

Oil Burner Safety Control DKO 996-N

For 2-stage oil burners with post-purge and intermittent operation

Flame detection:

- Photoresistor MZ 770 S
- Infrared-flicker detector IRD 1010



INTRODUCTION

The DKO 996-N oil burner safety control boxes are suitable for oil burners with post-purge. They are approved and certified according to the applicable European standards and regulations. The microprocessor-based programming sequence ensures extremely stable timings independent of voltage variations, ambient temperature and/or switch-on cycles. The built-in information system not only provides a continuous monitoring of the actual state of the box (very helpful especially for monitoring the start-up phase) but also informs about the possible cause of a lock out. The lock out cause is stored in such a way that it can be retrieved even after a power failure. The control box is designed for maximum safety in case of variations in the voltage supply. If the mains voltage drops below the permitted level, operation is interrupted and the control box automatically prevents the start sequence from being repeated. In this way, the safety of the system is not put at risk by a drop in the mains voltage. This low-voltage protection works not only during start-up but also permanently during operation.

TECHNICAL DATA

Operating voltage	220 / 240 V (-15... +10%) 50-60 Hz (±5%)
Fuse rating	10 A fast, 6 A slow
Power consumption	ca. 12 VA
Max. load per output	
term. 3 ignition trafo	1.0 A, cos φ 0.2
term. 4 motor	2.0 A, cos φ 0.4
term. 5 + 6 solenoid valves	0.5 A, cos φ 0.4
term. 7 alarm indicator	0.5 A, cos φ 0.4
total load	4.0 A, cos φ 0.4
	max. 16 A during 0.5 sec
Reset time from lock out	none

CONSTRUCTIONAL FEATURES

The control box circuitry is protected by a flame resistant, transparent plug-in type plastic housing. A central fixing screw locks the control box to the wiring base. The plug-in control box incorporates the microprocessor based timer, flame check and reset circuits. Manual reset from lock out and set to lock out is provided by a push button with an integrated LED information system. The wiring base S98 is equipped with spare- and extra terminals and allows, together with a variety of cable entry points, utmost flexibility of electrical wiring.

Dxx-N is the EN 298:2012 replacement of the Dxx.

Re-cycling (repetition) after a loss-of-flame during operation

Flame detectors	< 2 m length of cable
MZ 770 S	side-on and end-on viewing
Light sensitivity	better 6 Lux
IRD 1010.1	side-on or end-on viewing
Weight incl. Wiring base	190 g
Mounting position	any
Protection class	IP 40
Approved ambient parameter	
for control and flame detector	
-for operation	max. 95% at 30 ° C
-for storage	-20° C.....+60 ° C
Build-up of ice, penetration of	-20° C... +80 ° C
water and condensing water are	inadmissible
Approvals according to	EN 298:2012
European standard	Conformity to
	ECC DR –EMC:
	2014/30/EU
	-LVD 2014/35/EU

Table of timings (sec.)

Model	Pre-purge and ignition time pretv1	Stray light monitoring tf	Safety time ts	Post+ignition time after V1 tn	Delay time V2 tv2	Post-purge time tnb
05	15	5	5	7	20	30
21	15	5	5	10	20	90
22	5	5	5	7	20	30
23	5	5	5	10	20	90

APPLICATION FEATURES

1. Information system

The information system is microprocessor based and reports on all aspects of burner control box operation and flame supervision. It informs continuously about the actual programming sequence the unit is performing. Besides monitoring the programming sequence, it also identifies errors during start-up of operation without any additional testing devices. The automatically performed diagnoses is a valuable tool which facilitates service/maintenance work and therefore saves costs. The analysis of the error cause can be done directly on stage or if not possible afterwards as the lock out reason is stored in a non-volatile lock out mode memory. The information system communicates with the outside world using a LED (the used Flash-Code is similar to the Morse-Code). The messages are optically transmitted by flashing a LED appropriately. Using an (optional) additional terminal, the messages can be recorded and displayed in easy readable form.

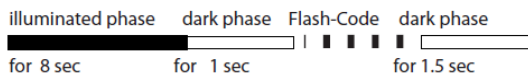
1.1 Programming sequence display

The built-in microprocessor controls not only the programming sequence but the information system as well. The individual phases of the programming sequence are displayed as Flash-Code. The following messages can be distinguished:

1.2 Lock-out diagnoses

In case of a failure the LED is permanently illuminated. Every 10 seconds the illumination is interrupted by a flash code, which indicates the cause of the error. Therefore the following sequence is performed which is repeated as long as the unit is not reset.

Sequence:



2. Flame control

The following detectors can be used for flame supervision:

- for yellow oil flame: photoresistor MZ 770 S (side-on and end-on viewing)
- for blue or yellow flame: infrared-flicker detector type IRD 1010.1

Generally, the no flame signal is generated at light levels below 3 Lux with respect to the operating cycle of the control. According to EN 298:2012 stray light safety level has to be established in conjunction with the accompanying burner. Connecting the IRD 1010.1 the correct wiring has to be observed.

2.1 Stray light monitoring

The stray light check is performed at the end of the pre-purge time for the duration as mentioned in the table of timings.

2.2 Post-purge

The post-purge takes place if the control thermostat opens.

3. Blinkcode Dxx-N

Normal Operation

•—	Idle state, no heat demand
•— —	Power supply not ok (frequency or voltage)
••	Waiting for FT-on
•••	Burner is starting
•	Burner in operation (from end of safety time)
•• — —	Burner is stopping (e.g. in post-purge)

Code is sent every 5 s; in between the LED is off

Burner lock-out

— •	False flame
• —	No flame at the end of the safety time
•• —	Flame failure in operation
•• — —	Oil pre-heater release temperature couldn't be reached (FT didn't close)
— — ••	Oil temperature below threshold during supervised phase (FT opened)
— — — —	Manual lock-out

Code is sent every 10 s; in between the LED is always on

Special Codes (lock-out)

X X X X X X	Other 6-pulse code indicates system lock-out (internal failure)
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Code is sent every 10 s; in between the LED is always on

Legend: flashlight signal: — long (½ s) • short (0.1 s)
 RT: heat demand
 FT: pre-heater release thermostat
 LW: air proving switch
 LK: air damper

4. Burner control

DKO 996-N with oil preheater The fuel heater of the burner has to have a temperature control switch. The closing contact-switch of the heater has to be connected between terminals 4 and 6. A special contact in the control unit connects the thermo-switch of the heater as soon as the burner is operating and a photocurrent is generated. Therefore an interruption of the burner operation due to a decrease in oil temperature is prevented (e.g. in case of high oil flow). According to EN 298:2012 A 2.1, the short circuiting of the thermostat is allowed only for an oil flow of max. 10 kg/h oil. Burners with a higher throughput have to shut down if the oil temperature gets below the allowed minimum. In such a case the thermostat has to be put in the phase-circuit and terminals 4 and 6 have to be connected with a link. The contact of the release thermostat of the oil preheater is monitored. If the contact does not close within the predefined time (400 sec), the programmer goes into lock out mode. Therefore excessive oil temperatures in the preheater over long periods can be prevented avoiding cracking of the oil and subsequent blocking of the preheater or nozzle.

DKO 996-N without oil preheater In such a case the terminals 4 and 6 have to be connected with a link.



Attention

The switch of the release thermostat for the oil preheater must never be linked between 4 and 9 or 6 and 9!

During lockout, the preheater will not be separated from power. This could lead to defective preheater due to burn out its heating winding.

5. Lock out and reset

The unit can be reset or brought into lock out mode in two different ways:

Internal In the lock out case the unit can be reset by pushing the built-in button meaning a new start-up cycle is performed.

External Instead of using the built-in lock out button the same function can be achieved by using an external button which connects terminal 9 with A (see also circuit and block diagram).

If the pushbutton (internal or external) is pressed during normal operation or during the start sequence for more than 100ms and afterwards released, the control box will perform a shutdown.



Please note The unit can only be brought to lockout mode or be reset if power is applied to the unit.

6. Safety

The design and control sequence of the DKO 996-N controls will comply with the currently applicable standards and regulations (see also TECHNICAL DATA). The controller is recycling. This means in case of loss of flame during operation the shut-off valves close immediately and a new start up will be performed.

7. Mounting and electrical wiring

Wiring base:

- 3 earth terminals with additional terminal for burner earthing
- 3 neutral terminals with internal permanent connection to neutral terminal 8
- 2 independent spare terminals (S1 and S2)
- extra terminals A, B and C are standard (wiring base S98 12-pin)
- 2 slide-in plates and 2 easy knock out holes plus 2 knock out holes in the base bottom facilitate the base wiring



Please note

To assist trouble-free operation the main neutral connection terminal 8 in the wiring base must be fully tightened. The terminal screws are already in the undone position. To connect a wire to the terminal, the screw only needs to be fastened.

General: The control box and detector probes should not be subjected to excessive vibration.

INSTALLATION INSTRUCTIONS AND MAINTENANCE

1. Important notes

- The controls must be installed by qualified personnel only. The relevant national regulations have to be observed.
- On commissioning, the wiring has to be carefully checked according the appropriate diagram, incorrect wiring can damage the unit and endanger the safety of the installation.
- The fuse rating has to ensure that the limits specified in TECHNICAL DATA will not be exceeded. If these precautions are not observed, the effect of a short circuit can cause severe damage to the control and installation.
- For safety reasons a minimum of one control shutdown every 24 hours has to be observed.
- Disconnect the power supply before the control box is plugged in or out.
- The control box is a safety device and must not be opened!

2. Function control

For safety reasons the flame detection system should be tested on commissioning the installation as well as after a service or longer shut-down.

- Start-up with covered flame detector
 - After lock out safety time is over the unit has to go into lock out mode!
- Start-up with exposed flame detector
 - After prepurge time the unit has to go into lock out mode!
- Normal start-up with burner in the normal position, cover up the flame detector
 - After start-up, and end of lock out safety time the unit has to go into lock out mode!

3. Fault finding

The built-in information system facilitates the trouble shooting in the case of problems occurring during start-up or during operation. A list of possible lock out messages can be found in APPLICATION FEATURES chapter 1.2.

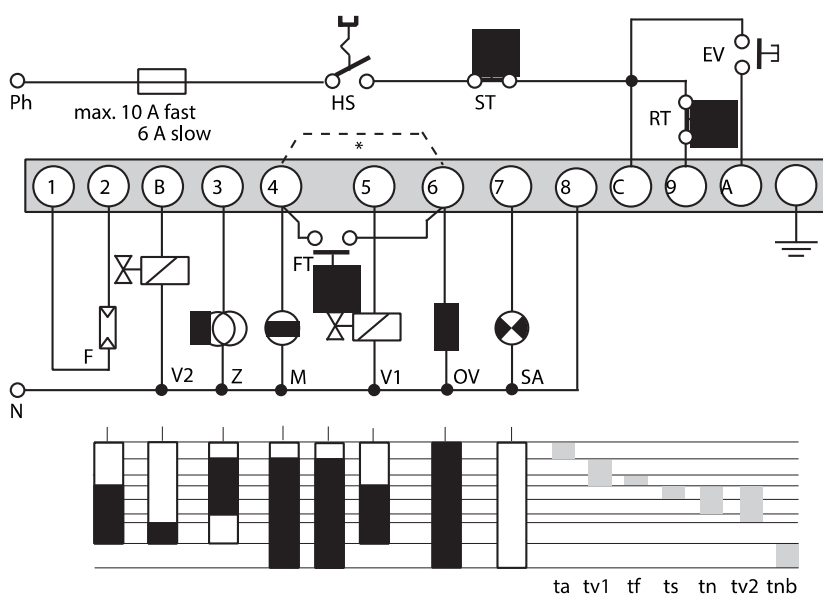


Please note: The control box is locked in lock out mode and the reason for the lock out is displayed until the control box is reset, either by an internal or external reset (see also subject "3. Lock out and reset").

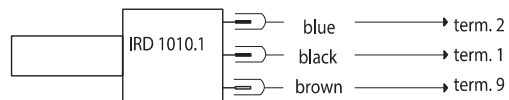
Removing the control box from its wiring base or by interrupting the supply line may **not** reset a lock out (according to EN 298:2012).

Error	Possible fault
Burner not working	- Thermostat circuit open - Faulty electrical wiring - Mains voltage < 187 V - Internal fuse defect - Terminal A continuously on power (e.g. terminal A is used as a support terminal)
Burner starts, flame not established, lock out	- Stray light on flame detector - No ignition or no fuel
Burner starts, flame established, after safety time, lock out	- Dirty or faulty flame detector - Insufficient light on detector - Sensitivity adjustment too low on IRD

CIRCUIT AND TIMING DIAGRAM DKO 996-N



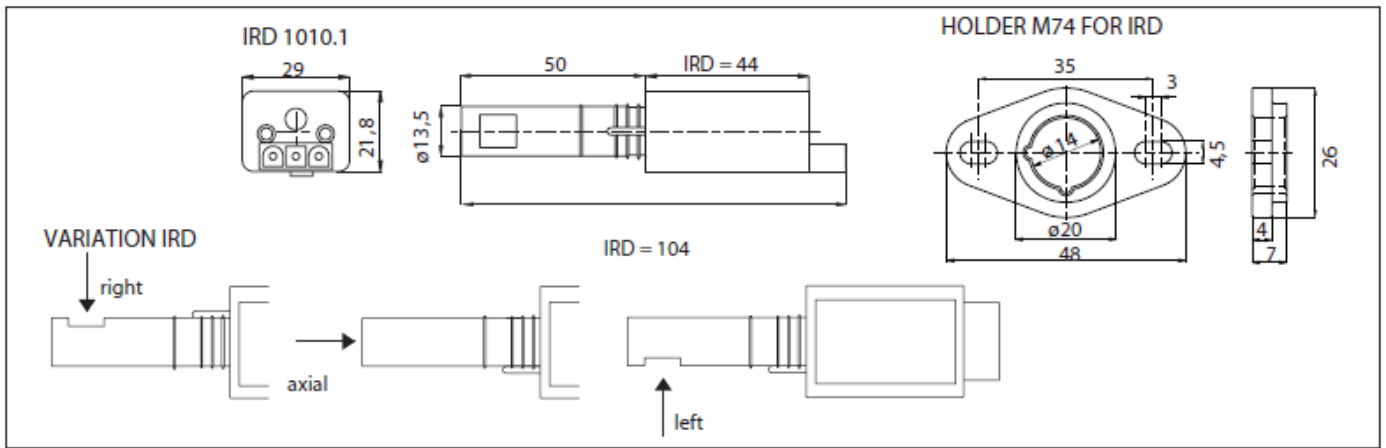
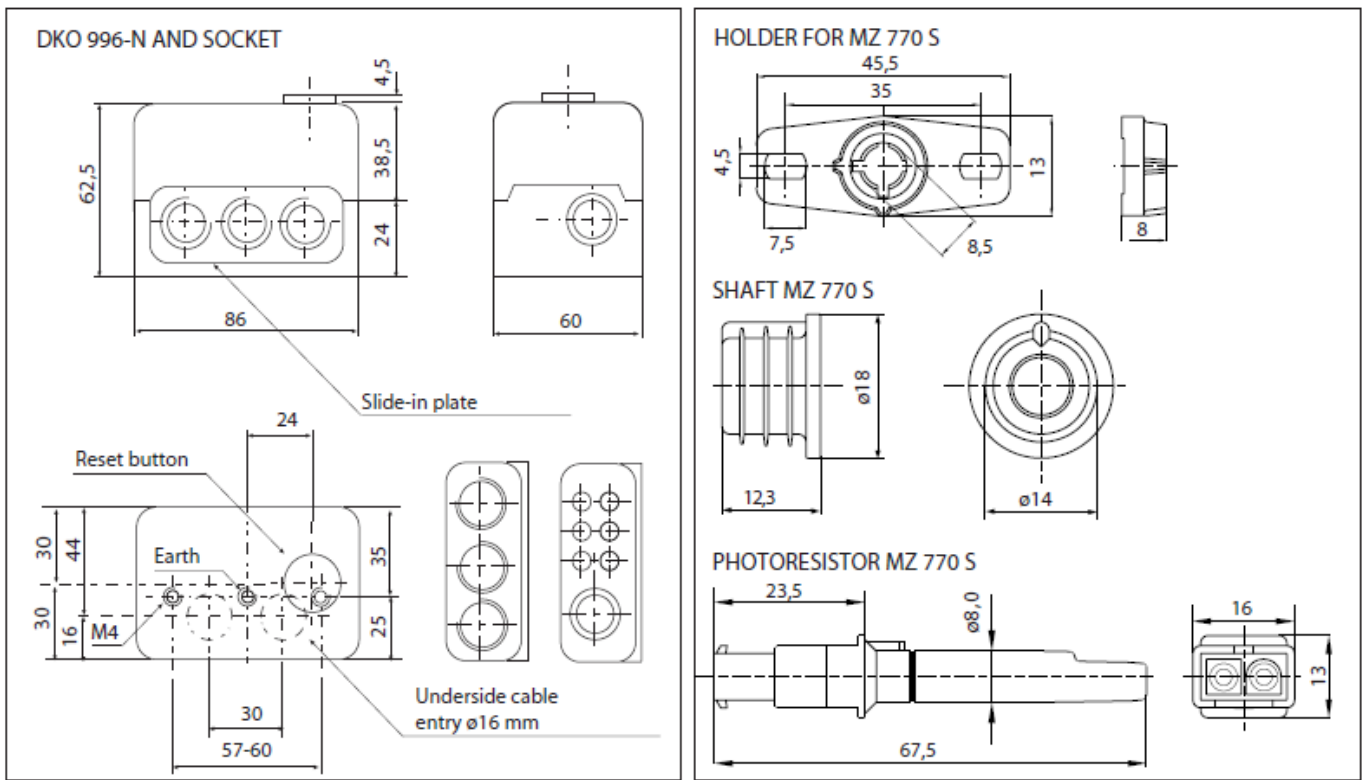
IRD-CONNECTION



- HS Mains switch
- ST Limit thermostat
- RT Control thermostat
- EV External reset and lock out button
- F Flame detector MZ 770 S (IRD 1010 see separate diagram)
- Z Ignition
- M Burner motor
- V1, V2 Solenoid valves
- FT Release thermostat oil preheater
- * With burners without fuel heaters term. 4 and 6 have to be connected with a link
- OV Oil preheater
- SA External lock out signal

- ta Pre-heat-time oil preheater
- tv1 Pre-purge and pre-ignition time
- tf stray light monitoring
- ts Lock out safety time
- tn Post-ignition time
- tv2 Delay time to oil V2
- tnb post-purge

- Models 22 and 23 = post purge can be interrupted by the heat demand (RT)



ORDERING INFORMATION

ITEM	DESIGNATION	ITEM NO.
Control box	DKO 996-N Mod. 05	0419005
Control box	DKO 996-N Mod. 21	0419021
Control box	DKO 996-N Mod. 22	0419022
Control box	DKO 996-N Mod. 23	0419023
Socket	Wiring base S 98 12-pin	75310
Insert plate	PG-Plate	70502
optional	Cable entry plate	70501
Flame detector	MZ 770 S	50001
optional	MZ 770 S with shaft	51001
optional	IRD 1010.1 right	16501
	IRD 1010.1 end-on	16502
	IRD 1010.1 left	16503
Support for flame detector	Holder for MZ 770 S	59101
optional	Holder M 74 for IRD	59074
Connection cable	Plug type, 3 core cable, 0.6 m with tag wire ends	7236001
Connection cable	Plug type, 2 core cable, 0.5 m with tag wire ends	7225001

The above mentioned ordering information refers to the standard version.

Special versions are also included in our product range.

Specifications subject to change without notice.

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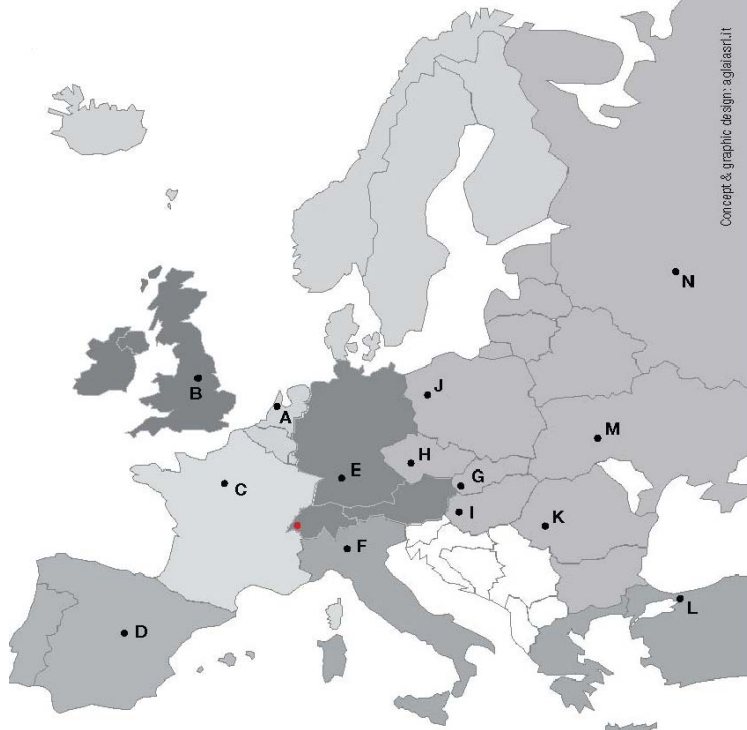
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