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Burner control unit for PROFIBUS-DP BCU 400..B1

Technical Information · GB
6 Edition 03.11l

- Easy transmission of activation signals and feedbacks via fieldbus cable
- Remote servicing and diagnostics facilities
- Saves installation and wiring costs
- Units can be exchanged during bus mode operation thanks to industrial plug connector system (SUB-D)
- Bus interface remains in operation when BCU® is switched off (standby mode)
- Certification for PROFIBUS-DP

AGA C US FM APPROVED CE

ПРОМЭЛЕКТРОНИКА / sales@prom-elec.com

Table of contents

Table of contents 2
1 Application 3
2 Certification 4
2.1 EC type-tested and certified pursuant to. 4
2.2 AGA 4
2.3 FM 4
2.4 Profibus User Organisation 4
3 Function 5
3.1 PROFIBUS-DP 5
3.2 Safety-related control signals 6
3.3 BCSoft 6
3.4 Configuration, Master-Slave procedure 6
3.5 Addressing 7
3.6 Network technology 7
3.7 Configuration 8
3.7.1 Bus communication 8
3.8 Program status 10
3.9 Fault messages 11
3.10 Connection diagrams 12
3.10.1 BCU 460..B1 12
3.10.2 BCU 465..B1 13
3.10.3 BCU 480..B1 14
4 Parameters 15
4.1 Scanning the parameters 17
4.2 Manual mode 17
5 Selection 18
5.1 Selection table 19
5.1.1 Type code 19
6 Project planning information 20
6.1 Safety-related control signals 20
6.2 Wiring the Profibus plug connector 20
6.3 EMC 20
6.4 Manual mode 21
7 Accessories 22
8 Technical data 23
8.1 BCU..B1 23
8.2 PROFIBUS-DP 23
9 Legend 24
10 Annex 25
10.1 Status and fault messages for PROFIBUS-DP . . 25
Feedback 27
Contact 27

▼ = To be continued

BCU 400..B1

In addition to the scope of functions and performance of the standard versions, the BCU..B1 is also equipped with a connection for the PROFIBUS-DP fieldbus.

1 Application

BCU 460..B1, BCU 460..L..B1, BCU 465..L..B1 and BCU 480..B1 correspond to the standard version in terms of their scope of functions and performance and, in addition, they can be equipped for connection to the PROFIBUS-DP fieldbus (see Technical Information bulletin BCU 460, BCU 465 and brochure BCU).

The conventional wide-spread systems used in industrial furnace and kiln construction require bridging of large distances for signal processing.

As a standardised fieldbus system, the PROFIBUS-DP considerably reduces development, installation and commissioning costs compared to conventional wiring.

The use of a standard bus system offers massive benefits over manufacturer-specific bespoke solutions. Time-tested hardware components, standardised connection methods and a series of tools of bus diagnostics and optimisation are available on the market from a whole range of manufacturers. The widespread use of the system ensures that the planning and service personnel are very familiar with how the system operates and how to handle it and can therefore operate the system efficiently.

2 Certification

The burner control units BCU 460, BCU 465 and BCU 480 are designed for applications pursuant to the Machinery Directive (98/37/EC).

2.1 EC type-tested and certified pursuant to

CE

- Gas Appliances Directive (90/396/EC) in conjunction with EN 298
- Low Voltage Directive (73/23/EEC) in conjunction with EN 60730
- Electromagnetic compatibility (89/336/EEC)

2.2 AGA

AGA

Certified under no. 6478

2.3 FM

FM APPROVED

BCU is FM approved.

Standard: Factory Mutual Research Standard 7610: June 1997

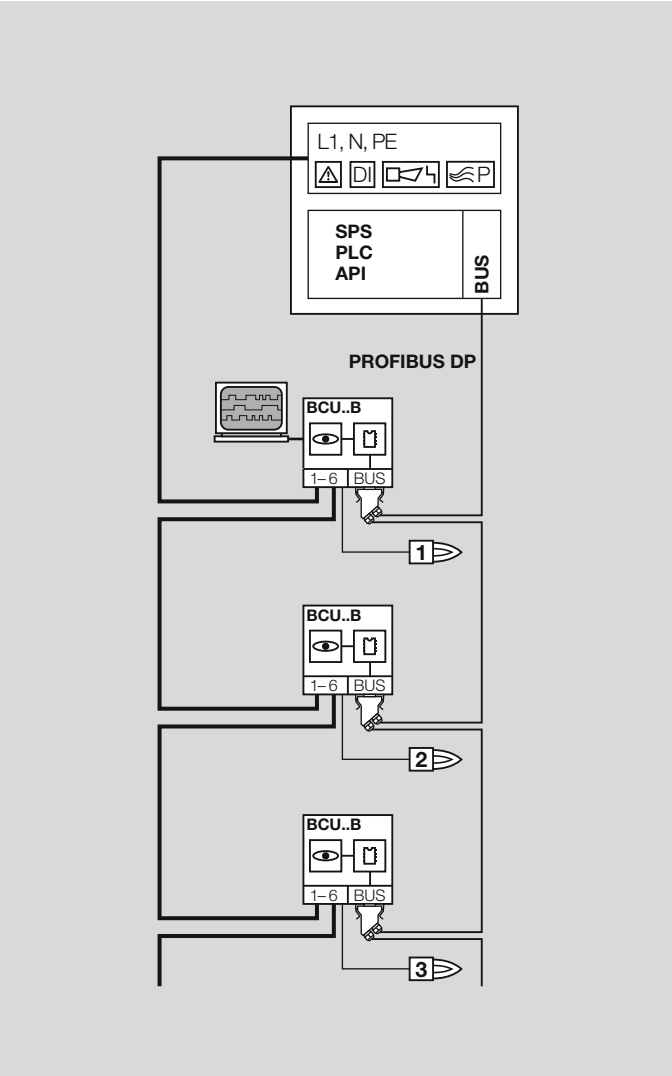
Suitable for applications pursuant to NFPA 86

(BCU..T see www.docuthek.com)

2.4 Profibus User Organisation

BCU..B1

PUO = PROFIBUS User Organisation,
Certificate no. Z 00692 pursuant to EN 50170-2



3 Function

BCU..B1 features the same scope of functions and performance of a BCU® without a PROFIBUS connection (see Technical Information bulletin BCU 440, BCU 460 and BCU 465).

3.1 PROFIBUS-DP

PROFIBUS is a manufacturer-independent, open fieldbus standard for diverse applications.

PROFIBUS-DP is a bus variant for communication between automation systems and distributed peripherals at the field level, optimised for speed and low connection costs.

On PROFIBUS-DP, the individual bus stations are connected via a 2-core shielded cable as standard.

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 control system (PLC) to the BCU..B1. In the opposite direction it sends operating status, the level of the flame signal and the current program status.

3.2 Safety-related control signals

Signals of the safety interlocks and digital input are transferred independently of the bus communication by separate cables. The air valve used to purge the furnace or kiln can either be activated via the PROFIBUS or via a separate cable to terminal 22. The purging process must be monitored by further measures, e. g. flow monitoring.

3.3 BCSoft

The Windows software BCSoft allows extended access to individual statistics, protocol functions, line recorders and the parameterisation of the burner control unit via an optical interface. Unit parameters which are not relevant to safety can be set and adjusted to the specific application.

3.4 Configuration, Master-Slave procedure

PROFIBUS-DP is structured as a Master-Slave system. This allows mono-master or multi-master systems to be implemented.

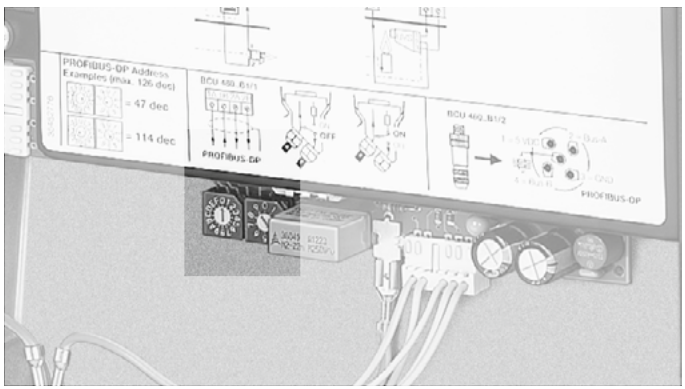
A distinction is made between three device types:

- DP Master Class 1 (DPM1)
  DPM1 devices are central controllers which exchange data with the distributed stations (slaves) on the basis of a defined cycle. This includes, for instance, the PLC, PC, CNC or VME systems with which the PROFIBUS-DP is operated.
- DP Master Class 2 (DPM2)
  DPM2 devices are programming, project planning or operator-control devices. They are used for configuration and commissioning of the system or for system operation and visualisation in ongoing operation.
- DP Slaves
  The devices which transmit input information from the periphery to the master and which issue output information from the master to the periphery are referred to as “slaves”.
  This also includes the BCU..B1.

3.5 Addressing

A maximum of 126 units (masters and slaves) can be connected to a PROFIBUS-DP system.

Each station is assigned an individual PROFIBUS address which can be set between 0 and 126 using two code switches on the BCU..B1 board.



3.6 Network technology

All devices are connected in a bus structure (line). Up to 32 stations (masters or slaves) can be connected in a single segment.

The beginning and end of each segment is fitted with an active bus terminator. Both bus terminators must have a permanent power supply to ensure error-free operation. The power supply for the bus terminator is provided by the BCU. The bus terminator can be connected in the bus connection plug.

If more than 32 stations are implemented or if there is a need to expand the network area, repeaters (amplifiers) must be used to link the individual bus segments.

3.7 Configuration

When planning a PROFIBUS-DP system, unit-specific parameters of each station are to be taken into account.

To allow for simple and standardised planning, the parameters of the BCU..B1 have been summarised in a so-called device master data file (GSD). The file structure is standardised so that it can be read by the planning units of different manufacturers.

The device master data file is supplied on a diskette with the BCU..B1.

The device master data file can also be ordered at www.docuthek.com. The steps required to copy the file are described in the instructions for the automation system.

3.7.1 Bus communication

Input bytes (BCU → Master)					
Bit	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4
0	/ 1	reserved	see Program status and fault massages table PROFIBUS DP	0 – 25,5 µA / 1 255 steps	0 – 25,5 µA 2 255 steps
1	2				
2					
3	A on				
4	P on				
5	DI on				
6					
7					
	BCU 460/465/480 basic I/O				
	BCU 460/465 standard I/O				
	BCU 480 standard I/O				

Output-Bytes (Master → BCU)	
Bit	Byte 0
0	
1	/ 1
2	A
3	P
4	2
5	reserved
6	reserved
7	reserved

I/O bytes: The programmer can choose the data to be transferred.

	Inputs	Outputs
460/465 Basic I/O	1 Byte	1 Byte
460/465 Standard I/O	4 Bytes	1 Byte
480 Basic I/O	1 Byte	1 Byte
480 Standard I/O	5 Bytes	1 Byte

Baud rate: Up to 1500 kbit/s.

The max. range per segment depends on the baud rate:

Baud rate [kbit/s]	Range [m]
93,75	1200
187,5	1000
500	400
1500	200

The specified ranges may be increased by using repeaters. No more than three repeaters should be connected in series.

The specified ranges relate to bus cable type A (two-core, shielded and twisted), e.g.

Siemens, Order No.: 6XV1830-0EH10 or
Lapp cable unitronic, Order No.: 2170-220T.

3.8 Program status

DISPLAY	Program status	BCU 460..B1	BCU 465..B1	BCU 480..B1
--	BCU switched off	●	●	●
00	Start-up position/standby	●	●	●
P0	Purge	○	●	●
1	Waiting time / Pause time	●	●	●
2	Safety time on start-up	●	●	●
3	Flame proving period	●	●	●
4	Operation	●	●	●
5	MB waiting time			●
6	MB safety time on start-up			●
7	MB flame proving period			●
8	MB operation			●
Ax*	Air valve	○	●	●
A1	Air supply		●	
A0	Air post ventilation		●	
A0	Cooling		●	
..	High temperature operation	○	○	○
30	Internal fault	●	●	●
31	Internal fault	●	●	●
32	Internal fault	●	●	●
33	Internal fault	●	●	●
bE	Internal fault	●	●	●

1 - 4 for the burner/pilot burner, 5 - 8 for the main burner (MB). In manual mode, two dots blink on the display.

** x = 1, 2, ... or 8, depending on the program status/position step. For example, for activation of the air valve in parameter/position step "Flame proving period", the display indicates A3.*

For a detailed list of the program statuses, see Technical Information bulletin BCU 460, BCU 465 and brochure BCU.

3.9 Fault messages

Fault message (blinking)	DISPLAY	BCU 460..B1	BCU 465..B1	BCU 480..B1
Flame simulation	1	●	●	●
Start-up without flame signal	2	●	●	●
Flame failure during flame proving period	3	●	●	●
Flame failure during operation	4	●	●	●
Too many remote resets	10	●	●	●
Fault Air monitor break contact check	d0		●	
Fault Air supply during purging	dP		●	
Fault Air supply in program step X	dX**		●	
Fuse F1 defective or safety interlocks discontinuity	S1	●	●	●
Permanent remote reset	S2	●	●	●
Timing cycle too short	S3	●	●	●
Bus fault	Pb	●	●	●
System fault	flickers*	●	●	●
EEPROM data change, NFS***	30	●	●	●
EEPROM data change, FS***	31	●	●	●
Undervoltage in power pack	32	●	●	●
Faulty parameterisation	33	●	●	●
Bus module fault	bE	●	●	●

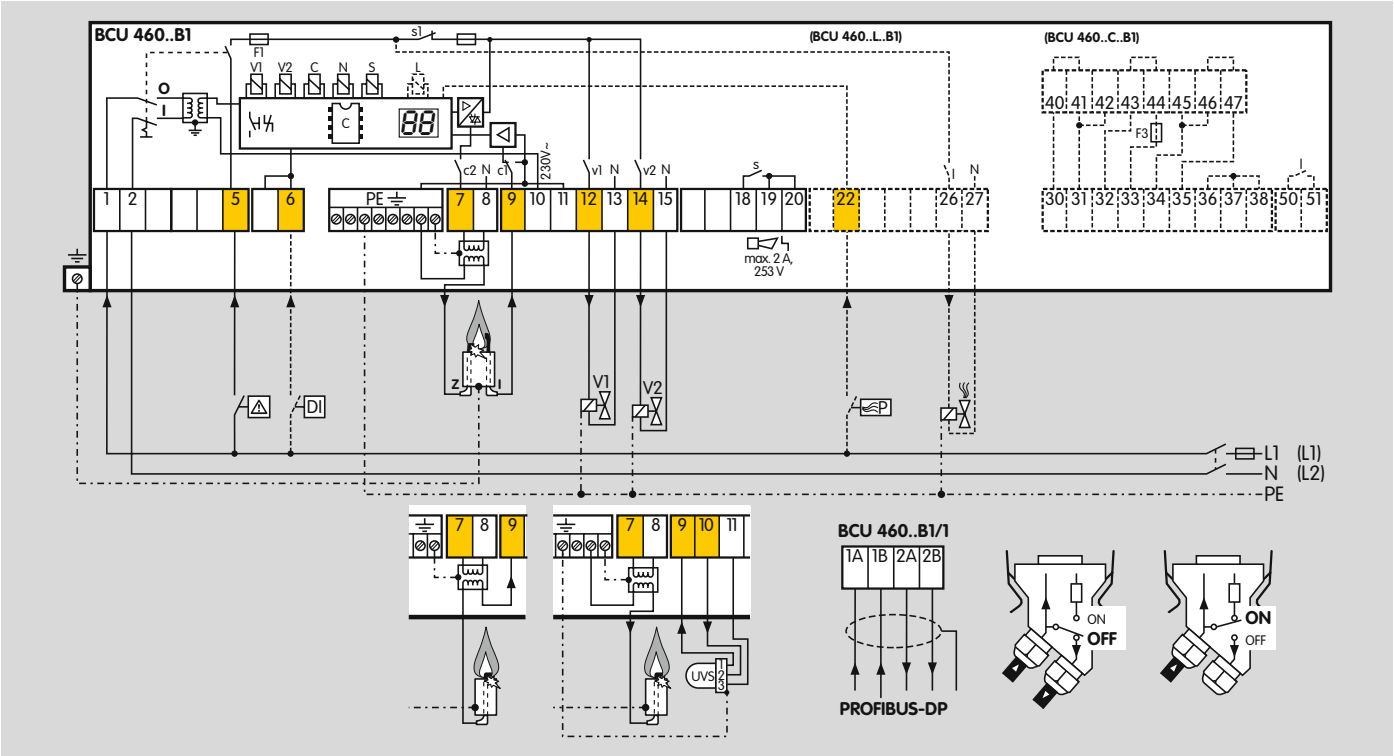
In manual mode, two dots blink on the display.

* *Display flickers = BCU system fault.*

** *x = 1, 2, ... or 8, depending on the program status/position step. For example, for a missing pressure switch input signal in parameter/ position step "Operation", the display indicates* d4.

*** *FS = input/output safety circuit, NFS = input/output control system.*

For a detailed list of the fault messages, see Technical Information bulletin BCU 460, BCU 465 and brochure BCU.

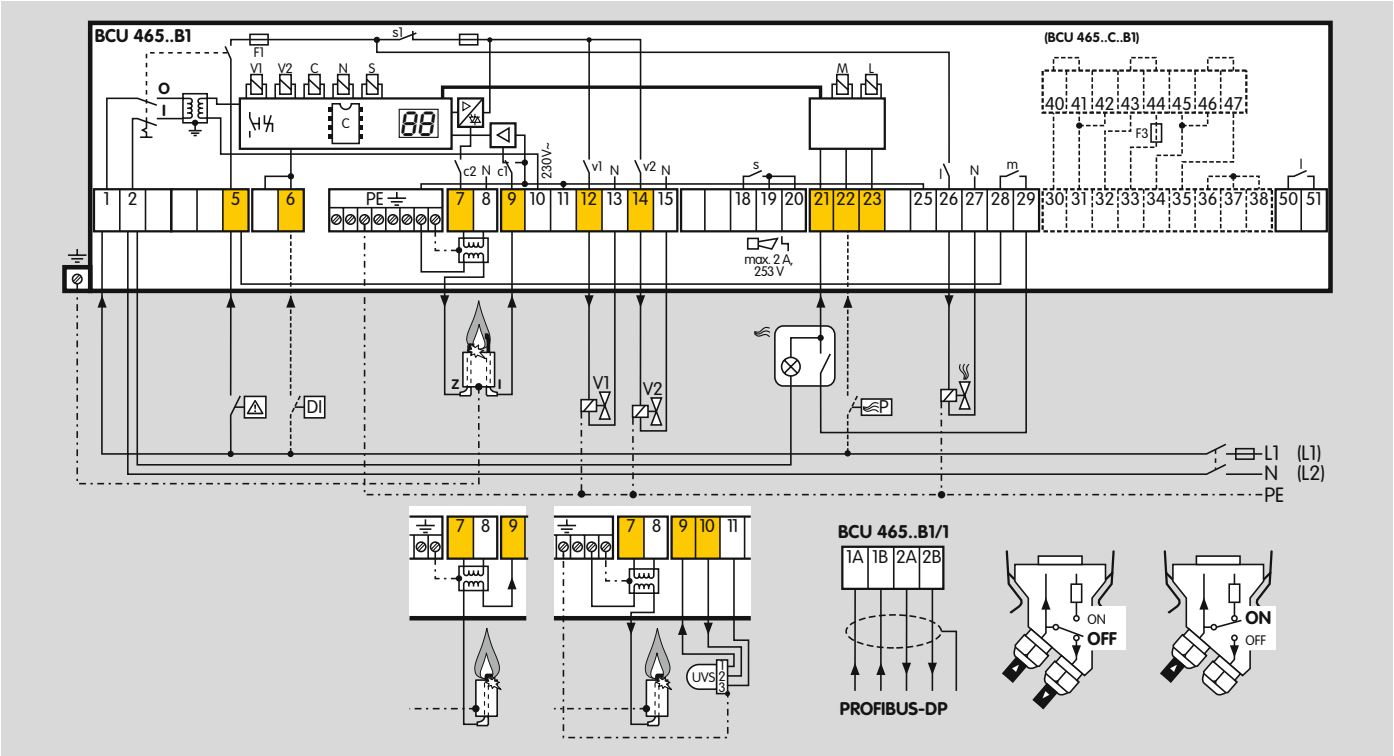


3.10 Connection diagrams

3.10.1 BCU 460..B1

For cable selection and wiring, see Projekt planning information.

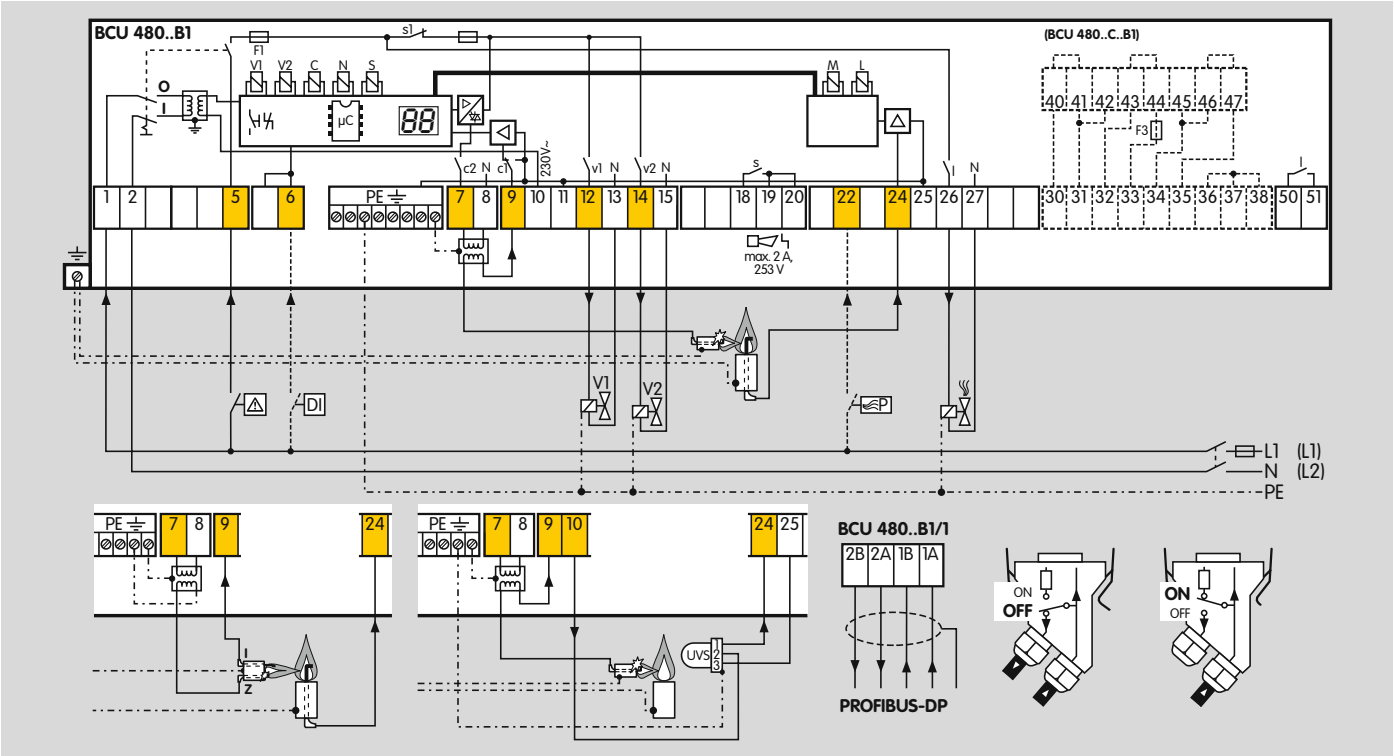
For the explanation of symbols, see Legend.



3.10.2 BCU 465..B1

For cable selection and wiring, see Projekt planning information.

For the explanation of symbols, see Legend.



3.10.3 BCU 480..B1

For cable selection and wiring, see Projekt planning informatione.

For the explanation of symbols, see Legend.

4 Parameters

Description	Parameter	Value range	Factory default setting	Adjustable*	BCU 460..B1	BCU 465..B1	BCU 480..B1
Flame signal, burner/pilot burner	01	0–99 µA	–	–	●	●	●
Flame signal, main burner	02	0–99 µA	–	–	–	–_	●
Program status when the most recent fault occurred	03	00–09	–	–	●	●	●
Switch-off threshold, burner/pilot burner	04	1–20 µA	1 µA	●	●	●	●
Switch-off threshold, main burner	05	1–20 µA	1 µA	●	–	–	●
Air flow monitoring during purging	06	0; 1	1	–	–	●**	–
Air flow monitoring during operation	07	0; 1	1	–	–	●**	–
Air flow monitoring, delayed	08	0; 1	0	–	–	●**	–
Start-up attempts, burner/pilot burner	10	1–4	1	–	●**	●**	●**
Start-up attempts, main burner	11	1–4	1**	–	–	–	●**
Restart, burner/pilot burner	12	0; 1	0	●	●	●	●
Restart, main burner	13	0; 1	0	●	–	–	●
Safety time during operation for V1 and V2	14	1; 2 s	1 s	–	●**	●**	●**
Flame simulation check in start-up position	15	0; 1	1	●	●	●	●
Permanent pilot burner	16	0; 1	1	●	–	–	●
Minimum combustion time t_B	20	t_{SA}–25s	tSA	●	●	●	●
Minimum burner pause time t_{BP}	21	0–250	0 s	●	●	●	●
Burner safety time on start-up t_{SA}	22	3; 5; 10 s	–	–	●**	●**	●**
Flame proving period, burner/pilot burner	23	0–25 s	0 s	●	●	●	●
Safety time on start-up, main burner	24	3; 5 s	**	–	–	–	●**
Flame proving period, main burner	25	0–25 s	0 s	●	–	–	●
Air valve control	30	0; 1; 2; 3	0	●	○	●	●
Air valve can be activated externally on start-up	31	0; 1	0	●	○	●	●
Air valve closed / can be activated in the event of malfunction	32	0; 1	1	●	○	●	●
High temperature operation	33	2; 3	**	–	○**	○**	○**

Description	Parameter	Value range	Factory default setting	Adjustable*	BCU 460..B1	BCU 465..B1	BCU 480..B1
Manual mode limited to 5 minutes	34	0; 1	1	●	●	●	●
UVS check (1 x in 24 hours)	35	0; 1	0	●	●	●	●
Low fire over run time t_{KN}	36	0; 5; 15; 25 s	0 S	–	○**	●**	●**
Air supply time t_{VL}	37	0–250 s	0 s	●	–	●	–
Air post ventilation time t_{NL}	38	0–3 s	0 s	●	–	●	–
Air supply time after safety shut-down	39	0–250 s	0 s	–	–	●**	–
Air supply time for restart / start-up attempts	40	0; 1	1	–	–	●**	–
Air supply time after reset	41	0; 1	1	–	–	●**	–

* *Adjustable using BCSoft software and a PC opto-adapter*
** *Please quote in your order*
0 = Function inactive
1 = Function active

4.1 Scanning the parameters

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

The flame signal and other parameters of the BCU® can be scanned one after the other by repeatedly pressing the Reset/Information button (for 2 seconds).

In the event of a fault, the BCU® halts the program run, the display blinks and it then displays the cause of the fault in coded form.

The BCU 400..B1 for PROFIBUS-DP indicates "--" when the mains switch has been switched off. This signals standby mode. The bus interface is still operational to maintain the function of the communication system. The control outputs of the BCU (valves, ignition transformer) are electrically separated from the mains voltage.

4.2 Manual mode

Parameter 34

If the Reset/Information button is pressed (for 2 s) during switch-on, the unit reverts to manual mode. Two dots blink on the display. In this operating mode, the burner control unit operates independently of the status of the bus and the inputs (apart from the pre-purge input and the safety interlocks).

In the factory default setting manual mode is limited to 5 minutes (parameter 34 = 1). During this time, the burner can be adjusted, for example. If parameter 34 is set to 0, the time limitation will be removed. Emergency operation is now possible, for example in the event of a lengthy bus fault. (In the event of a bus fault, Pb. will blink on the display).

5 Selection

BCU 460: Standard version; BCU 465: With extended air control;
BCU 480: For pilot and main burner monitoring

5.1 Selection table

Type	-3	-5	-10	/-3*	/-5*	/-10*	/1	/2	L*	5	15	25	W	R	1	2	3	8	GB	D2*	D3*	S2 – 4**	A*	C*	B1*	/1*
BCU 460	●	●	●				●	●	○	○	○	○	●	●	●	●	●	●	●	○	○	○		○	●	●
BCU 465	●	●	●				●	●	●	○	○	○	●	●	●	●	●	●	●	○	○	○	●	○	●	●
BCU 480	●	●	●	●	●	●	●	●	●	○	○	○	●	●	●	●	●	●	●	○	○	○		○	●	●

*● = standard, ○ = available, * if "none", this specification is omitted, ** if 1 start-up attempt, this specification is omitted.*
Please quote the default Parameter settings when ordering.

Order example:

BCU 465-5/1LW3GBACB1/1

5.1.1 Type code

Code	Description
3; 5; 10	1st safety time on start-up t_{SA} [s]
3*; 5*; 10*	2nd safety time on start-up t_{SA} [s]
1; 2	Safety time during operation t_{SB} [s]
L*	Air valve control = L*
5; 15; 25	Low fire over run time [s]
	Mains voltage
W	230 V AC, -15/+10%, 50/60 Hz
R	115 V AC, -15/+10%, 50/60 Hz
	Ignition transformer
1	TZI 5-15/100
2	TZI 7-25/20
3	TZI 7,5-12/100
8	TZI 7,5-20/33
D, F, I, NL, E GB	Front film in English with additional stickers in D, F, I, NL, E
	Digital input to interrupt the flame monitoring...
D3*	... for continuous operation
D2*	... for intermittent operation
S2 – 4**	Number of start-up attempts
A*	Air flow monitoring
C*	Additional signal distribution
B1*	For PROFIBUS-DP
/1*	9-pin D-Sub bus plug connector

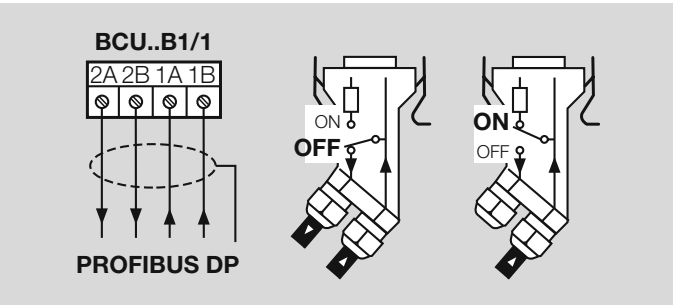
6 Project planning information

6.1 Safety-related control signals

Signals from the safety interlocks and digital input are transferred independently of the bus communication by separate cables.

The purge signals can be transferred via the bus communication or by a separate cable.

6.2 Wiring the Profibus plug connector



The Profibus plug connector must be ordered separately (see Accessories).

Data cables A and B must not be reversed.

The power supply for the bus terminator is provided by the BCU. The bus terminator can be connected in the Profibus plug connector.

Ensure an equi-potential bond between the different slaves and masters.

6.3 EMC

To achieve a high immunity of the system against electromagnetic interference radiation, a shielded data cable must be used. The shield must be connected to protective earth on both sides using wide-area shield clips that ensure good conductivity.

In addition, it must be ensured that all cables leading to and from the BCU® be installed as far away as possible from cables emitting strong fields (e.g. frequency converter cables).

6.4 Manual mode

For emergency operation, the time-limited manual mode can be deactivated.

If required, the BCU is delivered with manual mode preset without a time limit (parameter 34 = 0).

Further information can be found in the bibliography.

7 Accessories

Variosub Profibus plug connector, 9-pin, with deactivatable bus terminator, Order No.: 74960431.

Diskette with device master data files for BCU Profibus DP, Order No. 74960460, or at www.docuthek.com

Bibliography

- PROFIBUS Specification, EN 50170 Vol. 2 (Version 1.0).
- Installation Guideline for PROFIBUS DP/FMS, available from the Profibus User Organisation (PUO).
- PROFIBUS Technology and Application, Order No.: 4.001, available from the PUO.
- M. Popp, The New Rapid Way to PROFIBUS DP, a textbook for system operators.
- M. Popp, PROFIBUS DP Principles, Tips and Tricks for Users.
- www.profibus.com
- Kromschröder Technical Information bulletins “Burner control unit BCU 400”, “Burner control units BCU 460, BCU 465”.
- Kromschröder brochure “Burner control unit BCU”.

8 Technical data

Mains voltage:
230 V AC, -15/+10%, 50/60 Hz,
115 V AC, -15/+10%, 50/60 Hz,
For grounded and ungrounded mains.

Power consumption: approx. 9 VA plus inherent consumption of the ignition transformer.

Voltage to inputs and valves = mains voltage.

Signal and control line: max. 2.5 mm^2.

Cable for burner earth/PE wire: 4 mm^2.

Input voltage
Signal inputs:

	115 V AC	230 V AC
Signal „1“	80 – 126,5	160 – 253
Signal „0“	0 – 20	0 – 40

Input current signal inputs:

Signal “1”: typ. 2 mA

Output current:

max. 2 A per output, but total current for valves and ignition transformer: max. 2.5 A.

Fail-safe inputs and outputs:
All the inputs and outputs marked „□“ (see connection diagrams) may be used for safety tasks.

Flame control: Sensor voltage: approx. 230 V AC.
Sensor current: > 1 µA,
Length of sensor cable: max. 5 m.

Fuse in unit:
F1: 3.15 A, slow-acting, H,
pursuant to IEC 127-2/5,
F3: 3.15 A, slow-acting, H,
pursuant to IEC 127-2/5 (for BCU..C).

Operation and fault signalling contacts:
Signalling contact (not floating); max. 2 A, 264 V, not internally fused.

Max. number of operating cycles: 1,000,000.

Mains switch: 1000.

Reset/Information button: 1000.

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

Enclosure: IP 54 pursuant to IEC 529.

Weight: approx. 5 kg depending on version.

8.1 BCU..B1

External fuse: 12 A per zone.

8.2 PROFIBUS-DP

Manufacturer ID: 0x05DB.

ASIC type: SPC3.

SYNC- and FREEZE-capable.

Baud rate detection: Automatic.

Min. cycle time: 0.1 ms.

Diagnostic bytes: 6 (DP Standard).

Parameter bytes: 7 (DP Standard).

9 Legend

88	Display
88	Blinking display
⏻	Ready
✋	Manual mode
⚠	Safety interlock (Limits)
	Start-up signal
DI	High temperature operation
	Ignition transformer
	Gas valve
	Air valve
P	Purge
P on	Purging operating signal
A	Ext. air valve control
A on	Air valve operating signal
	Flame signal
	Operating signal
1, 2	Pilot and main burner
	Fault signal
	Reset
◀	Input signal
▶	Output signal
	Flame simulation check
t_W	Waiting time ≥ 2 s
t_{SA}	Safety time on start-up 3 s, 5 s or 10 s
t_{SB}	Safety time during operation < 1 s or < 2 s
t_Z	Ignition time 2 s, 3 s or 6 s

t_{LV}	Flame simulation delay time 25 s
t_{FS}	Flame proving period 0 – 25 s
	Air pressure switch (electrical connection)
	Air pressure switch
t_B	Minimum combustion time t_{SA} up to max. 25 s
t_{BP}	Minimum burner pause time 0 – 250 s
t_{KN}	Low fire over run time 0 s, 5 s, 15 s or 25 s
t_{VL}	Air supply time 0 – 250 s
t_{NL}	Air post ventilation time 0 – 3 s
	Input/Output safety circuit

10 Annex

10.1 Status and fault messages for PROFIBUS-DP

This table can be used to program the master.

Input bytes (BCU → master)						
Byte 2	Display	Status message Byte 0, Bit 2 = 0	Fault message Byte 0, Bit 2 = 1	BCU 460	BCU 465	BCU 480
0	00	Start-up position/Standby		●	●	●
0	A0	Air post ventilation			●	
0	A0	Cooling		○	●	●
1	01 A1*	Waiting time / Pause time	Flame simulation	●	●	●
1	A1	Air supply			●	
2	02 A2*	Safety time on start-up	Start-up without flame signal	●	●	●
3	03 A3*	Flame proving period	Flame failure during flame proving period	●	●	●
4	04 A4*	Operation	Flame failure during operation	●	●	●
5	05 A5*	Waiting time, main burner	Flame simulation, main burner			●
5	d0		Air monitor break contact check		●	
5	C0		Fault Position indicator during start-up		●	
6	06 A6*	Safety time on start-up, main burner	Start-up without flame signal, main burner			●

Input bytes (BCU → master)						
Byte 2	Display	Status message Byte 0, Bit 2 = 0	Fault message Byte 0, Bit 2 = 1	BCU 460	BCU 465	BCU 480
6	C2		Fault Position indicator during safety time		●	
6	d2		Fault Air supply during safety time		●	
7	07 A7*	Flame proving period, main burner	Flame failure during main burner flame proving period			●
7	C3		Fault Position indicator during flame proving period		●	
7	d3		Fault Air supply during flame proving period		●	
8	08 A8*	Operation, main burner	Flame failure during main burner operation			●
8	C4		Fault Position indicator during operation		●	
8	d4		Fault Air supply during operation		●	
9	P0	Purge		○	●	●
9	dP		Fault Air supply during purging		●	
10	10		Too many remote resets	●	●	●
11	d1		Fault Air supply during air supply		●	
12	dA		Fault Air supply during air post ventilation		●	
30	30	EEPROM data change, NFS**		●	●	●
31	31	EEPROM data change, FS**		●	●	●
33	33	Faulty parameterisation		●	●	●
51	51	Fuse F1 defective or safety interlocks discontinuity		●	●	●
52	52	Permanent remote reset		●	●	●
53	53	Timing cycle too short		●	●	●

* *Display on BCU..L upon activation of the air valve during program step x*

** *FS = input/output safety circuit, NFS = input/output control system*

● *= standard,* ○ *= available.*

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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