile fault lock-out). The fault signalling contact does, however, open as soon as the mains voltage fails.

19.3 Warning signal

The BCU reacts to operating faults, e.g. in the case of permanent remote resets, with a warning signal. The display blinks and shows the corresponding warning message. The warning signal ends once the cause has been eliminated.

The program sequence continues. No fault signal is activated.

19.4 Timeout

For some process faults, a timeout phase elapses before the BCU reacts to the fault. The phase starts as soon as the BCU detects the process fault and ends after 0 to 255 s. A safety shut-down or fault lock-out is then performed. If the process fault ends during the timeout phase, the process continues as before.

19.5 Lifting

After positioning the actuator IC 20, the BCU checks by means of brief lifting whether its feedback input (terminal 52) has been activated by the correct output signal from the actuator. The signal of the relevant control output (ignition, OPEN, CLOSE) is switched off briefly for this purpose. While the signal is switched off, the BCU may not detect a signal at the feedback input.

19.6 Diagnostic coverage DC

Measure of the effectiveness of diagnostics, which may be determined as the ratio between the failure rate of detected dangerous failures and the failure rate of total dangerous failures

NOTE: Diagnostic coverage can exist for the whole or parts of a safety-related system. For example, diagnostic coverage could exist for sensors and/or logic system and/or final elements. Unit: %.

from EN ISO 13849-1:2008

19.7 Mode of operation

IEC 61508 describes two modes of operation for safety functions. These are low demand mode and high demand or continuous mode.

In low demand mode, the frequency of demands for operation made on a safety-related system is not greater than one per year and is not greater than twice the proof-test frequency. In high demand mode or continuous mode, the frequency of demands for operation made on a safety-related system is greater than one per year or greater than twice the proof-test frequency.

See also IEC 61508-4

19.8 Safe failure fraction SFF

Fraction of safe failures related to all failures, which are assumed to appear

from EN 13611/A2:2011

19.9 Probability of dangerous failure PFH_D

Value describing the likelihood of dangerous failure per hour of a component for high demand mode or continuous mode. Unit: 1/h.

from EN 13611/A2:2011

19.10 Mean time to dangerous failure $MTTF_d$

Expectation of the mean time to dangerous failure

from EN ISO 13849-1:2008

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

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03251014

BCU 570 · Edition 01.15