

Flame detector FDU 510, FDU 520

TECHNICAL INFORMATION

- For burners in intermittent or continuous operation
- Flame control by UV or ionization
- Simple system integration using the PC programming and diagnostic software BCSoft
- Fieldbus connection (PROFINET and Modbus TCP) using optional bus module



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1 Application



Flame detectors FDU 510 and FDU 520 are used to monitor gas burners of unlimited capacity with or without a fan. They can be used on hot-air furnaces, gas-fired boilers, industrial furnaces and excess-gas flaring installations.

Flame detector FDU 510 is used for intermittent burner operation. Flame detector FDU 520 is used for continuous operation and for systems up to SIL 3 pursuant to EN 61508 together with Kromschröder burner control units or with a fail-safe burner control unit from another manufacturer.

The flame detectors are also suitable for multi-point burner monitoring and multi-flame control when used with a Kromschröder series 5 burner control unit.

Using the BCSoft program and the optional opto-adapter PCO 200, it is possible to set parameters to suit an application and also to read analysis and diagnostic information from the flame detector.

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

The optional bus module BCM 500 makes it possible to connect the FDU to a fieldbus interface in a PROFINET or Modbus TCP network. Networking via the fieldbus enables multiple FDUs to be controlled and monitored by an automation system (e.g. a PLC). The bus module is prepared for DIN rail installation. It is pushed on to the FDU from the side.



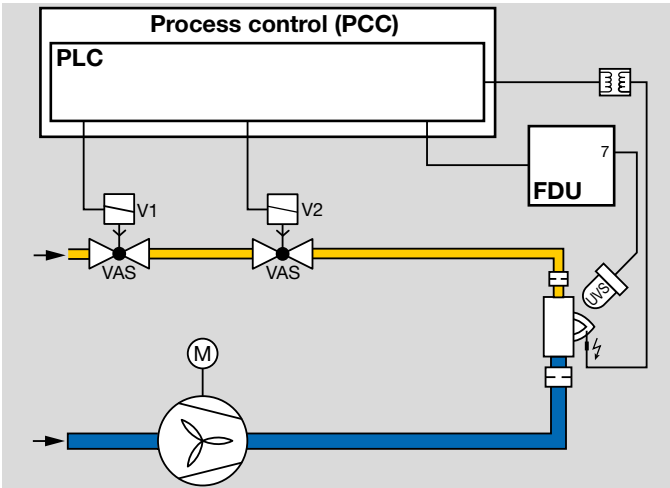
Bus module BCM 500 for connection to the FDU. The address for the fieldbus communication is set using three code switches.

1 Application



Roller hearth furnace

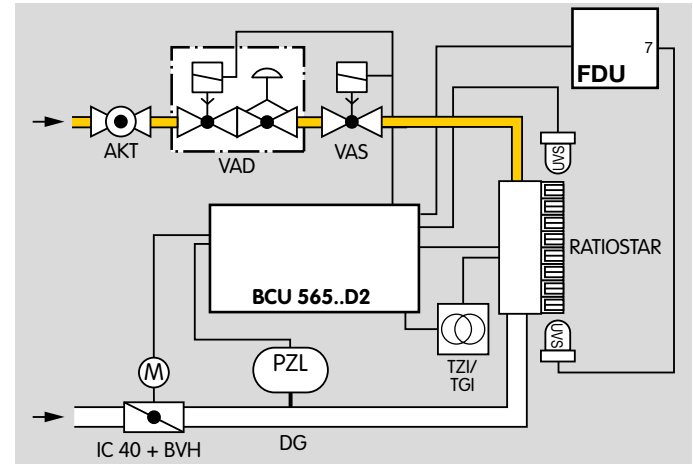
1.1 Using the PLC as a control unit



The FDU signals the presence of a flame to the PLC via a connected sensor (UV sensor or flame rod). The PLC controls and regulates the connected actuators to ensure safe burner start-up and operation.

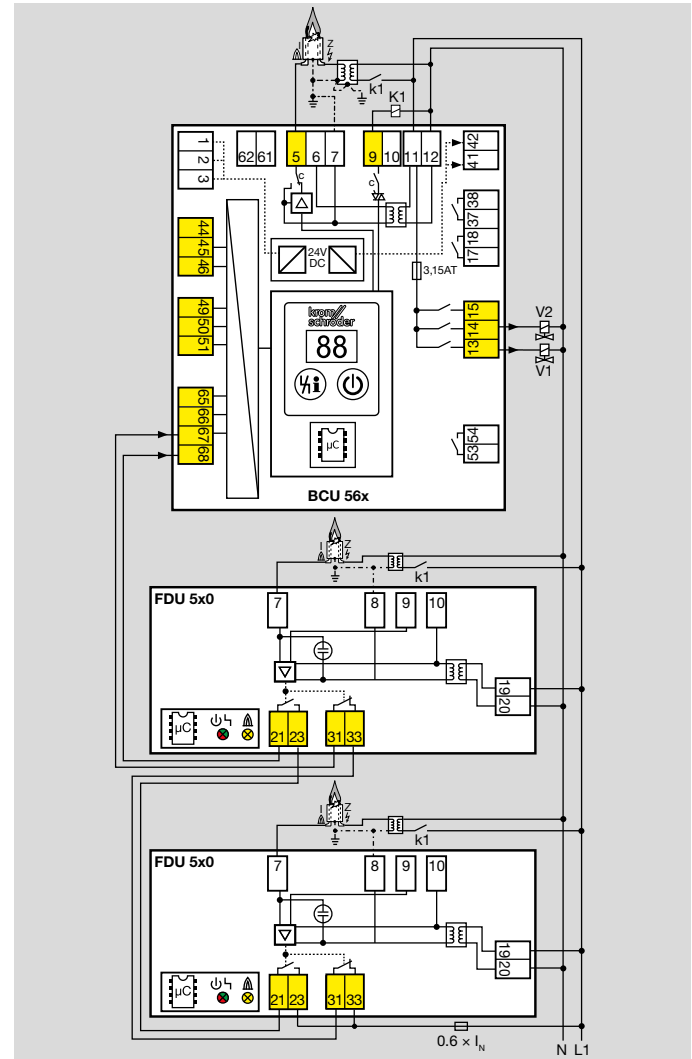
1.2 Multi-point monitoring

Kromschroder series 5 burner control units can be used to monitor the flame pattern on line burners using UV sensors or flame rods at multiple points. The flame signal is monitored by the FDU for flame detection at the second measuring point.



1.3 Multi-flame control

A group of burners can be monitored in conjunction with a Kromschroder burner control unit BCU 5. The BCU 5 takes charge of the flame detection for the first burner. The other burners are each monitored by an FDU 5.



2 Certification

2.1 Certificate download

Certificates – see www.docuthek.com

2.2 EU certified



- 2014/35/EU (LVD), Low Voltage Directive
- 2014/30/EU (EMC), Electromagnetic Compatibility Directive
- (EU) 2016/426 (GAR), Gas Appliances Regulation

Regulation:

- (EU) 2016/426 – GAR

Standards:

- EN 298:2012
- EN 60730-2-5
- EN 61508:2010, suitable for SIL 3

2.3 SIL, PL



For systems up to SIL 3 pursuant to EN 61508, see page 39 (14 Safety-specific characteristic values for SIL and PL).

Pursuant to EN ISO 13849-1, Table 4, the FDU 510, FDU 520..1 can be used up to PL e.

2.4 UL listed



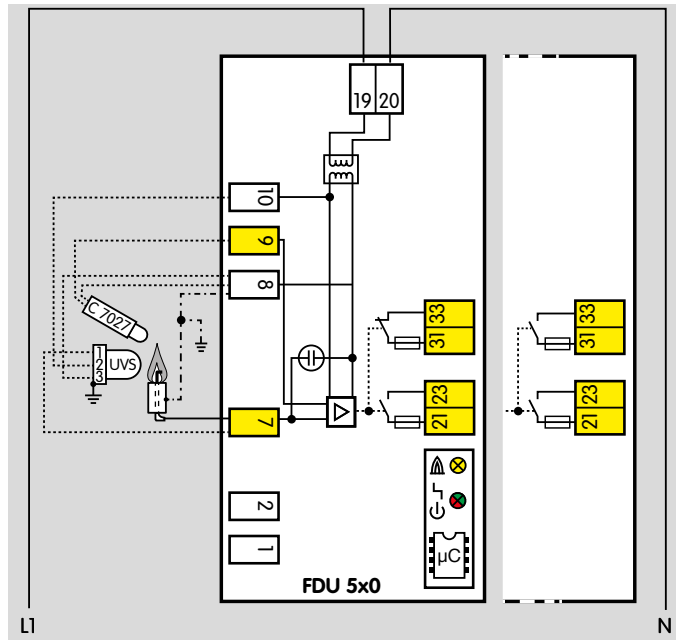
Underwriters Laboratories – UL 60730 “Automatic Electrical Controls”.

2.5 Eurasian Customs Union



The products FDU 510, FDU 520 meet the technical specifications of the Eurasian Customs Union.

3 Function



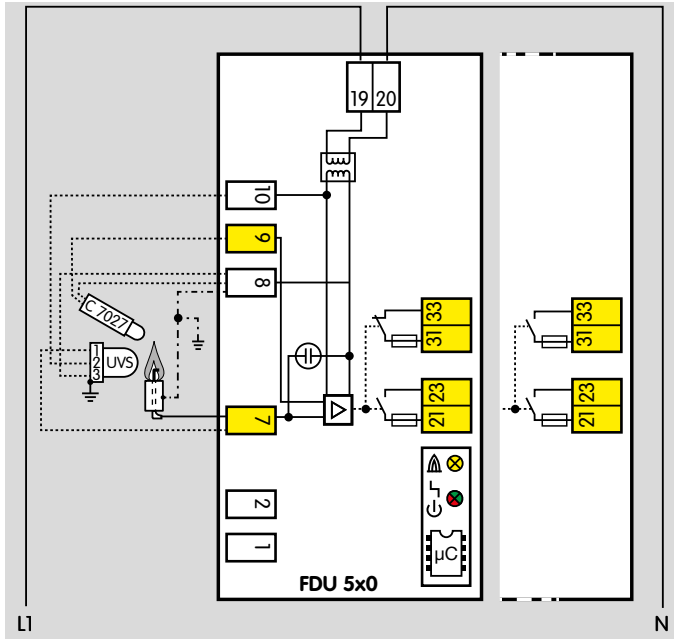
The red LED will flash in the event of an internal device error. In this case, the device will lock. An attempt can be made to reset the flame detector by pressing and holding the reset button (> 5 s).

After the voltage supply has been switched on, the flame detector will conduct a self-test (initialization). The two LEDs will be lit in yellow and red/green. Once the self-test has been successfully completed, the flame detector is ready for operation. The left LED will be lit in green.

As soon as a flame with sufficient intensity has been detected, the yellow LED will be lit.

The flame signal is sent via terminals 21/23 and 31/33 to the connected burner control unit or control unit (e.g. a fail-safe PLC). The burner control unit/control unit controls the gas valves, ignition transformer and, if applicable, the air actuator to start the burner safely and monitor the flame.

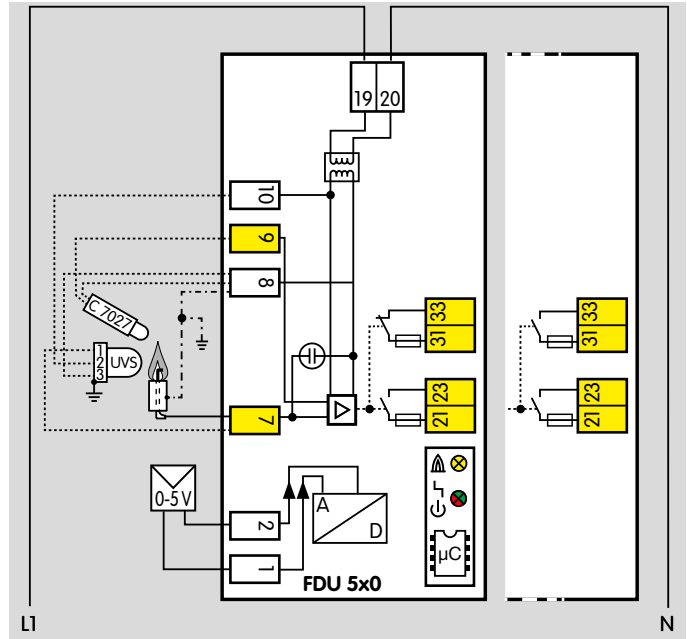
3.1 FDU 510, FDU 520



Electrical connection, see page 31 (9 Project planning information)

Explanation of symbols, see page 42 (17 Legend)

3.2 FDU 510, FDU 520 with 0 to 5 V output



Electrical connection, see page 31 (9 Project planning information)

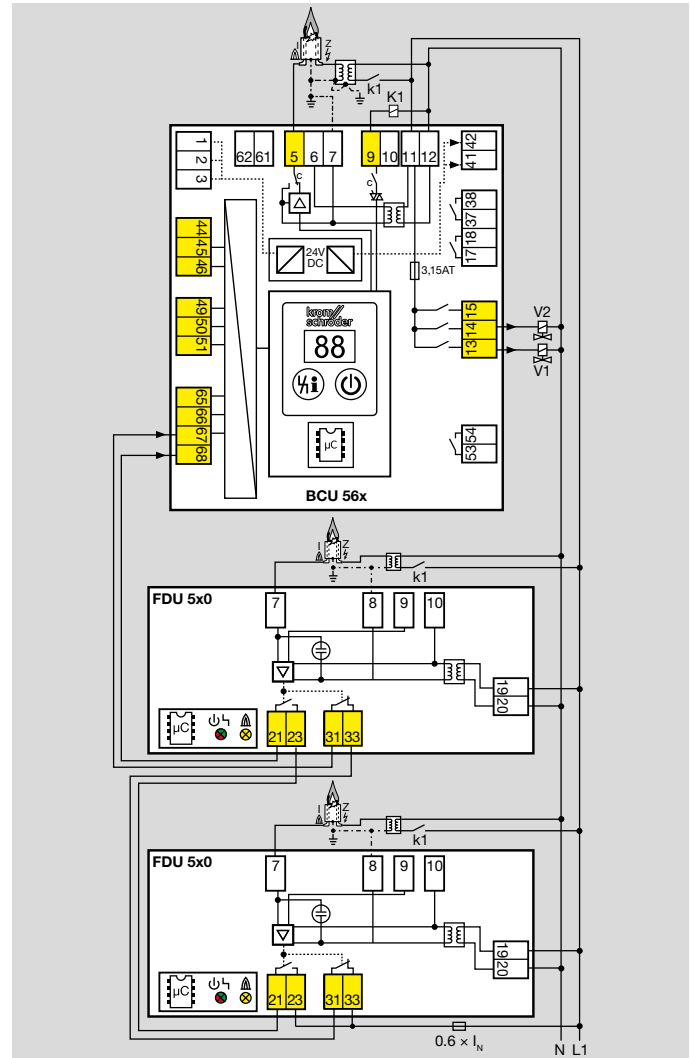
Explanation of symbols, see page 42 (17 Legend)

3.3 FDU connected to BCU 56x

Electrical connection, see page 31 (9 Project planning information)

Explanation of symbols, see page 42 (17 Legend)

- » BCU 56x: Parameter 72 = 21 and parameter 73 = 22 must be set on the BCU for operation using multi-frame control.

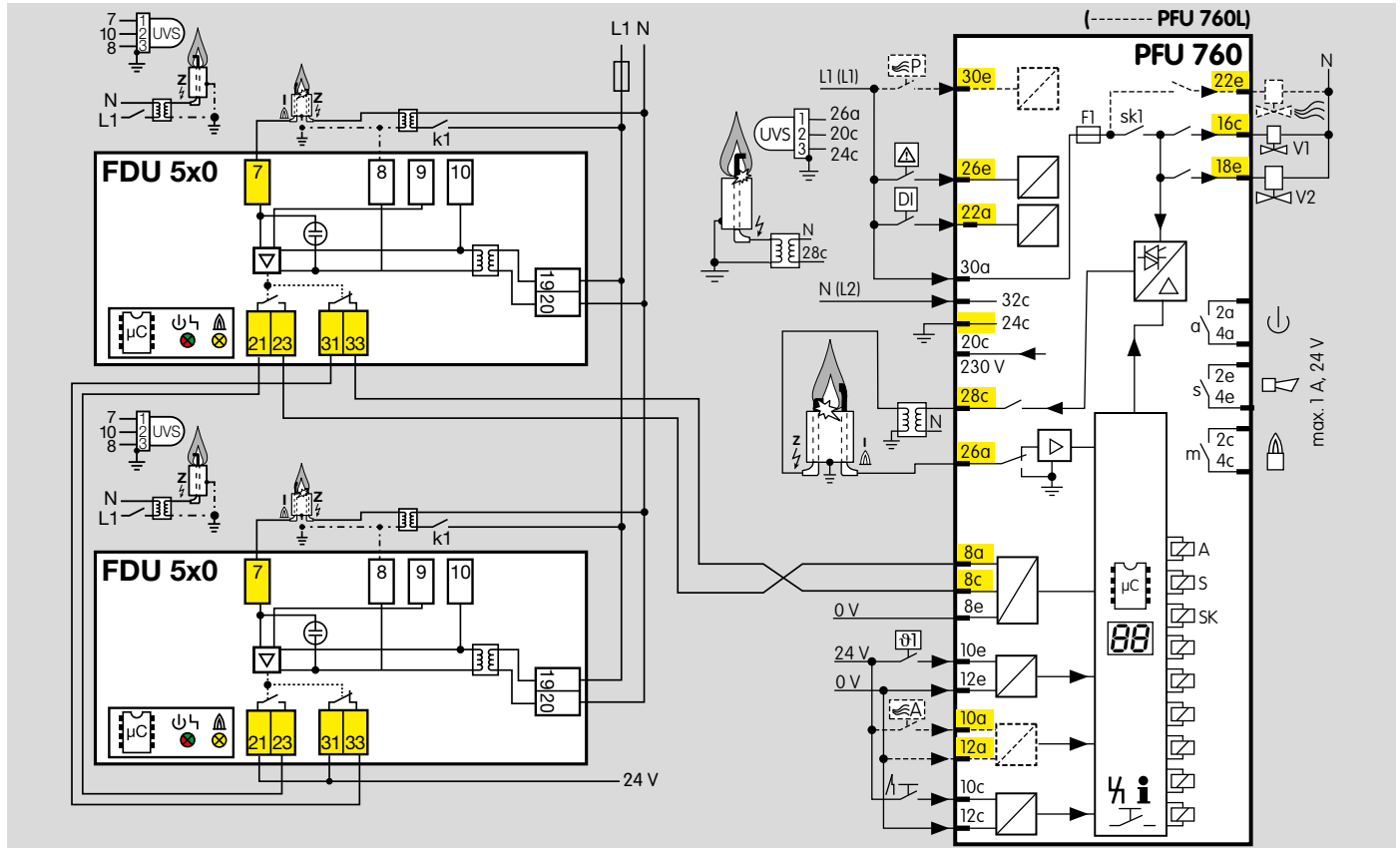


3.4 FDU connected to PFU 76x

Electrical connection, see page 31 (9 Project planning information)

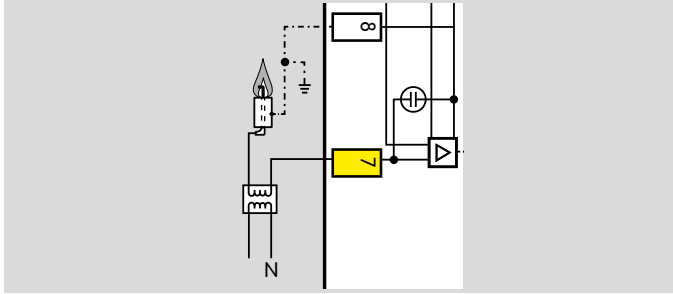
Explanation of symbols, see page 42 (17 Legend)

» PFU 76x: in order to activate multi-flame control, parameter 45 must be set to 1.



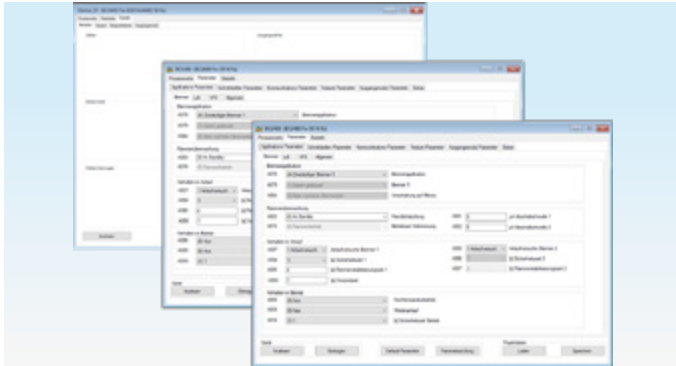
3.5 Ionization control in single-electrode operation

Parameter I004 = 0.



4 BCSOft

BCSoft is an engineering tool for PCs with a Windows operating system. BCSOft (from version 4.x.x) makes it possible to set device parameters in order to adjust them to the specific application. Device data can be logged and archived using BCSOft. The process values overview provides commissioning support. In the event of faults or service interventions, details on troubleshooting can be derived from the device statistics and the fault history.



The current version of the engineering tool BCSOft4 is available at www.docuthek.com.

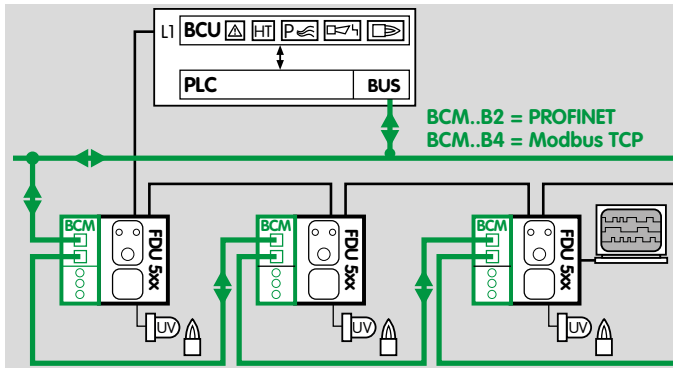
In addition to the engineering tool BCSOft, an opto-adapter with USB connection is required for data transfer between the PC and FDU 510, FDU 520. If the FDU is operated in conjunction with the bus module BCM 500, communication via Ethernet is possible.

BCSOft4 and opto-adapter PCO 200, see page 32 (10 Accessories).

5 Fieldbus communication

PROFINET and Modbus TCP are manufacturer-independent, open standards for industrial Ethernet. They cover the requirements for automation technology (manufacturing automation, process automation, drive applications without functional safety).

PROFINET and Modbus TCP are bus variants for fieldbus communication, optimized for speed and low connection costs.



The basic function of PROFINET and Modbus TCP is the exchange of process and required data between a controller (e.g. a PLC) and several distributed devices (e.g. BCM with BCU/FCU/FDU).

The signals from the devices are read into the controller cyclically. There, they are processed and are then output to the devices again.

5.1 FDU 510, FDU 520 and bus module BCM

The optional bus module BCM 500 is required to integrate a FDU 510, FDU 520 in a fieldbus system (PROFINET IO or Modbus TCP).

Signal states from the device inputs and outputs as well as information about the device status (operating states and flame signal), warnings and faults can be transferred via the bus module between the FDU 510, FDU 520 and PLC.

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 2-port switch. This allows the BCM 500 together with the FDU 510 or FDU 520 to be integrated in various network topologies (star, tree or line topology). Requirements such as Auto Negotiation and Auto Crossover are satisfied.



All network components which connect the automation system and the field devices must be certified for the relevant fieldbus use.

For information on planning and the structure of a network and the components to be used (e.g. cables, lines and switches):

for PROFINET, see PROFINET Installation Guide at www.profibus.com,

for Modbus TCP, see www.modbus.org.

5.2 Configuration, planning

Before commissioning, the bus module must be configured for data exchange with the fieldbus system using an engineering tool or BCSOft.

To do so:

- bus module BCM must be connected to the device (FDU 510, FDU 520),
- fieldbus communication must be enabled on the device (FDU 510, FDU 520),
- the code switches on the BCM must be set, see also page 27 (7.6.1 Fieldbus communication).

5.2.1 PROFINET/Device master data file (GSD)

In addition to cyclic data exchange, PROFINET also provides acyclic data exchange for events which are not constantly repeated such as sending device statistics. In the event that the bus communication is faulty or interrupted and during initialization of the bus communication after switching on, the digital signals are interpreted as “0”.

The technical properties of a device are described by the manufacturer in a device master data file (GSD file). The GSD file is required to integrate the device (FDU 510, FDU 520) in the configuration of the PLC. The GSD file contains the device image, the communications properties and all fault messages from the device in text form which are important for the configuration of the PROFINET network and the data exchange. Modules defined in the GSD file may be selected for configuration to integrate the device. The GSD file for the bus module 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.

5.2.2 Modbus TCP

The Modbus protocol is a communications protocol based on a Client/Server architecture. Once the TCP/IP connection between client (PLC) and server (FDU 510, FDU 520) has been established, useful data can be transferred via this connection as often and in as great an amount as required. The PLC and FDU 510, FDU 520 can establish up to 3 parallel TCP/IP connections at the same time. Using the function codes 3, 6 and 16, data can be transferred to and from the FDU 510, FDU 520. The PLC must send output data to the BCU/FCU at least every 125 ms in order to ensure data transfer and functioning of the FDU 510, FDU 520. If the output data is missing or sent too late, the bus module will interpret them as “0”.

5.2.3 Modules/Registers for process data

All modules (PROFINET) and registers (Modbus TCP) available for data exchange between the PLC and the flame detector FDU are shown in the following table.

Module (PROFINET) Register (Modbus TCP)	PROF- INET slot	Mod- bus ad- dress	Address	Operation
Inputs (FDU → PLC)	1	6	n	r
Outputs (PLC → FDU)	1	0	n	w
Burner 1 flame signal	2	9	n	r
Status signal	3	12	n	r
Fault and warning signals	4	15	n+3	r
Temperature	5	18	n...n+1	r
Input information	6	27	n	r
Output information	7	30	n...n+1	r

Modbus TCP – register structure

Example of “Inputs” register:

Modbus address	6	
Format	Word	
PLC address byte	Byte n .7 .0	Byte n+1 .7 .0

Inputs/Outputs

The digital input and output signals of the flame detector FDU are included in this module.

Input bytes (FDU → PLC)

The input bytes describe the digital signals which are transferred from the FDU to the digital inputs of the PLC. The digital signals take up 3 bytes (24 bits).

Bit	Byte n	Format
0	Reset	BOOL
1	Free	BOOL
2	Free	BOOL
3	Free	BOOL
4	Free	BOOL
5	Free	BOOL
6	Free	BOOL
7	Free	BOOL

Output bytes (PLC → FDU)

The output bytes describe the digital signals which are output by the PLC to the FDU. The digital signals to control the flame detector FDU occupy 1 byte (8 bits).

Bit	Byte n	Format
0	Ready for operation	BOOL
1	Flame signal	BOOL
2	FDU system fault	BOOL
3	Fault lock-out	BOOL
4	Safety shut-down	BOOL
5	Warning	BOOL
6	Free	BOOL
7	Free	BOOL

Flame signal (FDU → PLC)

The flame signal for the burner is transferred from the FDU to the PLC as an analogue value using this module. The flame signal occupies one byte with values from 0 to 255 (= flame signal from 0 to 25.5 μ A).

Bit	Byte n	Data type	Format	Value
0	Burner flame signal	Byte	DEC	0-255 (0-25.5 μ A)
1				
2				
3				
4				
5				
6				
7				

¹⁾ See code table "BusCommunication_FDU.xlsx" at www.docuthek.com.

Status signal (FDU → PLC)

This module transfers the status signals from the FDU 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 “BusCommunication_FDU.xlsx”.

Bit	Byte n	Data type	Format	Value
0	Status messages	Byte	DEC	0–255 ¹⁾
1				
2				
3				
4				
5				
6				
7				

¹⁾ See code table “BusCommunication_FDU.xlsx” at www.docuthek.com.

Fault and warning signals (FDU → PLC)

The fault and warning signals are transferred from the FDU to the PLC using this module. The fault and warning signals each occupy one word.

The interpretation for the fault messages and the warning messages can be taken from the code table “BusCommunication_FDU.xlsx”.

Bit	Byte n	Byte n+1	Data type	Format	Value
0	Fault signals		Word	DEC	0–65535 ¹⁾
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Bit	Byte n+2	Byte n+3	Data type	Format	Value
0	Warning signals		Word	DEC	0–65535 ¹⁾
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

¹⁾ See code table “BusCommunication_FDU.xlsx” at www.docuthek.com.

Temperature (FDU → PLC)

This module transfers the internal device temperature. The temperature occupies one word.

Bit	Byte n	Byte n+1	Data type	Format	Value
0	Temperature		Word	DEC	0–6554 (0–655.4 K)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

FDU input terminal information (FDU → PLC)

This module transfers the signal states of the digital inputs on the FDU to the PLC.

Input terminals		
Bit	Byte n	Format
0	Reset	BOOL
1	Free	BOOL
2	Free	BOOL
3	Free	BOOL
4	Free	BOOL
5	Free	BOOL
6	Free	BOOL
7	Free	BOOL

FDU output terminal information (FDU → PLC)

This module transfers the signal states of the digital outputs on the FDU (via output terminals and bus) to the PLC.

Bit	Byte n	Byte n+1	Format
0	Relay 1 (terminals 21/23)	Ready for operation	BOOL
1	Relay 2 (terminals 31/33)	Flame signal	BOOL
2	Free	FDU system fault	BOOL
3	Free	Fault lock-out	BOOL
4	Free	Safety shut-down	BOOL
5	Free	Warning	BOOL
6	Free	Free	BOOL
7	Free	Free	BOOL

5.2.4 Device parameters and statistics

PROFINET

With the help of acyclic communication between the PLC and FDU, 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).

Index	Description
1001	Parameter
1002	Device statistics, counter
1003	Device statistics, faults/warnings
1004	Operator statistics, counter
1005	Operator statistics, faults/warnings
1006	Fault history
1007	Extreme values (device)
1008	Time counter (device)
1009	Extreme values (operator)
1010	Time counter (operator/device)

The available data records differ in terms of their indexes. The contents and description of the registers are listed in the code table for flame detector FDU “BusCommunication_FDU.xlsx” at www.docuthek.com.

Modbus TCP

Register	Description
256–511	Parameters
512–767	Device statistics, counter
768–1023	Device statistics, faults/warnings
1024–1279	Operator statistics, counter
1280–1535	Operator statistics, faults/warnings
1536–1791	Fault history
1792–2047	Extreme values (device)
2048–2303	Time counters
2304–2559	Extreme values (operator)
2560–2815	Time counter (operator/device)

The available data records differ in terms of their indexes. The contents and description of the registers are listed in the code table for flame detector FDU “BusCommunication_FDU.xlsx” at www.docuthek.com.

6 Fault messages

Fault message (flashing)	DISPLAY	Description
Too many remote resets	<i>E 10</i>	Remote reset activated > 5 × in 15 min.
Mains voltage	<i>E 32</i>	Supply voltage too high/low
Faulty parameterization	<i>E 33</i>	Parameter set contains illegal settings
Permanent remote reset	<i>E 52</i>	Remote reset input activated > 10 s
Bus module	<i>E 67</i>	Incompatible or defective bus module
Assignment of master/slave devices	<i>E 69</i>	FDU is accessed by device(s) with unknown address
Invalid address	<i>n 1</i>	Invalid or incorrect address set on bus module
Invalid configuration	<i>n 2</i>	The bus module has received an incorrect configuration from the controller.
Invalid network name	<i>n 3</i>	Invalid network name or no address allocated in the network name
Controller in STOP position	<i>n 4</i>	Controller in STOP position
Ambient temperature	<i>OT</i>	The ambient temperature is too high for the FDU (excessive temperature).
Ambient temperature	<i>UT</i>	The ambient temperature is too low for the FDU (insufficient temperature).

7 Parameter

7.1 Application parameters

Name	Parameter	Value range	Factory default settings
page 25 (7.4.1 Burner 1 flame signal FS1 switch-off threshold)	A001	2–20 = Burner 1 flame signal switch-off threshold in μA (depending on I004)	2–20 μA where I004 = 0, 5–20 μA where I004 = 1, 2–5 μA where I004 = 2, 5 μA where I004 = 9
page 26 (7.5.1 Flame failure detection time (FFDT))	A018	1 = 0.7 s 2 = 1.7 s 3 = 2.7 s 4 = 3.7 s	1
page 27 (7.6.1 Fieldbus communication)	A080	0 = Off 1 = With address check 2 = No address check	2

7.2 Interface parameters

Name	Parameter	Value range	Factory default settings
page 28 (7.7.1 Flame control)	I004	0 = Ionization 1 = UVS sensor 2 = UVC sensor 9 = UV sensor C7027, C7227, C7035, C7235	0
page 29 (7.7.2 Function of contact 31/33)	I058	9 = Flame signal (NO contact) 10 = Flame signal (NC contact)	0

7.3 Scanning the parameters

Using an optionally available opto-adapter, it is possible to set parameters and read analysis and diagnostic information from the FDU using the BCSofT program, see page 32 (10 Accessories) and the BCSofT V4.x operating instructions at www.docuthek.com.

7.4 Flame control

The FDU 510, FDU 520 evaluates whether an adequate flame signal is provided by the burner with a flame amplifier using a flame rod or UV sensor.

7.4.1 Burner 1 flame signal FS1 switch-off threshold

Parameter A001

The sensitivity at which the flame detector detects a flame can be set using parameter A001.

As soon as the measured flame signal falls below the set value (2 to 20 μA), the FDU sends a signal to the burner control unit so that it performs a fault lock-out during the start-up after the elapse of the safety time or during operation after the elapse of the safety time during operation (parameter A019).

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

The adjustable range for the flame signal switch-off threshold for burner 1 is dependent on the setting of interface parameter I004, page 28 (7.7.1 Flame control):

I004 = 0 (ionization control): 2–20 μA ,

I004 = 1 (control using UVS sensor): 5–20 μA ,

I004 = 2 (control using UVC sensor): 5 μA ,

I004 = 9 (control using C7027, C7227, C7035, C7235): 2–5 μA

7.5 Safety limits

Parameter A019 can be used to adjust the safety limit (safety time during operation) to the system requirements.

7.5.1 Flame failure detection time (FFDT)

Parameter A018

Parameter A018 = 0.7, 1.7, 2.7 or 3.7 seconds

The flame failure detection time (FFDT) is the time that the FDU needs to stop the fuel supply after a flame failure during operation or an interruption at the safety current inputs (terminals 21, 23 and 31, 33). The flame failure detection time can be set to between 0.7 and 3.7 s in steps of 1 s. Prolonging the flame failure detection time increases the installation availability in the case of brief-duration signal fades (e.g. fades of the flame signal).

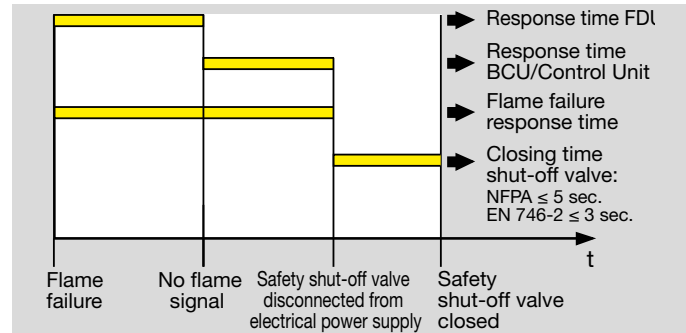
The requirements of national standards and regulations must be satisfied.

In accordance with EN 298, the maximum flame failure response time must not exceed 1 s. Specific application standards may permit other values.

Under EN 746-2, the safety time of the installation during operation (total closing time including that of the valves) must not exceed 3 s.

Under NFPA 86, section 8.10.3*, the maximum flame failure response time shall be ≤ 4 s.

Flame failure response time



7.6 Communication

7.6.1 Fieldbus communication

Parameter A080

Fieldbus communication can be enabled using parameter A080 when bus module BCM 500 is connected.

A device name/network name must be entered in the automation system/BCSoft for the unique identification of the unit (BCU/FCU/FDU) in the fieldbus system.

Parameter 80 = 0: Off. Fieldbus communication is disabled. Parameterization access using BCSoft via Ethernet is still possible.

Parameter 80 = 1: with address check. The device name/network name on delivery, for example for the FDU 510, is “not-assigned-fdu-510-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).



Code switch setting: upper switch (S1) = 10^2 (hundreds), centre switch (S2) = 10^1 (tens), lower switch (S3) = 10^0 (ones)

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

7.7 Interface parameters

7.7.1 Flame control

Parameter I004

Parameter I004 = 0: flame control is performed with a flame rod.

Parameter I004 = 1: flame control is performed with a UV sensor for intermittent operation (UVS).

- » For intermittent operation, the operating state of the complete system is limited to 24 h pursuant to EN 298. To meet the requirement for intermittent operation, the burner must be shut down and restarted automatically after a continuous operating time of 24 hours if it is not operated in compliance with the standard. The restart does not meet the requirements of EN 298 for UV sensor continuous operation because the required self-test (at least once per hour) is not performed while the burner is operating. This shut-down and subsequent restart are performed in the same way as a normal controlled shut-down. Depending on the parameterization, the burner is started with or without pre-purge. This process must be checked by the BCU/control unit and controlled independently if necessary (sensor in operation for more than 24 hours); it therefore must be checked whether the industrial process permits the pause in heat supply it creates.

Parameter 04 = 2: flame control is performed with a UV sensor for continuous operation (UVC 1).

The response times of the FDU and UV sensor for continuous operation are coordinated so that the set safety time during operation (parameter A019) is not extended.

Parameter I004 = 9: flame control is performed with a UV sensor for intermittent operation (C7027, C7227, C7035, C7235).

- » For intermittent operation, the operating state of the complete system is limited to 24 h pursuant to EN 298. To meet the requirement for intermittent operation, the burner must be shut down and restarted automatically after a continuous operating time of 24 hours if it is not operated in compliance with the standard. The restart does not meet the requirements of EN 298 for UV sensor continuous operation because the required self-test (at least once per hour) is not performed while the burner is operating. This shut-down and subsequent restart are performed in the same way as a normal controlled shut-down. Depending on the parameterization, the burner is started with or without pre-purge. This process must be checked by the BCU/control unit and controlled independently if necessary (sensor in operation for more than 24 hours); it therefore must be checked whether the industrial process permits the pause in heat supply it creates.

7.7.2 Function of contact 31/33

Parameter I058

The flame detector is fitted with two floating relays (relay 1 = contact for terminals 21/23, relay 2 = contact for terminals 31/33). The contact on relay 1 is closed as soon as the flame detector detects a flame signal. The contact on relay 2 is closed or opened depending on parameter I058.

Parameter I058 = 9: flame signal (NO contact). The contact for terminals 31/33 has a maker function.

Parameter I058 = 10: flame signal (NC contact). The contact for terminals 31/33 has a breaker function.

8 Selection

Option	FDU	
Series	510	520
Mains voltage	Q, W	Q, W
Flame control	1, 2, 3, T2, T5, T7	1, 2, 3, T2, T5, T7
Safety time during operation	1, 4	1, 4
Fail-safe bus	O1, O2	O1, O2
Output	-0, -1	-0, -1
Connection plugs	K0, K1, K2	K0, K1, K2

Order example

FDU 510W21O11K1

8.1 Type code

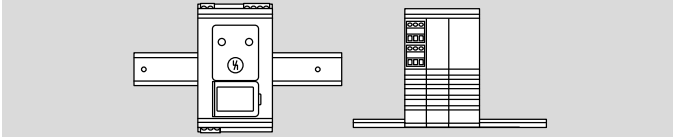
FDU	Flame detector
510	Series 510 for intermittent operation
520	Series 520 for continuous operation
Q	Mains voltage: 120 V AC, 50/60 Hz
W	Mains voltage: 230 V AC, 50/60 Hz
1	Flame control with flame rod or UVC
2	Flame control with UVS
3	Flame control with series C7027, C7035, C7227 and C7235
T2	Switch-off threshold: 2 μ A
T5	Switch-off threshold: 5 μ A
T7	Switch-off threshold: 7 μ A
1	Safety time during operation: 1 s
4	Safety time during operation: 4 s
O1	1 NO contact, 1 NC contact
O2	2 NO contacts
-0	No output
-1	0–5 V output
K0	No connection plugs
K1	Connection plugs with screw terminals
K2	Connection plugs with spring force terminals

9 Project planning information

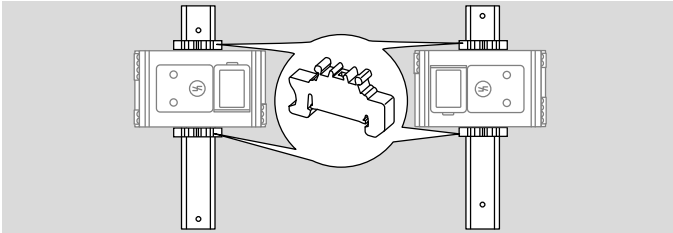
9.1 Installation

Installation position as required.

The FDU 510, FDU 520 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 FDU 510, FDU 520 from slipping.



Environment

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

9.2 Commissioning

Do not start the FDU 510, FDU 520 until the parameter settings and wiring are correct and the faultless processing of all input and output signals complies with the local standards.

9.3 Electrical connection

FDU 510, FDU 520 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 FDU 510, FDU 520 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 mm² (AWG 12), for spring force terminals max. 1.5 mm² (AWG 16).

Do not route FDU 510, FDU 520 cables in the same cable duct as frequency converter cables or cables emitting strong fields.

External electrical interference must be avoided.

9.4 Burner control unit

The FDU can be used for multi-flame control together with Kromschöder burner control units BCU 560 or PFU 760, see also page 11 (3.3 FDU connected to BCU 56x) and page 12 (3.4 FDU connected to PFU 76x).

10 Accessories

10.1 BCSoft

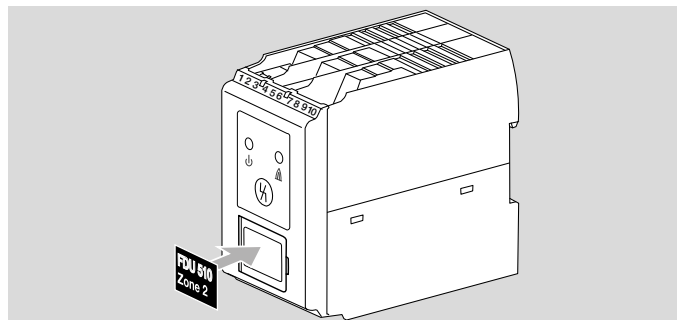
The current software can be downloaded from our Internet site at www.docuthek.com. To do so, you need to register in the DOCUTHEK.

10.1.1 Opto-adapter PCO 200



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

10.2 Stickers for labelling

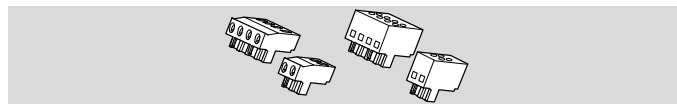


For printing with laser printers, plotters or engraving machines, 27 × 18 mm or 28 × 17.5 mm.

Colour: silver

10.3 Connection plug set

For wiring the FDU 510, FDU 520.



Connection plugs with screw terminals for FDU 510, FDU 520..K1

Order No.: 74924898.

Connection plugs with spring force terminals for FDU 510, FDU 520..K2

Order No.: 74924899.

11 BCM 500

11.1 Application



The bus module BCM 500 is used as a communication interface for devices of the BCU/FCU 500 product family for connection to a fieldbus communication system (Profinet or Modbus TCP). Networking via the fieldbus enables the FCU or BCU to be controlled and monitored by an automation system (e.g. PLC).

11.2 Function

The bus system transfers the control signals for starting, re-setting 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.

11.3 Electrical connection

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

Use shielded RJ45 plugs.

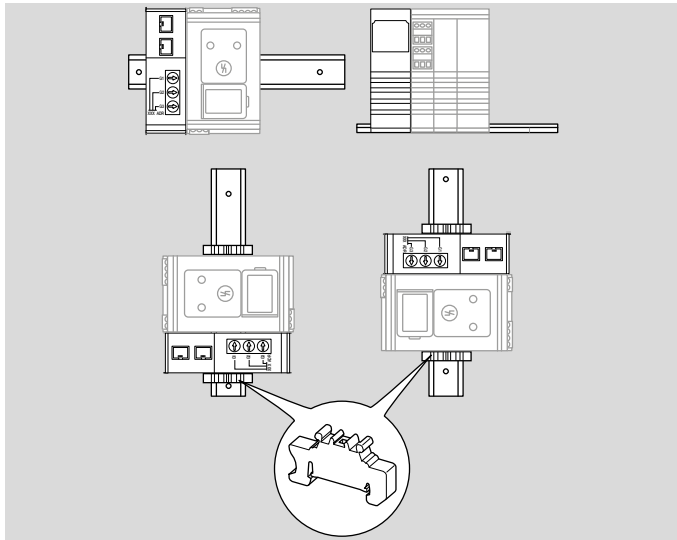
Cable length between 2 PROFINET subscribers: max. 100 m.

PROFINET installation guidelines, see www.profibus.com, for Modbus TCP, see www.modbus.org.

11.4 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 \geq IP 54, whereby no condensation is permitted.

11.5 Selection

Type code

Code	Description
BCM	Bus module
500	Series 500
S0	Standard communication
B2	Profinet
B4	Modbus TCP
/3	Two RJ45 sockets
-3	Three-point step control via bus

BCM..B2, Order No.: 74960663

BCM..B4, Order No.: 74960688

11.6 Technical data for BCM

Electrical data

Power consumption: 1.2 VA.

Power loss: 0.7 W.

Mechanical data

Dimensions (W × H × D):

32.5 × 110 × 100 mm (1.28 × 4.53 × 3.94 inch),

H = 115 mm (4.5 inch) with DIN rail.

Poids : 0,3 kg.

Ambient conditions

Icing, condensation and dew in and on the unit are not permitted.

Avoid direct sunlight or radiation from red-hot surfaces on the unit.

Note the maximum medium and ambient temperatures!

Avoid corrosive influences, e.g. salty ambient air or SO₂.

Ambient temperature:

-20 to +60°C (-4 to +140°F).

Transport temperature = ambient temperature.

Storage temperature:

-20 to +60°C (-4 to +140°F).

Enclosure: IP 20 pursuant to IEC 529.

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

Permitted operating altitude: < 2000 m AMSL.

12 Technical data

Ambient conditions

Condensation and dew in and on the unit are not permitted.

Avoid direct sunlight or radiation from red-hot surfaces on the unit.

Avoid corrosive influences, e.g. salty ambient air or SO₂.

Permitted relative humidity: min. 5%, max. 95%.

The unit may only be stored/installed in enclosed rooms/buildings that are not accessible to the public.

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

Transport temperature = ambient temperature.

Storage temperature: -20 to +80°C (-4 to +176°F).

Enclosure: IP 20 pursuant to IEC 529.

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

Permitted operating altitude: < 2000 m AMSL.

Mechanical data

Dimensions (W x H x D): 60 x 115 x 112 mm.

Weight: 0.4 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 min. 24,

wire cross-section AWG 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.

Electrical data

Supply voltage:

FDU..Q: 120 V AC, -15/+10%, 50/60 Hz, ± 5%,

FDU..W: 230 V AC, -15/+10%, 50/60 Hz, ± 5%,

for grounded or ungrounded mains.

Flame control:

with UV sensor or flame rod.

For intermittent or continuous operation.

Flame signal current:

ionization control: 1–25 µA,

UV control: 1–35 µA.

Ionization/UV cable:

max. 50 m (164 ft).

Contact rating:

max. 2 A, cos φ ≥ 0.6,

min. 2 mA, cos φ ≥ 0.6.

Power rating for SIL 3 applications:

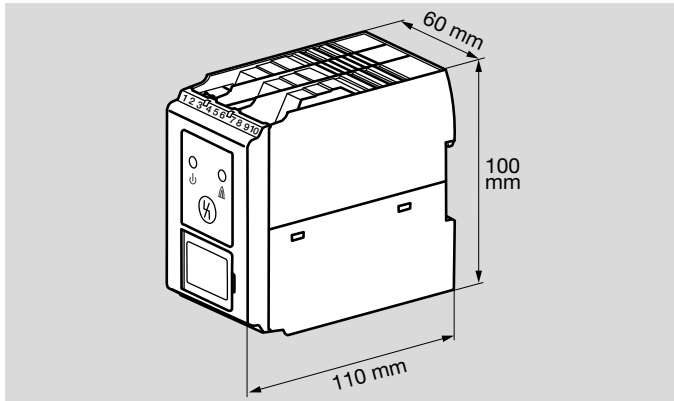
max. 0.1 A, cos φ = 1 for both NO and NC outputs,

230 V AC or 24 V DC.

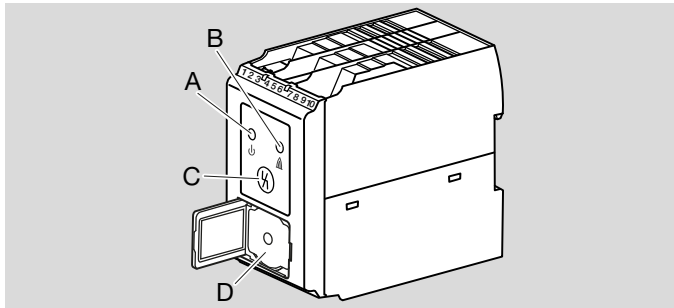
Number of operating cycles:

max. 250,000.

12.1 Dimensions



12.2 Operating controls



A: Red/green LED (fault signal/ready for operation)

B: Yellow LED (flame signal)

C: Reset button

D: Connection for opto-adapter

13 Converting units

See www.adlatus.org

14 Safety-specific characteristic values for SIL and PL

Certificates – see www.docuthek.com.

For systems up to SIL 3 pursuant to EN 61508.

Pursuant to EN ISO 13849-1, Table 4, the FDU 510, FDU 520..1 can be used up to PL e.

Suitable for Safety Integrity Level	Up to SIL 3
Diagnostic coverage DC	91%
Type of subsystem	Type B to EN 61508-2
Mode of operation	High demand mode pursuant to EN 61508-4 Continuous operation (to EN 298)
Mean probability of dangerous failure PFH _D	16.9×10^{-9} 1/h
Mean time to dangerous failure MT-TF _d	$MTTF_d = 1/PFH_D$
Safe failure fraction SFF	98.1%

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

PL	SIL
a	–
b	1
c	1
d	2
e	3

Max. service life under operating conditions:

10 years after date of production.

For a glossary of terms, see page 43 (18 Glossary).

15 Safety instructions

Scope of application:

As set out in "Industrial thermoprocessing equipment – Part 2:

Safety requirements for combustion and fuel handling systems" (EN 746-2) when used with fuels and oxidants which emit UV radiation during oxidation.

Action:

Type 2 pursuant to EN 60730-1.

Behaviour under fault conditions:

Pursuant to Type 2.AD2.Y. During a fault, the FDU switches off and uses a trip-free mechanism which cannot be re-closed.

Fault detection time:

Safety time during operation (in the event of a flame failure):
< 0.5 s.

Intermittent operation:

Possible pursuant to EN 298, Section 7.101.2.9. A flame simulation check must be conducted before starting the burner control unit.

Software class: corresponds to software class C which operates in a similar double-channel architecture with comparison.

Short-circuit fault exclusion:

No. Internal voltages are neither SELV nor PELV.

Interfaces

Type of wiring:

Attachment type X to EN 60730-1.

Connection terminals:

Supply voltage: 100 to 230 V AC, 50/60 Hz, between terminals L and N.

Ionization signal: 230 V AC between terminals ION (ionization output) and BM (burner ground). The voltage is provided by the burner control unit/automatic burner control unit.

DC signal:

No flame: < 1 μ A.


















Active flame: 2 to 25 μ A, depending on flame quality.

16 Maintenance

The fail-safe outputs (terminals 21/23 and 31/33) of the flame detector are not monitored for correct functioning. The fail-safe outputs are safeguarded with fuses that may not be replaced. The maximum number of operating cycles for the flame detector is 250,000. The device must be replaced when the maximum number of operating cycles has been exceeded.

The device and user statistics can be displayed using the engineering tool BCSoft for diagnostics and troubleshooting. The user statistics can be reset using engineering tool BCSoft.

17 Legend

Symbol	Description
	Ready for operation
	Safety interlocks (limits)
	Control element position check
LDS	Safety limits (limits during start-up)
	Gas valve
	Air valve
	Air/gas ratio control valve
	Pilot burner (burner 1)
	Main burner (burner 2)
	Purge
	External air valve control
 1	Burner flame signal
	Fault signal
	Start-up signal (1 = pilot burner, 2 = main burner)
	Input signal depending on parameter xx
	Actuator with butterfly valve
	Fan
	Input/Output, safety circuit

18 Glossary

18.1 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: %

see EN ISO 13849-1

18.2 Safe failure fraction SFF

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

see EN 13611/A2

18.3 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

see EN 13611/A2

18.4 Flame simulation

Light (e.g. from neighbouring burners, welding devices, ignition sparks, solar UV radiation) which is present in addition to that of the desired light from a flame. As of a certain intensity, it can adversely affect UV control and in this case must be covered up/filtered out or reduced by other means,

since otherwise the flame signal amplifier cannot detect if its own flame is extinguished.

18.5 Control unit

A control unit executes a specific program sequence while it reacts to signals from control and safety equipment, issues switching commands, controls the start-up switching sequence, monitors the operation of the burner and initiates the controlled shut-down and, if necessary, the safety shut-down and fault lock-out. The control unit always operates in conjunction with a flame detector.

For more information

The Honeywell Thermal Solutions family of products includes Honeywell Combustion Safety, Eclipse, Exothermics, Hauck, Kromschroder and Maxon. To learn more about our products, visit ThermalSolutions.honeywell.com or contact your Honeywell Sales Engineer.

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