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Operating instructions

Protective system control FCU 500 Furnace zone control FCU 505



Cert. version 02.19

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Safety

Please read and keep in a safe place



Please read through these instructions carefully before installing or operating. Following the installation, pass the instructions on to the operator. This unit must be installed and commissioned in accordance with the regulations and standards in force. These instructions can also be found at www.docuthek.com.

Explanation of symbols

■, **1**, **2**, **3**... = Action
> = Instruction

Liability

We will not be held liable for damage resulting from non-observance of the instructions and non-compliant use.

Safety instructions

Information that is relevant for safety is indicated in the instructions as follows:

DANGER

Indicates potentially fatal situations.

WARNING

Indicates possible danger to life and limb.

! CAUTION

Indicates possible material damage.

All interventions may only be carried out by qualified gas technicians. Electrical interventions may only be carried out by qualified electricians.

Conversion, spare parts

All technical changes are prohibited. Only use OEM spare parts.

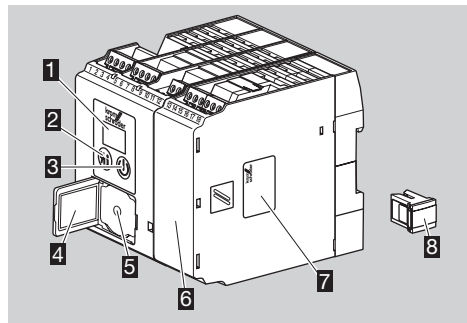
Checking the usage

The protective system control FCU 500 and furnace zone control FCU 505 are designed for the monitoring and controlling of central safety functions in multiple burner systems on an industrial furnace. The FCU 500 controls multiple zones acting as the central protective system control. The FCU 505 is used for protective system and capacity control in individual furnace zones.

Type code

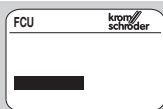
Code	Description
FCU 500	Protective system control
FCU 505	Furnace zone control
Q	Mains voltage: 120 V AC, 50/60 Hz
W	230 V AC, 50/60 Hz
C0	No valve proving system
C1	With valve proving system
	Capacity control:
F0	none
F1	with interface for actuator IC
F2	with interface for RBW
	Temperature monitoring:
H0	none
H1	with temperature monitoring
	Connection terminals:
K0	none
K1	screw terminals
K2	spring force terminals

Part designations



- 1 LED display for program status and fault messages
- 2 Reset/Information button
- 3 On/Off button
- 4 Type label
- 5 Connection for opto-adaptor
- 6 Power module, detachable
- 7 Power module type label
- 8 Parameter chip card

Type designation (FCU...), construction stage, input voltage – see type label.

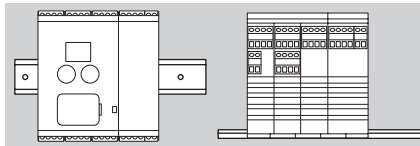


Installation

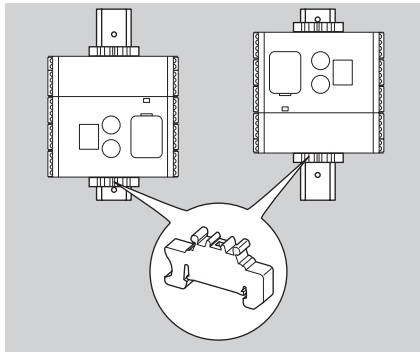
! CAUTION

Please observe the following to ensure that the burner control unit is not damaged:

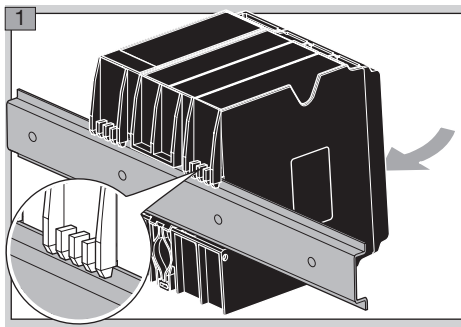
- Dropping the device can cause permanent damage. In this event, replace the entire device and associated modules before use.
- ▷ Installation position: vertically upright, horizontal or tilted to the left or right.
- ▷ The FCU mounting is designed for horizontally aligned 35 × 7.5 mm DIN rails.



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

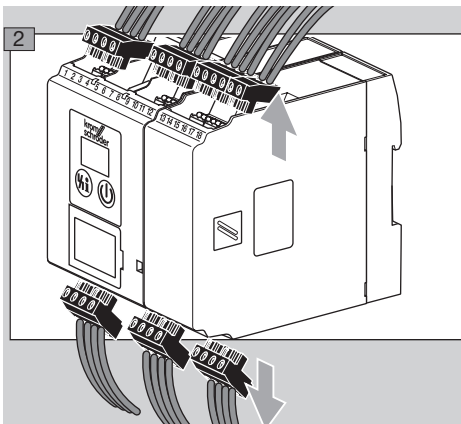


- ▷ Install in a clean environment (e.g. a control cabinet) with an enclosure ≥ IP 54, whereby no condensation is permitted.

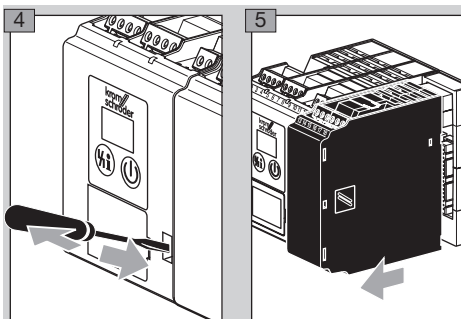


Replacing the protective system/ furnace zone control

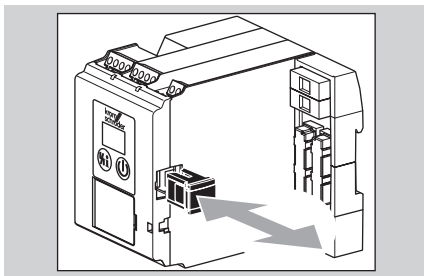
- 1 Disconnect the system from the electrical power supply.



- 3 Disengage the FCU from the DIN rail.



- 6 Transfer the parameter values from the old FCU to the new FCU.
- ▷ Remove the parameter chip card from the old FCU and insert into the new FCU.



! CAUTION

Malfunction (fault message $\overline{b_c}$)! The old and new FCUs must have the same hardware configuration (see type designation on type label). The parameter chip card is not backward compatible. If the parameter chip card has been operated in an FCU with more recent firmware, it cannot be used in a device with older firmware.

- ▷ Alternatively, the parameters values can be read from the old FCU and then read back into the new FCU using the separate BCSof software, see pages 13 (Adjustment) and 25 (Accessories).
- 7 Slide the power module back on.
- 8 Mount the FCU on the DIN rail again.
- 9 Reconnect the connection terminals.
- 10 Switch the system on again, see page 13 (Commissioning).
- ▷ Fault message $\overline{b_c}$: Parameter chip card from FCU construction stage B or above has been inserted into FCU construction stage A, see also page 15 (Assistance in the event of malfunction).

Cable selection

- ▷ Use cables suitable for the type of operation and complying with local regulations.
- ▷ Signal and control line for screw terminals max. 2.5 mm², for spring force terminals max. 1.5 mm².
- ▷ Do not route FCU cables in the same cable duct as frequency converter cables or cables emitting strong fields.
- ▷ Control lines must fulfil the requirements of EN 60204-1, Chapter 12.
- ▷ Avoid external electrical interference.

Wiring

- ▷ Do not reverse phase L1 and neutral conductor N.
- ▷ Do not install different phases of a three-phase current system at the inputs.
- ▷ Do not connect voltage to the outputs.
- ▷ A short-circuit on the outputs causes one of the replaceable fuses to trip.
- ▷ Ensure that the inputs at terminals 1 to 4 and 44 are only supplied with 24 V DC.
- ▷ 24 V DC power supply: + at terminal 62, - at terminal 61.
- ▷ Ensure that the 24 V DC outputs at terminals 41 and 42 are not connected to mains voltage.
- ▷ Do not set the remote reset so that it operates automatically in cycles.
- ▷ Wire the safety circuit inputs via contacts (relay contacts) only.
- ▷ The unit features an output for fan control (terminal 58). This single-pole contact can be loaded with a max. of 3 A. The max. start-up current of the fan motor may not exceed a value of max. 6 A for 1 s – use an external contactor if required.
- ▷ The limiters in the safety interlock (linking of all the relevant safety-related control and switching equipment for the use of the application, for example, safety temperature limiter) must isolate terminal 46 from the voltage supply. If the safety interlock is interrupted, the display shows a blinking **50** as a warning signal and all of the FCU's control outputs are disconnected from the electrical power supply.
- ▷ Connected control elements must be equipped with protective circuits in accordance with the manufacturer's instructions. The protective circuit prevents high voltage peaks which can cause malfunctioning of the FCU.
- ▷ Functions of terminals 51, 65, 66, 67 and 68 are dependent on parameter values:

Terminal	Dependent on parameter
51	69
65	70
66	71
67	72
68	73

- 1** Disconnect the system from the electrical power supply.
 - 2** Before wiring the FCU, ensure that the yellow parameter chip card has been installed in the FCU.
- ▷ Screw terminals or spring force terminals are available for the FCU:
Screw terminal, Order No.: 74923998,
spring force terminal, Order No.: 74924000.
 - 3** Wire as shown on the connection diagram – see page 6 (Connection diagram).
 - ▷ Ensure a good PE (ground) wire connection to the burner control units and burners.

FCU..H1

- ▷ Use type K NiCr-Ni, type N NiCrSi-NiSi or type S Pt10Rh-Pt Class 1 double thermocouples only.

Thermocouple	Temperature range (°C)
Type K NiCr-Ni	-40 to 1000
Type N NiCrSi-NiSi	-40 to 1000
Type S Pt10Rh-Pt	0 to 1600

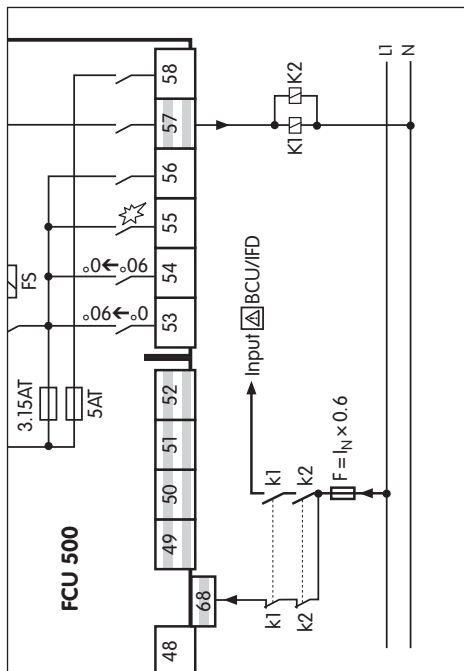
- ▷ Parameter 22 = 1: Type K double thermocouple NiCr-Ni
- ▷ Parameter 22 = 2: Type N double thermocouple NiCrSi-NiSi
- ▷ Parameter 22 = 3: Type S double thermocouple Pt10Rh-Pt
- ▷ STM:
Parameter 20 = 1: High temperature operation with STM. Position the double thermocouple at the coldest point in the furnace so that it can reliably detect whether the spontaneous ignition temperature (> 750°C) has been exceeded.
- ▷ STL:
Parameter 20 = 2: Maximum temperature monitoring using STL. Position the double thermocouple at the warmest point in the furnace so that it can reliably detect whether the maximum permitted temperature has been exceeded.
- ▷ STL and STM:
Parameter 20 = 3: High temperature operation with STM and maximum temperature monitoring with STL. Position the double thermocouple in the furnace in such a way that it can reliably detect whether the spontaneous ignition temperature (> 750°C) has been exceeded and also whether the maximum permitted furnace temperature has been exceeded.

FCU..C1

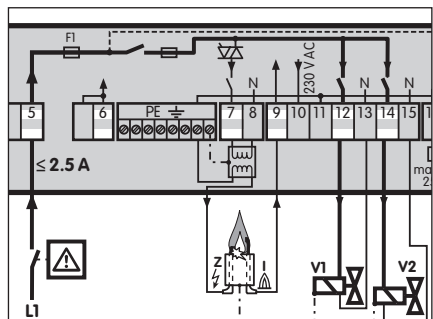
- ▷ Parameter 51 = 1: Tightness test before furnace start-up.
- ▷ Parameter 51 = 2: On; tightness test after furnace shut-down, after a fault lock-out or after mains on.
- ▷ Parameter 51 = 3: On; tightness test before furnace start-up and after furnace shut-down.
- ▷ Parameter 51 = 4: Permanent via proof of closure function (POC).

Safety interlock output in the case of higher power requirement

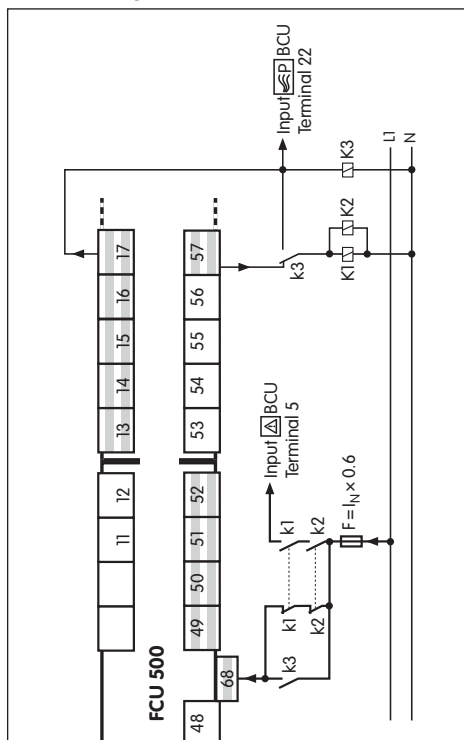
- ▷ The burner start enable signal is issued to the connected burner control units or automatic burner control units via the safety interlock output (terminal 57).
- ▷ For burner control units or automatic burner control units whose safety interlock input has a current consumption of $\leq 2 \text{ mA}$, the power (max. 0.5 A , $\cos \varphi = 1$) of the FCU is sufficient to directly activate them.
- ▷ In the event that a higher output current is required, the output current can be increased by means of a contact multiplier using two contactors. Design the circuit as follows:



▷ BCU with power supply for valves and ignition transformer via safety interlocks (terminal 5)



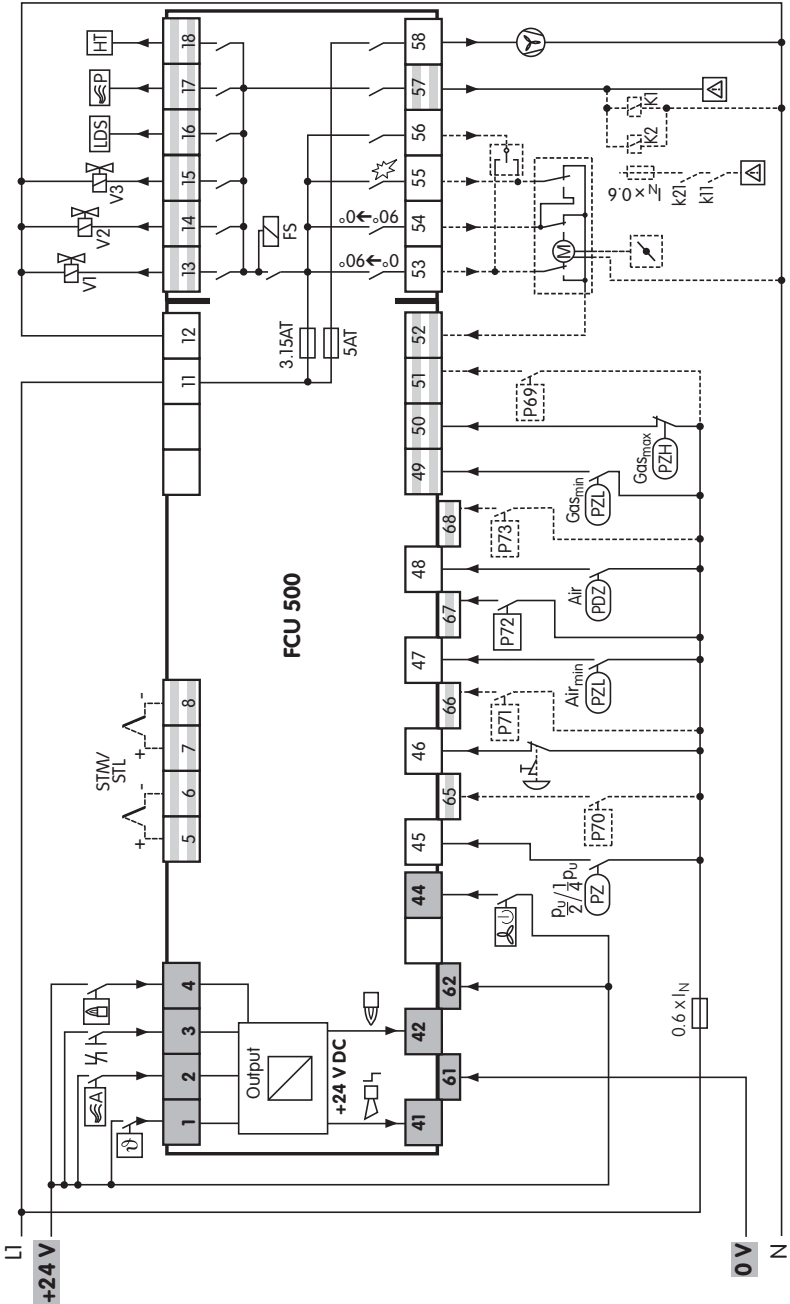
- ▷ In the event that a higher output current is required, the output current can be increased by means of a contact multiplier using three contactors. Design the circuit as follows:



Connection diagram

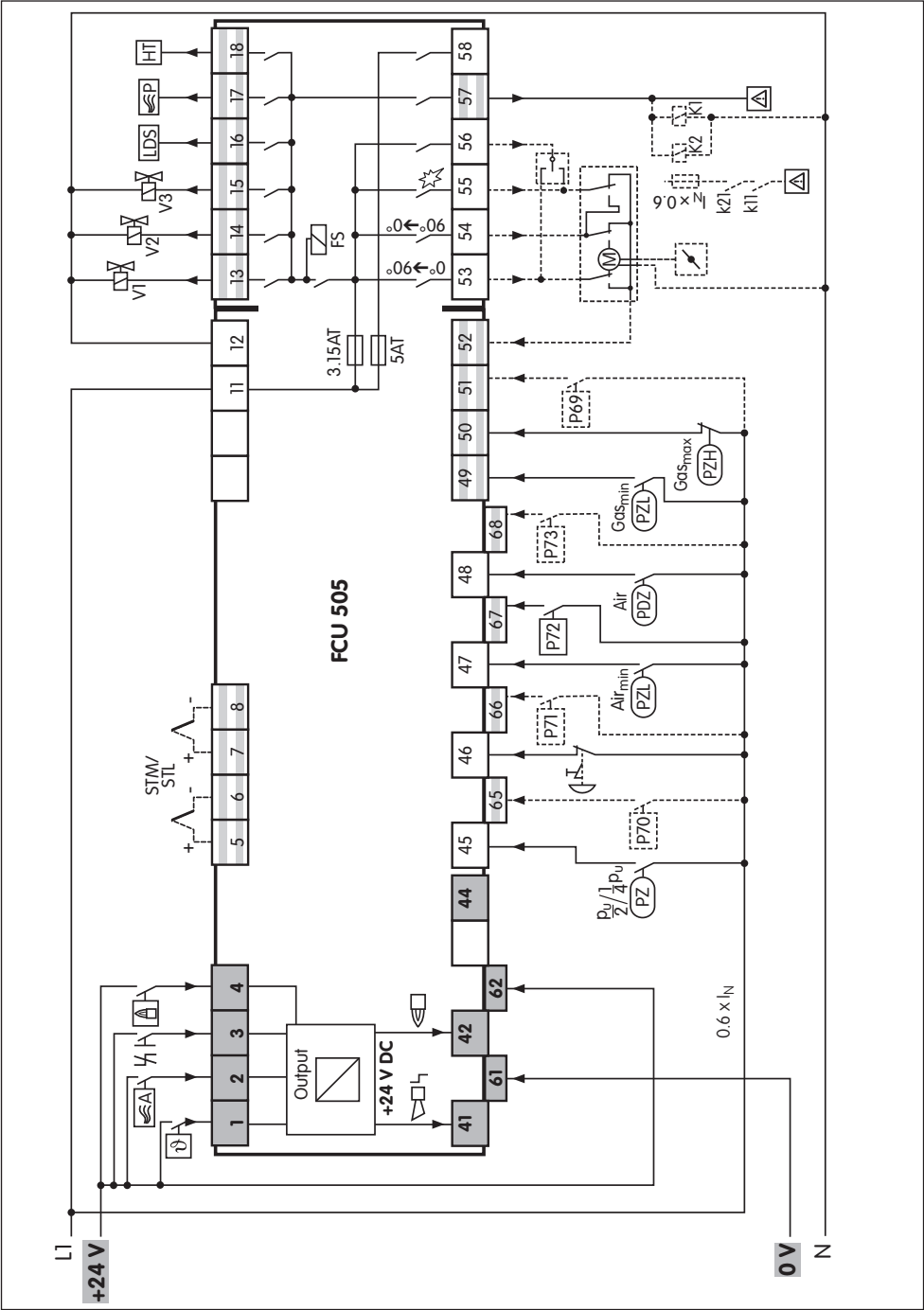
FCU 500

Legend – see page 23 (Legend).



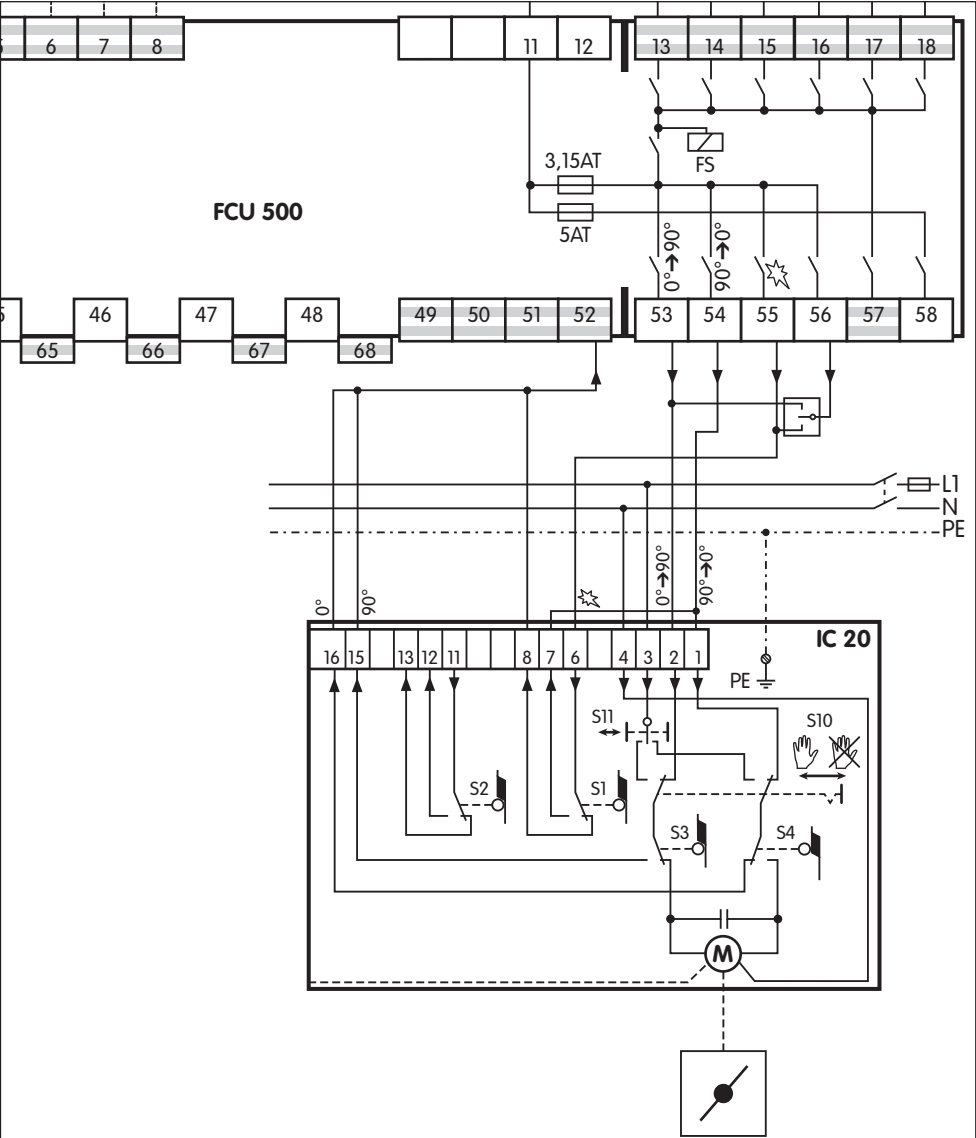
FCU 505

▷ Legend – see page 23 (Legend).



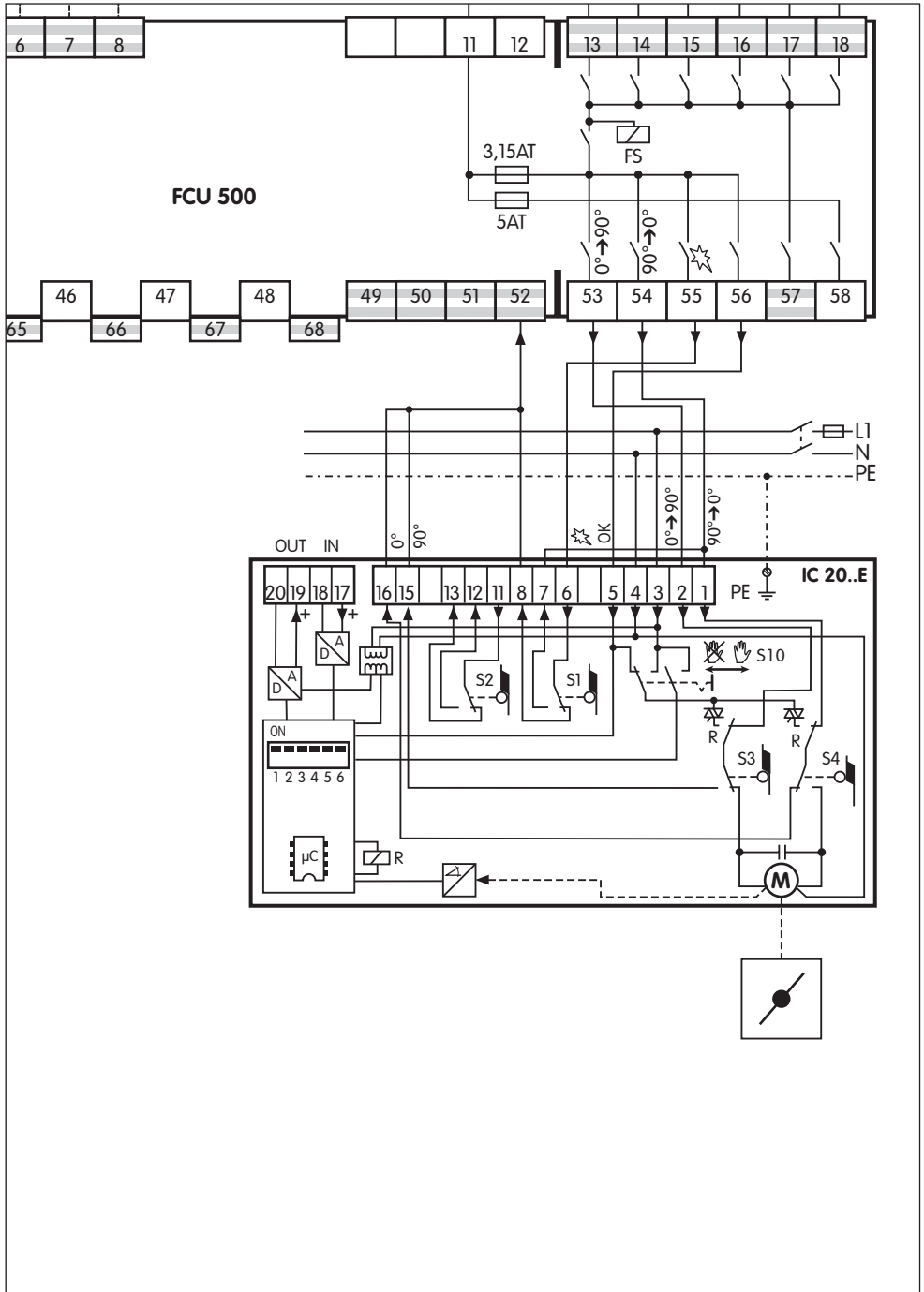
IC 20 connected to FCU..F1

- ▷ Parameter 40 = 1.
- ▷ Continuous control via three-point step controller.



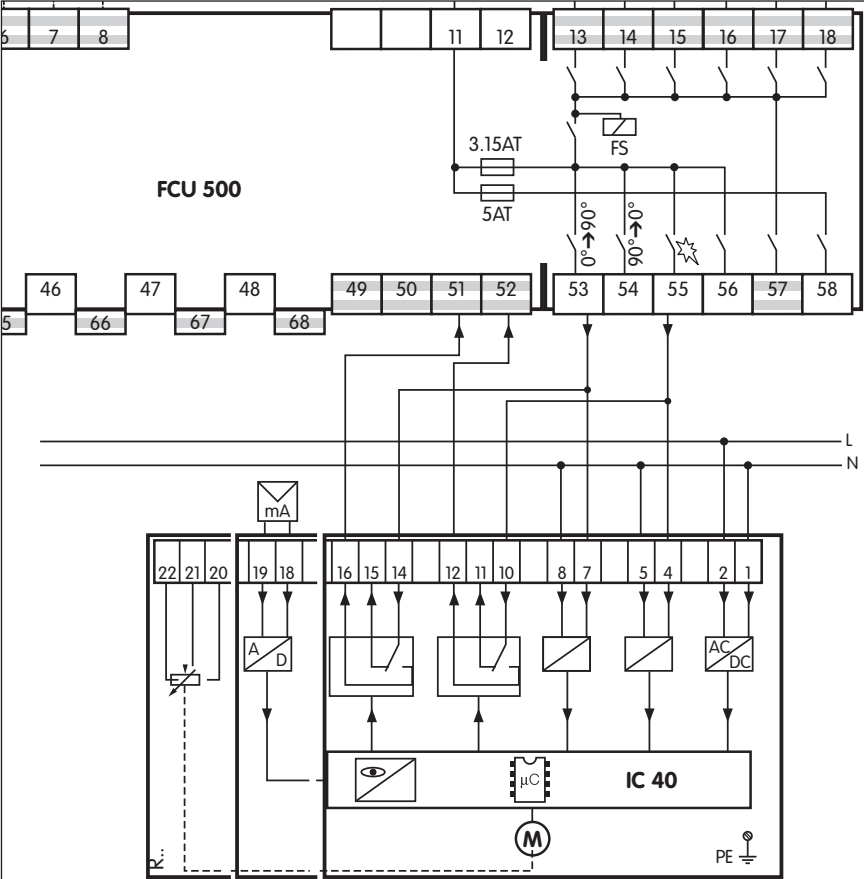
IC 20 E connected to FCU..F1

- ▷ Parameter 40 = 1.
- ▷ Continuous control via analogue input.



IC 40 connected to FCU..F1

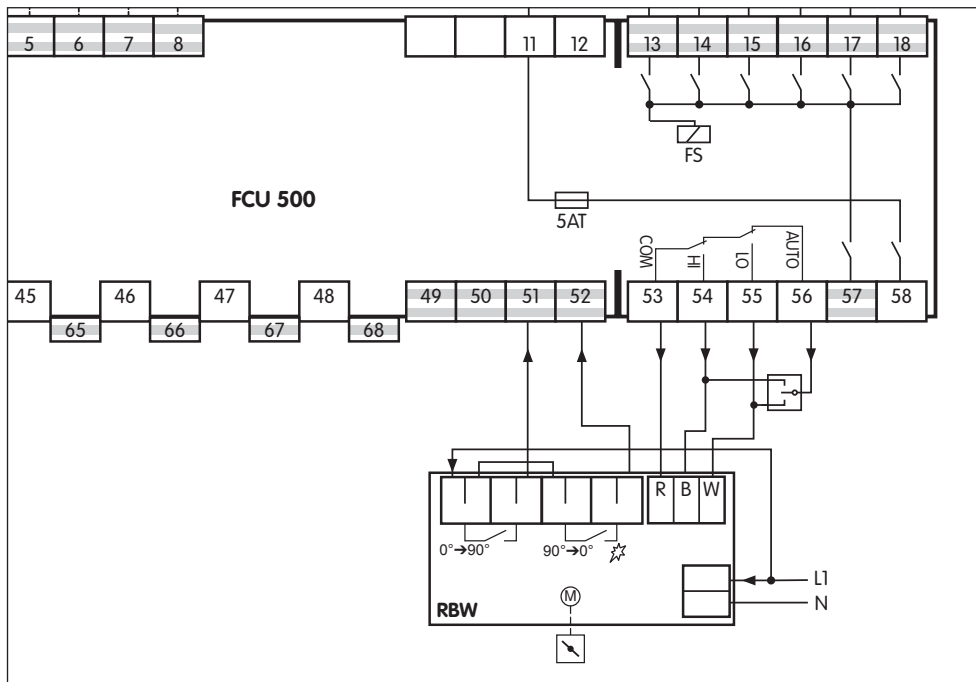
- ▷ Parameter 40 = 2.
- ▷ Continuous control via analogue input.
- ▷ Set IC 40 to operating mode 27, see operating instructions Actuators IC 20, IC 40, IC 40S.



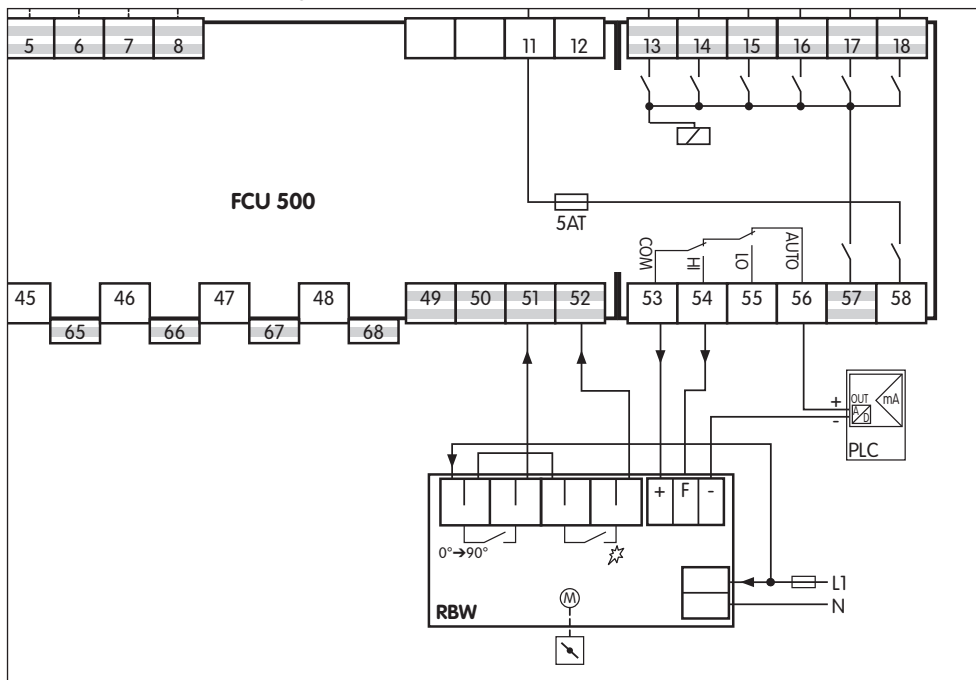
RBW valve connected to FCU..F2

▷ Parameter 40 = 3.

Continuous control via three-point step controller

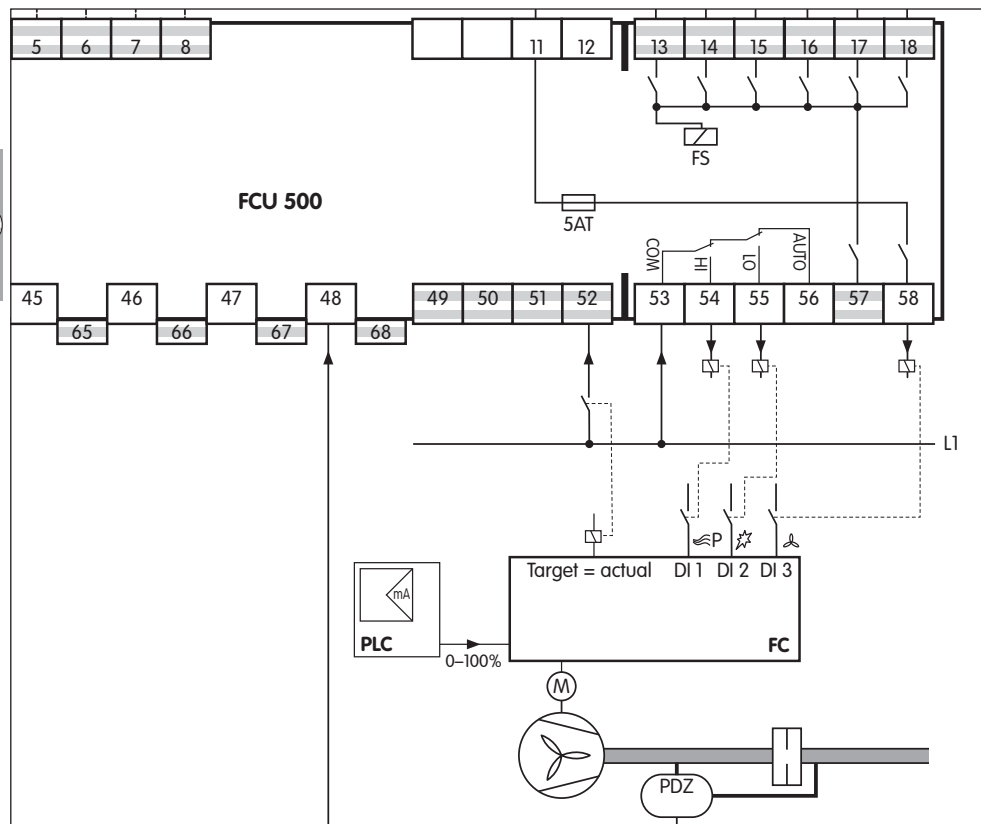


Continuous control via analogue input



Frequency converter connected to FCU..F2

- ▷ Parameter 40 = 4.
- ▷ Continuous control via speed-controlled fan.



Adjustment

In certain cases, it may be necessary to change the parameters set at the factory. Using the separate software package BCSoft and a PC opto-adapter, it is possible to modify parameters on the FCU, such as the pre-purge time or the behaviour in the event of a flame failure.

- ▷ The software package and the opto-adapter are available as accessories.
- ▷ Changed parameters are saved on the integrated parameter chip card.
- ▷ The factory settings are secured with a programmable password.
- ▷ If the password has been changed, the end customer can look up the changed password in the plant documentation or ask the system supplier.

Commissioning

- ▷ During operation, the 7-segment display shows the program status:

--	Device Off
00	Start-up position/standby
H0	Switch-on delay/min. pause time
H1	Waiting for purge signal from furnace FCU
H2	Waiting for start enable
Rc	Approaching minimum capacity
d0	"No flow" state check on fan
01	Fan run-up time t_{GV}
Ra	Approaching maximum capacity
d1	Low air pressure protection check
P1	Pre-purge
R1	Approaching ignition capacity
Ec	Valve check
H7	Controller enable switch-on delay
H8	Waiting for burner operating signal
08	Operation/controller enable
P9	Post-purge
C1	Controlled air flow
U1	Remote control (with OCU)
47	Data transfer (programming mode)
XX	High temperature mode
00	(blinking dots) Manual mode

WARNING

Risk of explosion! Check the system for tightness before commissioning.

Do not start the FCU until you are certain that the wiring is correct, the parameters have been set correctly and all input and output signals are being processed perfectly by means of conducting a function check and reading the parameters on the device.

- 1** Switch on the system.
 - ▷ The display indicates --.
- 2** Switch on the FCU by pressing the On/Off button.
 - ▷ The display indicates 00.
 - ▷ If the display blinks (fault), reset the FCU by pressing the Reset/Information button.
- 3** Apply the start-up signal to terminal 1.
 - ▷ The display indicates H0. The safety interlocks are checked during the switch-on delay time/min. pause time.
 - ▷ The display indicates 01. The fan starts.
 - ▷ The display indicates d1. The low air pressure protection check starts.
 - ▷ The display indicates P1. Pre-purge starts.
 - ▷ FCU..C1: the valve check runs in parallel to pre-purge. If the valve check lasts longer than pre-purge, the display indicates Ec.

- ▷ The display indicates **H7**. After pre-purge (and the end of the valve check on FCU..C1), the valves in the gas inlet section are opened.
- ▷ The display indicates **00**. The FCU issues the enable signal to the burner control units to start the burners.

High temperature operation

The FCU..H1 is fitted with an integrated temperature module for high temperature operation. As soon as the FCU has received the signal from the connected double thermocouples that the temperature defined in parameter 24 has been reached, a signal is sent to the high temperature inputs of the burner control units by the output at terminal 18. If voltage is applied to the high temperature inputs, the burner flames will no longer be monitored by the burner control units.

WARNING

Risk of explosion! High temperature operation is only permitted if the temperature in the furnace chamber is so high that the gas/air mixture is reliably combusted.

In countries where EN 746/NFPA 86 is applicable, if the furnace wall temperature is greater than or equal to 750°C (1400°F), the flame may be monitored by a fail-safe temperature monitoring device that complies with the standard.

Only if the temperature is greater than or equal to 750°C (1400°F) may voltage be applied to the high temperature inputs of the burner control units. Comply with the local safety regulations.

- ▷ In high temperature mode, the two dots in the display are lit permanently.
- ▷ The flame control system is placed out of operation.
- ▷ Once the furnace temperature falls below the value defined in parameter 24, terminal 18 is isolated from the voltage supply. The burner control units continue operating with flame control, depending on their setting.

Manual mode

- ▷ For adjustment of the furnace system or for fault-finding.
 - ▷ In Manual mode, the FCU operates independently of the status of the inputs for start-up signal (terminal 1), controlled air flow (terminal 2) and remote reset (terminal 3). The function of the controller enable/emergency stop input (terminal 46) is retained.
 - ▷ Manual mode is terminated by switching off the FCU or in the event of a power failure.
 - ▷ Parameter 67 = 0: Manual mode unlimited in time. The furnace may continue to be operated manually in the event of failure of the control system or the bus.
 - ▷ Parameter 67 = 1: The FCU will terminate Manual mode 5 minutes after the last time the Reset/Information button is pressed. It switches to the start-up position/standby (display **00**).
- 1 Switch on the FCU while holding the Reset/Information button. Hold the Reset/Information button until the two dots in the display start to blink.
 - ▷ If the Reset/Information button is pressed, the current step in Manual mode is shown. After the button has been held for 1 second, the next step will be shown. The FCU now executes its program sequence until the display indicates **00**.

FCU..F1 with IC 20

- ▷ Following controller enable (display **00**), actuator IC 20 can be opened and closed as required.
- 2 Press the Reset/Information button.
 - ▷ If the button continues to be held down, the actuator opens further until maximum capacity has been reached.
 - ▷ The display indicates **R1** with blinking dots.
 - ▷ Once the button has been released, the butterfly valve stops in the relevant position.
 - 3 Press the Reset/Information button again.
 - ▷ If the button continues to be held down, the actuator closes further until minimum capacity has been reached.
 - ▷ The display indicates **R2** with blinking dots.
 - ▷ A change of direction takes place each time the button is released and pressed again. When the butterfly valve has reached its final position, the dots disappear.

FCU 500..F1 with IC 40, FCU 500..F2 with RBW or frequency converter

- ▷ Following controller enable (status display **00**), it is possible to approach binary positions between minimum and maximum capacity.

Assistance in the event of malfunction

DANGER

Electric shocks can be fatal! Before working on possible live components, ensure the unit is disconnected from the power supply.

Fault-clearance must only be undertaken by authorized trained personnel.

- ▷ Faults may be cleared only using the measures described below.
- ▷ If the FCU does not respond even though all faults have been remedied: remove the unit and return it to the manufacturer for inspection.
- ▷ Internal device errors can only be acknowledged using the Reset/Information button on the FCU.
- ▷ In the event of a warning, the FCU can continue to be operated via the control inputs.
- ▷ If fault lock-out has been programmed, a fault must be acknowledged using the Reset/Information button.
- ▷ If safety shut-down has been programmed, no fault signal is sent via the fault signalling contact. As soon as the fault no longer exists, the fault message on the display disappears. Acknowledging the fault using the Reset/Information button is not necessary.

Faults

Cause

Remedy

The 7-segment display does not light up.


 Mains voltage is not applied.


- Check the wiring, apply mains voltage (see type label).



The display blinks and indicates .

 Actuation of the remote reset input is faulty.


 Too many remote resets. More than 5 × resets have been conducted within the last 15 minutes, either automatically or manually.

 Consecutive fault caused by a previous fault whose actual cause has not been remedied.


- Pay attention to previous fault messages.
- Remedy cause.
- ▷ The cause will not be remedied by performing a reset every time a fault lock-out occurs.
- Check whether remote reset complies with standards (EN 746 allows resetting only under supervision) and correct if necessary.
- ▷ The FCU may only be reset manually under supervision.
- Press the Reset/Information button on the FCU.



The display blinks and indicates .

 Voltage is applied to the output at terminal 56.

- Check the wiring and ensure that the voltage outputs and inputs have the same polarity and are not reversed.

 The unit has suffered an internal fault in the power module.

- Replace the power module.



The display blinks and indicates .

 Inputs 51 and 52 are activated simultaneously.

- Check input 51.

▷ Input 51 may only be activated if the valve is open.

- Check input 52.


▷ Input 52 may only be activated if the valve is in the ignition position.



The display blinks and indicates .

 Valve IC 20 has been wired incorrectly.


- Check the wiring. Wire the outputs and inputs of connection terminals 52 – 55 as shown in the connection diagram – see page 8 (IC 20 connected to FCU..F1).

 The unit has suffered an internal fault in the power module.

- Replace the power module.




The display blinks and indicates .

 The valve position is not constantly signalled back to the FCU.

- Check the wiring and ensure that the position for max. capacity/ignition capacity/Closed of the butterfly valve is constantly signalled back via terminal 52.



The display blinks and indicates .

 Faulty activation via the bus. Requirements for “Open” and “Close” set simultaneously.

- Ensure that “Open” and “Close” are not activated simultaneously.



? The display blinks and indicates 30.

- ! Abnormal data change in the parameters set for the FCU.
- Reset the parameters to their original values using the BCSofT software.
- Establish the cause of the fault to avoid repeat faults.
- Ensure that the cables have been installed properly – see page 3 (Cable selection).
- If the measures described above do not help, remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates 31.

- ! Abnormal data change in the parameters set for the FCU.
- Reset the parameters to their original values using the BCSofT software.
- Establish the cause of the fault to avoid repeat faults.
- Ensure that the cables have been installed properly – see page 3 (Cable selection).
- If the measures described above do not help, remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates 32.

- ! Supply voltage too low or too high.
- Operate the FCU in the specified mains voltage range (mains voltage +10/-15%, 50/60 Hz).
- ! The unit has suffered an internal fault.
- Remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates 33.

- ! Faulty parameterization.
- Check parameter settings using BCSofT.
- ! The unit has suffered an internal fault.
- Remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates 36.

- ! The unit has suffered an internal fault.



? The display blinks and indicates 37.

- ! Faulty feedback from contactors.
- Check voltage supply to terminal 68 – see page 5 (Safety interlock output in the case of higher power requirement).
- Check the setting of parameter 73.



? The display blinks and indicates 38.

- ! Interruption of signal at the "Fan feedback" input (terminal 44).
- Check voltage supply to terminal 44.
- Check the setting of parameter 31.



? The display blinks and indicates 40.

- ! The gas solenoid valve V1 is leaking.
- Check the gas solenoid valve V1.
- ! The gas pressure switch DGp_u/2 (DGp_u¼) for the tightness test has been set incorrectly.
- Check the inlet pressure.
- Set DGp_u/2 (DGp_u¼) to the correct inlet pressure.
- Check the wiring.
- ! The test pressure between V1 and V2 has not decreased.
- Check the installation.
- ! The test period is too long.
- Change parameter 56 (Measurement time) using BCSofT.
- If the fault cannot be remedied by doing this, remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates 41.

- ! The gas solenoid valve V2 or V3 is leaking.
- Check the gas solenoid valves V2/V3.
- ! The gas pressure switch DGp_u/2 (DGp_u¼) for the tightness test has been set incorrectly.
- Check the inlet pressure.
- Set DGp_u/2 (DGp_u¼) to the correct inlet pressure.
- Check the wiring.
- ! The test period is too long.
- Change parameter 56 (Measurement time) using BCSofT.

- If the fault cannot be remedied by doing this, remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates 42.

- ! Test volume V_{p2} is leaking.
- ! The gas solenoid valve V3, one of the burner-side valves or the pipework is leaking.
- Check the gas solenoid valves and pipework.
- ! The gas pressure switch $DG_{pU}/2$ ($DG_{pU}3/4$) has been set incorrectly.
- Check the inlet pressure.
- Set $DG_{pU}/2$ ($DG_{pU}3/4$) to the correct inlet pressure.
- Check voltage supply to terminal 45 (65).
- ! The set test period $V_{p1} + V_{p2}$ is too long.
- Change the test period using parameter 57.
- If the fault cannot be remedied by doing this, remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates 44.

- ! The FCU could not supply one of the test volumes (V_{p1} or V_{p2}).
- ! The FCU could not reduce the pressure of V_{p1} or V_{p2} .
- Faulty wiring of the activated valves.
- Check valve actuation.
- Faulty wiring of the pressure switches.
- Check voltage supply to terminal 46 (65).



? The display blinks and indicates 45.

- ! Faulty valve actuation.
- ! Reversed valve connection.
- Check the wiring of the valves.



? The display blinks and indicates 50.

- ! Interruption of signal at the "Enable/Emergency stop" input (terminal 46).
- Check voltage supply to terminal 46.
- Check the setting of parameter 10.



? The display blinks and indicates 51.

- ! Short-circuit on one of the outputs of the safety circuit.
- Check the wiring.
- Check fine-wire fuse F1 (3.15 A, slow-acting, H).
- ▷ The fine-wire fuse can be replaced once the power module has been removed, see also page 20 (Replacing the fuse)
- Then check the faultless processing of all input and output signals.
- ! The unit has suffered an internal fault in the power module.
- Replace the power module.



? The display blinks and indicates 52.

- ! The FCU is being permanently reset.
- Check voltage supply to terminal 3.
- Apply voltage to terminal 3 only for reset, approx. 1 second.



? The display blinks and indicates 60.

- ! The safety temperature limiter (STL) has detected an overtemperature condition.
- Check the temperature control.
- Check the wiring of terminals 5, 6, 7 and 8.
- ! The double thermocouple is defective.
- Replace the double thermocouple.
- If the fault cannot be remedied by doing this, remove the FCU and return it to the manufacturer for inspection.



? The display blinks and indicates 62.

- ! A cable discontinuity has been detected in the thermocouple at terminals 5 and 6.
- Check the wiring of terminals 5 and 6.
- Replace the double thermocouple.
- If the fault cannot be remedied by doing this, remove the FCU and return it to the manufacturer for inspection.



? The display blinks and indicates 63.

- ! A cable discontinuity has been detected in the thermocouple at terminals 7 and 8.

- Check the wiring of terminals 7 and 8.
- Replace the double thermocouple.
- If the fault cannot be remedied by doing this, remove the FCU and return it to the manufacturer for inspection.



? The display blinks and indicates 64.

- ! A malfunction (sensor short-circuit) has been detected in the thermocouple at terminals 5 and 6.
- Check the wiring of terminals 5 and 6.
- Replace the double thermocouple.
- If the fault cannot be remedied by doing this, remove the FCU and return it to the manufacturer for inspection.



? The display blinks and indicates 65.

- ! A malfunction (sensor short-circuit) has been detected in the thermocouple at terminals 7 and 8.
- Check the wiring of terminals 7 and 8.
- Replace the double thermocouple.
- If the fault cannot be remedied by doing this, remove the FCU and return it to the manufacturer for inspection.



? The display blinks and indicates 66.

- ! Limit value of the temperature difference set via Parameter 23 between the thermocouples at terminals 5 and 6, and terminals 7 and 8 has been exceeded.
- Check parameter 23 and adjust correctly.
- Replace the double thermocouple.
- If the fault cannot be remedied by doing this, remove the FCU and return it to the manufacturer for inspection.



? The display blinks and indicates 67.

- ! The thermocouples are being operated outside of the allowed temperature range.
- Use type K NiCr-Ni, type N NiCrSi-NiSi or type S Pt10Rh-Pt Class 1 double thermocouples:

Thermocouple	Temperature range (°C)
Typ K NiCr-Ni	-40 to 1000
Typ N NiCrSi-NiSi	-40 to 1000
Typ S Pt10Rh-Pt	0 to 1600



? The display blinks and indicates 70.

- ! The connected burner control units have not signalled "Operating position reached (burner started)" within the time defined by parameter 47.
- Check voltage supply to "Operating signal" input (terminal 4).
- Check the setting of parameter 47.



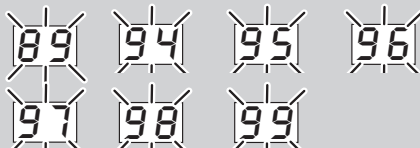
? The display blinks and indicates 72.

- ! The connected burner control units are not ready for operation.
- Check voltage supply to terminal 67.
- Check the setting of parameter 72.



? The display blinks and indicates 90.

- ! Internal error in the temperature module.
- Short-circuit the two connected thermocouples.
- Press the Reset/Information button on the FCU.
- ! If the display continues to blink and indicate 90, the device has suffered an internal error.
- Remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates 89, 94, 95, 96, 97, 98 or 99.

- ! System fault – the FCU has performed a safety shut-down. The cause may be a unit defect or abnormal EMC influence.
- Ensure that the ignition cable has been installed properly – see page 3 (Cable selection).
- Ensure that the EMC regulations for the system are satisfied – particularly for systems with frequency converters – see page 3 (Cable selection).
- Reset the unit.
- Disconnect the protective system control from the mains supply and then switch it on again.
- Check mains voltage and frequency.
- If the measures described above do not help, the unit has probably suffered a hardware defect – remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates d0.

- ! The “no flow” state check of the air pressure switch has failed.
- Check the function of the air pressure switch. Before the fan is switched on, there must be no high signal at the input for air monitoring (terminal 47) when air monitoring is activated.



? The display blinks and indicates d1.

- ! The operating check of the air pressure switch has failed. The air monitor, depending on the parameter setting for input 47 or 48 (P15 and P35), has not switched after fan start-up.
- Check the air monitor wiring.
- Check the air pressure switch setpoint.
- Check the function of the fan.



? The display blinks and indicates dP.

- ! The input signal (terminal 48) from the air pressure switch has dropped out during pre-purge.
- Check the air supply during the purging process.
- Check the electrical wiring of the air pressure switch.
- Check voltage supply to terminal 48.
- Check the air pressure switch setpoint.



? The display blinks and indicates dX.

- ! The input signal from the air pressure switch has dropped out during start-up/operation at position step X.
- ! Failure of the air supply at position step X.
- Check the air supply.
- Check the air pressure switch setpoint.



? The display blinks and indicates oX.

- ! The signal for monitoring the max. gas pressure (terminal 50) has dropped out at position step X.
- Check the wiring.
- Check the gas pressure.



? The display blinks and indicates uX.

- ! The signal for monitoring the min. gas pressure (terminal 49) has dropped out at position step X.
- Check the wiring.
- Check the gas pressure.



? The display blinks and indicates Ac.

- ! No “Closed” signal from actuator.
- Check the butterfly valve for air and the function of the limit switches in the actuator.
- Check the wiring.
- Check the actuator.
- If the fault cannot be remedied by doing this, remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates Ao.

- ! No “Open” signal from actuator.
- Check the butterfly valve for air and the function of the limit switches in the actuator.
- Check the wiring.
- Check the actuator.
- If the fault cannot be remedied by doing this, remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates A.

- ! No “Ignition position” signal from actuator.
- Check the butterfly valve for air and the function of the limit switches in the actuator.
- Check the wiring.
- Check the actuator.
- If the fault cannot be remedied by doing this, remove the unit and return it to the manufacturer for inspection.



? The display blinks and indicates bE.

- ! Internal communication with bus module has suffered a fault.
- Connected control elements must be equipped with protective circuits in accordance with the manufacturer's instructions.

- ▷ This prevents high voltage peaks which can cause malfunctioning of the FCU.
- Use suppressed terminal boots (1 kΩ).
- If the fault cannot be remedied by doing this, remove the unit and return it to the manufacturer for inspection.
- ! The bus module is defective.
- Replace the bus module.



? **The display blinks and indicates** n1.

- ! Incorrect or defective parameter chip card (PCC).
- Only the parameter chip card provided is to be used.
- Replace defective parameter chip card.



? **The display blinks and indicates** c1.

- ! No input signal from the proof of closure switch during standby.
- Check the wiring.
- ▷ Mains voltage must be supplied to the FCU if the valve is closed and no voltage is to be applied if the valve is open.
- Check that the proof of closure switch and valve function perfectly, replace defective valves.



? **The display blinks and indicates** c8.

- ! The FCU is receiving no information as to whether the POC switch contact is still open.
- Check the wiring.
- During start-up, mains voltage must be supplied to the FCU if the valve is closed and no voltage is to be applied if the valve is open.
- Check that the proof of closure switch and valve function perfectly, replace defective valves.



? **The display blinks and indicates** n0.

- ! BCU waiting for connection to PLC.
- Check whether the PLC is switched on.
- Check the network wiring.
- Check the PLC programming.
- Check whether the correct device name and IP address for the FCU have been entered in the PLC program.



? **The display blinks and indicates** n1.

- ! An invalid address has been set on the bus module.
- Adapt the bus module's address with the code switches to the address allocated in the PLC program.
- Check whether the bus module's address is in the permitted address range (001 to FEF).



? **The display blinks and indicates** n2.

- ! The bus module has received an incorrect configuration from the PLC.
- Check whether the correct GSD file was imported into the PLC.



? **The display blinks and indicates** n3.

- ! The device name for the FCU is invalid in the PLC program.
- ▷ Device name on delivery:
not-assigned-fcu-500-xxx
(xxx = code switch setting on the FCU).
- ▷ The device name must at least consist of the expression **fcu-500-xxx**.
- Check whether the code switch setting is identical to the entry (xxx) in the PLC program.
- Delete the expression "**not-assigned-**" in the PLC program or replace it with an individual name part (e.g. Furnacezone1-).



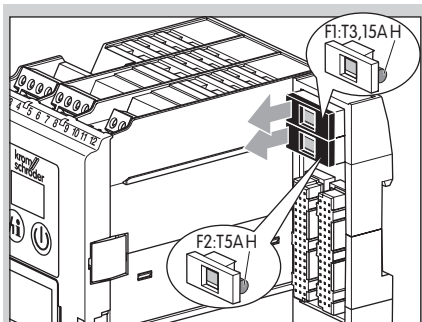
? **The display blinks and indicates** n4.

- ! The PLC is set to Stop.
- Start the PLC.

Replacing the fuse

- ▷ The device fuses F1 and F2 can be removed for inspection.
- 1** Disconnect the system from the electrical power supply.
- 2** Disconnect the connection terminals from the FCU.
- ▷ The connection cables may remain screwed to the connection terminals.
- 3** Disconnect the power module, see page 5 (Safety interlock output in the case of higher power requirement).

- 4 Remove the fuse holder (with fine-wire fuse F1 or F2).



- 5 Check fine-wire fuse F1 or F2 for correct functioning.
- 6 Replace the fine-wire fuse if defective.
 - ▷ When replacing the fuse, use only the approved fuse type (F1: 3.15 A, slow-acting, H; F2: 5 A, slow-acting, H; pursuant to ICE 60127-2/5).
 - First reconnect the power module, then reconnect the connection terminals and restart the system/FCU, see also page 13 (Commissioning).

Parameters and values

Scanning the parameters

- Press the Reset/Information button for 2 s. The display changes to parameter **10**.
- Release the button. The display stops at this parameter and indicates the related value.
- Press the button again for 2 s. The display changes to the next parameter. All parameters can be recalled one after the other in this way.
 - ▷ If the button is pressed only briefly, the display indicates what parameter is currently being displayed.
 - ▷ The normal program status is displayed again approx. 60 seconds after the last time the button is pressed.

Parameter values

- ▷ For all FCU 500 unit variants

Parameter	Name Values
	Emergency stop
10	0 = Off 1 = With safety shut-down 2 = With fault lock-out
	High gas pressure protection
12	0 = Off 1 = With safety shut-down 2 = With fault lock-out
	Low gas pressure protection
13	0 = Off 1 = With safety shut-down 2 = With fault lock-out
	Low air pressure protection
15	0 = Off 1 = With safety shut-down 2 = With fault lock-out
19	Safety time during operation 0; 1; 2 = Time in seconds
29	Fan in the event of fault 0 = Off 1 = On
30	Fan run-up time t_{GV} 0 - 6000 = Time in seconds
31	Fan ready for operation 0 = Off 1 = With safety shut-down 2 = With fault lock-out
32	Air flow monitoring during controlled air flow 0 = Off; maximum capacity 1 = On; maximum capacity 2 = Off; controller enable
34	Pre-purge time t_{PV} 0 - 6000 = Time in seconds
35	Air flow monitoring during pre-purge 0 = Off 1 = With safety shut-down 2 = With fault lock-out
37	Post-purge time t_{PN} 0 - 6000 = Time in seconds

Parameter	Name Values
38	Air flow monitoring during post-purge 0 = On; maximum capacity 1 = Off; maximum capacity 2 = Off; ignition capacity 3 = Off; controller enable
	Controller enable signal delay time t_{RF} 0; 10; 20; 30 - 250 = Time in seconds
	Minimum pause time t_P 0 - 3600 = Time in seconds
62	Switch-on delay time t_E 0 - 250 = Time in seconds
63	Operating time in Manual mode 0 = Unlimited 1 = 5 minutes
69	Function of terminal 51 0 = Off 1 = IC 40/RBW max. capacity feedback 2 = AND with emergency stop (trm. 46) 3 = AND with air min. (trm. 47) 4 = AND with air flow monitoring (trm. 48) 5 = AND with gas min. (trm. 49) 6 = AND with gas max. (trm. 50)
	Function of terminal 65 0 = Off 1 = Reduced DG test duration 2 = AND with emergency stop (trm. 46) 3 = AND with air min. (trm. 47) 4 = AND with air flow monitoring (trm. 48) 5 = AND with gas min. (trm. 49) 6 = AND with gas max. (trm. 50)
	Function of terminal 66 0 = Off 1 = FCU as zone control unit 2 = External HT signal
	3 = AND with emergency stop (trm. 46) 4 = AND with air min. (trm. 47) 5 = AND with air flow monitoring (trm. 48) 6 = AND with gas min. (trm. 49) 7 = AND with gas max. (trm. 50)
	Function of terminal 67 0 = Off 1 = BCU ready; safety shut-down 2 = BCU ready; fault lock-out 3 = AND with emergency stop (trm. 46) 4 = AND with air min. (trm. 47) 5 = AND with air flow monitoring (trm. 48) 6 = AND with gas min. (trm. 49) 7 = AND with gas max. (trm. 50)
	Function of terminal 68 0 = Off 1 = Contactor feedback 2 = AND with emergency stop (trm. 46) 3 = AND with air min. (trm. 47) 4 = AND with air flow monitoring (trm. 48) 5 = AND with gas min. (trm. 49) 6 = AND with gas max. (trm. 50)
73	Function of terminal 67 0 = Off 1 = BCU ready; safety shut-down 2 = BCU ready; fault lock-out 3 = AND with emergency stop (trm. 46) 4 = AND with air min. (trm. 47) 5 = AND with air flow monitoring (trm. 48) 6 = AND with gas min. (trm. 49) 7 = AND with gas max. (trm. 50)
77	Password 0000 - 9999

▷ Additional parameters for FCU..H1

Parameter	Name Values
20	Temperature monitoring mode 0 = Off 1 = STM function (high temperature operation) 2 = STL function 3 = STM and STL functions
	Thermocouple 1 = Type K 2 = Type N 3 = Type S
	Temperature difference limit value 10 - 100 = Temperature in °C
24	STM limit value (high temperature operation) 650 - 1200 (temperature in °C)
25	STL/FSTL limit value (system protection) 200 - 1600 (temperature in °C)
26	Temperature hysteresis 10 - 100 = Temperature in °C
27	Pre-purge in high temperature operation 0 = Off 1 = On

▷ Additional parameters for FCU..F1

Parameter	Name Values
40	Capacity control 0 = Off 1 = IC 20 2 = IC 40
	Running time 0 - 250 = Time in seconds
	Minimum enable time 0 - 250 = Time in seconds
45	Burner operating signal 0 = Off 1 = On; controller enable
47	Controller enable time limit 0 - 60 = Time in minutes

▷ Additional parameters for FCU..F2

Parameter	Name Values
40	Capacity control 0 = Off 3 = RBW 4 = Frequency converter
	RBW running time selection 0 = Off; position check 1 = On; for min./max. capacity 2 = On; for max. capacity 3 = On; for min. capacity
	RBW running time 0 - 250 = Running time in seconds, if parameter 41 = 1, 2 or 3
41	Minimum enable time 0 - 250 = Time in seconds
45	Burner operating signal 0 = Off 1 = On; controller enable

▷ Additional parameters for FCU..C1

Parameter	Name Values
51	Valve proving system 0 = Off 1 = Tightness test before start-up 2 = Tightness test after shut-down 3 = Tightness test before start-up & after shut-down 4 = POC function
	Tightness control test volume 1 = V_{p1} 2 = V_{p1} ; pressure reduction via V3 3 = $V_{p1} + V_{p2}$; pressure reduction via V3 4 = $V_{p1} + V_{p3}$; pressure reduction via V3 5 = $V_{p1} + V_{p2} + V_{p3}$; pressure reduction via V3
	Pressure reduction of V_{p2} 0 = In standby 1 = Upon start-up
	Relief valve V3 opening time t_{L3} 0 - 6000 = Venting time before V_{p1} test in seconds
	Measurement time for V_{p1} 3 = Time in seconds 5 - 25 = (in 5 s steps) 30 - 3600 = (in 10 s steps)
56	Measurement time $V_{p1} + V_{p2}$ 3 = Time in seconds 5 - 25 = (in 5 s steps) 30 - 3600 = (in 10 s steps)
	Valve opening time 1 t_{L1} 2 - 25 = Time for filling or pressure reduction in seconds
59	Valve opening time 2 t_{L2} 2 - 25 = Time for filling or pressure reduction in seconds
	Filling time before start-up 0 - 25 = Time in seconds

▷ Additional parameters for FCU with BCM 500

Parameter	Name Values
75	Capacity control (bus) 0 = Off 1 = MIN to MAX; STBY = MIN 2 = MIN to MAX; STBY = CLOSED 3 = IGNITION to MAX; STBY = CLOSED 4 = MIN to MAX; STBY = MIN; quick start 5 = IGNITION to MAX; STBY = MIN; quick start
	Bus communication 0 = Off 1 = On; with address check 2 = On; no address check

Legend

	Ready for operation
	Safety interlocks (limits)
	High temperature operation
LDS	Safety limits during start-up
	Gas valve
	Air valve
	Air/gas ratio control valve
	Burner
	Purge
	Controlled air flow
	Burner operating signal
	FCU start-up signal
	Emergency stop
	Pressure switch for tightness control (TC)
	Pressure switch for maximum pressure
	Pressure switch for minimum pressure
	Differential pressure switch
	Input signal depending on parameter xx
	Control element with butterfly valve
TC	Tightness control
$p_U/2$	Half of the inlet pressure
$p_U/4$	A quarter of the inlet pressure
$3p_U/4$	Three-quarters of the inlet pressure
p_d	Outlet pressure
	Valve with proof of closure switch
	Input/Output, safety circuit
	24 V DC input and output

Technical data

Ambient conditions

Avoid direct sunlight or radiation from red-hot surfaces on the unit.
Avoid corrosive influences, e.g. salty ambient air or SO₂.
The unit may only be stored/installed in enclosed rooms/buildings.
This unit is not suitable for cleaning with a high-pressure cleaner and/or cleaning products.
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).
Permitted operating altitude: < 2000 m AMSL.

Mechanical data

Weight: 0.7 kg.
Dimensions (W x H x D): 102 x 115 x 112 mm.
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, 12 A.
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

Mains voltage:
FCU..Q: 120 V AC, -15/+10%, 50/60 Hz, ± 5%,
FCU..W: 230 V AC, -15/+10%, 50/60 Hz, ± 5%.
Power consumption:
at 230 V AC approx. 6 W/11 VA, plus approx.
0.15 W/0.4 VA per AC input,
at 120 V AC approx. 3 W/5.5 VA, plus approx.
0.08 W/0.2 VA per AC input.
Contact rating:
control outputs LDS (terminal 16), purge (terminal 17), HT (terminal 18), safety interlocks (terminal 57): max. 0.5 A, cos φ = 1,
gas valves V1 (terminal 13), V2 (terminal 14), V3 (terminal 15): max. 1 A, cos φ = 1,
air valve (terminals 53, 54 and 55): max. 50 mA, cos φ = 1.
The total current for the simultaneous activation of outputs V1, V2, V3, HT, purge, LDS, safety interlocks and air valve must not exceed 2.5 A.
24 V DC signal for fault/operation: max. 0.1 A,
fan: max. 3 A (start-up current: 6 A < 1 s).

Number of operating cycles:
FCU:
24 V DC signal for fault/operation:
max. 10,000,000,
On/Off button, Reset/Information button:
1000,
power module:
control outputs LDS (terminal 16), purge (terminal 17), HT (terminal 18), safety interlocks (terminal 57),
gas valves V1 (terminal 13), V2 (terminal 14), V3 (terminal 15),
air valve (terminals 53, 54 and 55),
fan (terminal 58):
max. 250,000.
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

Inherent current:

Signal "1"	typ. < 2 mA
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Rated value	24 V DC
Signal "1"	24 V, ± 10%
Signal "0"	< 1 V

Inherent current:

Signal "1"	typ. 5 mA
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Fuses, replaceable, F1: T 3.15A H,
F2: T 5A H, pursuant to IEC 60127-2/5.

Designed lifetime

This information on the designed lifetime is based on using the product in accordance with these operating instructions. Once the designed lifetime has been reached, safety-relevant products must be replaced. Designed lifetime (based on date of manufacture): 10 years.

You can find further explanations in the applicable rules and regulations and on the afecor website (www.afecor.org).

This procedure applies to heating systems. For thermoprocessing equipment, observe local regulations.

Logistics

Transport

Protect the unit from external forces (blows, shocks, vibration).
Transport temperature: -20 to +60°C (-4 to +140°F).
Transport is subject to the ambient conditions described.
Report any transport damage on the unit or packaging without delay.
Check that the delivery is complete, see page 2 (Part designations).

Storage

Storage temperature: -20 to +60°C (-4 to +140°F).
Storage is subject to the ambient conditions described.

Storage time: 6 months before using for the first time. If stored for longer than this, the overall service life will be reduced by the corresponding amount of extra storage time.

Accessories

BCSoft

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

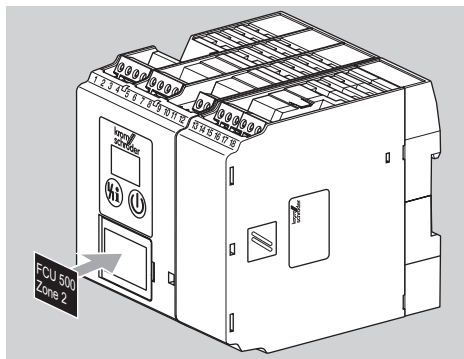
Opto-adapter PCO 200

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

Bluetooth adapter PCO 300

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

Stickers for labelling

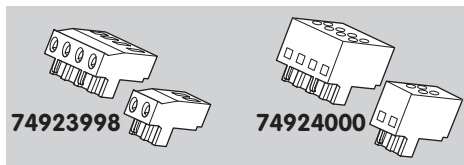


For printing with laser printers, plotters or engraving machines, 27 × 18 mm or 28 × 17.5 mm.

Colour: silver.

Connection plug set

For wiring the FCU.



Plug-in, with screw terminal,
Order No.: 74923998.

Plug-in, with spring force terminal, 2 connection options per terminal,
Order No.: 74924000.

Certification

Declaration of conformity



We, the manufacturer, hereby declare that the products FCU 500 and FCU 505 comply with the requirements of the listed Directives and Standards.

Directives:

- 2014/30/EU – EMC
- 2014/35/EU – LVD
- 2011/65/EU – RoHS II
- 2015/863/EU – RoHS III

Regulation:

- (EU) 2016/426 – GAR

Standards:

- EN 13611:2007+A2:2011
- EN 1643:2014
- EN 61508:2010, suitable for SIL 3

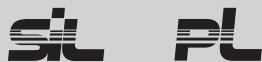
The relevant product corresponds to the tested type sample.

The production is subject to the surveillance procedure pursuant to Regulation (EU) 2016/426 Annex III paragraph 3.

Elster GmbH

Scan of the Declaration of conformity (D, GB) – see www.docuthek.com

SIL, PL



For systems up to SIL 3 pursuant to EN 61508.
Pursuant to EN ISO 13849-1, Table 4, the FCU can be used up to PL e.

FM approved



Factory Mutual (FM) Research Class:
7610 "Combustion Safeguards and Flame Sensing Systems"
Designed for applications pursuant to NFPA 86.

ANSI/CSA approved



Canadian Standards Association – ANSI Z21.20 and CSA 22.2

Eurasian Customs Union



The products FCU 500 meet the technical specifications of the Eurasian Customs Union.

REACH Regulation

The device contains substances of very high concern which are listed in the Candidate List of the European REACH Regulation No. 1907/2006. See Reach list HTS at www.docuthek.com.

Directive on the restriction of the use of hazardous substances (RoHS) in China

Scan of the Disclosure Table China RoHS2 – see certificates at www.docuthek.com

Disposal

Devices with electronic components:

WEEE Directive 2012/19/EU – Waste Electrical and Electronic Equipment Directive



At the end of the product life (number of operating cycles reached), dispose of the packaging and product in a corresponding recycling centre. Do not dispose of the unit with the usual domestic refuse. Do not burn the product. On request, old units may be returned carriage paid to the manufacturer in accordance with the relevant waste legislation requirements.

Contact

If you have any technical questions, please contact your local branch office/agent. The addresses are available on the Internet or from Elster GmbH.

We reserve the right to make technical modifications in the interests of progress.

Honeywell

**krom/
schroder**

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