SIEMENS

VALVEGYR®

Valve Proving System for automatic Shutoff Valves

LDU11...

The LDU11... valve proving system is designed for use with shutoff valves in connection with gas burners and gas appliances. In the event of inadmissible leakage, the system prevents the burner from starting up.
The LDU11... system conforms to the requirements of EN1643 covering automatic shutoff valves for use with gas burners and gas appliances to EN161.

The LDU11... and this Data Sheet are intended for use by OEMs which integrate the valve proving system in their products.

CC1N7696en
20.04.2016

Building Technologies Division

Use

The LDU11... is designed for automatic gas valve proving (leakage test) based on the pressure proving principle. It is for use on gas-fired combustion plant with or without vent pipe to atmosphere. In the case of plants with no vent pipe where EN standards apply, the notes given in «Connection examples without vent pipe to atmosphere» must be observed.

Used in connection with 1 or 2 commercially available pressure switches, valve proving is automatically initiated with every burner startup, either

- prior to burner startup
- during the prepurge time if it lasts a minimum of 60 seconds
- immediately after a controlled shutdown, or
- on completion of the burner control's control sequence, e.g. at the end of the postpurge time

The valve proving test is based on the 2-stage pressure proving principle:

1. The valve on the mains side is tested by evacuating the test space and by monitoring the atmospheric pressure in it.
2. The valve on the burner side is checked by pressurizing the test space and by monitoring the gas pressure.

If the pressure increases excessively during the first test phase called «Test1», or decreases excessively during the second test phase called «Test2», the LDU11.... will inhibit burner startup and initiate lockout. In that case, the lockout reset button will light up to indicate the fault. Remote indication of the fault is also possible. A program indicator, which stops whenever a fault occurs, indicates which of the valves is leaking. The LDU11... can be reset either on the unit itself or via an electric remote reset facility.

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 control unit.

- All activities (mounting, installation and service work, etc.) must be carried out 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 valve proving system's connection terminals
- Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring is in an orderly state
- Press the lockout reset button only manually (applying a force of no more than 10 N) without using any tools or pointed objects
- Do not press the lockout reset button on the unit for more than 10 seconds since longer presses will destroy the lockout relay
- Fall or shock can adversely affect the safety functions. Do not put such units into operation, even if they do not exhibit any damage

Mounting notes

- Ensure that the relevant national safety regulations are complied with

Installation notes

- Live and neutral conductors must not be interchanged

Standards and certificates

Applied directives:

- Low-voltage directive 2014/35/EC
- Directive for gas-fired appliances 2009/142/EC
- Directive for pressure devices 97/23/EC and 2014/68/EC (2016-07-16)
- Electromagnetic compatibility EMC (immunity) *) 2014/30/EC

*) The compliance with EMC emission requirements must be checked after the valve monitoring system is installed in the equipment

Compliance with the regulations of the applied directives is verified by the adherence to the following standards / regulations:

- Safety and control devices for gas burners and gas burning appliances - Valve proving systems for automatic shut-off valves DIN EN 1643

The relevant valid edition of the standards can be found in the declaration of conformity!

Note on **DIN EN 60335-2-102**
Household and similar electrical appliances - Safety - Part 2-102:
Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections.
The electrical connections of the LDU11 and the AGM comply with the requirements of EN 60335-2-102.

EAC Conformity mark (Eurasian Conformity mark)

ISO 9001:2008
ISO 14001:2004
OHSAS 18001:2007

Certified complete with plug-in base:

Type reference	FM APPROVED	DVGW	CSA	PCT	UL	TÜV CERT
LDU11.323A17	---	x	x	x	---	x
LDU11.323A27	---	x	---	x	---	x
LDU11.523A17	x	---	x	x	x	---
LDU11.523A27	x	---	---	x	---	---

Life cycle

LDU11... 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 specified in standard EN298 and the table containing the relevant test documentation as published by the European Association of Component Manufacturers (Afecor) (www.afecor.org).

The designed lifetime is based on use of the LDU11... 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 LDU11... 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 electric and electronic components and must not be disposed of together with domestic waste. Local and currently valid legislation must be complied with.

Mechanical design

Valve proving system LDU11...

- Plug-in design
- Exchangeable unit fuse (including spare fuse)

Housing

- Made of impact-proof and heat-resistant black plastic
- Lockout reset button with viewing window showing:
  – The fault signal lamp
  – The lockout indication
    - Coupled to the program spindle
    - With transparent lockout reset button
    - Easy-to-remember symbols indicating the type of fault and the time lockout occurred
    - Synchronous motor of the sequence switch with gear train and step action sequence switch
    - Camshaft with 15 nonadjustable cams
    - Program indicator at the head of the camshaft
    - 1 main and 1 auxiliary relay
    - Lockout relay can be electrically reset from a remote location and provides the «Lockout» and «Reset» functions
    - Unit fuse and spare fuse

All electrical components are interconnected via printed circuits.

Type summary

Type reference	Mains voltage	t3	t4
LDU11.323A17	AC 100...110 V	2.5 s	2.5 s
LDU11.323A27	AC 220...240 V	2.5 s	2.5 s
LDU11.523A17 [1])	AC 100...110 V	5 s	5 s
LDU11.523A27 [1])	AC 220...240 V	5 s	5 s

Legend

t3 Filling the test space
t4 Evacuating the test space

[1]) Valve opening times do not conform to EN1643

Ordering

Valve proving system LDU11... (without plug-in base) refer to «Type summary»
Plug-in base not included in the delivery, must be ordered as a separate item!

Connection accessories for medium-capacity refer to Data Sheet N7230

- Plug-in base **AGM11** with Pg11 threads for cable entry glands
- Plug-in base **AGM11.1** with M16 threads for cable entry glands

PTC resistor (AC 230 V) **AGK25**
- For load on terminal 4 of LMG2...

Technical data

General unit data LDU11...	Mains voltage	
	- LDU11.323A27	AC 220 V –15 %...AC 240 V +10 %
	- LDU11.323A17	AC 100 V –15 %...AC 110 V +10 %
	- LDU11.523A27 [1])	AC 220 V –15 %...AC 240 V +10 %
	- LDU11.523A17 [1])	AC 100 V –15 %...AC 110 V +10 %
	[1]) Valve opening times do not conform to EN 1643	
	Mains frequency	50...60 Hz ±6 %
	Unit fuse (built-in)	T6.3H250V to DIN EN 60127
	Primary fuse (external)	Max. 10 A (slow)
	Weight	Approx. 1000 g
	Power consumption	
	- During the test	Approx. AC 3.5 VA
	- During operation	Approx. AC 2.5 VA
	Mounting position	Optional
	Degree of protection	IP40 (to be ensured through mounting), except the connection area (terminal base)
	Safety class	I
	Perm. input current at terminal 1	Max. 5 A (peak current 20 A / 20 ms)
	Perm. current rating of control terminals	Max. 4 A (peak current 20 A / 20 ms)
	Required current rating of pressure switch (DW)	Min. 1 A, AC 250 V

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	-50...+60 °C
	Humidity	<95 % r.h.
	Operation	DIN EN 60721-3-3
	Climatic conditions	Class 3K5
	Mechanical conditions	Class 3M2
	Temperature range	-20...+60 °C
	Humidity	<95 % r.h.

Caution!
Condensation, formation of ice and ingress of water are not permitted!

During the first phase of the valve proving test called «Test1», atmospheric pressure must exist in the length of pipe between the valves to be tested. In plants with a vent pipe to atmosphere, atmospheric pressure is available if the valve proving test is made prior to or during the prepurge time. In plants without vent pipe, atmospheric pressure is made available as the valve proving system opens the valve on the burner side during evacuating the test space (t4). If the valve proving test LDU11... is performed after burner operation, the valve on the burner side after the controlled shutdown can be kept open until evacuating the test space (t4) has elapsed, thus lowering the pressure in the test space and making certain its gas content is burnt off in the combustion chamber during the postpurge time. Prerequisite for this procedure is a suitable control program of the burner control as provided by burner controls type LFE..., LFL..., LGK... or LEC...

The test space is closed off after evacuation. During the first test phase «Test1», which then follows, the LDU11... checks with the pressure switch if the atmospheric pressure in the test space is maintained. If the valve on the mains side is leaking, causing the pressure to rise above the switching point of the pressure switch, the LDU11... will trigger an alarm and initiate lockout. The program indicator then stops to indicate «Test1».

If the pressure does not increase because the valve closes correctly, the LDU11... continues its program with the second test phase «Test2». For that purpose, the valve on the mains side is opened during filling the test space (t3) so that the test space is pressurized («filling» the test space). During the second test phase – if the valve on the burner side is leaking – this pressure must not fall below the switching point of the pressure switch. If it does, the LDU11... will initiate lockout also, thus preventing the burner from starting up.

On successful completion of the second test phase, the LDU11... closes the internal control loop between terminals 3 and 6 (circuit path: terminal 3 - contact (ar2) - terminals 4 and 5 - contact III - terminal 6). This control loop is normally included in the burner control's start control loop.

After the control loop has been closed, the programming mechanism of the LDU11... returns to its start position to switch itself off. During these so-called idle steps, the positions of the programming mechanism's control contacts remain unchanged.

In the event of lockout, the programming mechanism stops and thus the position indicator fitted to the spindle of the mechanism. The symbol that stops above the reading mark indicates the test phase during which lockout occurred and also gives the number of programming steps completed from the start of this test phase (1 step = 2.5 seconds).

Meaning of the symbols:

►	Start position = operating position
▭	In plants without vent valve: Evacuation of test space by opening the valve on the burner side
Test1	«Test1» with atmospheric pressure (valve proving test on the mains side)
▬	Filling the test space by opening the valve on the mains side
Test2	«Test2» with gas pressure (valve proving test on the burner side)
I I I	Idle steps until programming mechanism switches itself off
►	Operating position = start position for the next valve proving test

In the event of lockout, all terminals receiving voltage from the valve proving system LDU11... will be deenergized, except terminal 13, which is used for lockout indication.

After a reset, the programming mechanism automatically returns to its start position to immediately program a new valve proving test.

☞ Note!
Do not press the reset button for more than 10 seconds.

Control sequence after a power failure

A power failure prior to evacuating the test space does not cause the control sequence to change.

If a power failure occurs after the evacuation, the valve proving test will not be continued when power is restored, but the programming mechanism first returns to its start position and then performs the complete valve proving test.

Calculation of the leakage rate escaping from a length of pipe

$$Q_{Leck} = \frac{(P_G - P_W) \times V \times 3600}{P_{atm} \times t_{Test}}$$

Legend

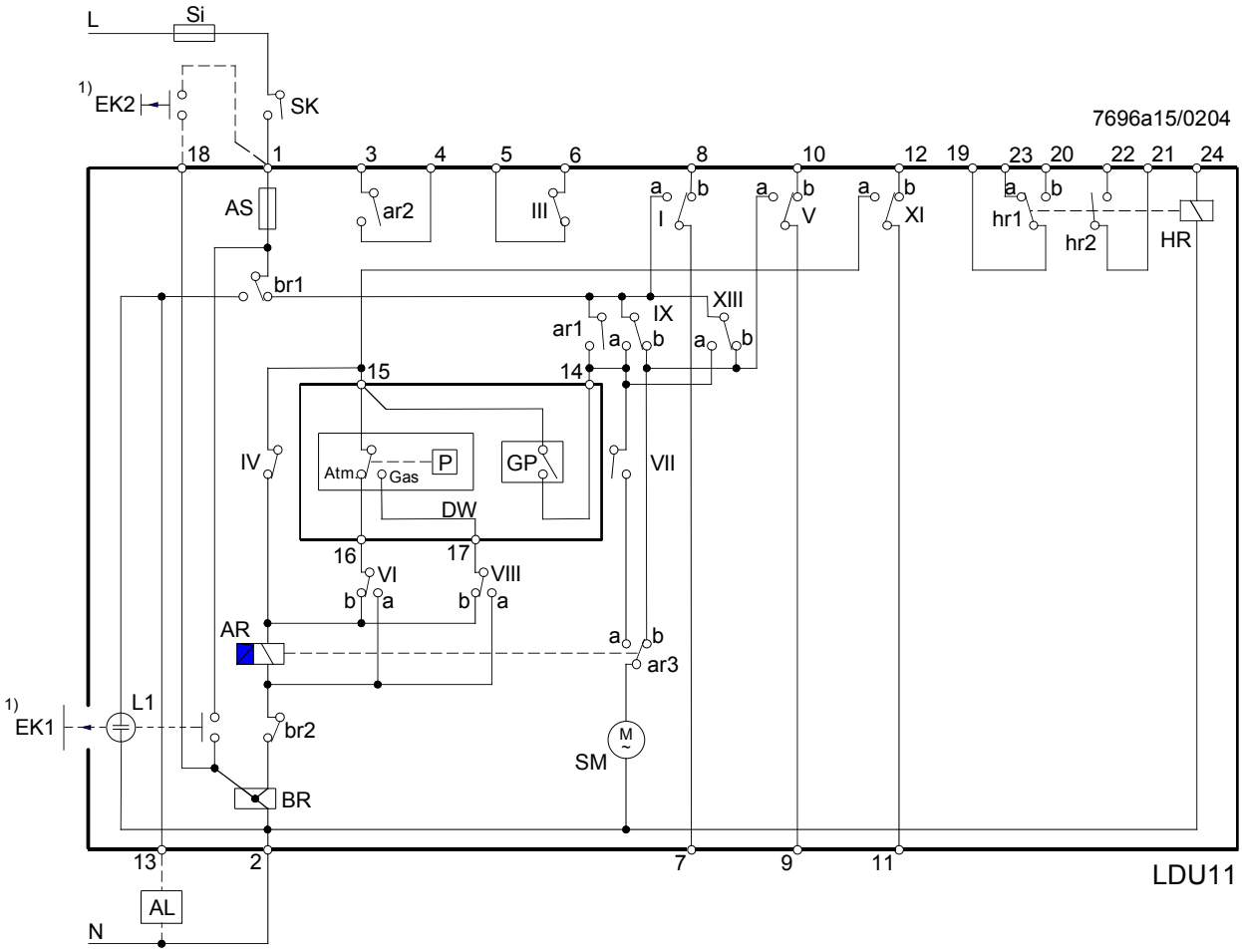
Q_{leck}	in dm³/h	Permissible leakage rate in dm³ per hour or liters per hour
P_G	in mbar	Overpressure in pipe section between the valves to be tested, at the beginning of the test phase
P_W	in mbar	Overpressure set on pressure switch «DW» (normally set to 50 % of the gas mains pressure)
P_{atm}	in mbar	Absolute pressure (1.013 mbar normal pressure)
V	in dm³	Volume of test space confined by the valves to be tested, including the space in the valves themselves
T_{test}	in s	Duration of proving time

Example

P_G	= 30 mbar	$Q_{Leck} = \frac{(30 - 15) \times 10.36 \times 3600}{1013 \times 27.5} = 20$ l/h
P_W	= 15 mbar	
P_{atm}	= 1013 mbar	Any valve leakage rate exceeding 20 l/h causes the LDU11... to initiate lockout
V	= 10.36 dm³	
t_{Test}	= 27.5 s	

Note!
Select volume of pipe section (V) between the gas valves to be checked and overpressure (P_W) set on pressure switch (DW) such that the maximum permissible gas leakage rate (Q_{Leck}) will not exceed the rate specified in the local regulations.

Connection diagram

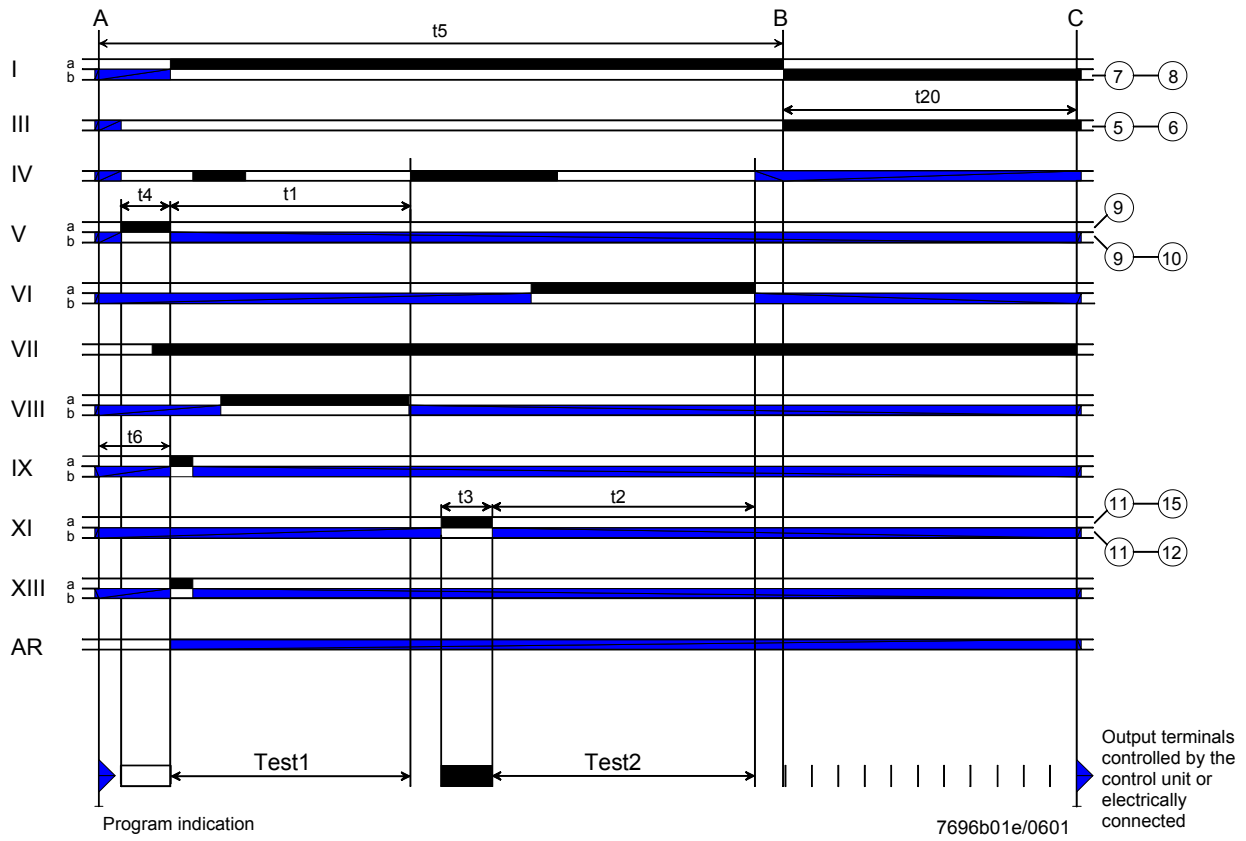


Legend

AL	Alarm signal for «leaking valve»
AR	Working relay with contacts (ar...)
AS	Unit fuse (built-in)
BR	Lockout relay with contacts (br...)
DW	Pressure switch for valve proving test (does not replace the gas pressure switch used to signal lack of gas)
EK1	Lockout reset button
EK2	Remote lockout reset button
GP	Gas pressure switch (for lack of gas)
HR	Auxiliary relay with contacts (hr...)
L1	Lockout warning lamp (built-in)
Si	External primary fuse
SK	Control contact (for initiating the valve proving test)
SM	Synchronous motor of programming mechanism

1) Do not press lockout reset button (EK) for more than 10 seconds

Sequence diagram



Legend

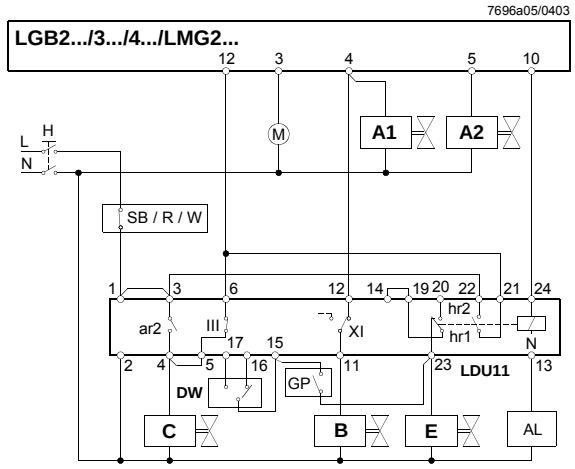
t1	22.1 s	First test phase with atmospheric pressure
t2	27 s	Second test phase with gas pressure
For LDU11.323...		
t3	2.5 s	Filling the test space
t4	2.5 s	Evacuating the test space
For LDU11.523...		
t3	5 s	Filling the test space
t4	5 s	Evacuating the test space
t5	66.3 s	Total duration of valve proving test until burner is released
t6	7.4 s	Interval from start to energizing working relay (AR)
t20	22.1 s	Running time of programming mechanism until it switches itself off in the operating = start position (idle steps)

A	Gas valves controlled to evacuate the test space
B	Gas valves controlled to fill the test space
C	Vent valve, normally open; closed during valve proving test from the beginning of «Test1»

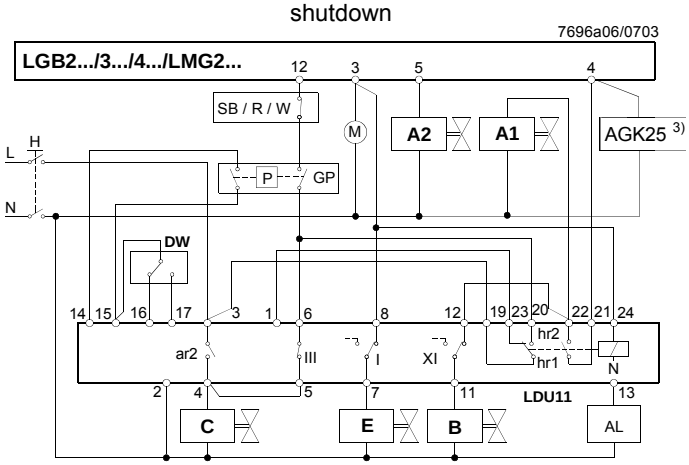
Connection examples with vent pipe to atmosphere using burner controls type LGB2..., LGB3... / LGB4... / LMG2...

For other connections, refer to the connection diagram of the relevant burner control.

Valve proving test prior to burner startup

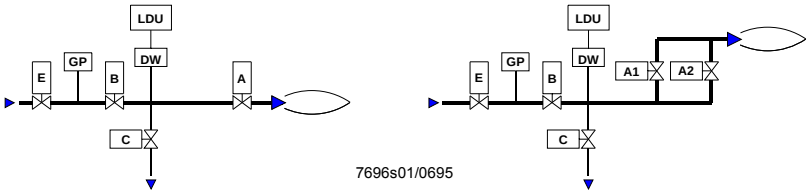


Valve proving test following immediately the controlled shutdown



3) Only in connection with LMG2...

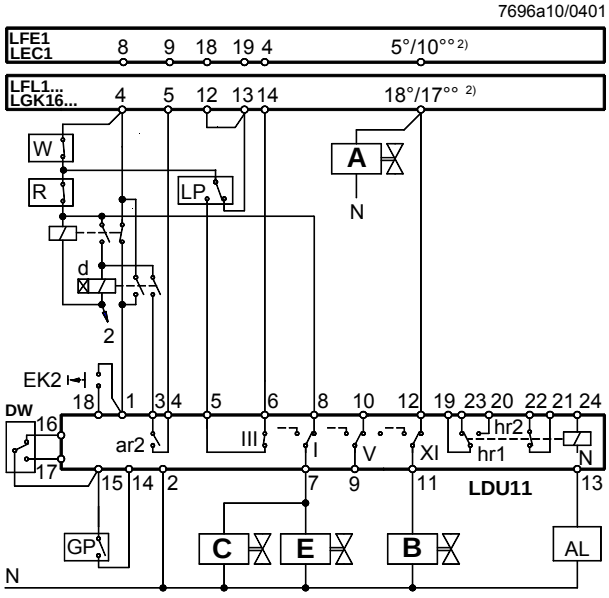
Plants with vent pipe to atmosphere



Connection examples with vent pipe to atmosphere using burner controls type LFE..., LFL... or LGK..., or the control unit LEC...

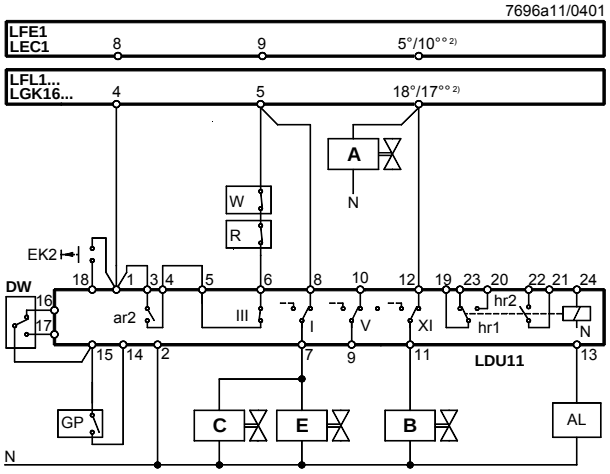
Check during the prepurge time (min. 60 seconds) and following immediately the controlled shutdown in plants with vent pipe to atmosphere. Delay on make of relay d >2 seconds.

2) Expanding flame burner or interrupted pilot burner



Check following immediately the controlled shutdown

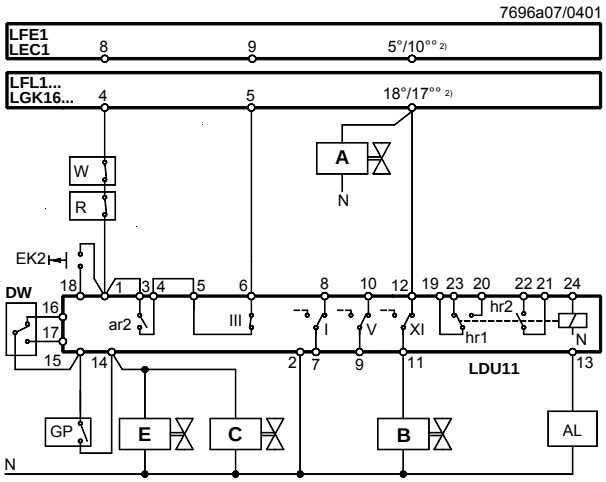
2) Expanding flame burner or interrupted pilot burner



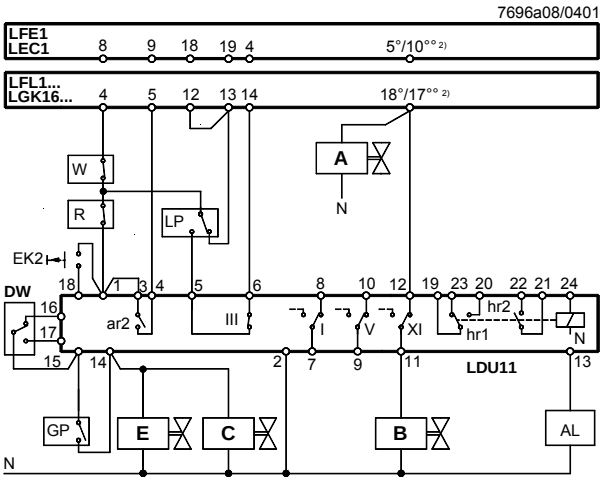
Connection examples with vent pipe to atmosphere using burner controls type LFE..., LFL... or LGK..., or the control unit LEC...

For other connections, refer to the connection diagram of the relevant burner control.

Check just prior to burner startup
[2] Expanding flame burner or interrupted pilot burner



Check during the prepurge time (min. 60 seconds)
[2] Expanding flame burner or interrupted pilot burner

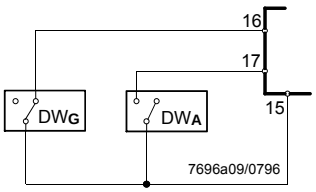


Valve proving test with 2 pressure switches

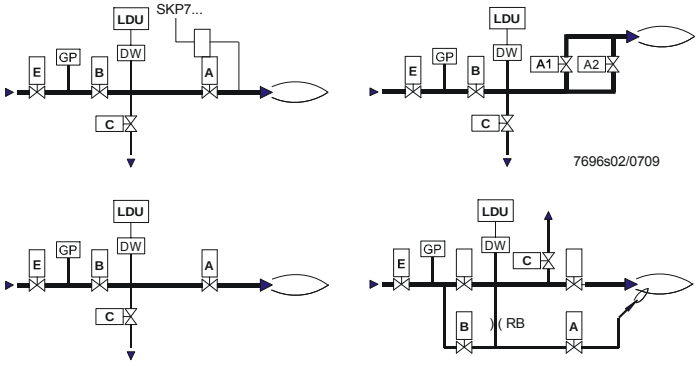
DWG Pressure switch for the valve proving test with gas pressure.
This pressure switch must be set to the minimum gas pressure permitted during the proving test.
If this pressure is not reached during the test, lockout will be initiated.

DWA Pressure switch for the gas valve proving test with atmospheric pressure.
This pressure switch must be set to the maximum gas pressure permitted during the proving test with atmospheric pressure.
If this pressure is exceeded during the test, lockout will be initiated.

Pressure switch (DWG) and pressure switch (DWA) must be overload-proof up to the gas pressure value.



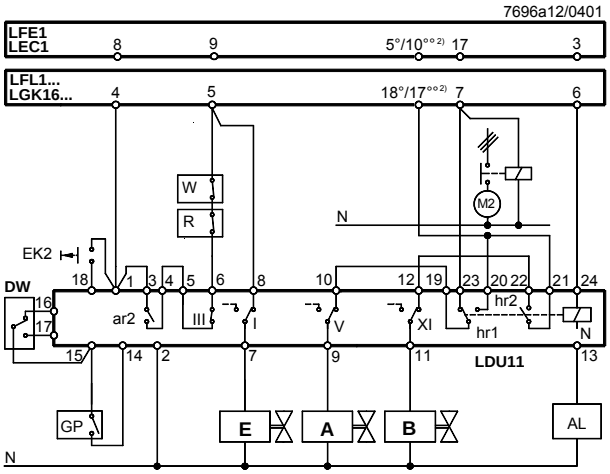
Plants with vent pipe (C) to atmosphere



Connection examples without vent pipe to atmosphere (for applications not covered by EN676) using burner controls type LFE..., LFL... or LGK..., or the control unit LEC...

Check following immediately the controlled shutdown in plants without vent pipe. Valve (A) or valve (A1) remains open after the controlled shutdown until the start of the first test phase is reached in order to evacuate the test space and to burn off the gas in the combustion chamber during the afterburn time.

[2] Expanding flame burner or interrupted pilot burner



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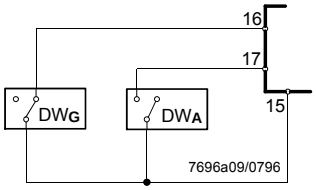
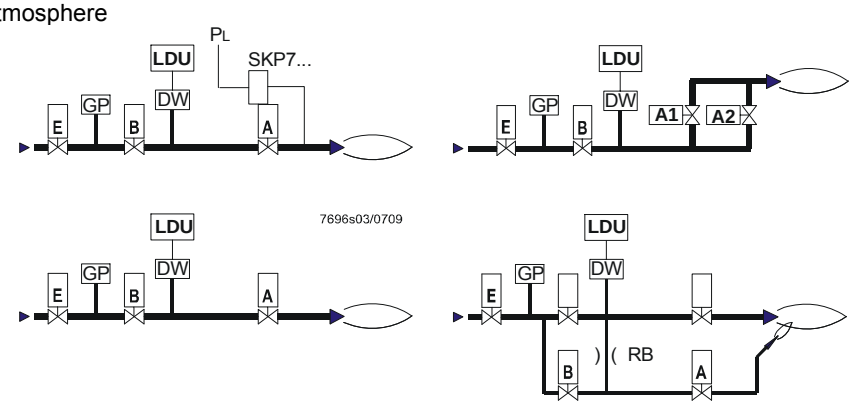
DWA Pressure switch for the gas valve proving test with atmospheric pressure. This pressure switch must be set to the maximum gas pressure permitted during the proving test with atmospheric pressure. If this pressure is exceeded during the test, lockout will be initiated.

Pressure switch (DWG) and pressure switch (DWA) must be overload-proof up to the gas pressure value.



Plants without vent pipe to atmosphere

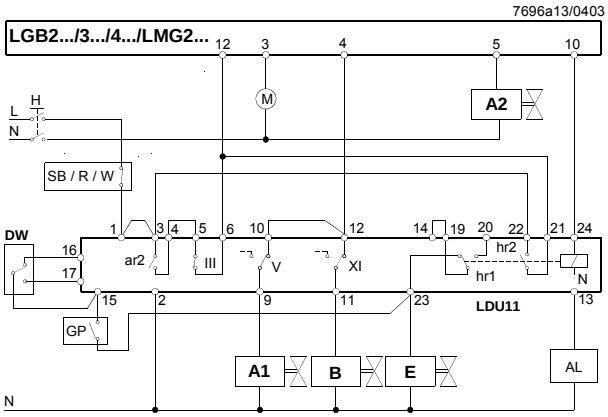


Air pressure (PL) for the SKP7... must be sufficiently high to open the SKP7... although the burner's air damper is closed. Otherwise, the LDU11... will initiate lockout when performing «Test1».

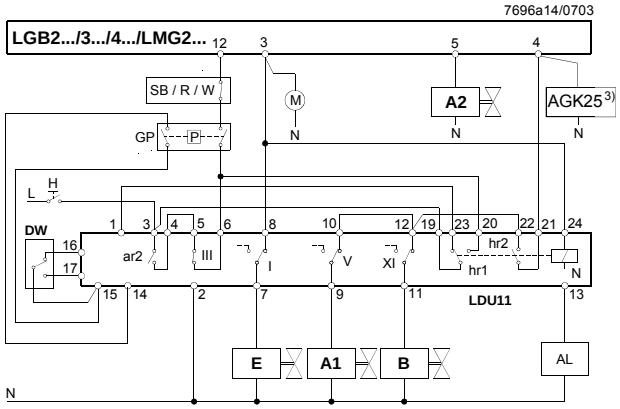
Connection examples without vent pipe to atmosphere using burner controls type LGB2... / LGB3... / LGB4... / LMG2...

For other connections, refer to the connection diagram of the relevant burner control.

Check prior to burner startup

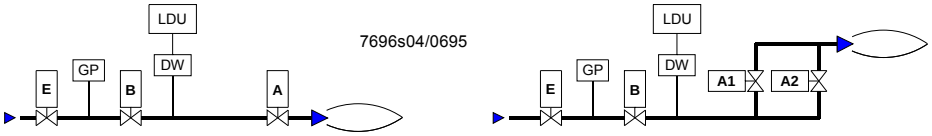


Check following immediately the controlled shutdown



3) Only in connection with LMG2...

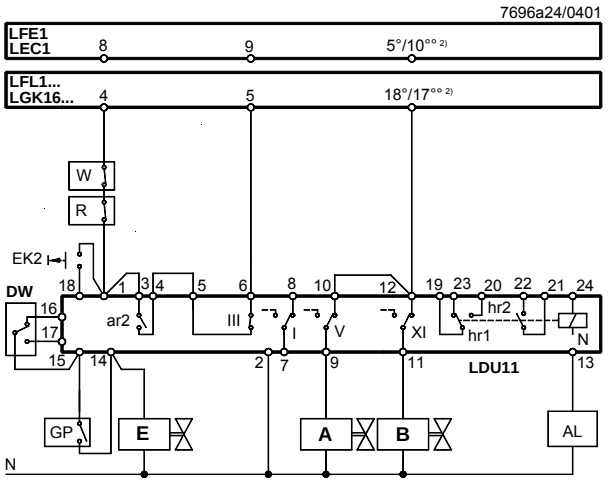
Plants without vent pipe to atmosphere



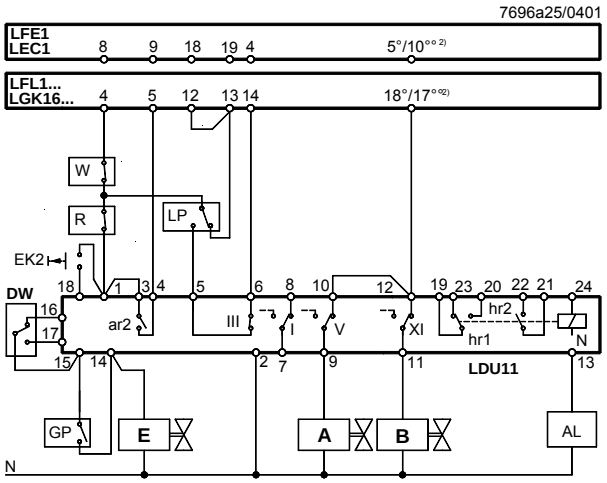
Connection examples without vent pipe to atmosphere using burner controls type LFE..., LFL... or LGK..., or the control unit LEC...

For other connections, refer to the connection diagram of the relevant burner control.

Check just prior to burner startup
2) Expanding flame burner or interrupted pilot burner



Check during the prepurge time (min. 60 seconds)
2) Expanding flame burner or interrupted pilot burner



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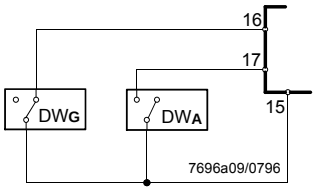
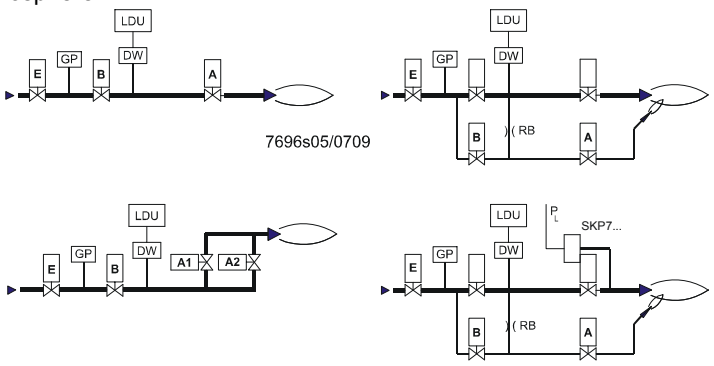


Plants without vent pipe to atmosphere

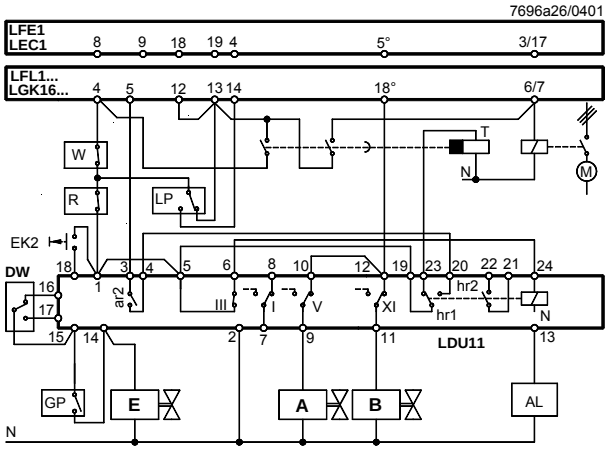


Air pressure (PL) for the SKP7... must be sufficiently high to open the SKP7... although the burner's air damper is closed. Otherwise, the LDU11... will initiate lockout when performing «Test1».

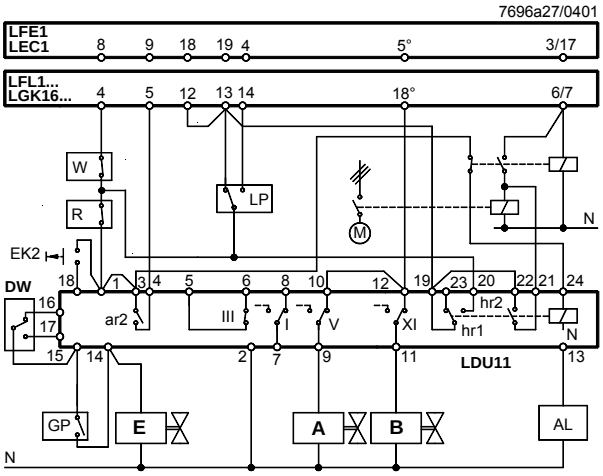
Connection examples without vent pipe to atmosphere using burner controls type LFE..., LFL... or LGK..., or control unit LEC... and actuator SKP7... with expanding flame burners

For other connections, refer to the connection diagram of the relevant burner control

Check just prior to burner startup



Check during the prepurge time (min. 60 seconds)

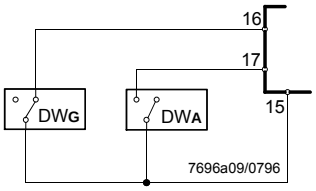


Valve proving test with 2 pressure switches

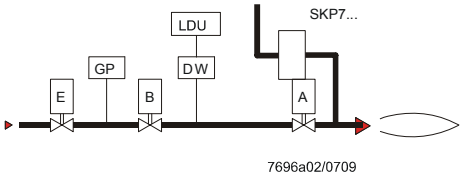
DWG Pressure switch for the valve proving test with gas pressure. This pressure switch must be set to the minimum gas pressure permitted during the proving test. If this pressure is not reached during the test, lockout will be initiated.

DWA Pressure switch for the gas valve proving test with atmospheric pressure. This pressure switch must be set to the maximum gas pressure permitted during the proving test with atmospheric pressure. If this pressure is exceeded during the test, lockout will be initiated.

Pressure switch (DWG) and pressure switch (DWA) must be overload-proof up to the gas pressure level.



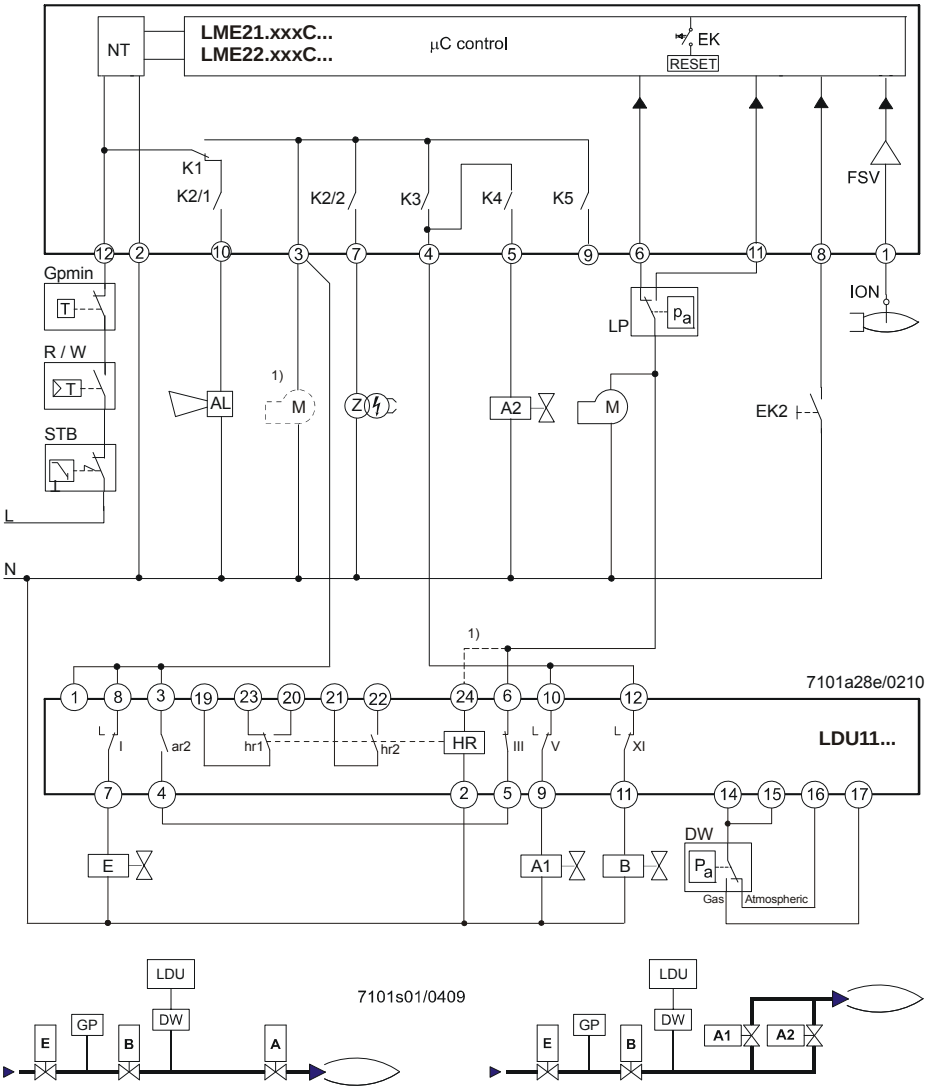
Plants without vent pipe to atmosphere



Connection examples without vent pipe to atmosphere using burner controls type LME21.xxxC... / LME22.xxxC... with expanding flame burners

For other connections, refer to the connection diagram of the relevant burner control.

- LME22.xxxC... / LME22.xxxC... with LDU11... valve proving
- Before startup of burner
- In the case of plants without vent pipe to atmosphere



1) Fan motor connected to terminal 3 of the LME22.xxxC.... / LME22.xxxC...

- Valve proving is started each time the system is switched on, with connection of terminal 3, after controller ON or after lockout
- If the LDU11... initiates lockout, valve proving can take up to 160 seconds. Therefore, the maximum permissible response time of the air pressure switch is 180 seconds
- With the LDU11…, faults during valve proving lead to lockout and, with the LME22.xxxC.... / LME22.xxxC..., to lockout due to air pressure switch timeout (blink code 03)

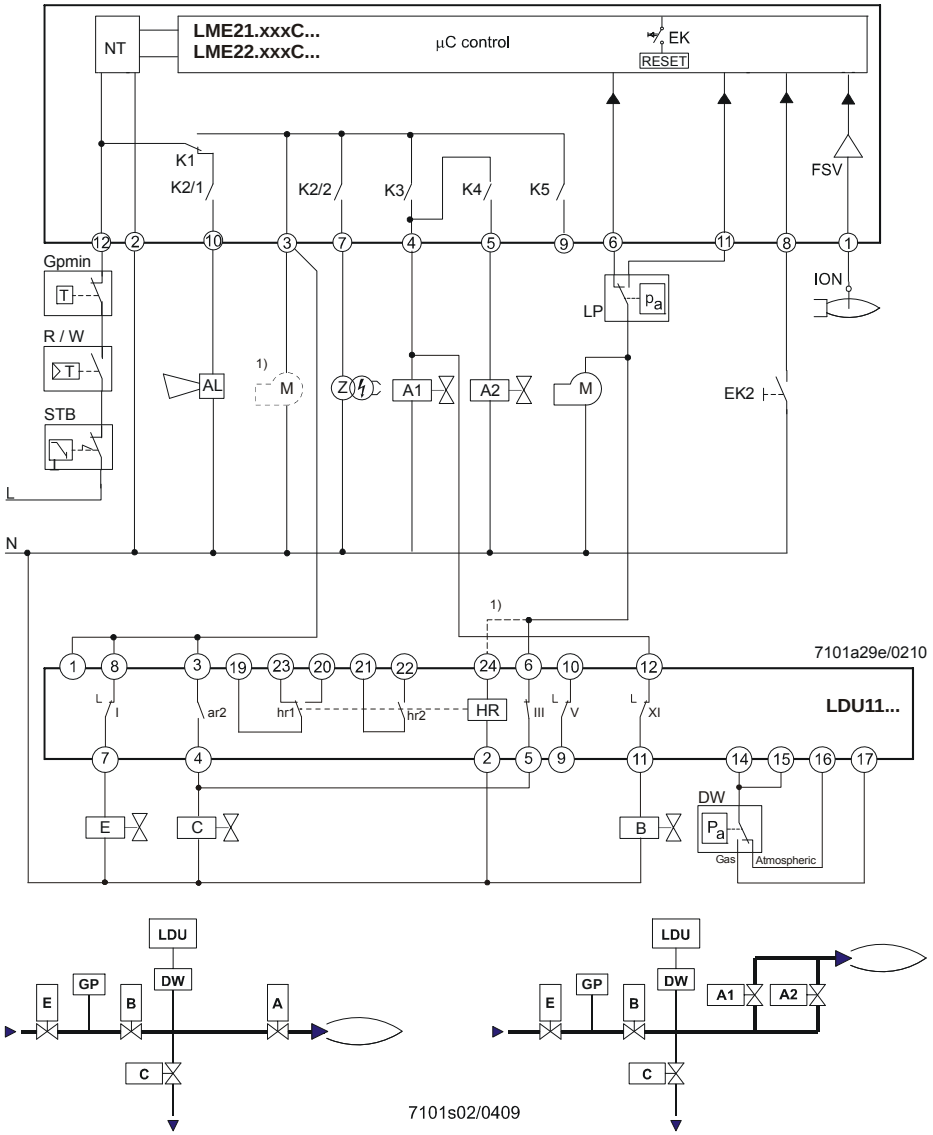
☞ • Note!
A faulty air pressure switch (switch does not make) leads to lockout (blink code 03) on completion of the pressure switch response time of 180 seconds and can be distinguished from lockout due to faulty valve proving only because the LDU11... did not go to lockout

- The fan motor can be connected either to terminal 3 in connection with a link between terminals 6 and 24 of the LDU11... (motor active during valve proving) or to terminal 6 of the LDU11... (motor active on completion of successful valve proving)

Connection examples with vent pipe to atmosphere using burner controls type LME21.xxxC... / LME22.xxxC... with expanding flame burners

For other connections, refer to the connection diagram of the relevant burner control.

- LME22.xxxC... / LME22.xxxC... with LDU11... valve proving
- Valve supervision before startup of burner
- In the case of plants with vent pipe to atmosphere



1) Fan motor connected to terminal 3 of the LME22.xxxC... / LME22.xxxC...

- Valve proving is started each time the system is switched on, with connection of terminal 3, after controller ON or after lockout
- If the LDU11... initiates lockout, valve proving can take up to 160 seconds. Therefore, the maximum permissible response time of the air pressure switch is 180 seconds
- With the LDU11…, faults during valve proving lead to lockout and, with the LME22.xxxC... / LME22.xxxC..., to lockout due to air pressure switch timeout (blink code 03)

☞

- Note!
  A faulty air pressure switch (switch does not make) leads to lockout (blink code 03) on completion of the pressure switch response time of 180 seconds and can be distinguished from lockout due to faulty valve proving only because the LDU11... did not go to lockout
- The fan motor can be connected either to terminal 3 in connection with a link between terminals 6 and 24 of the LDU11... (motor active during valve proving) or to terminal 6 of the LDU11... (motor active on completion of successful valve proving)

Legend

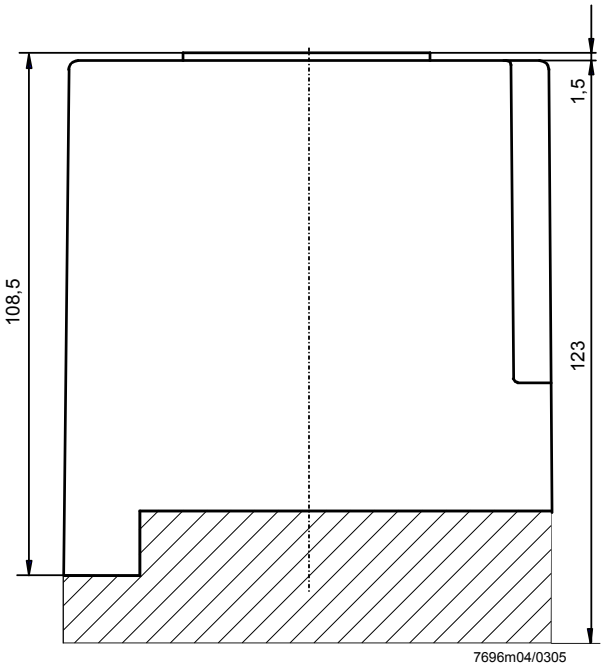
A, A1, A2	Gas valves controlled to evacuate the test space
AGK25	PTC resistor
AL	Alarm signal for «leaking valve»
ar...	Contacts (operating relay)
B	Gas valve controlled to fill the test space
C	Vent valve, normally open; closed during valve proving test from the beginning of «Test1»
DW	Pressure switch for valve proving test (does not replace the gas pressure switch used to signal lack of gas)
E	Safety shutoff valve, dead closed (optional)
EK	Lockout reset button (internal)
EK2	Remote lockout reset button
FSV	Flame signal amplifier
GP	Gas pressure switch (for lack of gas)
H	Main switch
ION	Ionization probe
K1...4	Internal relays
hr...	Contacts (auxiliary relay)
LP	Air pressure switch
M...	Fan («M2»: pre- and postpurging)
NT	Power supply
PL	Reference pressure for SKP7...
R	Control thermostat or pressurestat (e.g. boiler control thermostat)
RB	Pipe orifice; its diameter must be determined such that in the event of a leaking ignition gas valve (A), the ignition flame cannot afterburn on completion of the second safety time so that presence of the main flame cannot be simulated
SB	Safety limit thermostat
STB	Safety limit thermostat
T	Delay off time relay; the time should be set to approx. «t16» (min. «t7»... max. «t10») of the burner control
W	Limit thermostat or pressure switch or pressure limiter
Z	Ignition transformer
t7	Interval between start command and power at terminal 7 (start delay for «M2»)
t10	Interval from start to the beginning of the air pressure check, excluding running time of air damper
t16	Interval until OPEN command for the air damper is given

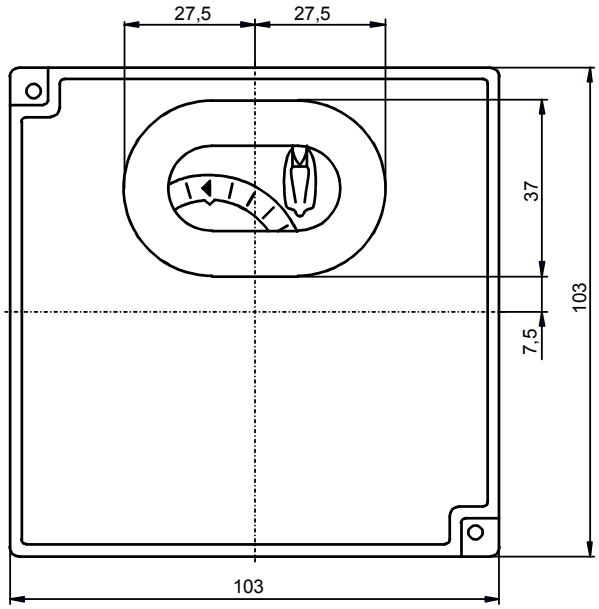
Dimensions

Dimensions in mm

LDU11...

Plug-in base AGM11 / AGM11.1





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Subject to change!