



Oil Burner Controls

LMO14...
LMO24...
LMO44...

Microcontroller-based oil burner controls for the startup, supervision and control of forced draft oil burners in intermittent operation. Standard versions with an oil throughput up to 30 kg / h, special versions above 30 kg / h.

The LMO14..., LMO24..., LMO44... and this Data Sheet are intended for use by OEMs which integrate the burner controls in their products.

Use, features

| | |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Use | <p>The LMO... are designed for the startup and supervision of 1- or 2-stage forced draft oil burners in intermittent operation. Yellow-burning flames are supervised with photo resistive detectors QRB..., blue-burning flames with blue-flame detectors QRC...</p> <p>In terms of housing dimensions, electrical connections and flame detectors, the LMO... are identical with the LOA... oil burner controls.</p> |
| General features | <ul style="list-style-type: none"> - Oil burners with fans to EN 267 - Burner controls for use with atomization oil burners of monoblock design to DIN EN 230:2005-10 - LMO44... for use with stationary direct-fired air heaters - Undervoltage detection - Electrical remote reset - Bridging contact for oil preheater - Monitoring of time for oil preheater - Accurate and reproducible control sequence thanks to digital signal handling - Controlled intermittent operation after 24 hours of continuous operation - Limitation of the number of repetitions - Multicolor indication of fault status and operational status messages |

Warning notes



To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

Do not open, interfere with or modify the unit!

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff
- Before making any wiring changes in the connection area, completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard
- Ensure protection against electric shock hazard by providing adequate protection for the burner control's connection terminals. If this is not observed, there is a risk of electric shock
- Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring is in an orderly state and make the safety checks as described in «Commissioning notes». If not observed, there is a risk of impairment of safety functions and of electric shock hazard
- Press the lockout reset button / operation button or the AGK20... lockout reset button extension only manually (applying a force of no more than 10 N) without using any tools or pointed objects. If not observed, there is a risk of impairment of safety functions and of electric shock hazard
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage. If not observed, there is a risk of impairment of safety functions and of electric shock hazard
- When replacing LOA26... or LOA36..., any ARK21... remote lockout reset module or similar modules fitted in the burner or boiler must be removed. If not observed, there is a risk of impairment of safety functions



Mounting notes

- Ensure that the relevant national safety regulations are complied with

Installation notes

- Always run the high-voltage ignition cables separately while observing the greatest possible distances to the unit and to other cables
- Install switches, fuses, earthing, etc., in compliance with local regulations
- Ensure that the maximum permissible amperages will not be exceeded (refer to «Technical data»)
- Do not feed external mains voltage to the control outputs of the unit. When testing the components controlled by the burner control (fuel valves, etc.), the LMO... may never be plugged in
- Do not mix up live and neutral conductors

Electrical connection of the flame detectors

It is important to achieve practically disturbance- and loss-free signal transmission:

- Never run the detector cable together with other cables
 - Line capacitance reduces the magnitude of the flame signal
 - Use a separate cable
- Observe the maximum permissible lengths of the detector cables (refer to «Technical data»)

Commissioning notes

- When commissioning the plant or when doing maintenance work, make the following safety checks:

| | Safety check | Anticipated response |
|----|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| a) | Burner startup with flame detector darkened | Lockout at the end of safety time (TSA) |
| b) | Burner startup with flame detector exposed to extraneous light | Lockout after no more than 40 seconds |
| c) | Burner operation with simulated loss of flame; for that purpose, darken the flame detector during operation and maintain that state | Repetition followed by lockout at the end of safety time (TSA) |

Standards and certificates



Conformity to EEC directives
- Electromagnetic compatibility EMC (immunity)
- Low-voltage directive

2004/108/EC
2006/95/EC



ISO 9001: 2008
Cert. 00739



ISO 14001: 2004
Cert. 38233



| Type | Identification code to EN 230: |
|----------|--------------------------------|
| LMO14... | F M L L X N |
| LMO24... | F M L L X N |
| LMO44... | F M L L X N to WLE |

Service notes

- Use the KF8885 / KF8833 / KF8840 service adapters for short periods of time only

Life cycle

Burner controls has a designed lifetime* of 250,000 burner startup cycles which, under normal operating conditions in heating mode, correspond to approx. 10 years of usage (starting from the production date given on the type field).

This lifetime is based on the endurance tests in the standard EN 230.
A summary of the conditions has been published by the European Control Manufacturers Association (Afecor) (www.afecor.org).

The designed lifetime is based on use of the burner controls according to the manufacturer's Data Sheet. After reaching the designed lifetime in terms of the number of burner startup cycles, or the respective time of usage, the burner control is to be replaced by authorized personnel.

* The designed lifetime is not the warranty time specified in the Terms of Delivery

Disposal notes



The unit contains electrical and electronic components and must not be disposed of together with domestic waste.
Local and currently valid legislation must be observed.

Mechanical design

The housing is made of impact-proof, heat-resistant and flame-retarding plastic. It is of plug-in design and engages audibly in the base. Burner controls LMO... are designed in black plastic.

The housing accommodates the

- microcontroller for the control sequence and the print relays for load control
- electronic flame signal amplifier
- lockout reset button with its integrated multicolor signal lamp (LED) for operational status and fault status messages and the socket for connecting the OCI400 interface or the AGK20... lockout reset button extension

Indication and diagnostics

- Multicolor indication of operational status and fault status messages
- Transmission of operational status and fault status messages and detailed service information via additional OCI400 interface and ACS400 / ACS410 PC software

Type summary

| Type reference | Mains voltage | Fuel valve stages | Burner capacity | ¹⁾ | Remote reset | tw max. | t1 / t1' min. | Times TSA max. | t3 min. | t3n max. | t4 min. | Comparable type of LOA... ⁴⁾ |
|-------------------------------------|---------------|-------------------|-----------------|---------------|--------------|---------|---------------|-------------------|---------|----------|---------|--------------------------------------------------------------------------|
| Standard versions | | | | | | | | | | | | |
| LMO14.111C2 | AC 230 V | 1 | <30 kg/h | • | • | 2.5 s | 15 / 16 s | 10 s | 15 s | 10 s | --- | LOA24.171B27 LOA26.171B27 ²⁾ LOA36.171A27 ²⁾ |
| LMO14.113C2 | AC 230 V | 1 | <30 kg/h | • | • | 2.5 s | 15 / 16 s | 10 s | 15 s | 3 s | --- | LOA24.173A27 ³⁾ |
| LMO24.111C2 | AC 230 V | 2 | <30 kg/h | • | • | 2.5 s | 15 / 16 s | 10 s | 15 s | 10 s | 15 s | LOA24.171B27 LOA26.171B27 ²⁾ LOA36.171A27 ²⁾ |
| LMO24.111C1 | AC 120 V | 2 | <30 kg/h | • | • | 2.5 s | 15 / 16 s | 10 s | 15 s | 10 s | 15 s | LOA24.171B17 |
| LMO24.255C2 | AC 230 V | 2 | </> 30 kg/h | • | • | 2.5 s | 25 / 26 s | 5 s | 25 s | 5 s | 15 s | --- |
| Version for flash-steam generators | | | | | | | | | | | | |
| LMO24.011C2 | AC 230 V | 2 | <30 kg/h | • | • | 2.5 s | 5 / 6 s | 10 s | 5 s | 10 s | 15 s | LOA24.571C27 |
| Suited for direct-fired air heaters | | | | | | | | | | | | |
| LMO44.255C2 | AC 230 V | 2 | </> 30kg/h | • | • | 2.5 s | 25 / 26 s | 5 s | 25 s | 5 s | 5 s | LOA44.252A27 |

Legend

| | |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| TSA | Ignition safety time |
| tw | Waiting time |
| t1 | Prepurge time |
| t1' | Purge time |
| t3 | Preignition time |
| t3n | Postignition time |
| t4 | Interval from flame signal to release of fuel valve 2 (BV2) |
| ¹⁾ | Bridging contact for oil preheater |
| ²⁾ | No actuator (SA) function |
| ³⁾ | In case of replacement, ignition transformer must be rewired from terminal 7 (LOA...) to terminal 6 (LMO...) |
| ⁴⁾ | LMO... can replace LOA..., but the instructions given in the Data Sheet, other technical documentation and the specification must be followed |

Oil burner control (without plug-in base) refer to «Type summary»

Connection accessories for small burner controls refer to Data Sheet N7201

- Plug-in base AGK11...
- Cable holders AGK65..., AGK66

Flame detectors

- Photo resistive detectors QRB1... refer to Data Sheet N7714
- Blue-flame detectors QRC1... refer to Data Sheet N7716

Interface OCI400

refer to Data Sheet N7614

Interface between burner control and PC

Facilitates viewing and recording setting parameters on site in connection with the ACS400 / ACS410 PC software

PC software ACS400

refer to User Documentation J7350

PC software for visualizing the burner controls

PC software ACS410

refer to User Documentation J7352

PC software for setting the parameters and for visualizing the burner controls

Demo case KF8891

refer to User Manual B7989

- For demonstrating the functions of burner controls

Test adapter KF8885

refer to Operating Instructions B7986

- For checking the functions of burner controls on the burner
- With switch for manual startup of the burner
- With switch for simulating the oil preheater's release contact
- With 2 pairs of jacks for measuring the flame detector current



Test adapter KF8833

- For checking the functions of burner controls on the burner
- With signal lamps for program indication
- With one pair of jacks for measuring the flame detector current



Test adapter KF8840

- For checking the functions of burner controls on the burner
- With signal lamps for program indication
- With on / off switch for simulating the flame signal
- With holes for checking the control voltages at the tabs of the burner control
- With one pair of jacks for measuring the flame detector's resistance



Extension of lockout reset button

- Extension 19 mm: **AGK20.19**
- Extension 43 mm: **AGK20.43**
- Extension 55 mm: **AGK20.55**

Technical data

| | | |
|-------------------|--------------------------------|--------------------------------------------------|
| General unit data | Mains voltage | AC 230 V +10 % / -15 % AC 120 V +10 % / -15 % |
| | Mains frequency | 50...60 Hz ± 6 % |
| | External primary fuse (Si) | 6.3 A (slow) |
| | Power consumption | 12 VA |
| | Perm. mounting orientation | Optional |
| | Weight | Approx. 200 g |
| | Safety class | I (burner control with plug-in base) |
| | Degree of protection | IP40 (to be ensured through mounting) |
| | Perm. cable lengths | Max. 3 m at a line capacitance of 100 pF/m |
| | Detector cable laid separately | 10 m |
| | Remote reset laid separately | 20 m |

| Perm. current at $\cos\varphi \geq 0.6$ | LMO14... | LMO24... | LMO44... |
|-----------------------------------------|----------|----------|----------|
| Terminal 1 | Max. 5 A | Max. 5 A | Max. 5 A |
| Terminals 3 and 8 | Max. 3 A | Max. 3 A | Max. 3 A |
| Terminals 4 and 5 | Max. 1 A | Max. 1 A | Max. 1 A |
| Terminal 6 | Max. 1 A | Max. 2 A | Max. 2 A |
| Terminal 10 | Max. 1 A | Max. 1 A | Max. 1 A |

Environmental conditions

| | |
|-----------------------|------------------|
| Storage | DIN EN 60721-3-1 |
| Climatic conditions | Class 1K3 |
| Mechanical conditions | Class 1M2 |
| Temperature range | -20...+60 °C |
| Humidity | <95 % r.h. |
| Transport | DIN EN 60721-3-2 |
| Climatic conditions | Class 2K2 |
| Mechanical conditions | Class 2M2 |
| Temperature range | -20...+60 °C |
| Humidity | <95 % r.h. |
| Operation | DIN EN 60721-3-3 |
| Climatic conditions | Class 3K3 |
| Mechanical conditions | Class 3M3 |
| Temperature range | |
| - LMO14... / LMO24... | -5...+60 °C |
| - LMO44... | -20...+60 °C |
| Humidity | <95 % r.h. |



Attention!

Condensation, formation of ice and ingress of water are not permitted! If this is not observed, there is a risk of loss of safety functions and a risk of electric shock.

Technical data (cont'd)

Flame supervision with
QRB... or QRC...

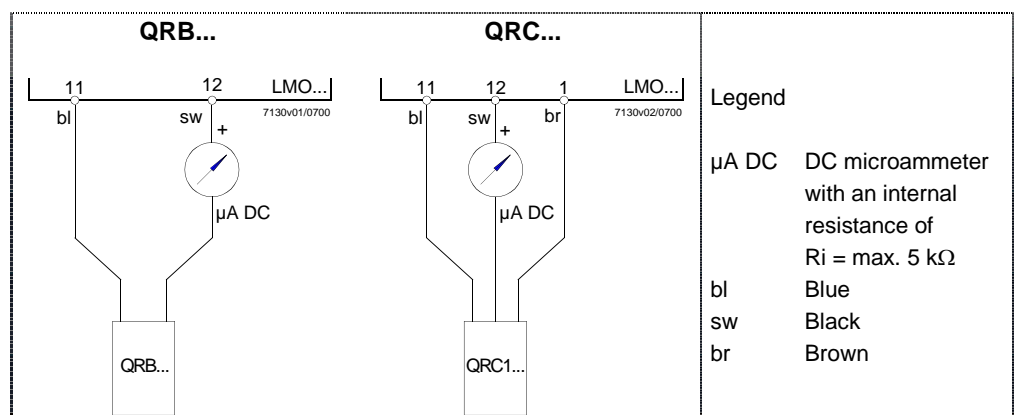
| | Detector current required (with flame) | Perm. detector current (without flame) | Possible detector current with flame (typically) |
|----------------------------|----------------------------------------------|----------------------------------------------|--------------------------------------------------------|
| QRB...¹⁾ | Min. 45 μ A | Max. 5.5 μ A | 100 μ A |
| QRC...¹⁾ | Min. 45 μ A | Max. 5.5 μ A | 70 μ A |

Green LED for
operational status
indication

| | Detector current in operation: - Flame signal instable - Green LED flashing | Detector current in operation: - Flame signal stable - Green LED steady on |
|----------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| QRB...¹⁾ | <45 μ A | >45 μ A |
| QRC...¹⁾ | <45 μ A | >45 μ A |

- ¹⁾ The values given in the table above only apply under the following conditions:
- Mains voltage depending on execution AC 120 V or AC 230 V
 - Ambient temperature 23 °C

Measuring circuit
for detector current



As an alternative to detector current measurement, the Interface OCI400 / with PC software ACS400 / ACS410 can be used. In that case, the DC microammeter is not required.

Function

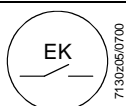
| | |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preconditions for startup | <ul style="list-style-type: none"> • Burner control is reset • Reset button «EK1» or «EK2» not used • All contacts in the line are closed and there is demand for heat • No undervoltage • Flame detector is darkened and there is no extraneous light |
| Undervoltage | <ul style="list-style-type: none"> • Safety shutdown from the operating position takes place should mains voltage drop below about AC 165 V (U_N = AC 230 V) or AC 75 V (U_N = AC 120 V) • Restart is initiated when mains voltage exceeds about AC 175 V (U_N = AC 230 V) or AC 95 V (U_N = AC 120 V) |
| Time supervision oil preheater | If the oil preheater's release contact does not close within 10 minutes, the burner control will initiate lockout. |
| Controlled intermittent operation | After no more than 24 hours of continuous operation, the burner control will initiate automatic controlled shutdown followed by a restart. |
| Control sequence in the event of fault | If lockout occurs, the outputs for the fuel valves, the burner motor and the ignition equipment will immediately be deactivated (<1 second). In the event of lockout, the LMO... remains locked and the red signal lamp (LED) will light up. The burner control can immediately be reset. This state is also maintained in the case of mains failure. |

| Cause | Response |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Mains failure | Restart |
| Voltage has fallen below the undervoltage threshold | Safety shutdown, followed by restart |
| Extraneous light during prepurge time (t ₁), 5 s before fuel valve (BV1) release | Lockout at the end of prepurge time (t ₁) |
| Extraneous light during waiting time (t _w) | Prevention of startup, lockout after 40 seconds at the latest |
| No flame at the end of safety time (TSA) | Lockout at the end of safety time (TSA), blink code 2 |
| Loss of flame during operation | Max. 3 repetitions, followed by lockout |
| Oil preheater's release contact does not close within 10 minutes | Lockout |

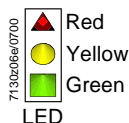
| | |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resetting the burner control | When lockout occurs, the burner control can immediately be reset. To do this, press the lockout reset button for about 1 second (<3 seconds). The LMO... can only be reset when all contacts in the line are closed and when there is no undervoltage. |
| Ignition program with LMO14.113x2 and LMO24.113x2 | If the flame is lost during safety time (TSA), the burner will be reignited, but only until the end of safety time (TSA). This means that several ignition attempts can be made during safety time (TSA) (see <i>Control sequence</i>). |
| Limitation of repetitions | If the flame is lost during operation, a maximum of 3 repetitions can be made. If the flame is lost for the fourth time during operation, the burner will initiate lockout. The repetition count is restarted each time controlled switching on by control thermostat or pressurestat (R) takes place. |

Operation, display, diagnostics

Operation



Lockout reset button «EK» is the key operating element for resetting the burner control and for activating / deactivating the diagnostic functions.



The multicolor signal lamp (LED) in the lockout reset button is the key indicating element for both visual diagnostics and interface diagnostics.

Both «EK» and LED are located under the transparent cover of the lockout reset button.

There are 2 diagnostic choices:

1. Visual diagnostics: Operational status indication or diagnostics of the cause of fault.
2. Interface diagnostics: With the help of the interface OCI400 and PC software ACS400 / ACS410 or flue gas analyzers of different makes.

Visual diagnostics:

In normal operation, the different operating states are indicated in the form of color codes according to the color code table given below.

Operational status indication

During startup, status indication takes place according to the following table:

| Color code table for multicolor signal lamp (LED) | | |
|---------------------------------------------------|-------------------|-------------------|
| Status | Color code | Color |
| Waiting time «tw», other waiting states | ○..... | Off |
| Oil preheater on | ●..... | Yellow |
| Ignition phase, ignition controlled | ●○●○●○●○●○●○ | Flashing yellow |
| Operation, flame o.k. | □..... | Green |
| Operation, flame not o.k. | □○□○□○□○□○□○ | Flashing green |
| Extraneous light on burner startup | □▲□▲□▲□▲□▲ | Green-red |
| Undervoltage | ●▲●▲●▲●▲●▲ | Yellow-red |
| Fault, alarm | ▲..... | Red |
| Error code output (refer to «Error code table») | ▲○ ▲○ ▲○ ▲○ ▲○ | Flashing red |
| Interface diagnostics | ▲▲▲▲▲▲▲▲ | Red flicker light |

Legend

..... Steady on
○ Off

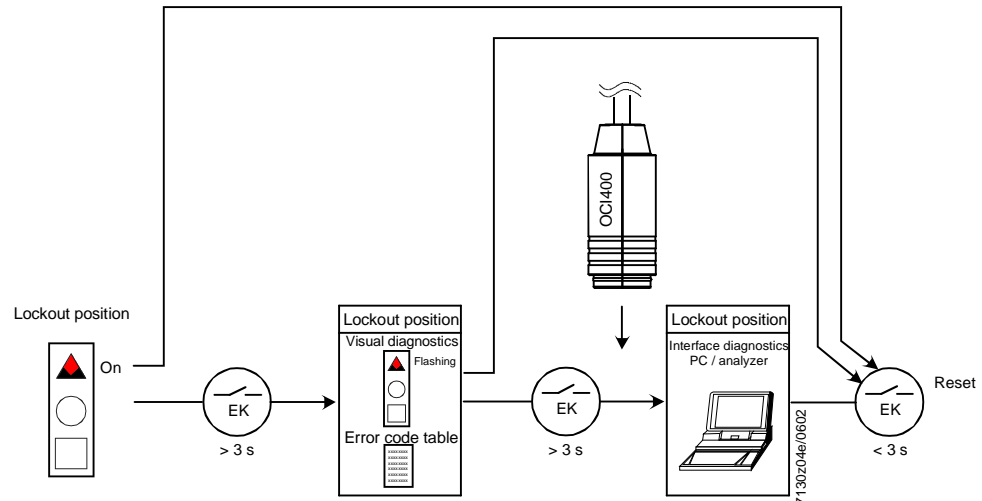
▲ Red
● Yellow
□ Green

Operation, display, diagnostics (cont'd)

Diagnostics of the cause of fault

After lockout, the red signal lamp (LED) remains steady on. In that condition, the visual diagnostics of the cause of fault according to the error code table can be activated by pressing the lockout reset button for more than 3 seconds. Pressing the reset button again for at least 3 seconds, the interface diagnostics will be activated. Interface diagnostics works only if the AGK20... lockout reset button extension is not fitted. If, by accident, interface diagnostics has been activated, in which case the slightly red light of the signal lamp flickers, it can be deactivated by pressing again the lockout reset button for at least 3 seconds. The instant of switching over is indicated by a yellow light pulse.

The following sequence activates the diagnostics of the cause of fault:

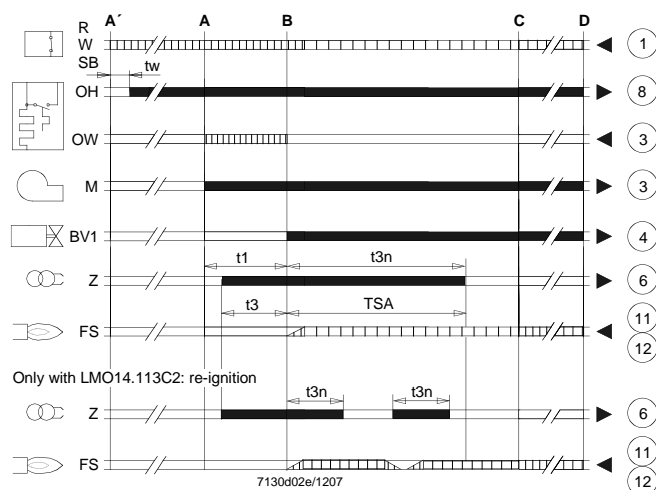


| Error code table | | |
|-------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Red blink code of signal lamp (LED) | Alarm (AL) at term. 10 | Possible cause |
| 2 blinks | On | No establishment of flame at the end of safety time (TSA) - Faulty or soiled fuel valves - Faulty or soiled flame detector - Poor adjustment of burner, no fuel - Faulty ignition equipment |
| 3 blinks | On | Free |
| 4 blinks | On | Extraneous light on burner startup |
| 5 blinks | On | Free |
| 6 blinks | On | Free |
| 7 blinks | On | Too many losses of flame during operation (limitation of the number of repetitions) - Faulty or soiled fuel valves - Faulty or soiled flame detector - Poor adjustment of burner |
| 8 blinks | On | Time supervision oil preheater |
| 9 blinks | On | Free |
| 10 blinks | Off | Wiring fault or internal fault, output contacts, other faults |

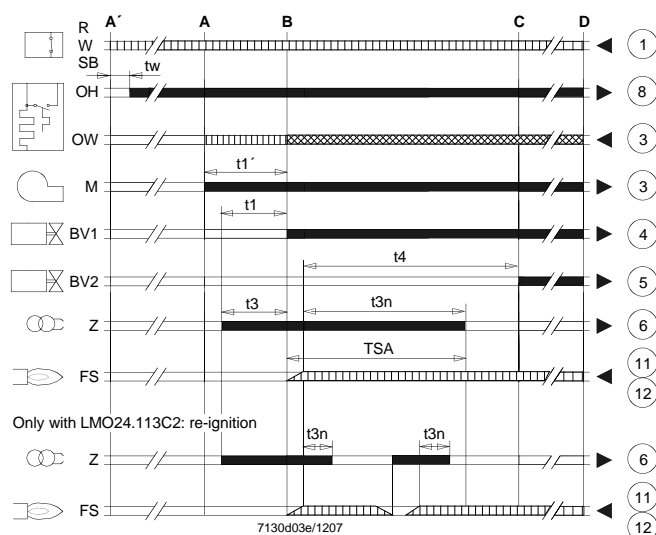
During the time the cause of fault is diagnosed, the control outputs are deactivated burner remains shut down.

The diagnostics of the cause of fault is quit and the burner switched on again by resetting the burner control. Press the lockout reset button for about 1 second (<3 seconds).

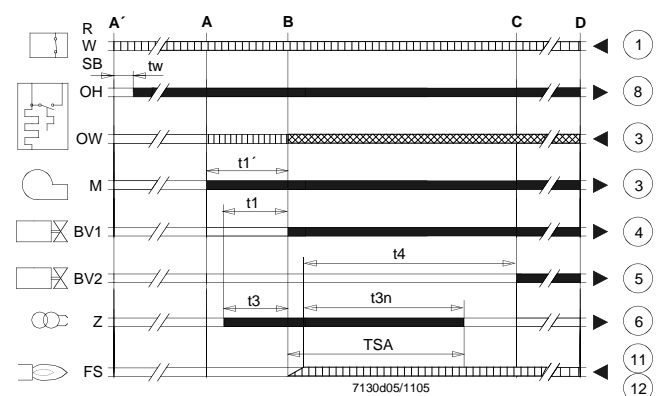
Control sequence LMO14...






Control sequence LMO24...



Control sequence LMO44...



Legend

| | |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| AL | Alarm device |
| BV... | Fuel valve |
| EK1 | Lockout reset button |
| EK2 | Remote lockout reset button |
| FS | Flame signal |
| FSV | Flame signal amplifier |
| K... | Contacts of control relay |
| kbr | Cable link (required only when no oil preheater is used) |
| LED | 3-color signal lamp |
| M | Burner motor |
| OW | Release contact of oil preheater |
| OH | Oil preheater |
| QRB... | Photo resistive flame detector |
| QRC... | Blue-flame detector |
| | bl = blue, br = brown, sw = black |
| R | Control thermostat or pressurestat |
| SB | Safety limit thermostat |
| Si | External primary fuse |
| W | Limit thermostat or pressure switch |
| Z | Ignition transformer |
| TSA | Ignition safety time |
| tw | Waiting time |
| t1 | Prepurge time |
| t1' | Purge time |
| t3 | Preignition time |
| t3n | Postignition time |
| t4 | Interval from flame signal to release of fuel valve 2 (BV2) |
| A' | Start of startup sequence with burners using an oil preheater (OH) |
| A | Start of startup sequence with burners using no oil preheater (OH) |
| B | Time of flame establishment |
| C | Operating position |
| D | Controlled shutdown by control thermostat or pressurestat (R) |
|  | Control signals |
|  | Required input signals |
|  | Perm. input signals |
| μC1 | Microcontroller 1 |
| μC2 | Microcontroller 2 |

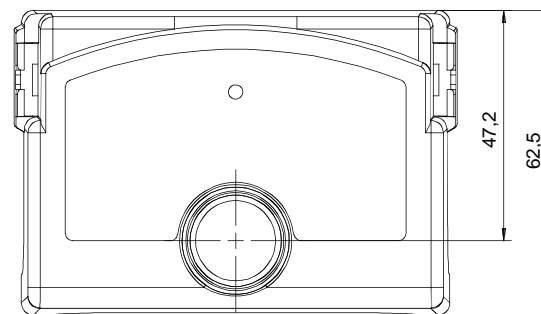
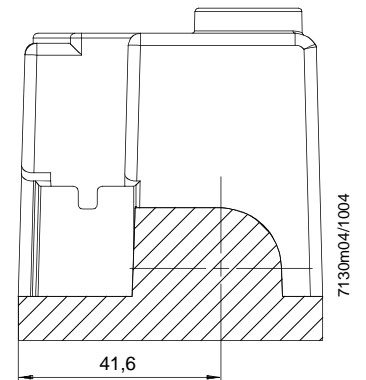
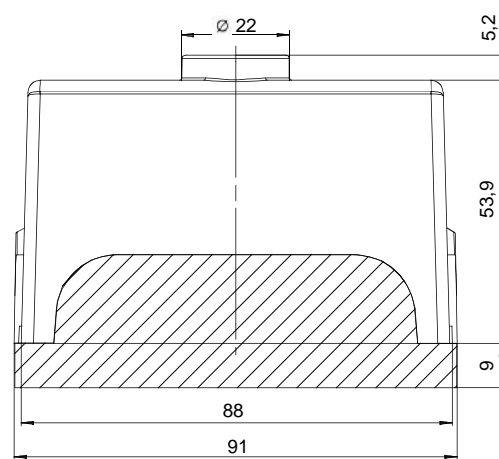
Dimensions

Dimensions in mm

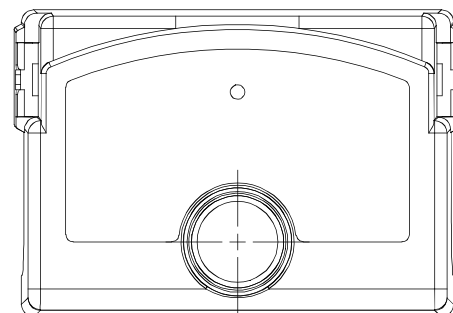
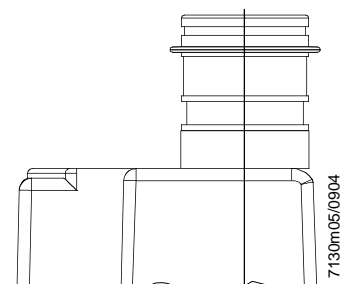
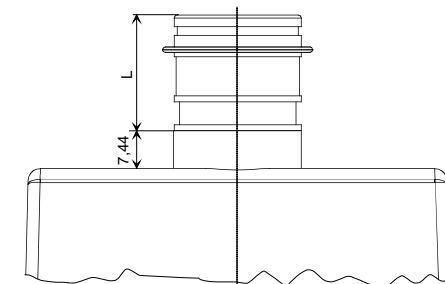
LMO...



Plug-in base AGK11...



LMO... with extension of
lockout reset button
AGK20...



| Type reference | Length «L» in mm |
|----------------|------------------|
| AGK20.19 | 19 |
| AGK20.43 | 43 |
| AGK20.55 | 55 |