SIEMENS

LMV36...

AGM60...

LMV36.520A1 / AGM60.4A9

Basic unit with integrated fuel-air ratio control for forced draft burners

Basic Documentation

The LMV36... / AGM60... and this Basic Documentation are intended for OEMs which integrate the units in their products!

Software version
V03.30

CC1P7544en
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Building Technologies Division
Industry Sector

Supplementary documentation

Contents

1 Safety notes

1.1 Warning notes

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

LMV36... basic unit and AGM60... switch unit are safety devices! Do not open, interfere with or modify the units. Siemens does not assume responsibility for damage resulting from unauthorized interference!

Inside of this documentation are warning notes which also be must observed!

After commissioning and after each service visit, check the flue gas values across the entire load range!

The present Basic Documentation describes a wide choice of applications and functions and shall serve as a guideline. The correct functioning of the units must be checked and proven by function checks on a test rig or on the plant itself!

- All activities (mounting, installation and service work, etc.) must be performed by qualified personnel
- Degree of protection IP40 as per DIN EN 60529 for the basic unit must be ensured through adequate mounting of the LMV36... basic unit and the AGM60... switch unit by the burner or boiler manufacturer
- 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 and that it is indeed dead. If not disconnected, there is a risk of electric shock hazard
- Protection against electric shock hazard on the LMV36..., the AGM60... and on all connected electrical components must be ensured through adequate mounting. In terms of design, stability and protection, the cover used must conform to EN 60730
- After each activity (mounting, installation and service work, etc.), check to ensure that wiring is in an orderly state and that the parameters are correctly set
- 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
- When programming the air-fuel ratio control curves, the commissioning engineer must constantly watch the quality of the combustion process (e.g. by means of a flue gas analyzer) and, in the event of poor combustion values or dangerous conditions, take appropriate actions, e.g. by shutting down the system manually
- When starting up a dual-fuel burner, both fuel trains must be put into full operation, thus making certain that fuel changeover by the user cannot lead to critical conditions
- The inputs and outputs of the AGM60... may only be used for the application covered by this document and only in connection with the sensors and actuators specified for the application, the reason being that only these have been checked and released in terms of error effects. If you want to use the sensors and actuators on other applications, please contact Siemens
- The following plug-on terminations carry FELV (functional extra low-voltage) (also refer to chapter *Electrical connection of LMV36... and AGM60...*), thus ensuring adequate separation from mains voltage:
  - BCI (X56) for the connecting cable of AZL2... or PC tool ACS410
  - COM (X92) for accessories, such as the OCI410...
  - Plug-on terminations for actuators (X54) or for the AGV61.100 connecting cable when using 2 fuel actuators via AGM60...

  These plug-on terminations may be disconnected or exchanged only when the plant is dead (all-polar disconnection)
- The plugs of the connecting cables for the LMV36… or other accessories, such as the OCI410... interface (plugged into the BCI), may be removed or exchanged only when the plant is shut down (all-polar disconnection), since the BCI does not provide safe separation from mains voltage.

- The connection for the SQM3… or SQN1... actuators does not provide safe separation from mains voltage. Prior to connecting or changing one of these actuators, the plant must be shut down (all-polar disconnection)
- When setting up a system with the AGM60..., check to ensure that the sensors and actuators are correctly assigned to fuels

To ensure safety and reliability of the LMV36... and the AGM60..., the following points must also be observed:

- Condensation and ingress of humidity must be avoided. Should such conditions occur, make sure that the unit is completed dry before switching on again!
- Static charges must be avoided since they can damage the unit's electronic components when touched.
  Recommendation: Use ESD equipment
- If the unit fuse was blown due to overload or a short-circuit at the connection terminals, the LMV36... must be replaced since the switching contacts could have been damaged

1.2 Mounting notes

- Ensure that the relevant national safety regulations and regulations relating to standards are complied with
- In geographical areas where DIN regulations apply, the requirements of VDE must be satisfied, especially DIN / VDE 0100, 0550 and DIN / VDE 0722

1.2.1 LMV36...

- The LMV36... basic unit must be secured with fixing screws M4 (UNC32) or M5 (UNC24), observing a maximum tightening torque of 1.8 Nm and using all 4 fixing points. Additional mounting surfaces on the housing are provided to improve mechanical stability. These must completely rest on the mounting surface to which the unit is secured. The flatness of that mounting surface must be within a tolerance band of 0.3 mm
- Touch protection of the external fuel selector must be ensured by fitting the selector as a separate component (e.g. in a control panel door or under the burner hood)

Notes on mounting

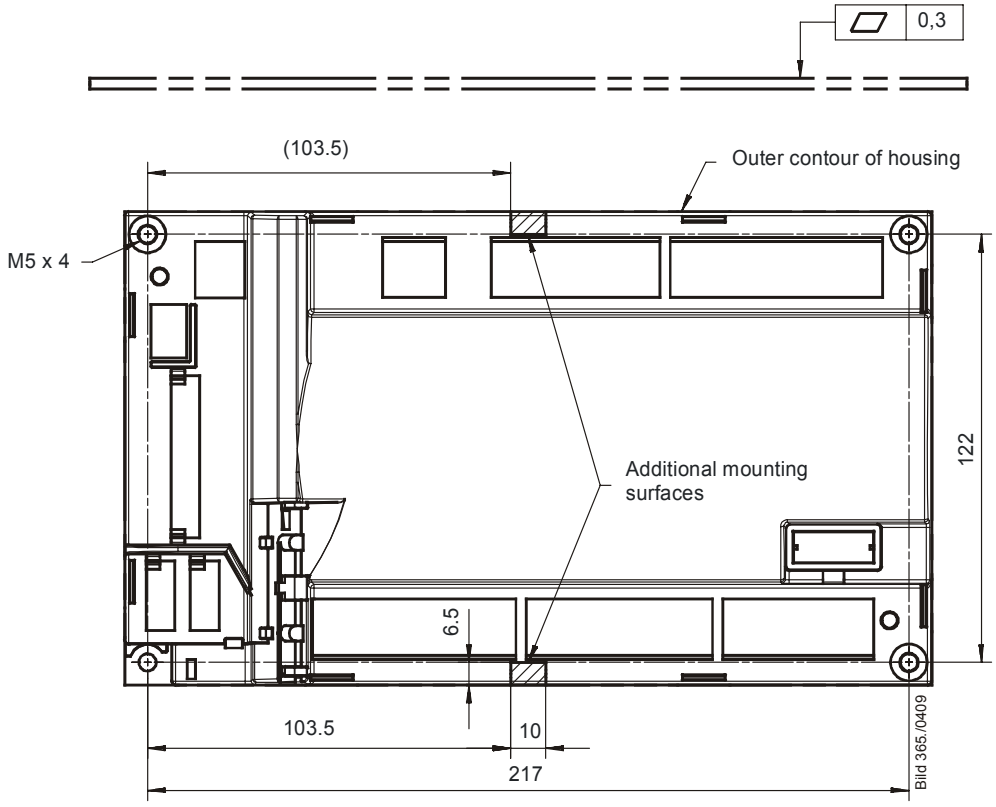


Figure 1: LMV36... note on mounting

1.2.2 AGM60...

Notes for mounting

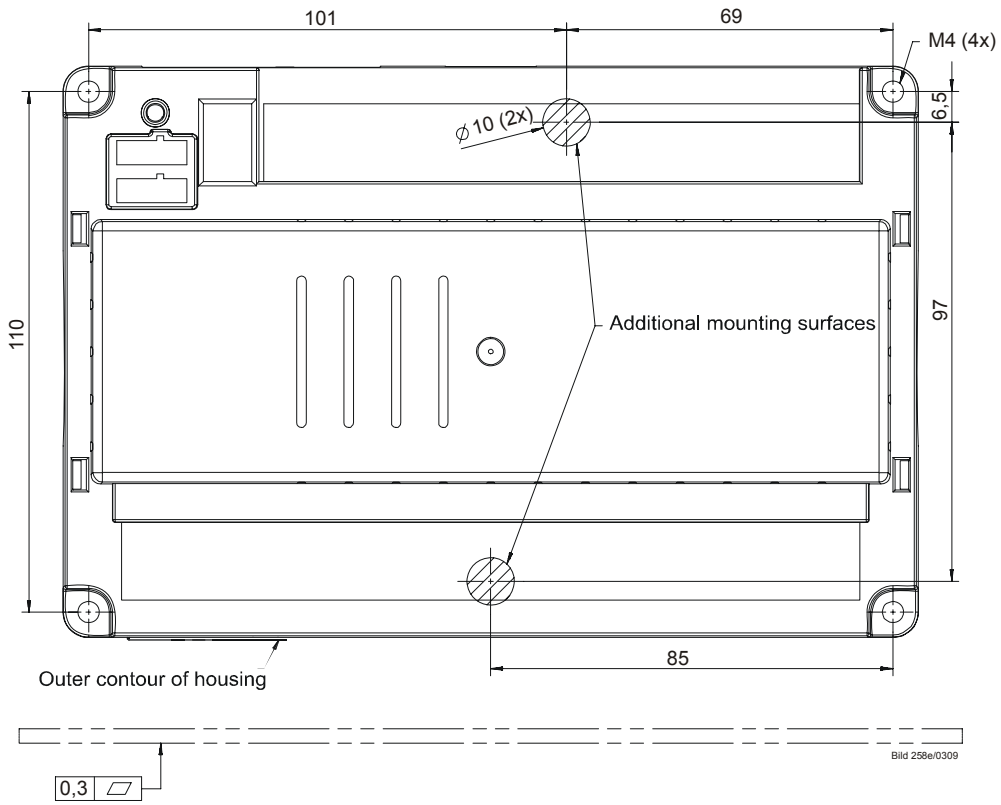
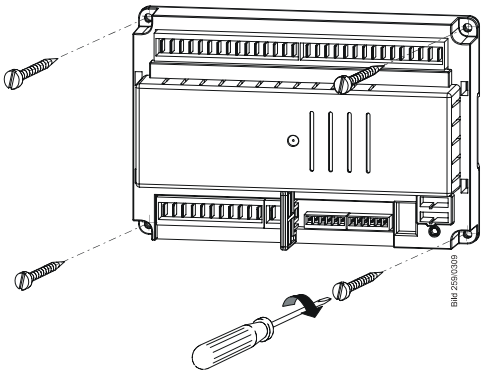


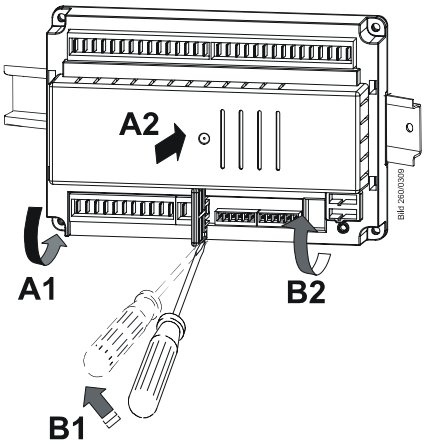
Figure 2: AGM60... note for mounting

Mounting method

Screwed



On a DIN rail



A = mounting **B = removal**

Mounting on DIN rails requires a mounting clip!

If the unit is screwed on, following must be observed:

- The AGM60… switch unit must be secured with fixing screws M4 (UNC32), observing a maximum tightening torque of 1.8 Nm and using all 4 fixing points
- The additional mounting surfaces on the housing must be used; they are provided to improve mechanical stability and must fully rest on the mounting surface. The flatness of the mounting surface must be within a tolerance band of 0.3 mm

1.3 Installation notes

- Always run the high-voltage ignition cables separate from the unit and other cables while observing the greatest possible distances
- Ensure that the electrical wiring inside the boiler is in compliance with national and local safety regulations
- Mains power must always be supplied via *L* and *N*. This means that no potential differential must exist between the neutral conductor *N* and protective earth *PE*
- Phase and neutral conductor must not be interchanged (dangerous malfunctions, loss of protection against electric shock hazard, etc.)
- Make certain that strain relief of the connected cables is in compliance with the relevant standards (e.g. as per DIN EN 60730 and DIN EN 60335)
- Ensure that spliced wires cannot get into contact with neighboring terminals. Use adequate ferrules
- Run the high-voltage ignition cable completely separate from all other cables
- The burner manufacturer must protect unused terminals of LMV36... and AGM60... by fitting dummy plugs (exception: X64 (reserved) and X74)
- When making the wiring, ensure that the AC 120 V sections is strictly separated from other voltage sections, thus ensuring protection against electric shock hazard (for more detailed information, refer to chapter *Electrical connection of LMV36... and AGM60...*)
- The plugs of connecting line for the LMV36…, must be connected or disconnected only when the plant is dead (all-polar disconnection), since the BCI does not ensure safe separation from mains voltage
- AGV50... signal cable from LMV36... and AZL2...
  Since the BCI carries FELV (refer to chapter *Electrical connection of LMV36... and AGM60...*), use of the AGV50… signal cable for connection from the LMV36... to the AZL2... is mandatory, or observe the respective specification. The cable is specified for use under the burner hood. When using other types of cable that do not conform to the specification, protection against electric shock hazard is not necessarily ensured
- Do not lay signal cable AGV50... from the LMV36... to the AZL2... together with other cables
- Service operation with a longer signal cable from the LMV36...:
  If a longer signal cable is required for service work for example (short-time usage, <24 hours), note that the above application under the burner hood no longer applies and, for this reason, the signal cable can be subjected to increased mechanical stress. In that case, use a reinforced signal cable
- Both the AGV50... signal cable and the AZL2... must be shipped and stored so that no damage due to dust and water can occur when the products are used in the field
- To ensure protection against electric shock hazard, make certain that – prior to switching on power – the AGV50... signal cable is correctly connected to the AZL2...
- The AZL2... must be used in a dry and clean environment
- The connection between the actuators and the regulating units for fuel and combustion air or any other regulating units must be form-fitted

1.3.1 Use of the AGM60...

- To ensure correct fuel changeover, output *Safety valve (SV) / magnetic clutch (X6-03.3)* must be connected to the respective input of the AGM60... (X32-01.5), the reason being the following:
  Depending on the signal level at this output, the AGM60... sends the point in time for fuel changeover to the LMV36...

Caution!

- The AGM60... must always be powered via the LMV36... basic unit and never directly by mains voltage
- The live conductor for fuel changeover (refer to chapter *Fuel changeover*) must always be picked up at terminal X31-01.4 of the AGM60…
- Connecting cable between LMV36... and AGM60... (also refer to chapter *Makeup of system*): Use of this connecting cable is mandatory (available as an accessory item, refer to chapter *Type summary*)

1.4 Electrical connections of LMV36... and AGM60...

For LMV36... and AGM60..., the following low-voltage categories are in use:

- SELV (safety extra low-voltage) and PELV (protective extra low-voltage) ensure protection against electric shock hazard
- FELV (functional extra low-voltage)
  Functional extra low-voltage without safe separation provides no protection, so that risk would not be excluded in the event of failure

1.4.1 LMV36...

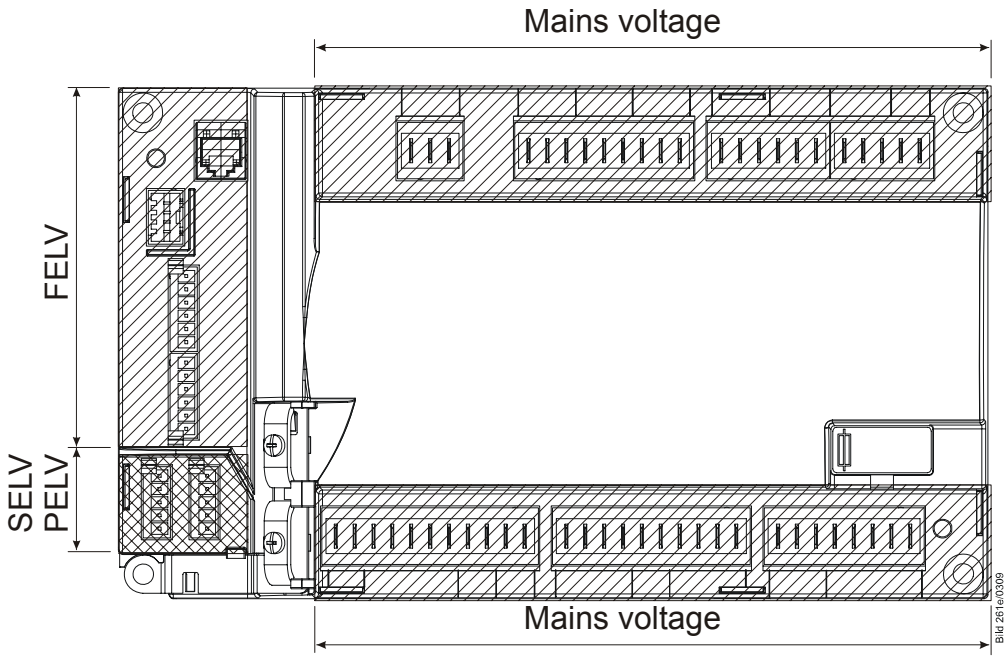


Figure 3: LMV36... electrical connection

Note
The safety class of the connected components determines whether SELV or PELV applies. In the case of PELV, the respective component is earthed and connected to protective earth.

1.4.2 AGM60...

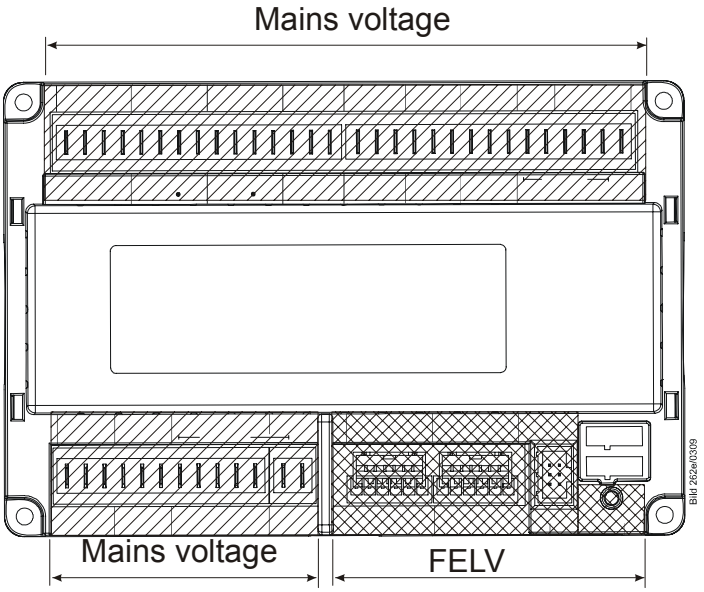


Figure 4: AGM60... electrical connection

When installing the unit, make certain that non-insulated parts in the mounting frame do not get into contact with the connection terminals. Also observe the lateral connecting area:

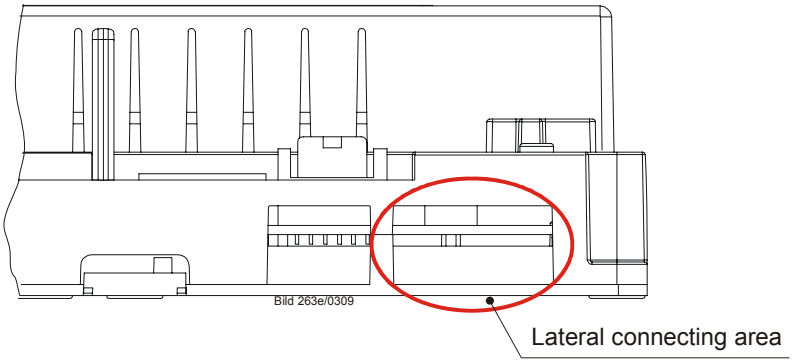


Figure 5: AGM60... lateral connecting area

1.5 Electrical connection of flame detectors

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

- Never run the detector cables together with other cables
  – Line capacitance reduces the magnitude of the flame signal
  – Use a separate cable
- Observe the permissible detector cable lengths
- The mains-powered ionization probe is not protected against electric shock hazard. It must be protected against accidental contact
- Earth the burner in compliance with the relevant regulations; earthing the boiler alone does not suffice
- Locate the ignition electrode and the ionization probe such that the ignition spark cannot arc over to the ionization probe (risk of electrical overloads)

1.6 Commissioning notes

- When commissioning the unit, check **all safety functions**
- There is no absolute protection against incorrect use of the RASTx connectors. For this reason, prior to commissioning the plant, check the correct assignment of all connectors
- Electromagnetic emissions must be checked on an application-specific basis

After the plant has been installed and commissioned, the person responsible for the plant / heating engineer must **document** the parameterized values and settings (e.g. curve characteristics) used for fuel-air ratio control.
These data can be printed out with the help of the ACS410 PC software, for example, or must be written down.
This document must be kept in a safe place and checked by the expert.

Caution!
On the OEM level of the LMV36..., parameter settings other than those specified in the application standards can be made. For this reason, check whether the parameter settings made are in compliance with the relevant application standards (e.g. EN 298, EN 230, EN 676, EN 267, etc.), or whether the respective plant demands special approval!

Fuel-air ratio control system

The selected setting values of fuel and combustion air must be assigned such that – while giving consideration to the combustion chamber / fuel pressure, temperature and combustion air pressure, as well as wear of actuators and controlling elements, etc. – correct operation with sufficient amounts of excess air is ensured across the burner's full output range for an extensive period of time (until the next regular inspection is due; also refer to chapter *Monitoring the positions*). This must be proven by the burner / boiler manufacturer by measuring the characteristic combustion process values. If the standardization process is repeated, the fuel-air ratio control system must be rechecked.

Basic unit section

Prior to commissioning the system, the following points must be checked:

- Parameterization of operating mode (e.g. «G mod», «Gp1 mod», «Lo mod», etc.) must accord with the type of burner used (refer to chapter *Selection of operating mode*)
- Correct assignment of the valves to the valve outputs of the LMV36...
- Correct setting of the time parameters, especially the safety and prepurge times
- Correct functioning of the flame detector in the event of loss of flame during operation (including the response time), with extraneous light, during the prepurge time and, when there is no establishment of flame, at the end of the safety time
- Activation of the valve proving function and determination of the correct leakage rate, if required by the application (refer to chapter *Valve proving*)

The functions of the following available or required input status signals must be checked:

- Air pressure
- Minimum gas pressure / maximum gas pressure or POC
- Gas pressure valve proving
- Minimum oil pressure and maximum oil pressure
- Safety loop (e.g. safety limiter)

Duties of the expert when making the approval tests

	Action	**Check / response**
a)	Burner startup with flame detector darkened	Lockout at the end of safety time 1 (TSA1)
b)	Burner startup with flame detector exposed to extraneous light, e.g. to incandescent light with detectors for visible radiation, quartz-halogen bulb or cigarette lighter flame with detectors for UV radiation	Lockout at prepurge time (t1)
c)	Simulation of loss of flame during operation. For that, darken the flame detector in the operating position and maintain that state	Lockout or restart, depending on the basic unit's configuration
d)	Check the plant's response time with loss of flame during operation. For that purpose, manually disconnect the fuel valves from power and check the time from this moment the basic unit requires to turn off power to the valve	Turning off power to the valves by the basic unit within the period of time permitted for the respective type of plant
e)	Check the safe operation of the burner while giving consideration to system tolerances	System tolerances are the result of a number of factors, such as: - Tolerances of actuators plus mechanical linkage to the controlling elements - Environmental conditions (temperature, air conditions) - Type of fuel (calorific value / pressure) - Type of supply air path and flue ways Example of procedure for checking the burner's response to actuator tolerances: - Approach a output point in programming mode (e.g. low-fire or high-fire) - Change the actuator's position against the optimum fuel-air ratio setting as can be expected in the case of tolerances - Check the flue gas values with a flue gas analyzer **Recommendation:** Make this readjustment against the optimum fuel-air ratio setting for one actuator at a time!

Further checks may be required, depending on the field of use and the relevant standards.

1.7 Notes on settings and parameter settings

- When adjusting the electronic fuel-air ratio control system integrated in the LMV36..., allow for sufficient amounts of excess air since – over a period of time – the flue gas settings are affected by a number of factors (e.g. density of air, wear of actuators and controlling elements, etc.). For this reason, the flue gas values initially set must be checked at regular intervals
- To safeguard against inadvertent or unauthorized parameter transfer from the PC software to the basic unit, the OEM must assign an individual burner identification (ID) for each burner. Compliance with this regulation is mandatory to ensure that the LMV36... system prevents the transfer of parameter sets of some other plant (with inadequate and possibly dangerous parameter values) to the LMV36... system via the PC tool. In addition, the fuel-air ratio control parameters must be manually approached and the combustion values checked
- With the LMV36... system, it is to be noted that the unit's characteristics are determined primarily by the specific parameter settings rather than the type of unit. This means that, among other things, each time a plant is commissioned, the parameter settings must be checked and the LMV36... must not be transferred from one plant to another without adapting the parameter settings to the new plant
- When using the ACS410 PC software, the safety notes given in the relevant Installation and Operating Instructions (J7352) must also be observed
- A password protects the parameter level against unauthorized access. The OEM allocates individual passwords to the setting levels he can access. The default passwords used by Siemens must be changed by the OEM. These passwords are confidential and may only be given to persons authorized to access such setting levels
- The responsibility for setting the parameters lies with the person who – in accordance with his access rights – made changes to the respective setting level

In particular, the OEM (burner and / or boiler manufacturer) assumes responsibility for the correct parameter settings in compliance with the standards covering the specific applications (e.g. EN 676, EN 267, EN 1643, etc.).

1.8 Standards and certificates

Conformity to EEC directives

- Electromagnetic compatibility EMC (immunity)	2004/108/EC
- Directive for gas-fired appliances	90/396/EEC
- Low-voltage directive	2006/95/EC
- Pressure equipment directive	97/23/EC

ISO 9001: 2010
Cert. 00739

ISO 14001: 2010
Cert. 38233

- **Identification code as per EN 230 / EN 298, chapter 4** **F T / M C L B B**

1.9 Service notes

- **If fuses are blown, the unit must be returned to Siemens** (refer to chapter *Warning notes*)
- Error diagnostics can only be made via the LMV36... (BCI)

1.10 Life cycle

LMV36... The burner management system LMV36... 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).

AGM60... The AGM60... switch unit has a designed lifetime* of 5,000 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).

General This lifetime is based on the endurance tests specified in EN 230 / EN 298 and the table containing the relevant test documentation published by the European Association of Component Manufacturers (Afecor) (www.afecor.org).

The designed lifetime is based on use of the LMV36... / AGM60... according to the manufacturer's Basic Documentation. When reaching the designed lifetime in terms of the number of burner startup cycles or time of usage, the LMV36... / AGM60... must be replaced by authorized personnel.

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

1.11 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 observe

2 Makeup of structure / function description

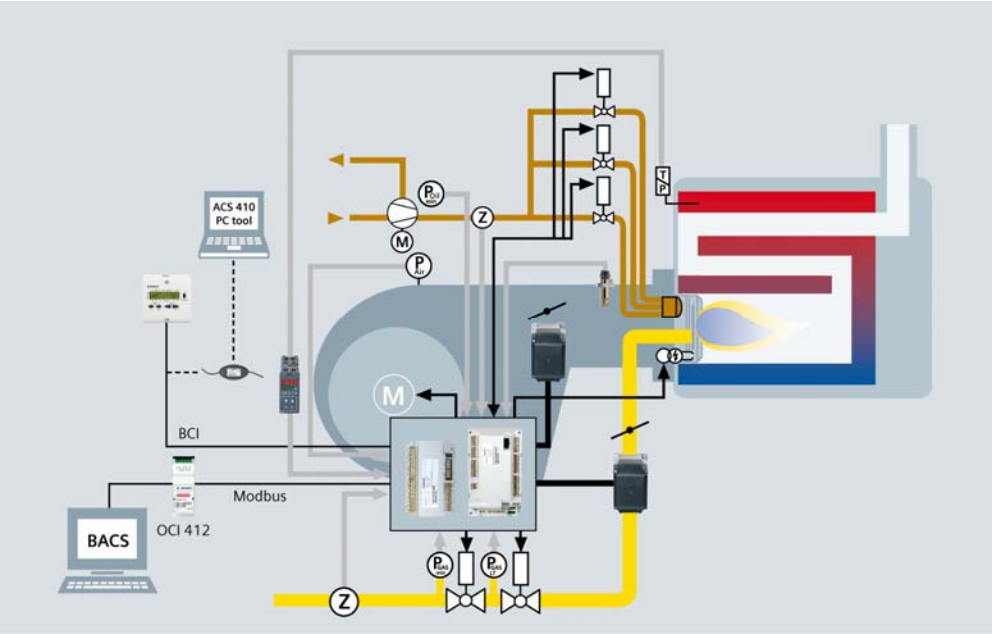
2.1 LMV36...

The LMV36... is a microprocessor-based burner management system with matching system components for the control and supervision of forced draft burners of medium to high capacity.

For using of dual fuel with 2 fuel actuators, AGM60... switch unit is required.

Following are integrated in the LMV36...:

- Burner management system complete with valve proving system
- Electronic fuel-air ratio control system for a maximum of 2 SQM3... or SQN1... actuators
- Control of VSD for air fan
- Modbus interface



Example: Dual fuel burner, gas modulating and oil 3-stage

2.2 For North American

For intermittent operation in connection with the LMV36…, / AGM60... the ionization probe or the QRA... or QRB... optical flame detectors can be used. **Continuous operation is possible only when using an ionization probe and without AGM60...**

2.3 General information

The burner management system is operated and parameterized either via the AZL2... display and operating unit or with the help of the PC tool.
The AZL2... with LCD and menu-driven operation facilitates straightforward use and targeted diagnostics. When making diagnostics, the display shows the operating states, the type of error and the point in time the error occurred. Passwords protect the different parameter levels of the burner / boiler manufacturer and heating engineer against unauthorized access. There is also a COM port which can be accessed from a superposed system, such as a building automation and control system (BACS). A PC with ACS410 software can be connected via the BCI and OCI410… interface. Among other features, the ACS410 software (for dual fuel burner → on request) affords convenient readout of settings and operating states, parameterization of the LMV36..., and trend recordings.
The burner / boiler manufacturer can select from different types of fuel trains and make use of a wide choice of individual parameter settings (program times, configuration of inputs / outputs, etc.), enabling him to make optimum adaptations to the relevant application. The actuators are driven by stepper motors and can be positioned with high resolution. Specific features and actuator settings are defined by the LMV36... basic unit.

2.4 AGM60...

The AGM60… switch unit connected to the LMV36... serves for changeover of valve control or for feedback signals from the 2 types of fuel. The signals are monitored by the LMV36... basic unit (same as with the single-fuel variant) which, in the event of fault, also triggers shutdown.

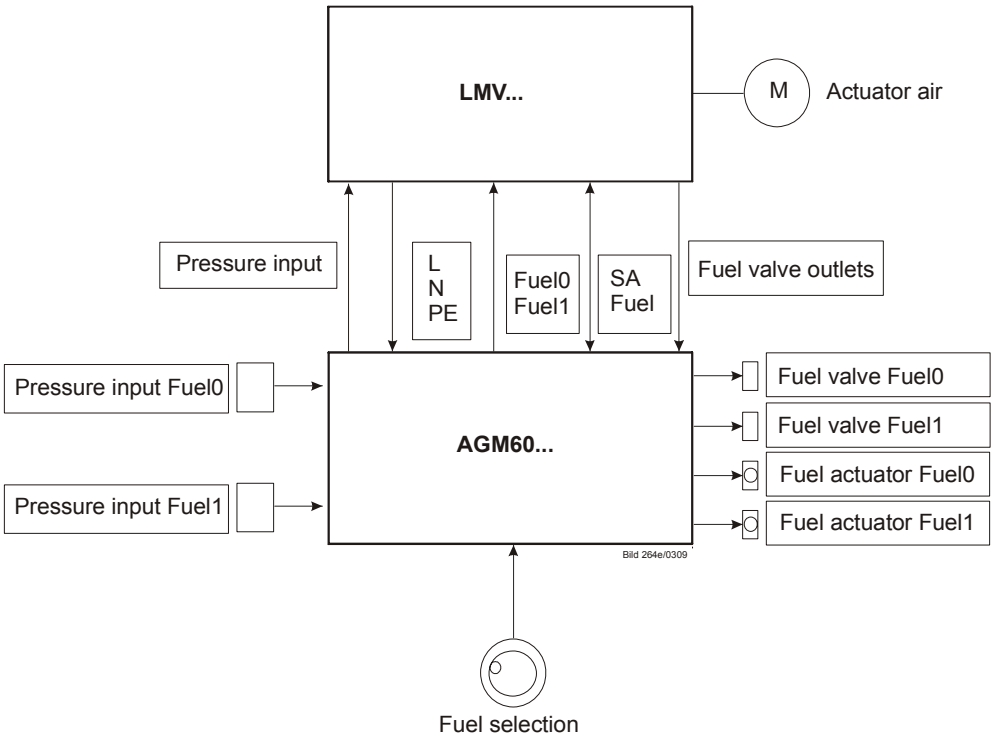


Figure 6: AGM60... connected to the LMV36...

2.4.1 Electrical connections of fuel actuators

When using only 1 fuel actuator, it must be connected directly to the LMV36... In that case, a connecting cable (AGV61.100) is not required.
When using 2 fuel actuators for each type, they must be connected to the AGM60...

Fuel selection choices:
- Gas / oil
- Gas / gas
- Oil / oil

When wiring the components, we recommend to make the following fuel assignments as standard:
Fuel 0 = gas
Fuel 1 = oil
This can be set via parameter 201 / 301 (refer to chapter *Selection of operating mode*).

Following switching's of inputs and outputs are made via AGM60...:
- Fuel at the LMV36...
- Fuel valve
- Pressure switch or POC
- Actuator (SQM3... or SQN1...)

2.4.2 Continuous operation

The LMV36... basic unit together with the AGM60... is not approved for continuous operation.

In the case of intermittent operation in connection with the LMV36..., an ionization probe or flame detector QRA..., QRB... or QRC... can be used.

2.4.3 Fuel changeover

The fuel selection is made by an external connected switch at AGM60...
The changeover logic of the AGM60... generates feedback signals *Fuel 0* and *Fuel 1* which are fed to the LMV36... basic unit for evaluation.

☞ Note
Fuel changeover via the AZL2... or a BAC system is not technically possible.

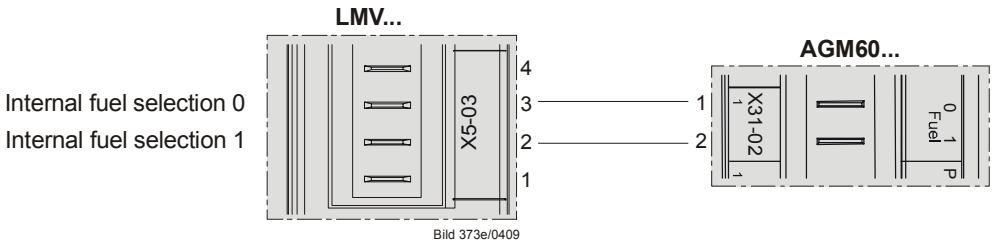


Figure 7: Fuel changeover

The next burner start after shutdown or safety shutdown takes place with the **new** type of fuel.

After fuel changeover, any manually selected output or output called for by the BAC system is cancelled and automatic operation is activated, thus enabling automatic restart with the new fuel if there is a request for heat.

Exception:
The manual off function for manual output and burner off (output = 0) via the BAC system are maintained.

Feedback signals *Fuel 0* and *Fuel 1* can also be used for manual reset and lockout (refer to chapter *Fuel selection / reset / lockout*).

2.4.4 Extra fuel selector

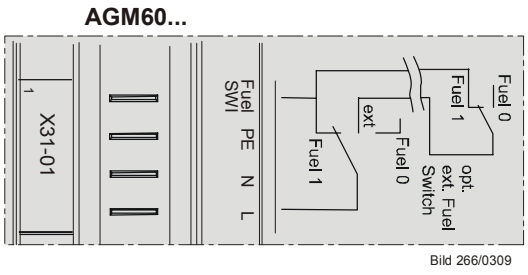


Figure 8: AGM60... extra fuel selector

3 Type summary

3.1 LMV36...

Microprocessor-based basic unit for single-fuel burners of any capacity, with electronic fuel-air ratio control, up to 2 actuators and integrated valve proving system.

Product no.	Mains voltage	Parameter set	Flame detectors
LMV36.520A1	AC 120 V	US	QRA2… / QRA4.U / QRA10… / QRB… / ION

3.2 AGM60...

The AGM60… switch unit is for connection to the LMV36... and used for change-over of valve control and/or for handling feedback signals from the 2 types of fuel.

Product no.	Mains voltage
AGM60.4A9	AC 120 V

3.3 Fuel selector

The fuel selector is **not** a component of the AGM60... and does **not** constitute part of the scope of delivery.

4 Technical data

4.1 LMV36... basic unit

Mains voltage	AC 120 V -15 % / +10 %
Mains frequency	50 / 60 Hz ±6 %
Power consumption	<30 W (typically)
Safety class	I, with parts according to II and III to DIN EN 60730-1
Degree of protection	IP00
	Note The burner or boiler manufacturer must ensure degree of protection IP40 for the LMV36... as per DIN EN 60529 through adequate installation

4.1.1 Terminal loading *Inputs*

• Perm. mains primary fuse (externally)	Max. 16 AT
• Unit fuse F1 (internally)	6.3 AT (DIN EN 60127 2 / 5)
• Mains supply: Input current depending on the operating state of the unit	
Undervoltage	
• Safety shutdown from operating position at mains voltage	Approx. AC 93 V
• Restart on rise in mains voltage	Approx. AC 95 V
Status inputs: Status inputs (with the exception of the safety loop) of the contact feedback network (CFN) are used for system supervision and require mains-related input voltage	
• Input safety loop	Refer to *Terminal loading outputs*
• Input currents and input voltages - UeMax - UeMin - IeMax - IeMin	 UN +10 % UN -15 % 1.5 mA peak 0.7 mA peak
• Contact material recommendation for external signal sources (LP, Pmin, Pmax, etc.)	Gold-plated silver contacts
• Transition / settling behavior / bounce - Perm. bounce time of contacts when switching on / off	 Max. 50 ms (after the bounce time, contact must stay closed or open)
• UN	AC 120 V
• Voltage detection - On - Off	 AC 90...132 V <AC 40 V

4.1.2 Terminal loading *Outputs*

Total contact loading:	
• Rated voltage	AC 120 V, 50 / 60 Hz
• Unit input current (safety loop) from: - Fan motor contactor - Ignition transformer - Valves - Oil pump / magnetic clutch (optional via AGM60...)	Max. 5 A

Individual contact loading:	
Fan motor contactor	
• Rated voltage	AC 120 V, 50 / 60 Hz
• Rated current	1.6 A pilot duty output declaration to UL372
• Power factor	Cosφ >0.4
Alarm output	
• Rated voltage	AC 120 V, 50 / 60 Hz
• Rated current	1 A
• Power factor	Cosφ >0.4
Ignition transformer	
• Rated voltage	AC 120 V, 50 / 60 Hz
• Rated current	1.6 A pilot duty output declaration to UL372 or 250 VA ignition output declaration to UL372
• Power factor	Cosφ >0.2
Fuel valves	
• Rated voltage	AC 120 V, 50 / 60 Hz
• Rated current	1.6 A pilot duty output declaration to UL372
• Power factor	Cosφ >0.4
Operation display	
• Rated voltage	AC 120 V, 50 / 60 Hz
• Rated current	0.5 A
• Power factor	Cosφ >0.4

4.1.3 Analog output / load output X74.3

Accuracy of output voltage	±1%

4.1.4 Cable lengths

• Mains line AC 120 V	Max. 100 m (100 pF/m)
• Display, BCI	For installation under the burner hood or in the control panel Max. 3 m (100 pF/m)
• Load controller (LR) X5-03	Max. 20 m (100 pF/m)
• Load controller analog X64 (24 mA)	Max. 20 m (100 pF/m)
• Safety loop / burner flange (total)	Max. 20 m (100 pF/m)
• External lockout reset button	Max. 20 m (100 pF/m)
• Safety valve (SV)	Max. 20 m (100 pF/m)
• VSD control ¹)²)	Max. 3 m (100 pF/m)
• Speed input	Max. 3 m (100 pF/m)
• Fuel valve (V1/V2/V3)	Max. 3 m (100 pF/m)
• Pilot valve (PV)	Max. 3 m (100 pF/m)
• Ignition transformer (Z)	Max. 3 m (100 pF/m)
• Other lines	Max. 3 m (100 pF/m)

¹) Do not run the cable together with other cables. If not observed, hum voltage might cause electromagnetic interference

²) Shorter cable length due to closed control loop

Specification as per EN 60730-1	
Type of shutdown or interruption of each circuit	
Shutdown with microswitch	1-pole
Mode of operation	Type 2 B

4.1.5 Cross-sectional areas

The cross-sectional areas of the mains power lines (L, N, and PE) and, if required, the safety loop (safety limit thermostat, water shortage, etc.) must be sized for rated currents according to the selected external primary fuse. The cross-sectional areas of the other cables must be sized in accordance with the internal unit fuse (max. 6.3 AT).

Min. cross-sectional area	0.75 mm² (single- or multi-core as per VDE 0100)

Cable insulation must meet the relevant temperature requirements and environmental conditions.

Fuses used inside LMV36... basic unit	
- F1	6.3 AT DIN EN 60127 2 / 5

4.2 Signal cable AGV50... from AZL2... → BCI

Signal cable	Color white Unshielded Conductor 4 x 0.141 mm² With RJ11 connector
Cable length - AGV50.100 - AGV50.300	 1 m 3 m
Supplier	Recommended: Hütter http://www.huetter.co.at/telefonkabel.htm Order number: on request
Location	Under the burner hood (extra measures required for SKII EN 60730-1)

4.3 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	-30...+60 °C
Humidity	<95 % r.h.
Operation	DIN EN 60721-3-3
Climatic conditions	Class 3K3
Mechanical conditions	Class 3M3
Temperature range	-20...+60 °C
Humidity	<95 % r.h.

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

4.4 Flame detectors

4.4.1 Ionization probe

For continuous operation!

No-load voltage at ION terminal (X10–05 terminal 2)	Approx. UMains

Caution!
Protect the ionization probe against electric shock hazard!

Short-circuit current	Max. AC 1 mA
Required detector current	Min. DC 4 µA, flame display approx. 30 %
Possible detector current	Max. DC 16…40 µA, flame display approx. 100 %
Max. perm. length of detector cable (laid separately)	3 m (wire–ground 100 pF/m)

Note
The higher the detector cable's capacitance (cable length), the more voltage at the ionization probe, and thus the detector current, drops. Long cable lengths plus very highly resistive flames might necessitate low-capacitance detector cables (e.g. ignition cable). In spite of technical measures taken in the circuitry aimed at compensating potential adverse effects of the ignition spark on the ionization current, it must be made certain that the minimum detector current required is already reached during the ignition phase. If this is not the case, the connections on the primary side of the ignition transformer must be changed and / or the electrodes relocated.

Threshold values when flame is supervised by an ionization probe:	
- Start prevention (extraneous light)	Intensity of flame (parameter 954) ≥18%
- Operation	Intensity of flame (parameter 954) >24%

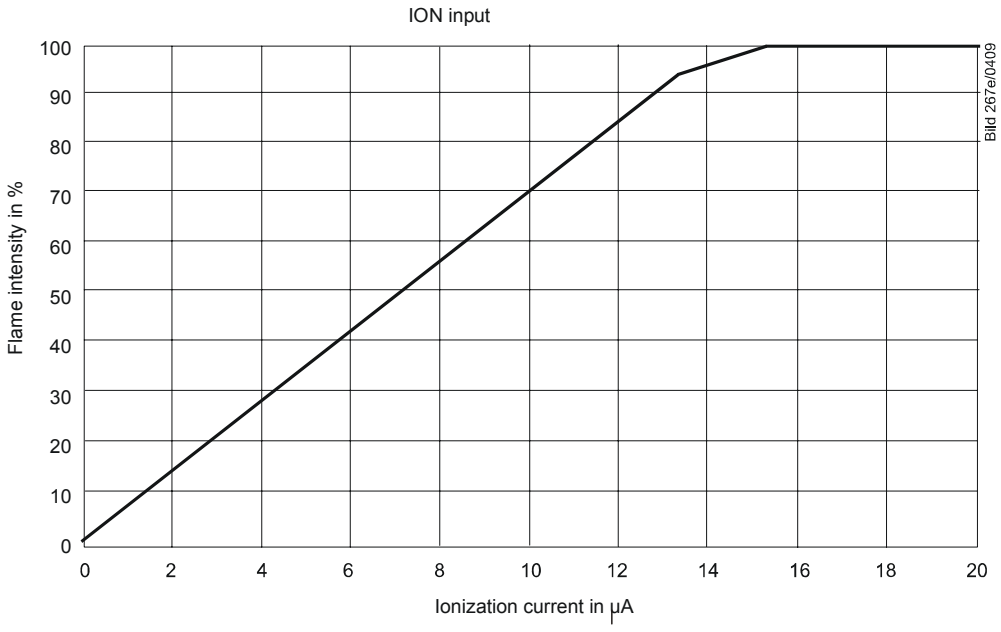


Figure 9: Ionization input at AC 120 V

4.4.2 UV flame detectors QRA2… / QRA4.U / QRA10…

Caution!
If flame detectors QRA2… / QRA4.U / QRA10... are used for flame supervision with the LMV36..., it must be ensured that the basic unit is permanently connected to power (conforming to EN 230 / EN 298), thus enabling the system to detect flame detector failures during startup and shutdown. Generally, the system works with QRA... flame detectors in intermittent operation.
For technical data, refer to Data Sheet N7712 covering QRA2... / QRA10... UV flame detector!
For technical data, refer to Data Sheet N7711 covering QRA4.U UV flame detector!

Threshold values when flame is supervised by QRA...:	
- Start prevention (extraneous light)	Intensity of flame (parameter 954) ≥18%
- Operation	Intensity of flame (parameter 954) >24%

4.4.3 Photoresistive flame detectors QRB…

No-load voltage at QRB... terminal (X10–05 terminal 3)	Approx. DC 5 V
Max. perm. length of QRB... detector cable (laid separately)	3 m (wire – wire 100 pF/m)

Note
A detector resistance of RF <500 Ω is identified as a short-circuit and leads to safety shutdown in operation as if the flame had been lost.

For this reason, before considering the use of a highly sensitive photoresistive detector (QRB1B... or QRB3S), it should be checked whether this type of flame detector is indeed required! Increased line capacitance between QRB... connection and mains live wire *L* has an adverse effect on the sensitivity and increases the risk of damaged flame detectors due to overvoltage. Always run detector cables separately!

Threshold values when flame is supervised by QRB...:	
Start prevention (extraneous light) with **R**QRB	<400 kΩ Intensity of flame ≥10%
Operation with **R**QRB	<230 kΩ Intensity of flame >16%
Short-circuit detection with **R**QRB	<0.5 kΩ

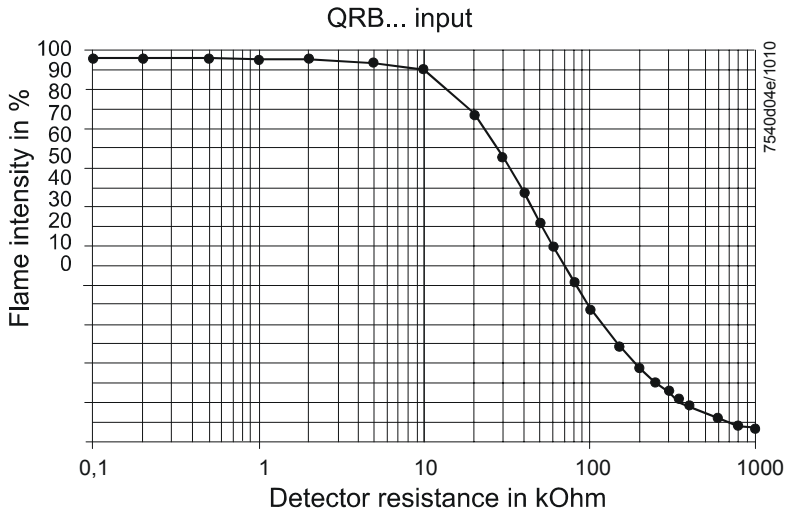


Figure 10: QRB… input at AC 120 V

4.5 Switch unit AGM60...

Mains voltage	AC 120 V -15% / +10%
Mains frequency	50/60 Hz ±6%
Power consumption	<5 W (typically) (without actuator supply)
Safety class	I with parts according to II and III to DIN EN 60730-1
Galvanic separation between mains voltage terminals and actuator signal lines and actuator supply lines	No
Degree of protection	IP00 Note: The burner or boiler manufacturer (OEM) must ensure degree of protection IP40 to DIN EN 60529 for burner controls by adequate installation of the AGM60... The AGM60... together with the LMV36... is suited for installation under the burner hood or inside a control cabinet or control panel
Detection time fuel changeover	<400 ms
Switching frequency fuel changeover	Min. 3 s
Switching cycles fuel changeover	Max. 5´000
Perm. mains primary fuse (externally)	Max. 6.3 AT Power must always be supplied via the basic unit (refer to chapter *Inputs / Outputs*)
Mains supply: Input current depending on the operating state of the unit	
Mains voltage is monitored by the burner control	
Dimensions (W x H x D)	180.7 x 120.7 x 51.7 mm
Mounting	Top hat rail to DIN EN 60715, 35 mm or screwed

4.5.1 Terminal output *Inputs*

Status input: Fuel selection, pressure switch	
• Input currents and input voltages - UeMax - UeMin - IeMax - IeMin	 UN +10% UN -15% 1.5 mA peak 0.7 mA peak
• Contact material recommendation for external switching contact, transducer (Pmax, POC)	Gold-plated silver contacts
• Transition / settling behavior / bounce - Perm. bounce time of contacts when switching on/off	 Max. 50 ms (after the bounce time, the contact must stay closed or open)
• UN	AC 120 V
• Voltage detection - On - Off	 AC 90...132 V <AC 40 V

4.5.2 Terminal output *Outputs*

Total contact output:	
• Rated voltage	AC 120 V, 50/60 Hz
Refer also *Total contact output* in chapter *Terminal output Outputs*	

Individual contact loads:	
Fuel valve	
• Rated voltage	AC 120 V, 50/60 Hz
• Rated current	1.6 pilot duty output declaration to UL732
• Power factor	Cosφ >0.4
Safety valve (SV) (magnetic clutch / oil pump)	
• Rated voltage	AC 120 V, 50/60 Hz
• Rated current	1.6 A pilot duty output declaration to UL732
• Power factor	Cosφ >0.4
Connections for pressure switch	
• Rated voltage	AC 120 V , 50/60 Hz
• Rated current	1.5 mA
• Power factor	---
Power supply for pressure switch-max (Pmax) / POC (X5-02.3 or X22-02.3)	
• IaMax	<10 mA
Fuel feedback to LMV36... (X31-02.1 or X31-02.2)	
• IaMax	<10 mA

4.5.3 Cable lengths

• Mains line LMV36... → AGM60...	Max. 3 m (100 pF/m)
• Fuel valves	Max. 3 m (100 pF/m)
• Other lines	Max. 3 m (100 pF/m)
• Fuel selector	Max. 20 m (100 pF/m)
• Load controller LR	Max. 20 m (100 pF/m)

Specification as per EN 60730-1	
Type of shutdown or interruption of each circuit	
Shutdown with microswitch	Single-pole
Mode of operation	Type 2 B

4.5.4 Cross-sectional areas

The cross-sectional areas of the power supply lines (L, N and PE) must be capable of carrying the rated currents according to the built-in unit fuse of the respective basic unit (max. 6.3 AT).

Min. cross-sectional area	0.75 mm² (single- or multi-core to VDE 0100)

Cable insulations must satisfy the relevant temperature requirements and environmental conditions.

4.5.5 Electrical connections of actuators

The ready connected actuator cables must not be extended.

4.5.6 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	-30...+60 °C
Humidity	<95% r.h.
Operation	DIN EN 60721-3-3
Climatic conditions	Class 3K3
Mechanical conditions	Class 3M3
Temperature range	-20...+60 °C
Humidity	<95% r.h.

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

5 Dimensions

5.1 LMV36...

Dimensions in mm

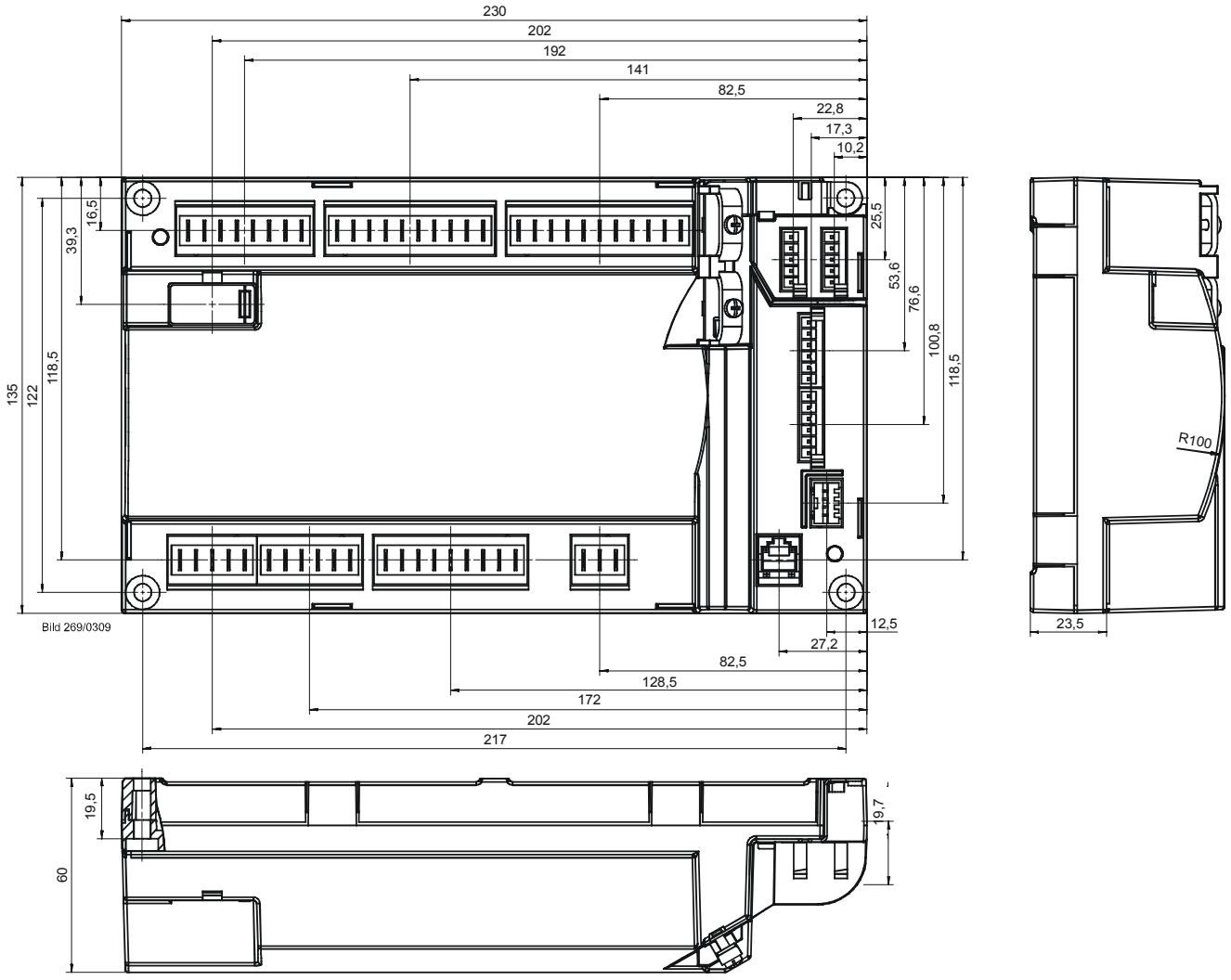


Figure 11: Dimensions of the LMV36...

5.2 AGM60...

Dimensions in mm

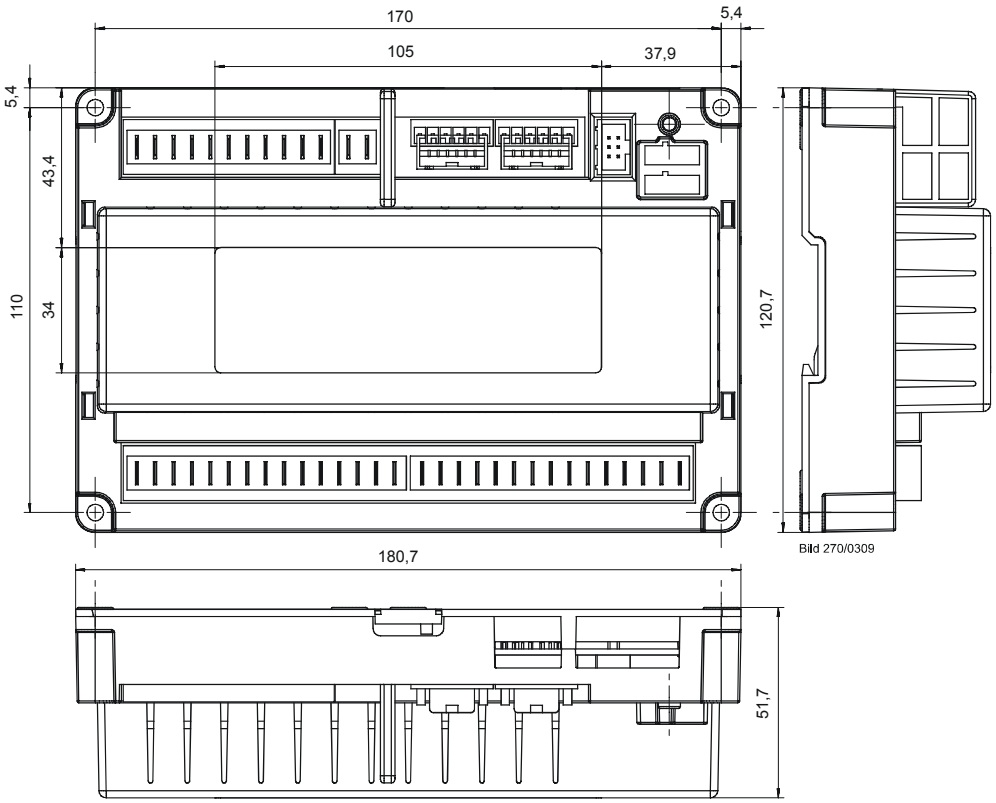


Figure 12: Dimensions of the AGM60...

6 Basic unit

6.1 Description of inputs and outputs

This chapter covers the key features of the basic unit's inputs and outputs. For exact use of the inputs and the activation of outputs, refer to chapter *Sequence diagrams*.

Flame signal input and flame detector X10–05 and X10–06

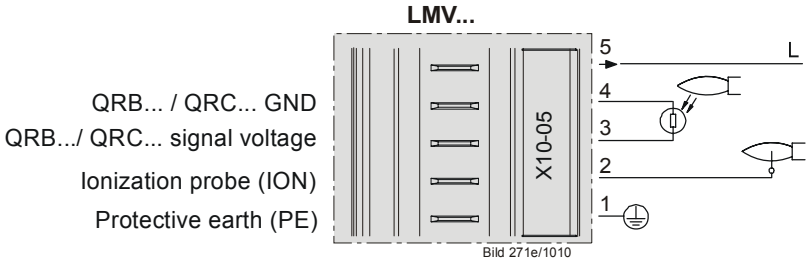


Figure 13: Flame signal input X10-05

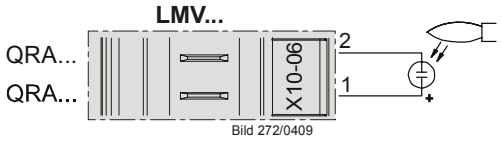


Figure 14: Flame signal input X10-06

Connection choices:

- Ionization probe
- QRA2... / QRA10...
- QRA4.U
- QRB...

6.2 Flame detectors

- For display of the flame on the AZL2..., the following general conditions apply:
  - Display is subject to various component tolerances, which means that deviations of ± 10% can occur
  - Note that, for physical reasons, there is no linear relationship between flame display and detector signal values

The LMV36... system can be used with different types of flame detectors. For the correct use of flame detectors, refer to chapter *Sequence diagrams*.
The flame detector used must be correctly parameterized.

Caution!
Continuous operation is possible only when using an ionization probe!

In the hardware of the LMV36..., the flame signals are subdivided into 2 groups (group 0 covering types the QRB... and group 1 covering ionization and the QRA…). The flame detector for gas is selected via parameter 221 (fuel 0) / 321 (fuel 1), that for oil via parameter 261 (fuel 0) / 361 (fuel 1).

No.	Parameter
221	Gas: Active detector flame evaluation 0 = QRB 1 = ION / QRA
321	Fuel 1 gas: Active detector of flame evaluation 0 = QRB 1 = ION / QRA…
261	Oil: Active detector of flame evaluation 0 = QRB 1 = ION / QRA
361	Fuel 1 oil: Active detector of flame evaluation 0 = QRB 1 = ION / QRA…

6.2.1 Loss of flame

In the event of loss of flame, the unit initiates safety shutdown, followed by a restart, if required. A repetition counter can be used to select the number of flame losses after which the unit shall initiate lockout (refer to chapter *Repetition counter*).

Error code	Diagnostic code	Meaning for the LMV36... system
7	0	Loss of flame

No.	Parameter
186	Software drop-out delay time of flame signal (100 ms) Index 0 = QRB... (0 = inactive, >1) Index 1 = ION / QRA... (0 = inactive, >3 -only 200 ms steps)
187	Fuel 1: Software drop-out delay time of flame signal (100 ms) Index 0 = QRB... (0 = inactive, >1) Index 1 = ION / QRA... (0 = inactive, >3 -only 200 ms steps)
240	Repetition limit value loss of flame 1 = No repetition 2 = 1 Repetition
340	Repetition limit value loss of flame 1 = No repetition 2 = 1 Repetition
280	Repetition limit value loss of flame 1 = No repetition 2 = 1 Repetition
380	Repetition limit value loss of flame 1 = No repetition 2 = 1 Repetition

Caution!
The response time of the flame detector leads to an extension of the second safety time (TSA2). This must be taken into account when designing the burner!

6.2.2 Extraneous light

Extraneous light during standby (phase 12) leads to prevention of startup, followed by a restart. Extraneous light during the prepurge phase results in immediate lockout. If extraneous light occurs during the shutdown phase, the system switches to the safety phase.

One repetition is permitted. This means that if the error occurs again the next time the system is shut down, the unit will initiate lockout.

Error code	Diagnostic code	Meaning for the LMV36... system
4	0	Extraneous light during startup
	1	Extraneous light during shutdown
	2	Extraneous light during startup – prevention of startup

6.2.3 No flame at the end of safety time (TSA)

If no flame is established by the end of the first safety time, the unit initiates lockout.

Error code	Diagnostic code	Meaning for the LMV36... system
2	1	No flame at the end of safety time 1 (TSA1)
	2	No flame at the end of safety time 2 (TSA2)

6.2.4 Flame intensity

The flame's intensity can be displayed. It is standardized from 0 to 100%.

No.	Parameter
954	Intensity of flame

Note
Also refer to chapter *Intensity of flame during curve settings*.

6.2.5 Supervision of flame detector

Error code	Diagnostic code	Meaning for the LMV36... system
93	3	Short-circuit of flame detector

At the QRB… flame detector's input, the LMV36... checks the detector for short-circuits in operation.

6.3 Digital inputs

6.3.1 Safety loop X3–04 (optional pressure switch-max (Pmax)), terminals 1 and 2

Input for connection of the safety loop. When any of the series-connected contacts included in the loop opens, power supply to the fuel valves, the fan and the ignition equipment is instantly cut.

The safety loop includes the following components:
- External burner switch (ON / OFF)
- Safety limiter / safety pressure limiter (SL / SPL)
- External control thermostat and / or pressurestat, if required
- Water shortage switch

Note
Pressure switch-max (Pmax) when using POC via X5-02.

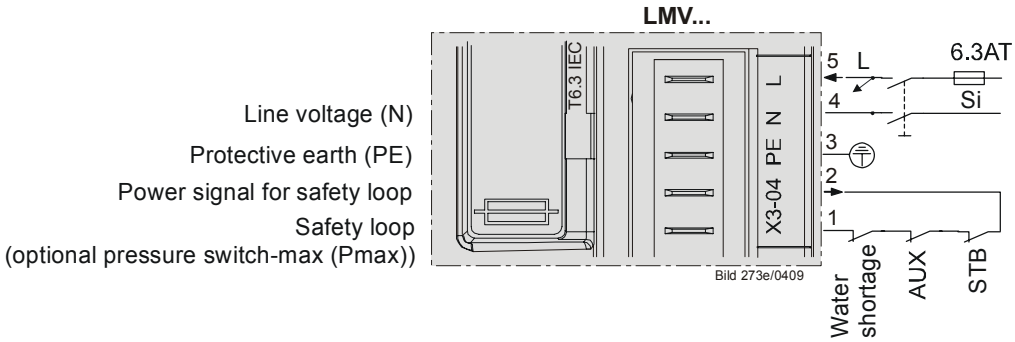


Figure 15: Safety loop (optional pressure switch-max (Pmax)) X3-04

For diagnostic purposes, the contacts of the components included in the safety loop and the burner flange contact are combined for delivering the safety loop signal. If there is no such signal, the system initiates safety shutdown in any event.

If, with *Load controller ON,* there is no signal from the safety loop (start prevention), error code 22 is translated to text display **OFF S** (S = safety loop) and the numerical value appears in the error history.

Error code	Diagnostic code	Meaning for the LMV36... system
22 **OFF S**	0	Safety loop / burner flange Open

For the input, a repetition counter can be parameterized. Here, it is possible to set the number of errors permitted until lockout occurs (refer to chapter *Repetition counter*).

No.	Parameter
215	Repetition limit safety loop 1 = No repetition 2...15 = number of repetitions 16 = constant repetition

6.3.2 (Burner flange) X3–03, terminals 1 and 2

End switch burner flange (component of safety loop).

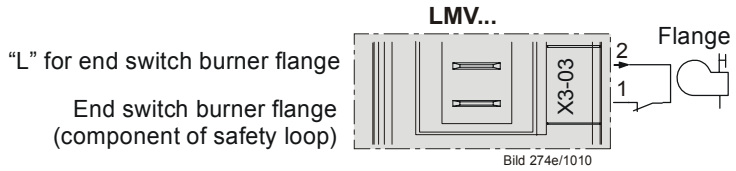


Figure 16: Burner flange X3-03

For error diagnostics and parameters, refer to chapter *Safety loop*.

6.3.3 Input for external controller (ON / OFF) X5–03, terminal 1

When the external control loop is closed, the internal input message *Heat request* is generated.
A heat request exists when the external controller signal is pending and, depending on the configuration, a load controller calls for heat (refer to chapter *Connection of load controllers*).
When there are no more requests for heat, the burner shuts down. The fuel valves are closed, either immediately when the timer has elapsed, or when the low-fire position is reached, depending on the parameter settings (refer to chapter *End of operating position*).

Note
Burner startup takes place only when this contact is closed.

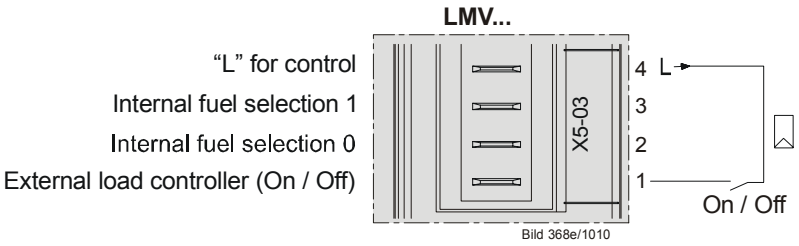


Figure 17: Inputs for external load controller ON / OFF X5-03

6.3.4 Air pressure switch (APS) X3–02

Input for connection of an air pressure switch: Air pressure is anticipated when the fan is switched on. If there is no air pressure signal, the system initiates lockout.
The air pressure switch must have an NO contact.

If no air pressure switch is required (e.g. when firing on oil), a wire link to the fan output must be fitted (between X3-02, terminal 1, and X3-05, terminal 1).

Caution!
The OEM must check to see whether the burner can be operated without air pressure switch. This may necessitate a special approval, depending on the type of application.

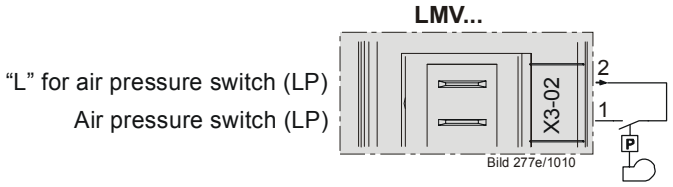


Figure 18: Air pressure switch (APS) X3-02

Error code	Diagnostic code	Meaning for the LMV36... system
3	0	Air pressure off
	1	Air pressure on
	4	Air pressure on – prevention of startup

6.3.5 Pressure switch for gas valve proving (P LT) X9-04

Input for connection of *Pressure switch valve proving* (P LT) X9-04.
The input is active only when firing on gas and when the valve proving is activated (refer to chapter *Program sequence*).

No.	Parameter
241	Gas: Execution valve proving 0 = no valve proving 1 = valve proving on startup 2 = valve proving on shutdown 3 = valve proving on startup and shutdown
341	Fuel 1 gas: Execution valve proving 0 = no valve proving 1 = valve proving on startup 2 = valve proving on shutdown 3 = valve proving on startup and shutdown

Pressure switch valve proving (PLT)
or oil pressure switch-min (Pmin)

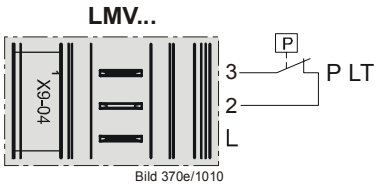


Figure 19: LMV36…: Pressure switch valve proving gas (P LT) X9-04

Pressure switch valve proving (PLT)
or oil pressure switch-min (Pmin)

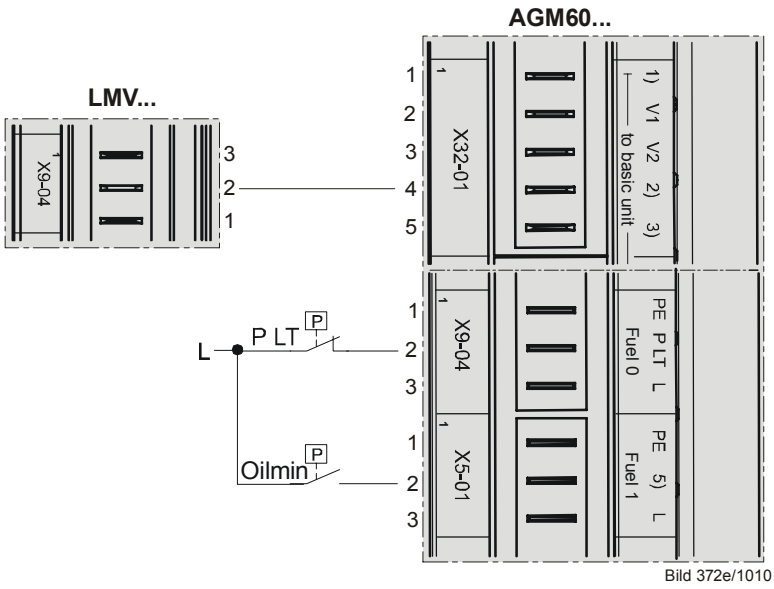


Figure 20: LMV36… with AGM60…: Pressure switch valve proving gas (P LT) X9-04

Pressure switch valve proving (P LT)

Input for connection of valve proving with own pressure switch for valve proving.
The input is active only when valve proving is activated.

Error code	Diagnostic code	Meaning for the LMV36... system
12	0	Fuel valve 1 (V1) leaking
	1	Fuel valve 2 (V2) leaking

Note
When using configuration *Valve proving*, it is not possible to use the input for *Start release gas*.

6.3.6 Gas pressure switch-min (Pmin), start release gas X5–01

Input for connection of a pressure switch-min for gas: If the plant does not require a pressure switch-min, a wire link must be fitted between terminals 2 and 3.

Gas pressure switch-min

In all types of gas trains, minimum gas pressure is expected from phase 22. If no gas pressure is detected when the maximum time (P214) has elapsed, the gas shortage program is started (refer to chapter *Gas shortage program*).

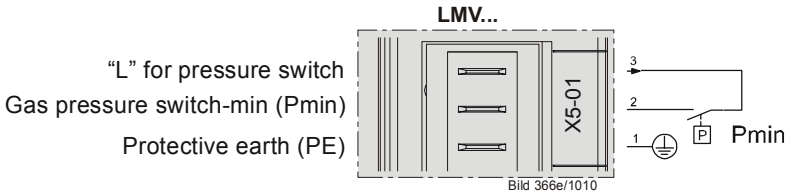


Figure 21: Gas pressure switch-min (Pmin) X5-01

Caution!
The OEM must check to see whether the burner can be operated without pressure switch-min. This may necessitate a special approval, depending on the type of application.

No.	Parameter
214	Max. time start release
285	Oil: Gas pressure switch-min with «Lo Gp» 0 = inactive 1 = active

During the safety times (TSA1/TSA2), the signal received from pressure switch-min is only assessed after a certain period of time in order to ignore the pressure shocks that occur the moment the valves open. The time to elapse for signal assessment can be parameterized.

No.	Parameter
229	Gas: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)
329	Fuel 1 gas: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)

If there is no gas pressure, at least safety shutdown is initiated.

Error code	Diagnostic code	Meaning for the LMV36... system
20	0	Pressure switch-min (Pmin) No minimum gas pressure

For the input, a repetition counter can be parameterized. It can be used to set the number of errors permitted until lockout occurs. The counter also impacts the gas shortage program (refer to chapter *Repetition counter*).

No.	Parameter
223	Repetition limit value gas pressure switch-min 1 = No repetition 2...15 = number of repetitions 16 = constant repetition
323	Repetition limit value gas pressure switch-min 1 = No repetition 2...15 = number of repetitions 16 = constant repetition

Start release gas

If, at the same time, the input is used as a start release input (e.g. for an air supply damper), it can be connected in series with the pressure switch.
When selecting *Valve proving via pressure switch-min* (P236), function *Start release gas* is not supported.

6.3.7 Oil pressure switch-min (Pmin) X9-04 (X5–01 on AGM60...)

Input for connection of a pressure switch-min for oil: If the plant does not require a pressure switch-min, a wire link between terminal 2 and terminal 3 must be fitted.

Caution!
The OEM must check to see whether the burner can be operated without using a pressure switch-min. This may necessitate a special approval, depending on the application.

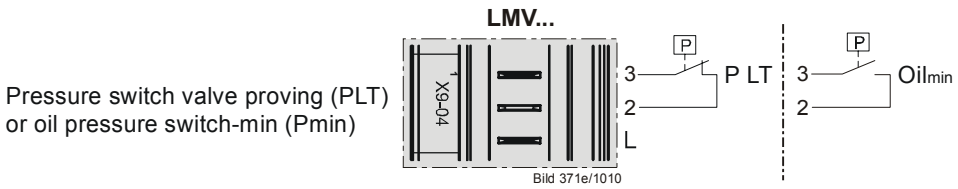


Figure 22: LMV36...: Oil pressure switch valve proving (P LT) X9-04

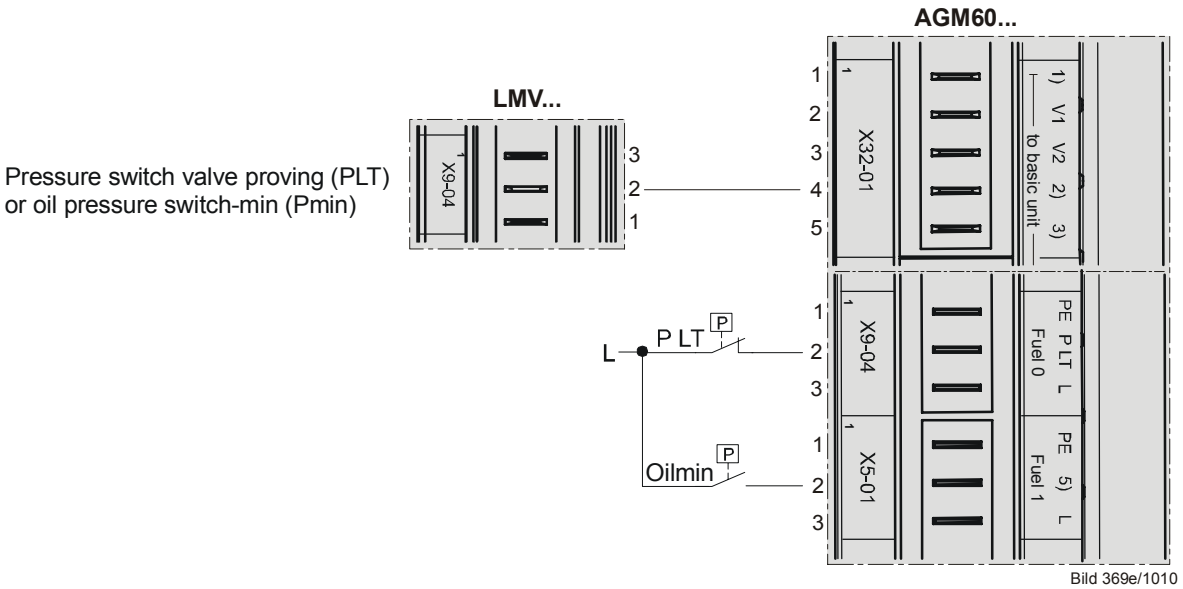


Figure 23: LMV36... with AGM60...: Oil pressure switch valve proving (P LT) X9-04

Oil pressure switch-min

In all types of oil train, the minimum oil pressure is expected from phase 38. If no oil pressure is detected when the maximum time (P217) has elapsed or if, subsequently, the oil pressure drops, the system initiates lockout.

No.	Parameter
217	Max. Waiting time for detection of detector or pressure signal (e.g. homerun, preignition «Lo»)

Error code	Diagnostic code	Meaning for the LMV36... system
20	0	Pressure switch-min (Pmin) No min. oil pressure

During the safety times (TSA1/TSA2), the signal from pressure switch-min is only assessed after a certain period of time in order to ignore the pressure shocks that occur the moment the valves open. The time to elapse for signal assessment can be parameterized.

No.	Parameter
269	Oil: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)
369	Fuel 1 oil: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)

6.3.8 Setting the time for checking the pressure switch

For oil pressure switch-min, the point in time from which the check is made can be set via parameter 276 (active from phase 38, or from safety time (TSA)).

No.	Parameter
276	Oil: Pressure switch-min input 0 = inactive 1 = active from phase 38 2 = active from safety time (TSA)
376	Fuel 1 Oil: Pressure switch-min input 0 = inactive 1 = active from phase 38 2 = active from safety time (TSA)

6.3.9 Gas / oil pressure switch-max (Pmax) / or POC contact, start release oil X5–02

Input for connection of a pressure switch-max for gas or oil: The sensor must have an NC contact, which means that the contact opens when the adjusted maximum pressure is exceeded. If the plant does not require a pressure switch-max, a wire link must be fitted between terminals 2 and 3.

Caution!
The OEM must check to see whether the burner can be operated without pressure switch-max. This may necessitate a special approval, depending on the type of application.

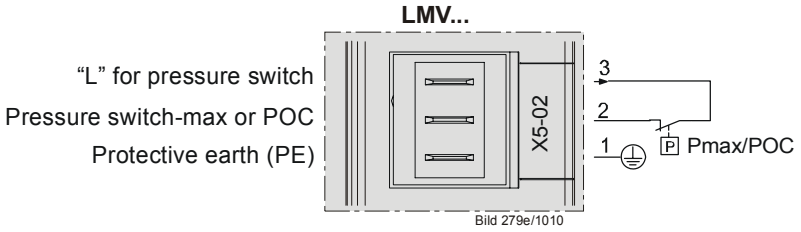


Figure 24: LMV36...: Gas / oil Pressure switch-max (Pmax) or POC X5-02

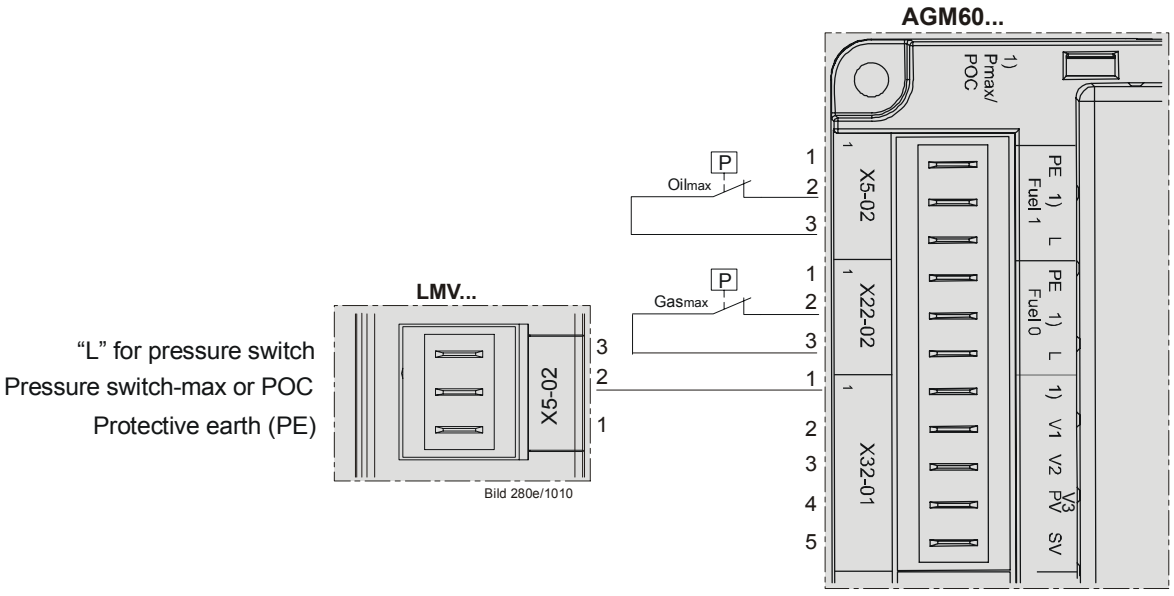


Figure 25: LMV36... with AGM60...: Gas / oil pressure switch-max (Pmax) or POC X5-02

The connection facility can also be used as POC (proof of closure) (refer to chapter *Sequence diagrams*).

No.	Parameter
237	Gas: Pressure switch-max / POC input 0 = inactive 1 = pressure switch-max 2 = POC 3 = pressure switch valve proving
337	Fuel 1 gas: Pressure switch-max / POC input 0 = inactive 1 = pressure switch-max 2 = POC 3 = pressure switch valve proving

Note
If the input is used for POC or for pressure switch valve proving can be included in the safety loop. In that case, pressure switch-max must not be fitted between the valves, but downstream from them.

Gas pressure switch-max

In all types of gas trains, the maximum gas pressure is monitored from phase 40. If the maximum gas pressure is exceeded, the system initiates lockout.

Error code	Diagnostic code	Meaning for the LMV36... system
14	0	POC open
	1	POC closed
21	0	Pressure switch-max (Pmax): Max. gas pressure exceeded

During the safety times (TSA1 / TSA2), the signal from pressure switch-max is only assessed after a certain period time has elapsed in order to ignore the pressure shocks that occur the moment the valves open.

No.	Parameter
229	Gas: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)
329	Fuel 1 gas: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)

Pressure switch-max-oil

In all types of oil trains, the maximum oil pressure is monitored from phase 22. If the maximum oil pressure is exceeded after the maximum time (parameter 214) has elapsed, or during the subsequent phases, the system initiates lockout.

No.	Parameter
214	Max. time start release

Error code	Diagnostic code	Meaning for the LMV36... system
14	0	POC open
	1	POC closed
21	0	Pressure switch-max (Pmax): Max. oil pressure exceeded

During the safety times (TSA1 / TSA2), the signal from pressure switch-max is only assessed after a certain period of time has elapsed to ignore the pressure shocks that occur the moment the valves open.

No.	Parameter
269	Oil: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)
369	Fuel 1 oil: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)

The terminal can also be used for POC (Proof of Closure) (refer to chapter *Sequence diagrams*).

No.	Parameter
277	Oil: Pressure switch-max / POC input 0 = inactive 1 = pressure switch-max 2 = POC
377	Fuel 1 oil: Pressure switch-max / POC input 0 = inactive 1 = pressure switch-max 2 = POC

Note
If the input is used for POC, pressure switch-max can be included in the safety loop. In that case, pressure switch-max must not be fitted between the valves, but after them.

Start release oil

If the input is simultaneously used as a start release input (e.g. for an air supply damper), the latter can be connected in series with the pressure switch.
If the input is parameterized for POC, it cannot be used as a start release input.

6.3.10 Fuel selection

The fuel selection is made by an external connected switch at AGM60...

The selection made is transmitted to the LMV36... basic unit via 2 signal lines (internal fuel selection 0 + 1).

Fuel 0 = 1, Fuel 1 = 0 → Fuel 0 is selected
Fuel 0 = 0, Fuel 1 = 1 → Fuel 1 is selected
Fuel 0 = 0, Fuel 1 = 0 → Line interrupted → Safety shutdown / lockout
Fuel 0 = 1, Fuel 1 = 1 → Reset

Next time the burner is started up after shutdown or safety shutdown, the **new** fuel is used.

After fuel changeover, any manually selected output or output called for by the BAC system is cancelled and automatic operation is activated, thus enabling an automatic restart with the new fuel if there is a request for heat.

Exception:
The manual off function for manual output and burner off (output = 0) via the BAC system are maintained.

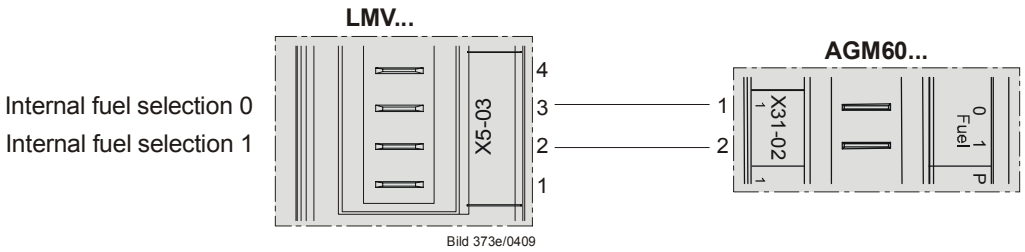


Figure 26: LMV36... with AGM60…: Fuel selection

6.3.11 Reset X8-04, terminal 1

Input for connection of a reset button. The basic unit can be reset or manually locked via this input (refer to chapter *Reset / manual locking*).

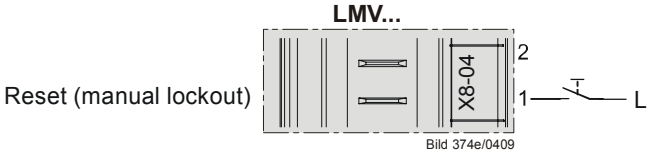


Figure 27: Reset X8-04

6.4 Digital outputs

Safety-related outputs, type SI

Using a contact feedback network (CFN), these contacts are read back by the microcomputers and checked for their correct positions.

Non-safety-related outputs, type No-SI

These outputs are not monitored by the CFN and, for this reason, can only be used for non-safety-related actuators, or actuators made safe in some other form (e.g. alarm).

6.4.1 Output alarm type No-SI X3–05, terminal 2

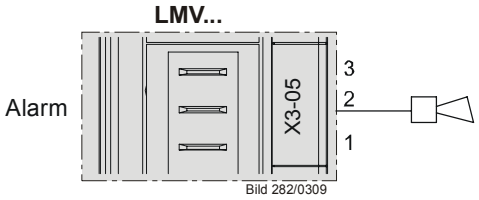


Figure 28: Output alarm X3-05

Output for connection of an alarm lamp or horn.
The output is activated when the unit is in the lockout position (phase 00).
This output can also be used to indicate start prevention.

6.4.2 Fan motor contactor type SI X3–05, terminal 1

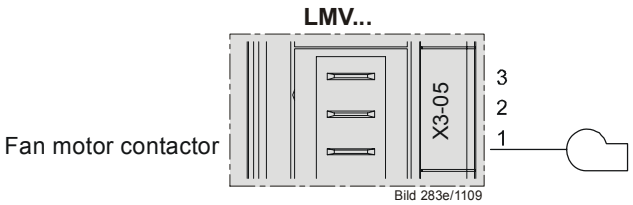


Figure 29: Fan motor contactor X3-05

Output for control of a fan power contactor (200 VA). In accordance with the sequence diagrams, the fan is on in phase 22 (refer to chapter *Sequence diagrams*).

6.4.3 Fan continuous purging X3–05, terminal 3

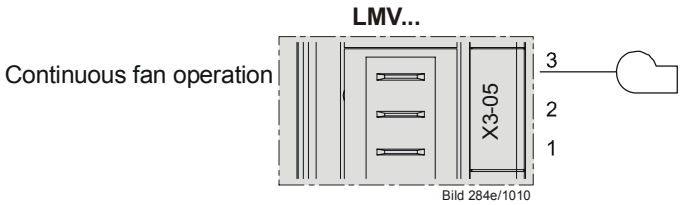


Figure 30: Continuous fan operation X3-05

If continuous purging is required, the fan motor contactor must be connected to *Continuous fan operation – X3-05*, terminal 3. This terminal is tapped behind the unit fuse and the safety loop (refer to chapter *Continuous fan*).

6.4.4 Output ignition (Z) type SI (IGNITION) X4–02

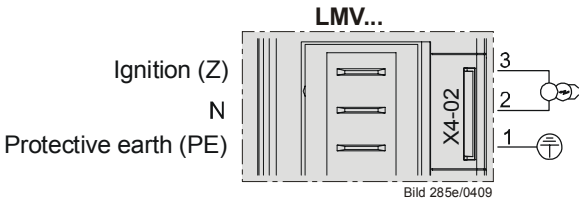


Figure 31: Output ignition (Z) X4-02

Output for the connection of ignition transformers or electronic ignition modules.

Gas

When firing on gas, ignition is switched on in phase 38 just before reaching safety time 1 (TSA1).

The preignition time in phase 38 can be parameterized.

No.	Parameter
226	Gas: Preignition time
326	Fuel 1 gas: Preignition time

Oil

When firing on oil, there is a choice of short and long preignition (same as with gas).

No.	Parameter
281	Oil: Point in time oil is ignited 0 = short preignition (Ph38) 1 = long preignition (with fan) (Ph22)
381	Fuel 1 oil: Point in time oil is ignited 0 = short preignition (Ph38) 1 = long preignition (with fan) (Ph22)

When using long preignition, ignition is switched on in phase 22, together with the fan.

In the case of short preignition, the preignition time can be parameterized.

No.	Parameter
266	Oil: Preignition time
366	Fuel 1 oil: Preignition time

6.4.5 Outputs fuel valves type SI (V1...V3 / PV) X8–02, X7-01, X7-02

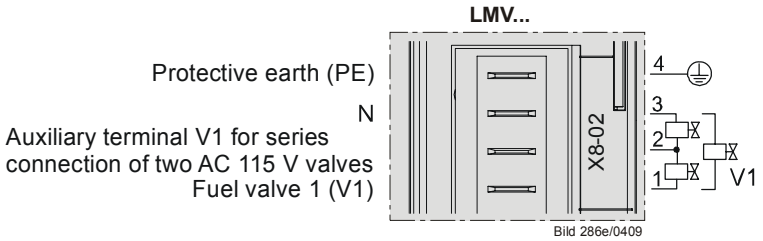


Figure 32: LMV36...: Output fuel valve (V1) X8-02

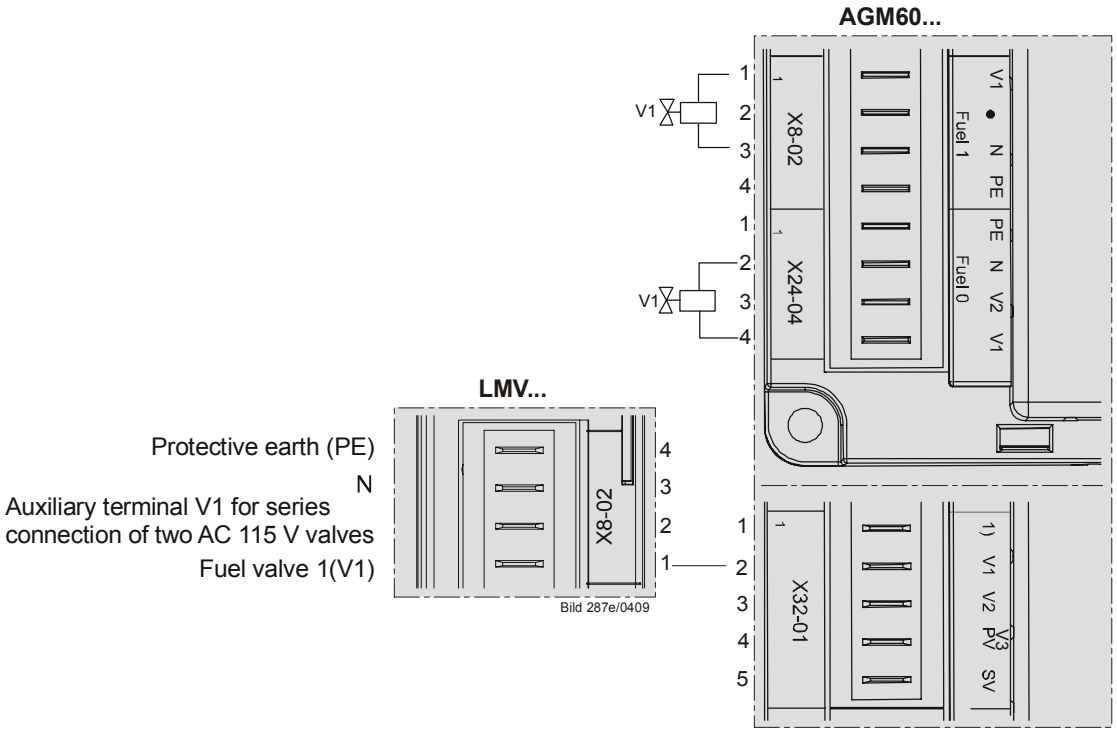


Figure 33: LMV36... with AGM60…: Output fuel valve (V1) X8-02

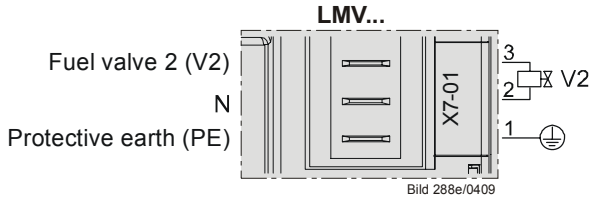


Figure 34: LMV36...: Output fuel valve (V2) X7-01

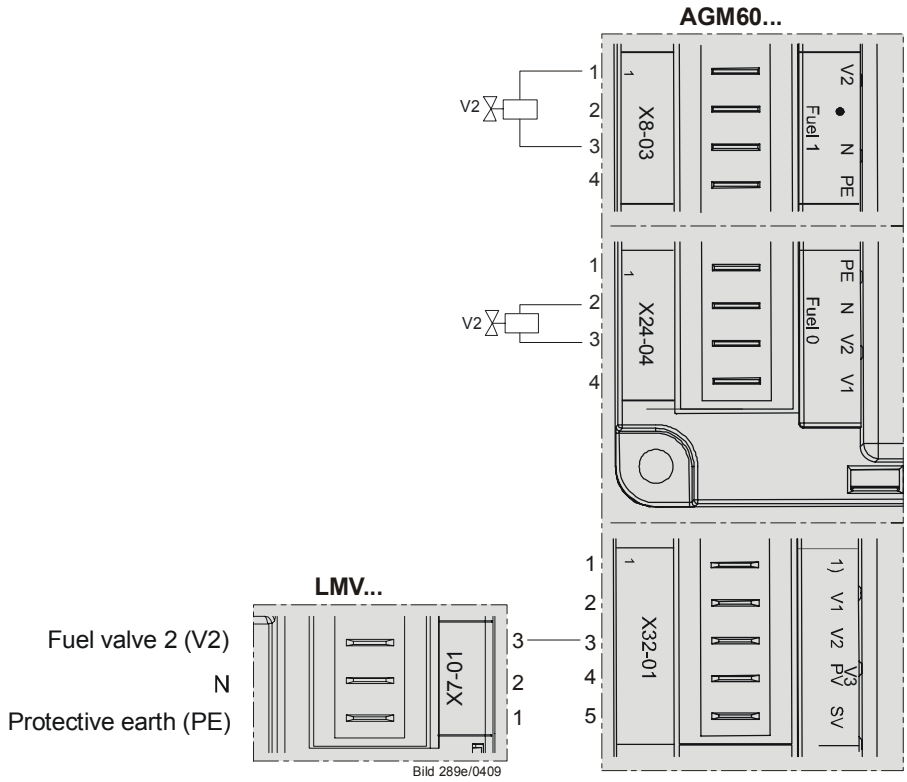


Figure 35: LMV36... with AGM60…: Output fuel valve (V2) X7-01

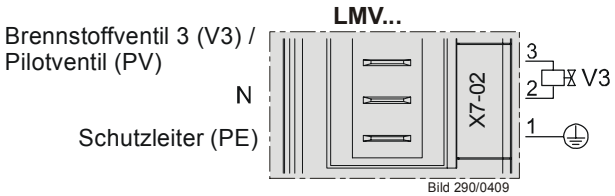


Figure 36: LMV36...: Output fuel valve (V3) / pilot valve PV X7-02

Outputs for connection of the gas or oil valves, depending on the selected type of fuel train (refer to chapter *Sequence diagrams*).

6.4.6 Output safety valve (SV) type SI X6–03 / magnetic clutch

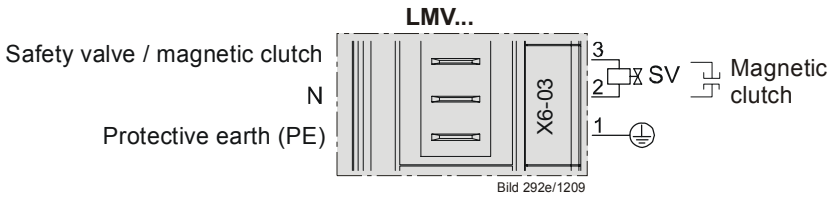


Figure 37: LMV36...: Output safety valve (SV) / magnetic clutch X6-03

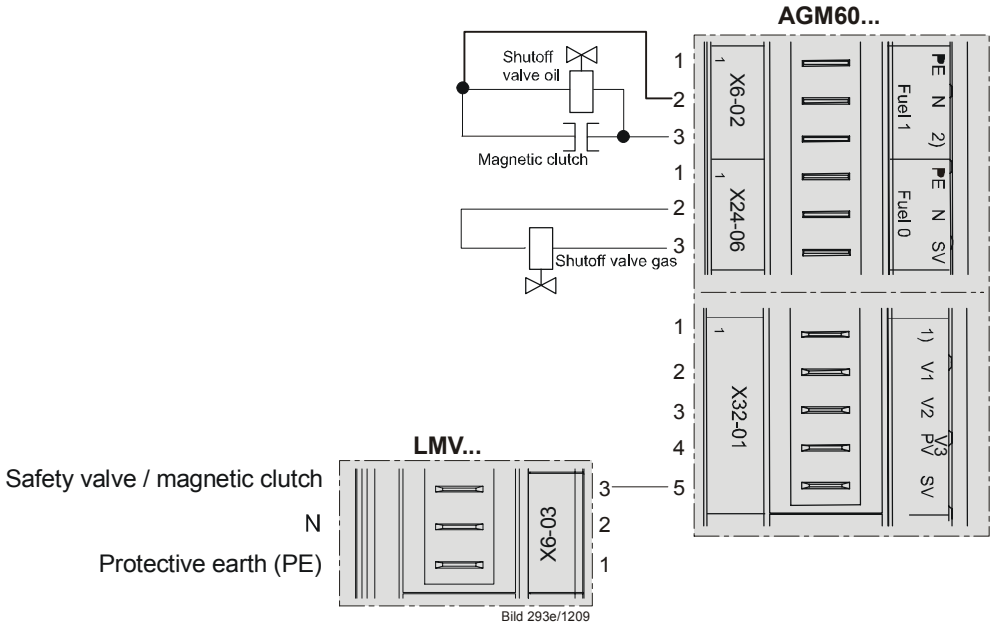


Figure 38: LMV36... with AGM60...: Output safety valve (SV) / magnetic clutch X6-03

Output for connection of an oil shutoff valve / oil connection valve or safety valve for liquefied gas. The output is connected parallel to the output for the fan.

6.4.7 Output for indication of operation X8-04 terminal 2

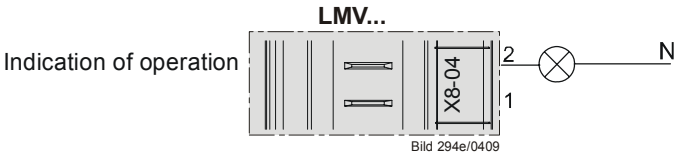


Figure 39: Output for indication of operation X8-04

Output for connection of indication of operation.

Caution!
The output is connected parallel to the fuel valve (V1).

6.5 Program sequence

The program sequence is shown in the form of sequence diagrams (refer to chapter *Fuel trains application examples*). Using a number of parameters, the program sequence can be adapted to the respective application.

6.5.1 Time parameters

Using a number of time parameters, the time characteristics of the different types of fuel trains can be matched to the requirements of the respective application.

In single-fuel operation or in dual-fuel operation, the parameters 225...299 are assigned to fuel 0.

No.	Parameter
211	Fan rump-up time
212	Max. time down to low-fire
213	Waiting time home run
214	Max. time start release
217	Max. Waiting time for detection of detector or pressure signal (e.g. homerun, preignition «Lo»)
225	Gas: Prepurge time
226	Gas: Preignition time
227	Gas: Safety time 1 (TSA1)
229	Gas: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)
230	Gas: Interval 1
231	Gas: Safety time 2 (TSA2)
232	Gas: Interval 2
233	Gas: Afterburn time
234	Gas: Postpurge time (no extraneous light test)
242	Gas: Valve proving evacuation time
243	Gas: Valve proving time test atmospheric pressure
244	Gas: Valve proving filling time
245	Gas: Valve proving time test gas pressure
246	Gas: Waiting time gas shortage
248	Gas: Postpurge time (t3) (abortion if load controller On)
265	Oil: Prepurge time
266	Oil: Preignition time
267	Oil: Safety time 1 (TSA1)
269	Oil: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)
270	Oil: Interval 1
271	Oil: Safety time 2 (TSA2)
272	Oil: Interval 2
273	Oil: Afterburn time
274	Oil: Postpurge time (no extraneous light test)
284	Oil: Postpurge time (t3) (abortion if load controller On)

In dual-fuel operation, the parameters 325...399 are assigned to fuel 1.

No.	Parameter
325	Fuel 1 gas: Prepurge time
326	Fuel 1 gas: Preignition time
327	Fuel 1 gas: Safety time 1 (TSA1)
329	Fuel 1 gas: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)
330	Fuel 1 gas: Interval 1
331	Fuel 1 gas: Safety time 2 (TSA2)
332	Fuel 1 gas: Interval 2
333	Fuel 1 gas: Afterburn time
334	Fuel 1 gas: Postpurge time (no extraneous light test)
342	Fuel 1 gas: Valve proving evacuation time
343	Fuel 1 gas: Valve proving time test atmospheric pressure
344	Fuel 1 gas: Valve proving filling time
345	Fuel 1 gas: Valve proving time test gas pressure
346	Fuel 1 gas: Waiting time gas shortage
348	Fuel 1 gas: Postpurge time 3 (abortion if load controller On)
365	Fuel 1 oil: Prepurge time
366	Fuel 1 oil: Preignition time
367	Fuel 1 oil: Safety time 1 (TSA1)
369	Fuel 1 oil: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)
370	Fuel 1 oil: Interval 1
371	Fuel 1 oil: Safety time 2 (TSA2)
372	Fuel 1 oil: Interval 2
373	Fuel 1 oil: Afterburn time
374	Fuel 1 oil: Postpurge time (no extraneous light test)
384	Fuel 1 oil: Postpurge time 3 (abortion if load controller On)

Caution!
The OEM or the heating engineer must make certain that the times conform to the standards covering the respective type of plant.

6.5.2 Valve proving

Valve proving is active only when firing on gas. Valve proving designed to detect leaking gas valves and, if necessary, to prevent the valves from opening or ignition from being switched on. Lockout is initiated, if required.

When making the valve proving test, the gas valve on the burner side is opened first to bring the test space to atmospheric pressure. When the valve is closed, the pressure in the test space is not allowed to exceed a certain level. Then, the test space is pressurized by opening the gas valve on the mains side. After closing, the gas pressure must not fall below a certain level. Type of valve proving can be selected via parameter 236 / 336.

Valve proving can be parameterized to take place on startup, shutdown, or both.

Recommendation: Perform valve proving on shutdown.

No.	Parameter
236	Gas: Pressure switch-min input 0 = inactive 1 = pressure switch-min (upstream of fuel valve 1 (V1)) 2 = valve proving via pressure switch-min (between fuel valve 1 (V1) and fuel valve 2 (V2))
237	Gas: Pressure switch-max / POC input 0 = inactive 1 = pressure switch-max 2 = POC 3 = pressure switch valve proving
241	Gas: Execution valve proving 0 = no valve proving 1 = valve proving on startup 2 = valve proving on shutdown 3 = valve proving on startup and shutdown
242	Gas: Valve proving evacuation time
243	Gas: Valve proving time test atmospheric pressure
244	Gas: Valve proving filling time
245	Gas: Valve proving time test gas pressure
336	Fuel 1 gas: Pressure switch-min input 0 = inactive 1 = pressure switch-min (upstream of fuel valve 1 (V1)) 2 = valve proving via pressure switch-min (between fuel valve 1 (V1) and fuel valve 2 (V2))
337	Gas: Pressure switch-max / POC input 0 = inactive 1 = pressure switch-max 2 = POC 3 = pressure switch valve proving
341	Fuel 1 gas: Execution valve proving 0 = no valve proving 1 = valve proving on startup 2 = valve proving on shutdown 3 = valve proving on startup and shutdown
342	Fuel 1 gas: Valve proving evacuation time
343	Fuel 1 gas: Valve proving time test atmospheric pressure
344	Fuel 1 gas: Valve proving filling time
345	Fuel 1 gas: Valve proving time test gas pressure

Caution!
If valve proving is parameterized to take place on startup and shutdown, the gas valves must run through additional switching cycles. As a result, strain on the gas valves (wear) increases.

Caution!
The OEM must set the evacuation, filling and test times for atmospheric or mains pressure on every plant in compliance with the requirements of EN 1643.

It must be ensured that the 2 test times are correctly set. It is to be checked whether the gas required for the test may be fed into the combustion chamber (on the relevant application). The test times are safety-related. After a reset and in the case of aborted or prevented valve proving, the unit performs valve proving on the next startup (only when valve proving is activated). Prepurging with valve proving is active during the startup phase, even if it was deactivated.

Examples of aborted valve proving:
If the safety loop or the start prevention input for gas (containing Pmin) opens during valve proving.

Valve proving – calculation of leakage rate

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

QLeck	in l/h	Leakage rate in liters per hour
PG	in mbar	**Overpressure** between the valves at the beginning of the test phase
PW	in mbar	Overpressure set on the pressure switch (normally 50% of the gas inlet pressure)
Patm	in mbar	**Absolute air pressure** (1013 mbar normal pressure)
V	in l	Volume between the valves (test volume) including valve volume and pilot pipe, if present (Gp1 mod)
tTest	in s	Test time

6.5.3 Valve proving with separate pressure switch (P LT) X9-04

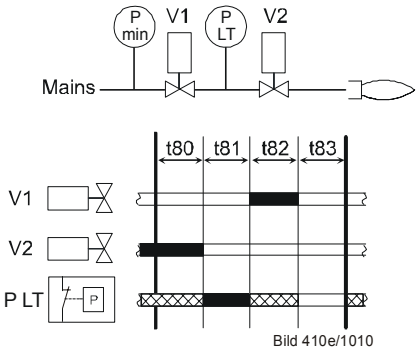


Figure 1: Valve proving with separate pressure switch (P LT)

Step 1: t80 – evacuation of test space.
Gas valve on the burner side is opened to bring the test space to atmospheric pressure.

Step 2: t81 – atmospheric pressure test.
When the gas valve has closed, the gas pressure in the test space must not exceed a certain level.

Step 3: t82 – filling of test space.
Gas valve on the mains side opens to fill the test space.

Step 4: t83 – gas pressure test.
When the gas valve has closed, the gas pressure in the test space must not drop below a certain level.

Legend

t80	Evacuation of test space (P242)
t81	Atmospheric pressure test (P243)
t82	Filling of test space (P244)
t83	Gas pressure test (P245)
V…	Fuel valve
P LT	Pressure switch – valve proving
Pmin	Pressure switch-min
■	Input/output signal 1 (ON)
□	Input/output signal 0 (OFF)
▨	Input permissible signal 1 (ON) or 0 (OFF)

6.5.4 Valve proving via gas pressure switch-min X5-01

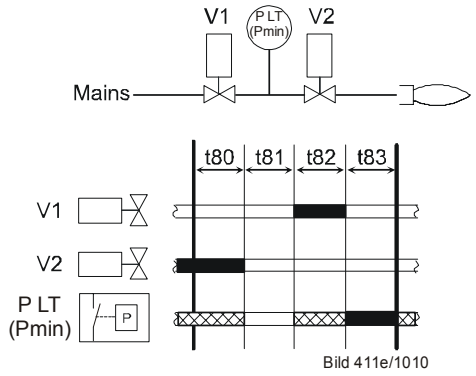


Figure 2: Valve proving via gas pressure switch-min

Step 1: t80 – evacuation of test space.
Gas valve on the burner side is opened to bring the test space to atmospheric pressure.

Step 2: t81 – atmospheric pressure test.
When the gas has closed, the gas pressure in the test space must not exceed a certain level.

Step 3: t82 – filling of test space.
Gas valve on the mains side opens to fill the test space.

Step 4: t83 – gas pressure test.
When the gas valve has closed, the gas pressure in the test space must not drop below a certain level.

Legend

t80	Evacuation of test space (P242)
t81	Atmospheric pressure test (P243)
t82	Filling of test space (P244)
t83	Gas pressure test (P245)
V…	Fuel valve
Pmin	Pressure switch-min
P LT	Pressure switch – valve proving
■	Input/output signal 1 (ON)
□	Input/output signal 0 (OFF)
▨	Input permissible signal 1 (ON) or 0 (OFF)

Performing valve proving via gas pressure switch-min affects the program sequence as follows (see Addendum *Sequence diagram «G»*):

a) Valve proving on startup:
   Gas pressure switch-min (gas shortage test) is not sampled in phase 22, but during valve proving at the end of the filling time.
b) Valve proving on shutdown / deactivated:
   Gas pressure switch-min is sampled after preignition. For that purpose, a new phase 39 (*Pmin* test) is introduced and, at the end of the phase (duration of phase = filling time). In practice, this represents an *extension* of preignition by the filling time, if valve proving via gas pressure switch-min was selected.

Valve proving test can only be made via the gas pressure switch-min.
The pressure switch must be fitted between the valves.
This has an impact on the program sequence (refer to chapter *Sequence diagrams*).
Valve proving continues to be activated via parameters 241 and 341.

6.5.4.1. Lockout phase (phase 00)

The relays of the fuel valves and the safety relay (fan) are deenergized, the alarm relay is energized and lockout takes place. This means that phase 00 can only be quit via a manual reset. The time of phase 00 is unlimited.

6.5.4.2. Safety phase (phase 02)

The safety phase is an intermediate phase which is completed prior to triggering lockout. The relays of the fuel valves and the safety relay (fan) are deenergized, but lockout does not yet take place. The alarm relay is not yet activated. If possible or permitted, safety checks or repetition counter checks are made whose results decide on the transition to *Lockout phase* or *Standby*. The duration of the safety phase is dynamic (depending on the extent of testing), the maximum time being 30 seconds.
This process is aimed primarily at avoiding unwanted lockouts, e.g. resulting from EMC problems.

6.5.5 Special functions during the program sequence

6.5.5.1. Reset / manual lockout

The system can be manually locked by simultaneously pressing the **Info** button and **any other button** on the AZL2... This function enables the user to interlock the system from any operating level, that is, to trigger unalterable shutdown. Due to the system's makeup, this facility does not constitute an *Emergency OFF* function.

When making a reset, the following actions are carried out:
- Alarm relay and fault display are switched off
- The lockout position is cancelled
- The unit makes a reset and then changes to standby

The system can be reset in 3 different ways:

1. Reset on the AZL2... display and operating unit

If the unit is in the lockout position, a reset can be made by pressing the **Info** button for 1…3 seconds. The function is available only when the unit is in the lockout position. Longer or shorter pushes on the button do not produce a reset so that the system maintains the lockout position.

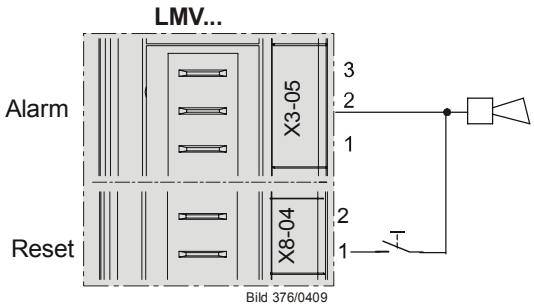
Error code	Diagnostic code	Meaning for the LMV36... system
167	2	Manual lockout by the AZL2...

2. Resetting by pressing the button by the *Reset* connection terminal on the LMV36... basic unit (X8-04, terminal 1)

If the unit is in the lockout position, a reset can be made by pressing the button for 1…3 seconds. Longer or shorter pushes on the button are ignored so that the system maintains the lockout position.
If the unit is **not** in the lockout position and the reset button is pressed for 1…6 seconds, a change to the lockout position takes place.
If this response is not desirable, it is possible to tap the supply for the reset button from the alarm output, thus achieving the same response as described above under **1**.

Error code	Diagnostic code	Meaning for the LMV36... system
167	1	Manual lockout by contact

Without manual lockout



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With manual lockout

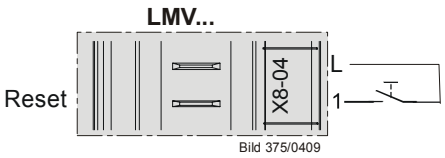


Bild 375/0409

3. Resetting via the PC tool

Refer to the documentation covering the PC tool (J7352).

Error code	Diagnostic code	Meaning for the LMV36... system
167	3	Manual lockout by PC tool

6.5.5.2. Alarm upon prevention of startup

If start prevention occurs, it is shown on the display of the AZL2...
Start prevention takes place only when a heat request is delivered **and** when one of the startup criteria is not fulfilled.
The time to elapse from prevention of startup to display on the AZL2... is set to a fixed value of 5 seconds.

In addition, it is possible to indicate preventions of startup via the alarm output. This function can be activated per parameter.

No.	Parameter
210	Alarm in the event of start prevention 0 = inactive 1 = active

If *Alarm in the event of start prevention* is activated via the alarm relay, prevention of startup and lockout can only be distinguished via the display on the AZL2... Preventions of startup are displayed as **Err:**, lockouts as **Loc:**.

Note
If, in the event of prevention of startup, reset contact on the LMV36... basic unit (X8-04.1 / terminal 1) is pressed, the unit locks out manually.
The time from occurrence of prevention of startup to indication by the alarm contact equals the time to the display on the AZL2...

6.5.5.3. Possible preventions of startup

On the normal display, error code 201 is translated to text display **OFF UPr0** or **OFF UPr1** (UPr = unprogrammiert = not programmed); the numerical value appears in the error history.

Error code	Diagnostic code	Meaning for the LMV36... system
201 **OFF UPr0** or **OFF UPr1**	1	No operating mode selected
	2…3	No fuel train defined
	4…7	No curve defined
	8…15	Standardized speed undefined
	16…31	Backup / restore was not possible
		Other preventions of startup:
3	4	Air pressure on – prevention of startup
4	2	Extraneous light during startup – prevention of startup
14	64	POC open- prevention of startup
22 **OFF S**	1	Safety loop / burner flange open- prevention of startup
83	#	Speed error VSD
97	#	Error relay supervision
	0	Safety relay contacts have welded or external power supply fed to safety relay

No.	Parameter
642	Standardized speed Index 0 = speed 1 Index 1 = speed 2 (internal monitoring)
935	Absolute speed
936	Standardized speed

6.5.5.4. Repetition counter

Repetition counters are available for different types of errors. They are used to set the number of errors permitted until lockout occurs. The last error initiates lockout. When setting the number of errors to 3, for example, a repetition (restart) takes place after the first 2 errors, and after the third error, the system initiates lockout.

Note
Setting 16 means an infinite number of repetitions = no lockout.

Functions with adjustable repetition counter

No.	Parameter
215	Repetition limit safety loop 1 = no repetition 2...15 = number of repetitions 16 = constant repetition
223 323	Repetition limit value gas pressure switch-min 1 = no repetition 2...15 = number of repetitions 16 = constant repetition Recharging time: After the *Operation* phase
240 340 280 380	Repetition limit value loss of flame 1 = No repetition 2 = 1 repetition Recharging time: After the *Operation* phase Parameter assignment: 240 / 340 Gas / fuel 0 280 / 380 Oil / fuel 0

Error code	Diagnostic code	Meaning for the LMV36... system
7	0	Loss of flame
20	0	Pressure switch-min (Pmin) No minimum gas / oil pressure
22 **OFF S**	0	Safety loop / burner flange open

If the adjustable repetition counter limits are changed, the actual counter is recharged only when the associated recharging time is reached: After power-on or after a reset.

Note
If immediate recharging shall be enforced, the basic unit can be manually locked and then reset.

Functions with fixed repetition counters

These counters cannot be set.

Meaning	Settings	
	Unit	Basic setting
Number of repetitions in the event of error: - Speed standardization VSD - Speed error - Referencing error actuator - Positioning error actuator Recharging time: - End of *Shutdown* phase	---	3
Number of repetitions in the event of error: - Relay - Relay control Recharging time: - End of *Operation* phase	---	2
Number of repetition in the event of internal error Recharging time: - After 24 hours of operation	---	5

Error code	Diagnostic code	Meaning
82	#	Error during VSD's speed standardization
83	#	Speed error VSD
85	#	Referencing error ones actuators
86	#	Error fuel actuator
87	#	Error air actuator
95...98	#	Error relay supervision
99…100	#	Internal error relay control

6.5.5.5. Start without prepurging (as per EN 676)

When using valve proving and 2 fuel valves of class A, prepurging is not required (conforming to EN 676).
Prepurging can be deactivated via parameter.

No.	Parameter
222	Gas: Prepurging 0 = inactive 1 = active
322	Fuel 1 gas: Prepurging 0 = inactive 1 = active

When prepurging is activated, it is performed in accordance with the adjusted prepurge time.
If not activated, it is nevertheless performed of the following conditions apply:

- Alterable lockout position
- After an off time of >24 hours
- In the event of a power failure (power-on)
- In the event of shutdown due to an interruption of gas supply (safety shutdown)

No.	Parameter
225	Gas: Prepurge time
325	Fuel 1 gas: Prepurge time

6.5.5.6. Gas shortage program

Valve proving via gas pressure switch-min (P236 = 2)
Since gas pressure switch-min is not located between the fuel valves, the gas shortage test cannot be made in phase 22. Therefore, when performing valve proving on startup, the gas shortage test is made at the end of the filling time (end of phase 82). With no valve proving on startup, the gas shortage test is made directly before safety time 1 is started (end of phase 39).

Standard valve proving (P236 = 1)
If the gas pressure is too low, startup is aborted in phase 22.

No.	Parameter
246	Gas: Waiting time gas shortage
346	Fuel 1 gas: Waiting time gas shortage

If gas shortage occurs with the last of the parameterized number of start attempts, the system initiates lockout.

No.	Parameter
223	Repetition limit value gas pressure switch-min 1 = no repetition 2...15 = number of repetitions 16 = constant repetition
323	Repetition limit value gas pressure switch-min 1 = no repetition 2...15 = number of repetitions 16 = constant repetition

In that case, the system makes with gas shortage program a selectable number of start attempts until lockout occurs. The waiting time from one start attempt to the next is doubled each time, starting from an adjustable waiting time.

6.5.5.7. Program stop function

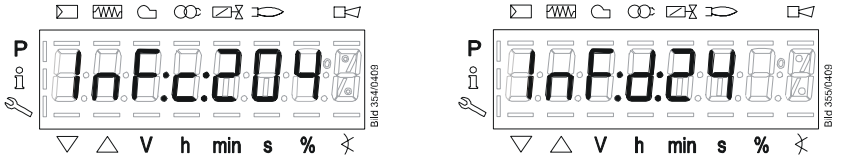
To simplify the burner settings in connection with commissioning and service work, the program sequence of the LMV36... can be stopped at the following positions:

1) Air damper in prepurge position 24
2) Ignition position 36
3) Interval 1 44
4) Interval 2 52

The program stops are integrated in the setting sequence when the plant is commissioned (refer to chapter *Air-fuel ratio curves – settings and commissioning*).
After the initial settings, program stops can be activated on the parameter level.

No.	Parameter
208	Program stop 0 = inactive 1 = PrePurgP (Ph24) 2 = IgnitPos (Ph36) 3 = interval 1 (Ph44) 4 = interval 2 (Ph52)

The program stop function is maintained until manually deactivated. If the system halts at one of the program stops, a message appears on the display of the AZL2....



Example: **C:204** alternating with **d:24** corresponding to program stop in prepurge position.

Figure 40: Message in the case of program stop

6.5.5.8. Forced intermittent operation (<24 hours)

When forced intermittent operation is activated, the unit shuts down for a moment after 23 hours and 45 minutes of uninterrupted operation.

Forced intermittent operation is a standard feature.

No.	Parameter
239	Gas: Forced intermittent operation 0 = inactive 1 = active
279	Oil: Forced intermittent operation 0 = inactive 1 = active
339	Fuel 1 gas. Forced intermittent operation 0 = inactive 1 = active
379	Fuel 1 oil: Forced intermittent operation 0 = inactive 1 = active

6.5.5.9. Low-fire shutdown

To prevent the boiler from being shut down under full or nearly full load conditions, electronic air-fuel ratio control can run the burner to the low-fire position first when there is no more request for heat (refer to chapter *End of operating position*).

6.5.5.10. Continuous fan

With burners that can be damaged by heat (e.g. several burners using the same combustion chamber), continuous purging may be required. In that case, the fan operates continuously in all phases.
For that purpose, the fan motor contactor is to be connected to X3-05, terminal 3, tapped after the unit fuse and the safety loop.
For checking the air pressure switch, a pressure switch relief valve must be connected to fan output X3-05, terminal 1. When output X3-05, terminal 1, is activated, the relief valve diverts the fan pressure to the air pressure switch and, when deactivated, ensures that no pressure is fed to the switch.

Example:

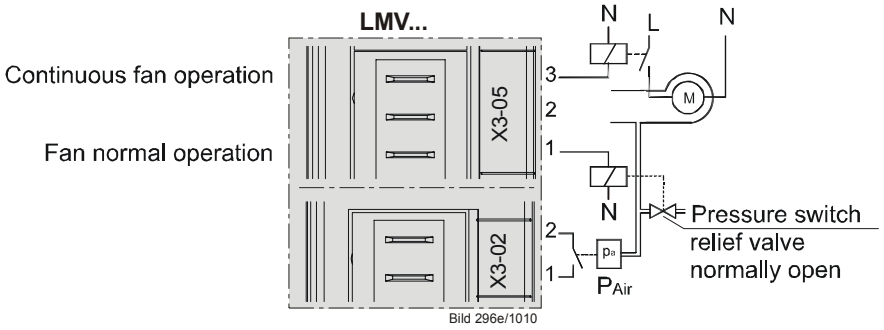


Figure 41: Continuous fan

6.5.5.11. Test function for burner approval – loss-of-flame test (TÜV test)

The purpose of this test is to verify the detection time required in the event of loss of flame when applying for burner approval. When starting the test, the fuel valves are shut to determine the time (resolution of 0.2 seconds) until the basic unit detects loss of flame.

Procedure:

- Determine the burner output at which the test shall be made, using parameter 133 (fuel 0) or parameter 134 (fuel 1). If these parameters are not set, the test is carried out at the current output of the system
- Start the test by entering the value of 1 for parameter 124.
  If the burner's output for the test is set (parameter 133 or 134), the system is driven to that output level first. To ensure this functionality, the presetting of parameter 121 (manual output) is used. This cancels any manual output that was previously active
- Now, the LMV36… shuts the fuel valves, leading to loss of flame
- The evaluation is made by the basic unit by measuring the time the system requires from fuel valve shutdown until loss of flame is detected.
  Then, the measured value is available as a diagnostic code in connection with error C:7 (loss of flame)

  The resolution is 0.2 seconds.

  Example:
  The display of C:7 D:10 means that the time required from valve shutdown to detection of loss of flame is 2 seconds (D:10 corresponding 10 x 0.2 seconds).

When the test is successfully completed, parameter 124 is reset to 0. If unsuccessful, a negative value is delivered for diagnostic purposes and error code 150 is entered.

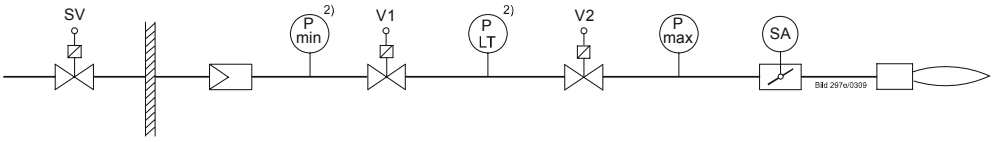
-1 = invalid phase (test possible in phase 60 only) – message displayed: C:150 D: 1
-2 = default output < minimum output – message displayed: C:150 D:2
-3 = default output > maximum output – message displayed: C:150 D:3
-4 = manual abortion (no error, start variable was manually reset to 0) – message displayed: C:150 D:4
-5 = timeout with TÜV test (no loss of flame within 50 seconds after valves were shut) – lockout: C:150 D:5

Values previously set for the burner's output at which the test shall be made (parameter 133 or 134) remain stored.

6.6 Fuel trains (application examples)

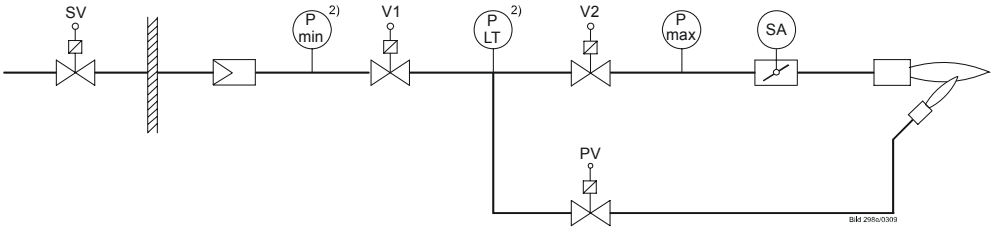
Gas direct ignition
(Operating mode 1, 7, 14, 19)

Program **G** Direct ignition



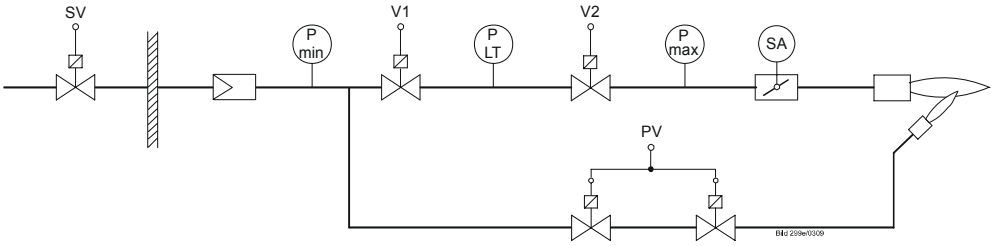
Gas pilot ignition 1
(Operating mode 2, 8, 15, 20)

Program **Gp1** Gas pilot

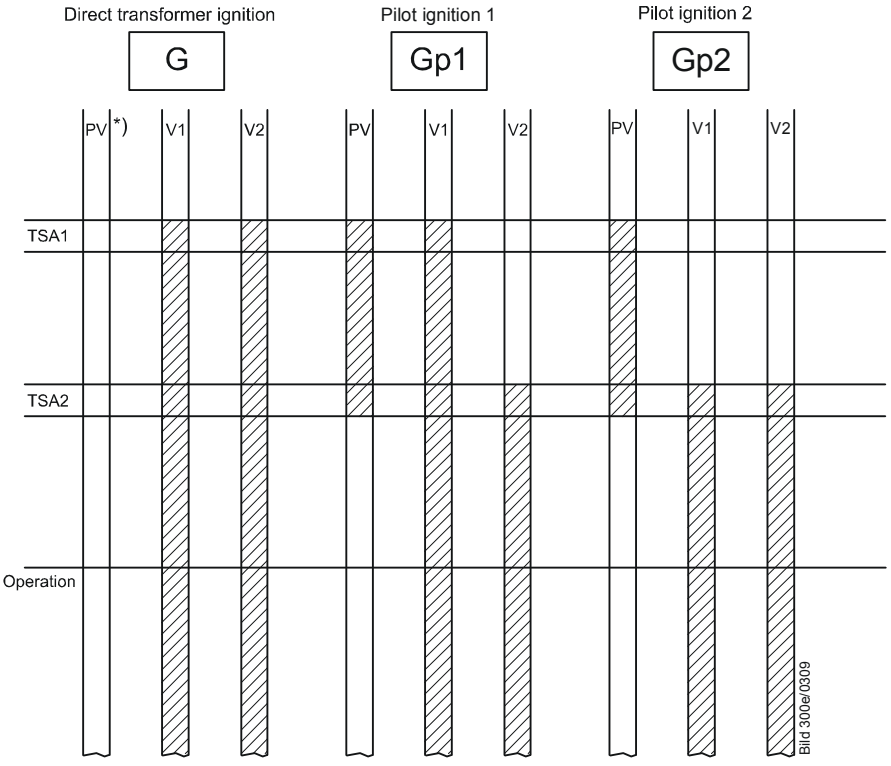


Gas pilot ignition 2
(Operating mode 3, 9, 16, 21)

Program **Gp2** Gas pilot



Fuel valve control program Gas (always modulate)



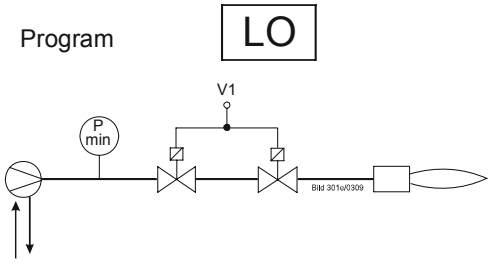
Legend for fuel trains:

*) Not used
1) Series connection of 2 DC 115 V valves
2) For *Valve proving via pressure switch-min (Pmin),* fitted between fuel valves (V1 / V2)

LO Light oil
No Normally Open
P LT Valve proving
Pmax Pressure switch-max
Pmin Pressure switch-min
PV Pilot valve
SA Actuator
SV Safety valve (outdoors)
TSA... Safety time
V Fuel valve

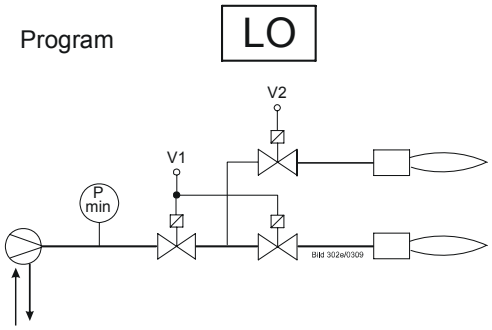
Light oil direct ignition, multistage
(Operating mode 5, 17)

1-stage burner



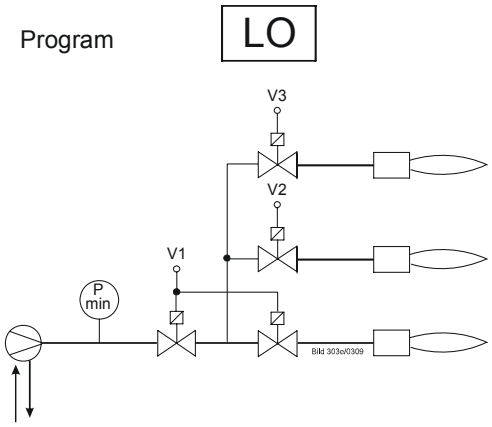
2-stage burner

(Operating mode 5, 17)



3-stage burner

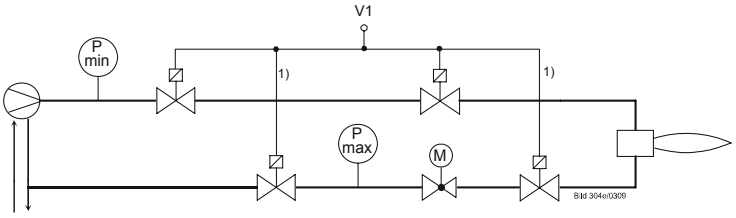
(Operating mode 6, 18)



Light oil direct ignition, modulating
(Operating mode 4, 22)

Modulating burner (without shutdown facility for adjustable head)

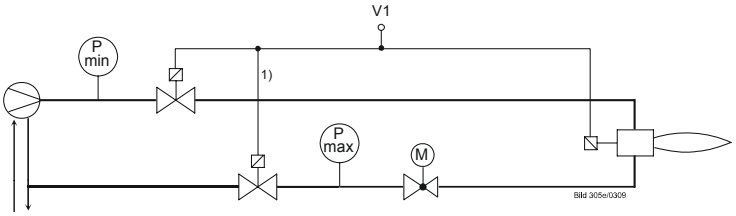
Program LO



(Operating mode 4, 22)

Modulating burner (with shutdown facility for adjustable head)

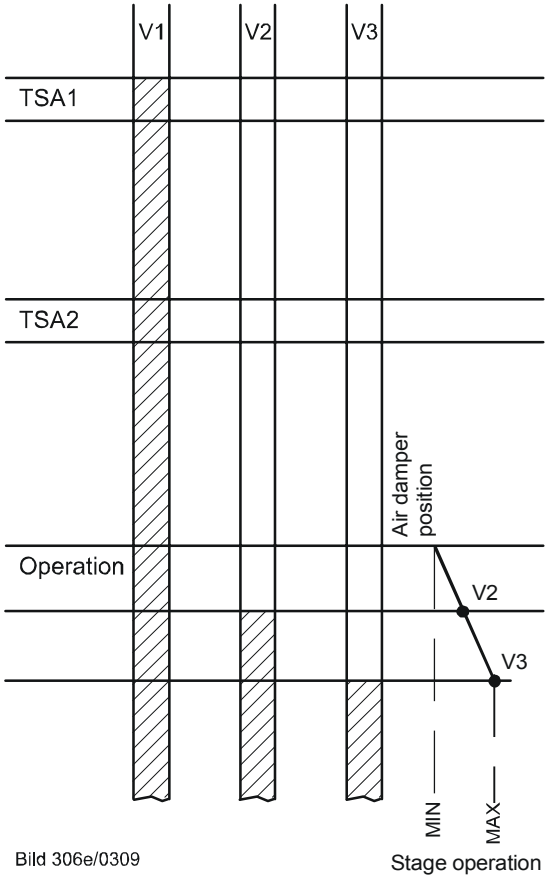
Program LO



Fuel valve control program

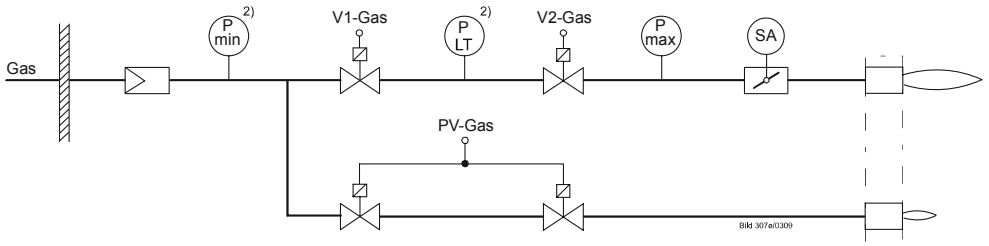
Light oil (transformer for direct ignition)

LO



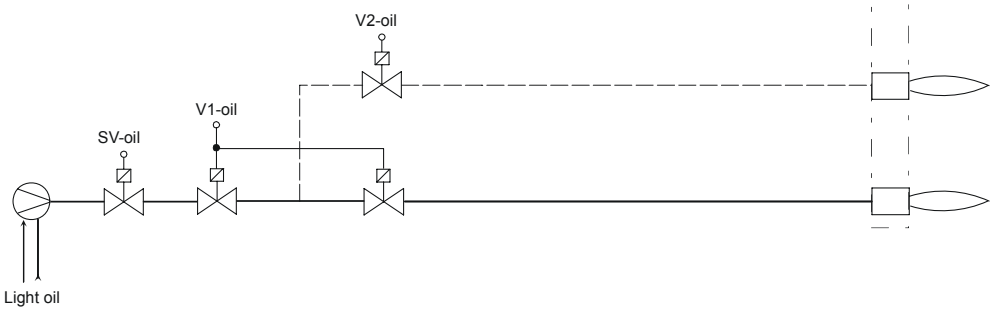
Dual fuel burner gas/ light oil
with gas pilot ignition
(Operating mode 3, 9, 16, 21)

Program **GP2**



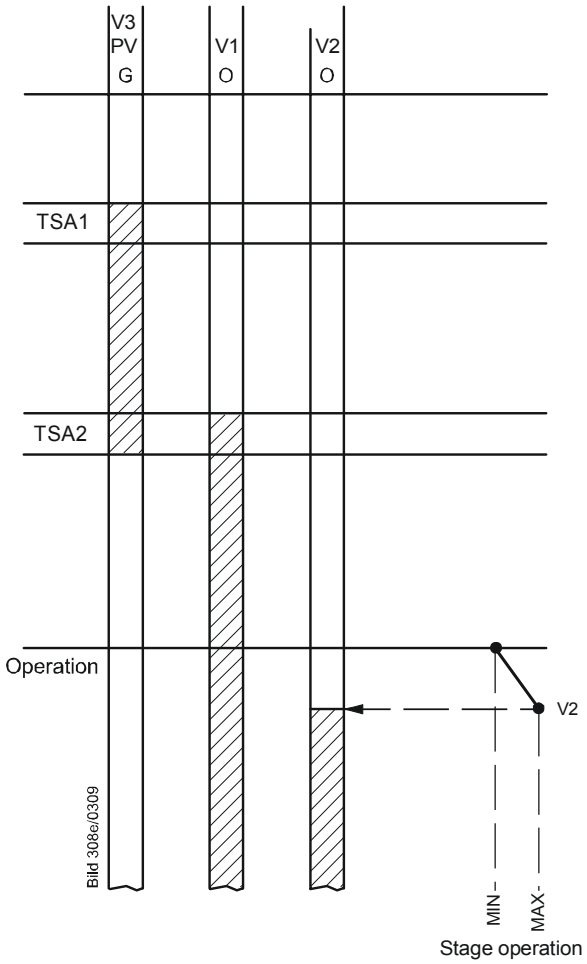
(Operating mode 10, 11)

Program **LOgp**



Fuel valve control program Light oil (with gas pilot ignition)

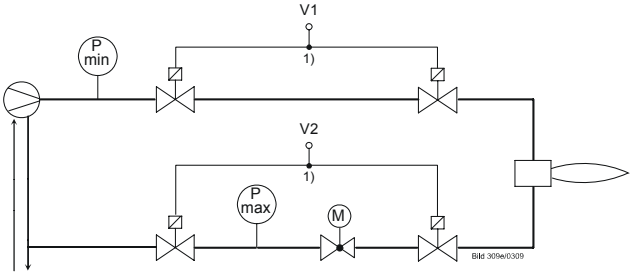
LOgp



Light oil direct ignition modulating with 2 fuel valves (Operating mode 12)

Modulating burner (without shutdown facility for adjustable head)

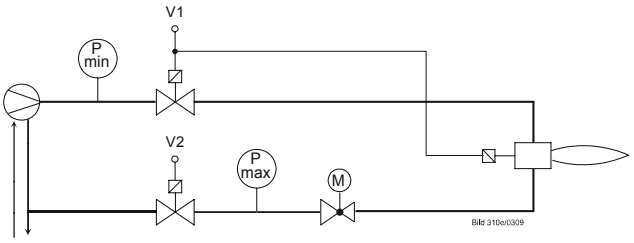
Program LO-2V



(Operating mode 12)

Modulating burner (with shutdown facility for adjustable head)

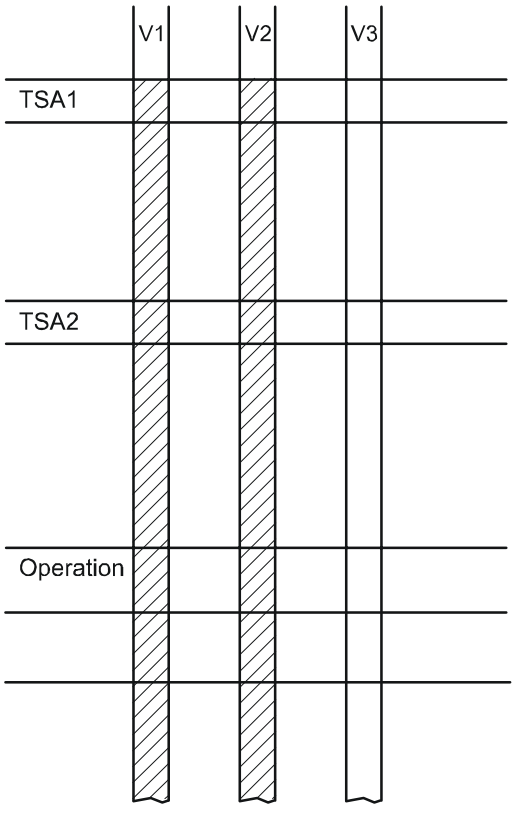
Program LO-2V



Fuel valve control program

Light oil (transformer for direct ignition)

LO-2V



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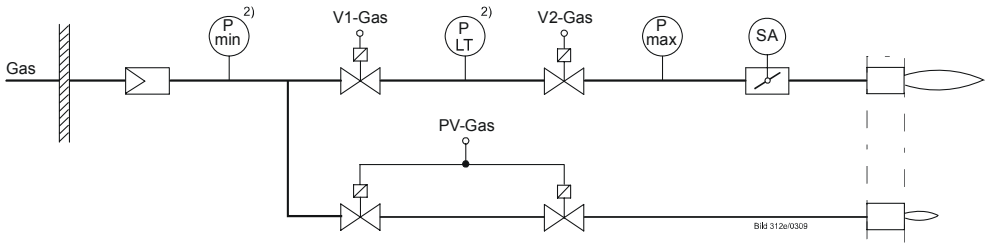
Dual fuel burner gas / light oil with gas pilot ignition with 2 fuel valves
(Operating mode 3, 9, 16, 21)

Program GP2

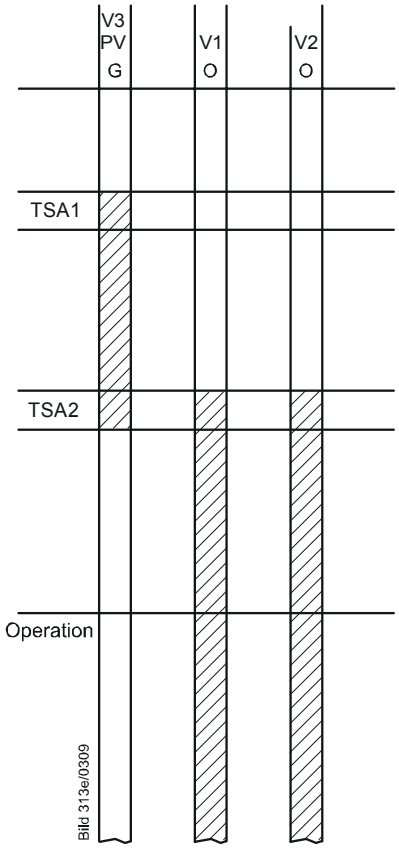


(Operating mode 13)

Program LOgp-2V

Fuel valve control program Light oil (with gas pilot ignition)

LOgp-2V



6.7 Sequence diagrams

The phase numbers given in the sequence diagrams can be read from the following process data:

No.	Parameter
961	Phase (state for external module and display)

6.7.1 Gas direct ignition «G», «G mod», «G mod pneu»

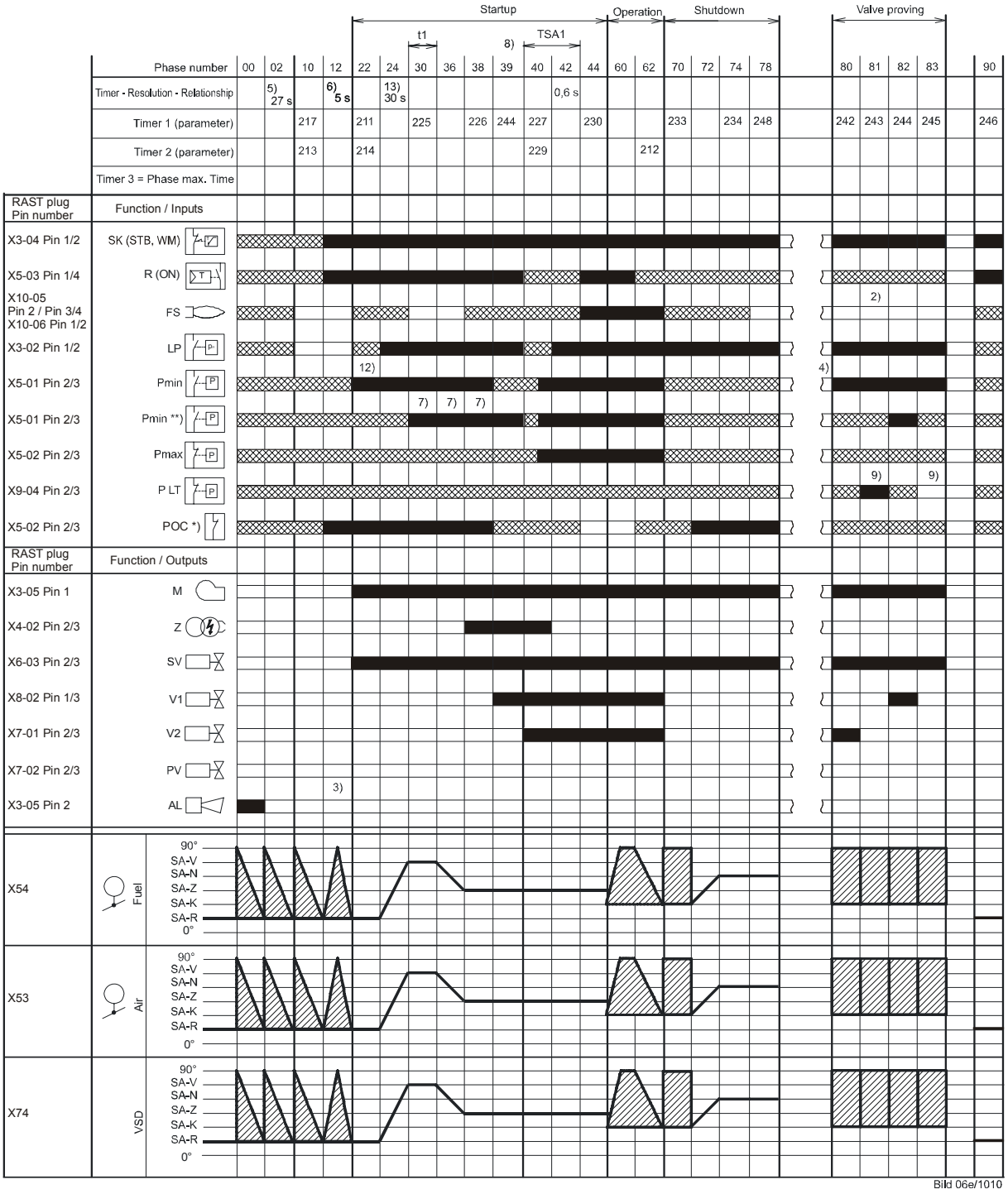


Figure 42: Program for gas direct ignition (G), (G mod), (G mod pneu)

6.7.2 Gas pilot ignition 1 «Gp1», «Gp1 mod», «Gp1 mod pneu»

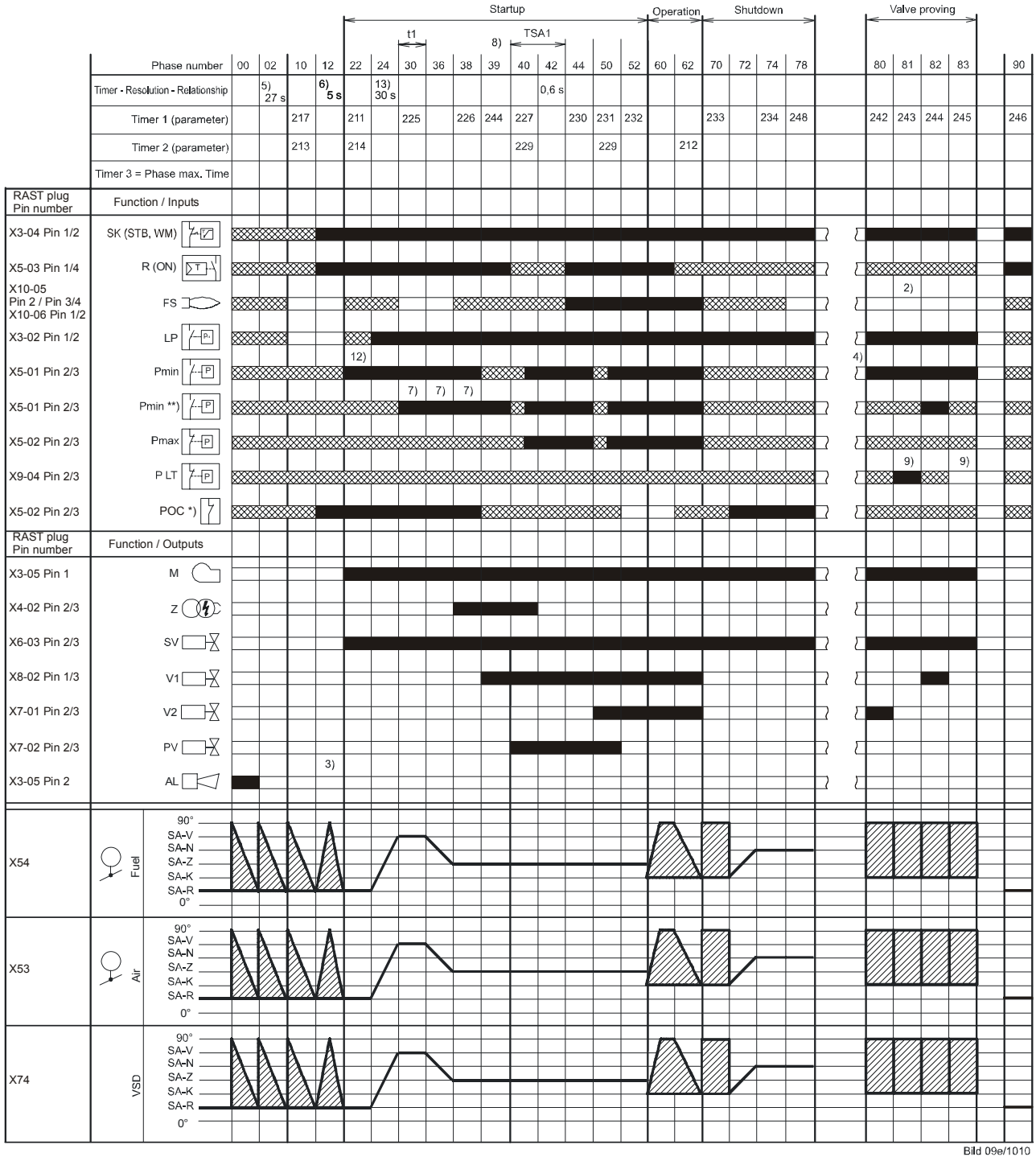


Figure 43: Program for gas pilot ignition (Gp1), (Gp1 mod), (Gp1 mod pneu)

6.7.3 Gas pilot ignition 2 «Gp2», «Gp2 mod», «Gp2 mod pneu»

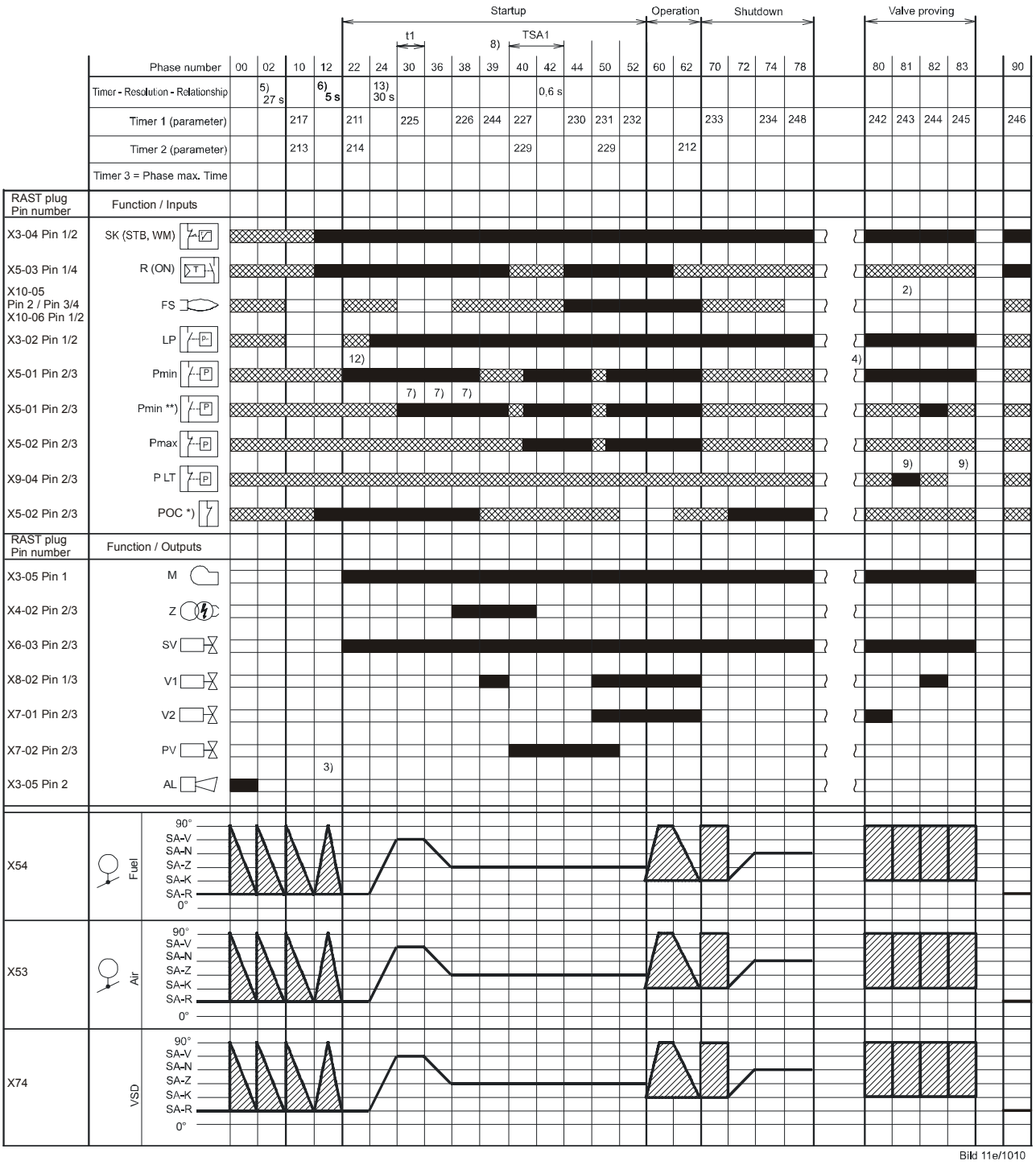


Figure 44: Program for gas pilot ignition (Gp2), (Gp2 mod), (Gp2 mod pneu)

6.7.4 Light oil direct ignition «Lo», «Lo mod», «Lo 2-stage», «Lo 3-stage»

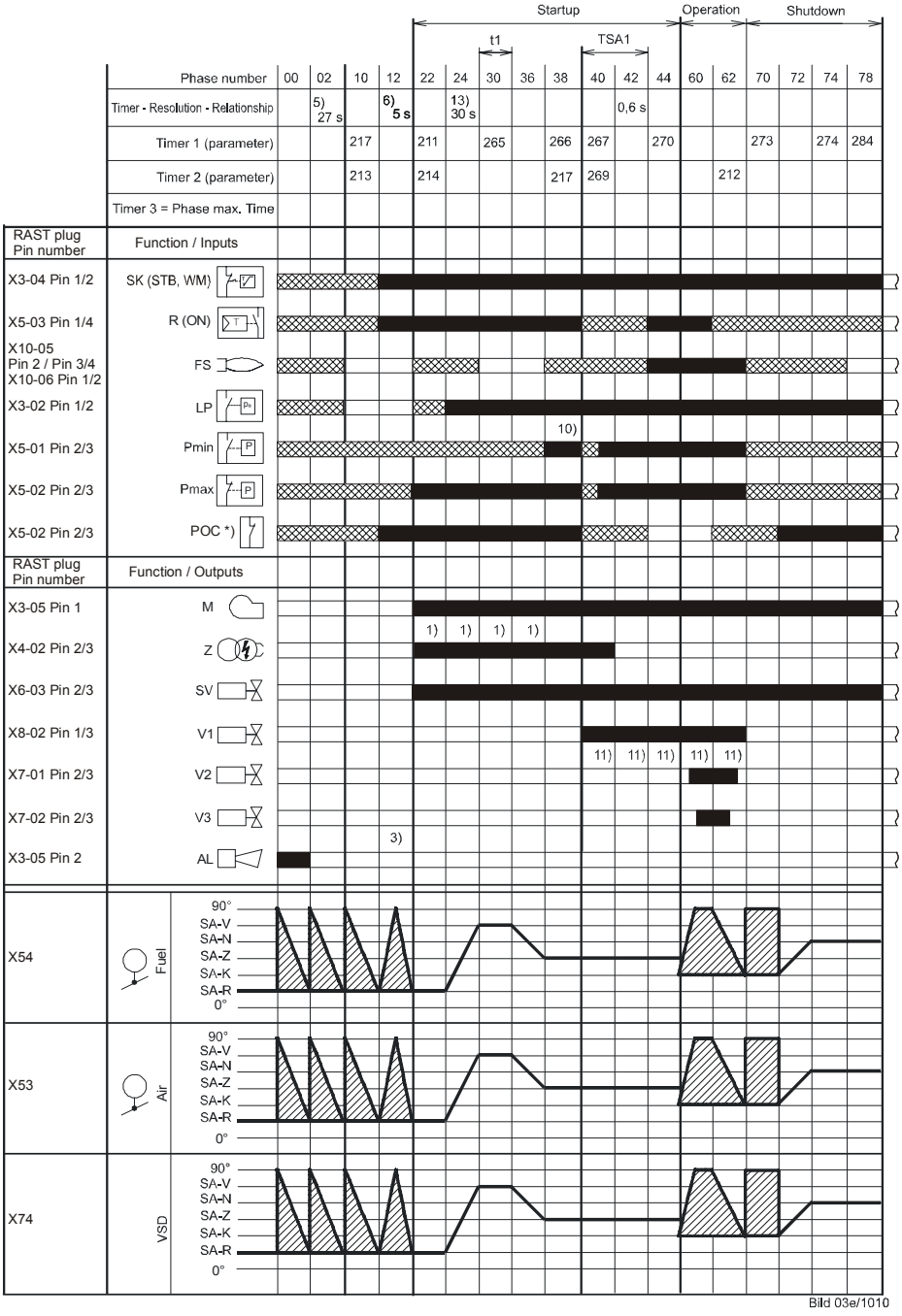


Figure 45: Program for light oil direct ignition (Lo), (Lo mod), (Lo 2-stage), (Lo 3-stage)

6.7.5 Light oil pilot ignition «Lo Gp»

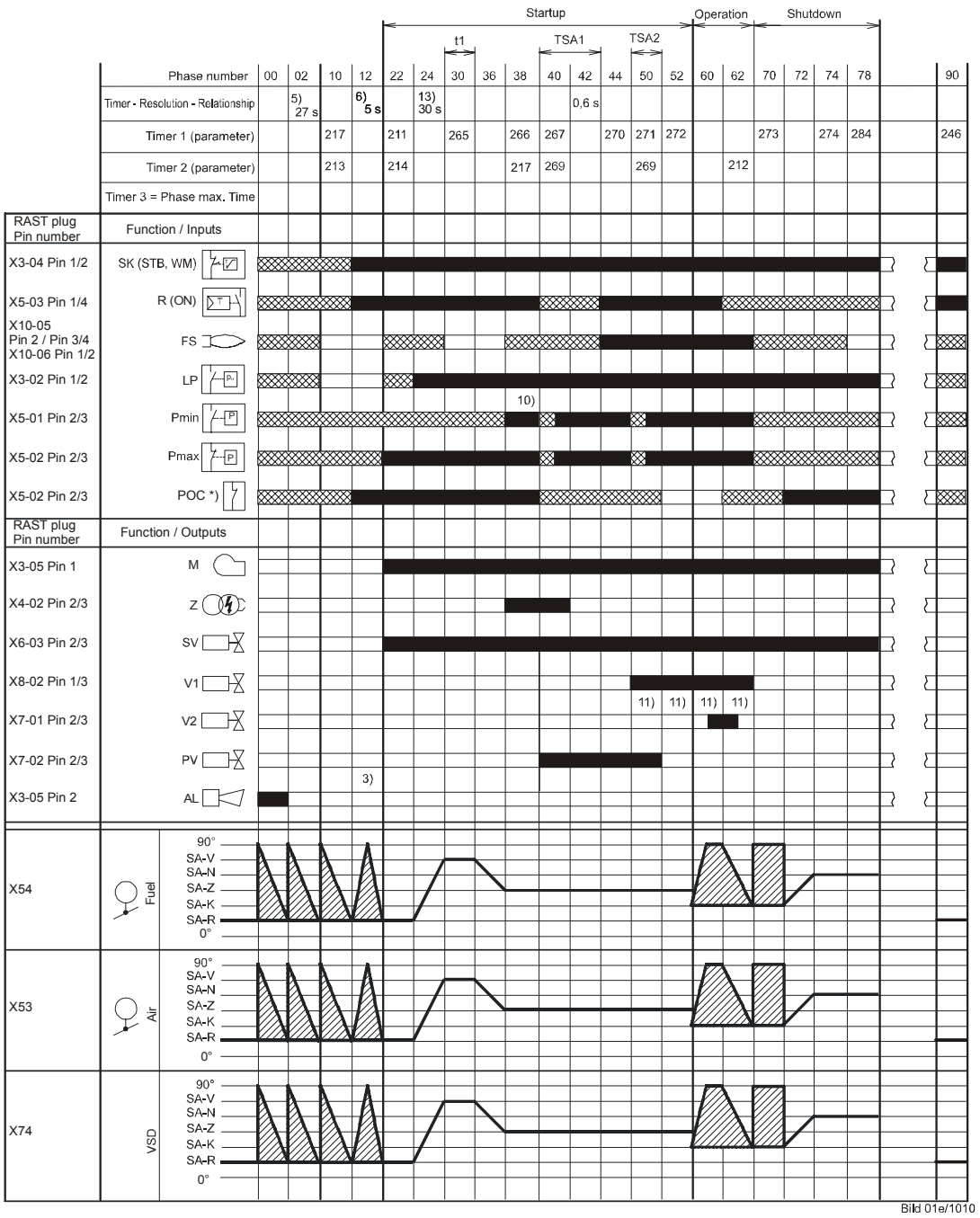


Figure 46: Program light pilot ignition (Lo Gp)

6.7.6 Legend to sequence diagrams

6.7.7 Legend to the sequence diagrams

Note
Not all phases, times, indices, abbreviations and symbols appear in the individual sequence diagrams or are needed there!

Phase numbers

00	Lockout phase
02	Safety phase
10	Home run
12	Standby (stationary)
22	Fan motor (M) = ON, safety valve (SV) = ON
24	Air damper (LK) ⇒ fuel valve (V) – position
30	Prepurging
36	Air damper (LK) ⇒ ignition (Z) – position
38	Preignition ignition (Z) = ON
39	Test pressure switch-min (Pmin)
40	Fuel valve (V) = ON
42	Ignition (Z) = OFF
44	Interval 1 (t44)
50	Safety time 2 (TSA2)
52	Interval 2 (t52)
60	Operation 1 (stationary)
62	Operation 2 air damper (LK) ⇒ low-fire (KL) – position
70	Afterburn time (t13)
72	Air damper (LK) ⇒ Rated load (NL) – position
74	Postpurge time (t8)
78	Postpurge time (t3)
80	Evacuation of test space
81	Atmospheric pressure test
82	Filling of test space
83	Gas pressure test
90	Gas shortage waiting time

Valve proving is performed depending on the parameter settings:
Simultaneously with the prepurge time and/or the afterburn time.

Times

TSA1	1st safety time
TSA2	2nd safety time
t1	Prepurge time
t3	Postpurge time
t8	Postpurge time
t13	Afterburn time
t44	Interval 1
t52	Interval 2

Indices

1)	Parameter:	Short/long prepurge time for oil only Short/long on time of oil pump – time
2)	Only with valve proving during startup	
3)	Parameter:	With/without alarm in the event of start prevention
4)	If signal is faulty in the startup phase, phase 10 is next, otherwise phase 70	
5)	Max. time safety phase, then lockout	
6)	Time from occurrence of start prevention to signaling	
7)	Only in case of valve proving during startup (valve proving via pressure switch-min)	
8)	Only in case of startup without valve proving (valve proving via pressure switch -min)	
9)	Inverse logic in case of valve proving via pressure switch-min	
10)	Parameter:	Oil pressure min-input 1 = active from phase 38 2 = active from safety time
11)	Only with fuel train *Lo* and 2 fuel valves	
12)	Parameter 223:	Repetition limit value gas pressure switch-min in connection with gas shortage program parameter 246 (phase 90)
13)	Max. drop-in/response time for air pressure switch	
14)	Alternative to valve proving	
15)	Alternative to pressure switch-max (Pmax) or POC	

Abbreviations

AL	Alarm
FS	Flame signal
GM	Fan motor contactor
LP	Air pressure switch
M	Fan motor
P LT	Pressure switch for valve proving
Pmax	Pressure switch-max
Pmin	Pressure switch-min
POC	Proof of closure
PV	Pilot valve
R	Temperature or pressure controller
SB	Safety limiter
SK	Safety loop
STB	Safety limit thermostat
SV	Safety valve
WM	Water shortage
V1	Fuel valve 1
V2	Fuel valve 2
VP	Combustion pressure switch
Z	Ignition transformer

SA	Actuator
SA-K	Low-fire position of actuator
SA-N	Postpurge position of actuator
SA-R	Home position of actuator
SA-V	Rated load position of actuator
SA-Z	Ignition load position of actuator

7 AGM60...

7.1 System with AGM60... and one fuel actuator

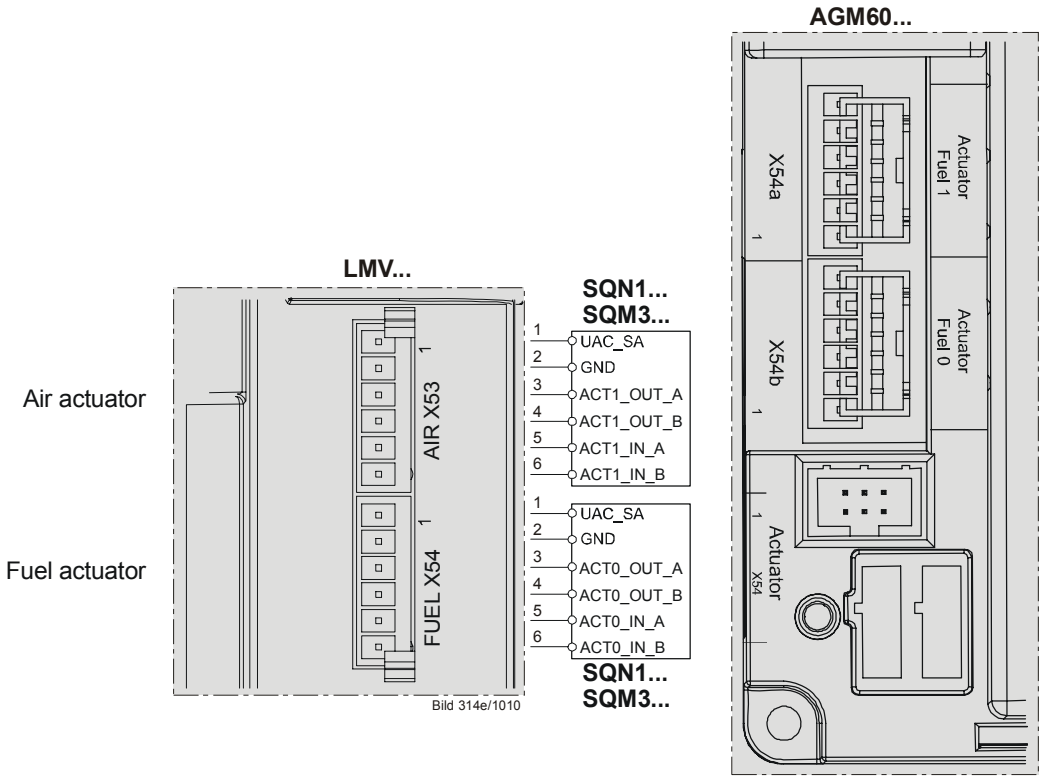


Figure 47: LMV36... with AGM60...: System with AGM60... and one fuel actuator

7.2 System with AGM60... and two fuel actuators

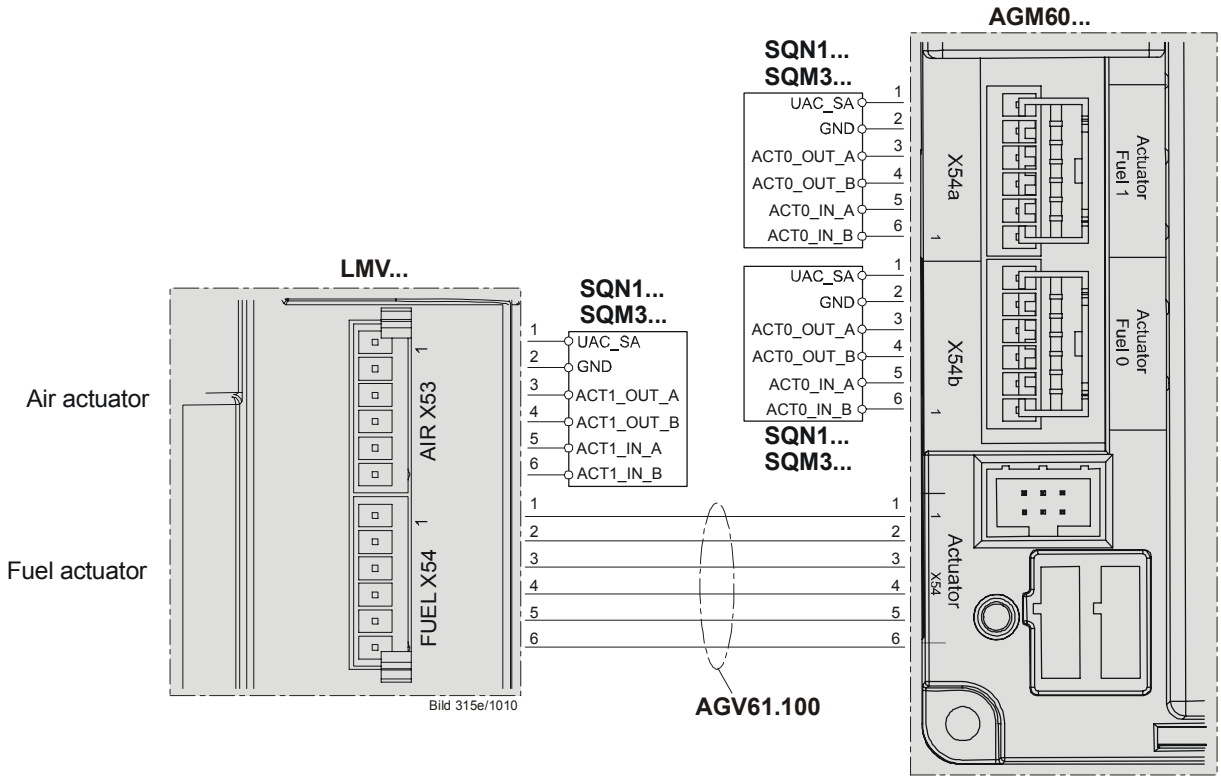


Figure 48: LMV36... with AGM60...: System with AGM60... and two fuel actuator

7.3 Connecting cable between AGM60... and LMV36... basic unit (AGV61.100 cable)

This cable is required when, due to the selected type of fuel train (refer to chapter *Selection of operating mode*), 2 fuel actuators are needed.
For that, the 2 fuel actuators must be connected to terminals X54a and X54b of the AGM60... The AGV61.100 cable is required for making the electrical connection between the 2 fuel actuators and the basic unit.

If only 1 fuel actuator is used, it must be connected directly to the basic unit.

Connection plug assignment of cable:
1 = pink or alternatively red
2 = white or alternatively black
3 = brown
4 = grey
5 = yellow
6 = green

8 Selection of operating mode

To facilitate straightforward adaptation of the LMV36... to different types of burners, the system offers automatic configuration of the operating mode. This means that – derived from parameter 201 (fuel 0) / 301 (fuel 1) – the most important settings of configurations relating to the operating mode are made automatically. Very often in that case, the only manual settings to be made are those for the fuel-air ratio control system. After selection of the operating mode, parameters that are not required will be hidden (e.g. oil parameters when firing on gas).

No.	Parameter
201	Burner operating mode (fuel train, modulating / multistage, actuators, etc.) -- = undefined (delete curves) 1 = G mod 2 = Gp1 mod 3 = Gp2 mod 4 = Lo mod 5 = Lo 2-stage 6 = Lo 3-stage 7 = G mod pneu 8 = Gp1 mod pneu 9 = Gp2 mod pneu 10 = LoGp mod 11 = LoGp 2-stage 12 = Lo mod 2 fuel valves 13 = LoGp mod 2 fuel valves 14 = G mod pneu without actuator 15 = Gp1 mod pneu without actuator 16 = Gp2 mod pneu without actuator 17 = Lo 2-stage without actuator 18 = Lo 3-stage without actuator 19 = G mod gas actuator only 20 = Gp1 mod gas actuator only 21 = Gp2 mod gas actuator only 22 = Lo mod oil actuator only
301	Fuel 1: Burner operating mode (fuel train, modulating / multistage, actuators, etc.) -- = undefined (delete curves) 1 = G mod 2 = Gp1 mod 3 = Gp2 mod 4 = Lo mod 5 = Lo 2-stage 6 = Lo 3-stage 7 = G mod pneu 8 = Gp1 mod pneu 9 = Gp2 mod pneu 10 = LoGp mod 11 = LoGp 2-stage 12 = Lo mod 2 fuel valves 13 = LoGp mod 2 fuel valves 14 = G mod pneu without actuator 15 = Gp1 mod pneu without actuator 16 = Gp2 mod pneu without actuator 17 = Lo 2-stage without actuator 18 = Lo 3-stage without actuator 19 = G mod gas actuator only 20 = Gp1 mod gas actuator only 21 = Gp2 mod gas actuator only 22 = Lo mod oil actuator only

Operating mode P201 / P301	Fuel train	Fuel-air ratio control	Fuel actuator	Air actuator	Feedback signal VSD	Description
1	G mod	Modulating electronic	●	●	●	Gas direct ignition, modulating electronic fuel-air ratio control Optional with VSD with speed feedback signal
2	Gp1 mod	Modulating electronic	●	●	●	Gas pilot ignition 1, modulating electronic fuel-air ratio control Optional with VSD with speed feedback signal
3	Gp2 mod	Modulating electronic	●	●	●	Gas pilot ignition 2, modulating electronic fuel-air ratio control Optional with VSD with speed feedback signal
4	Lo mod	Modulating electronic	●	●	●	Oil direct ignition, modulating electronic fuel-air ratio control Optional with VSD with speed feedback signal
5	Lo 2-stage	2-stage		●	●	Oil direct ignition, electronic 2-stage fuel-air ratio control Optional with VSD with speed feedback signal
6	Lo 3-stage	3-stage		●	●	Oil direct ignition, electronic 3-stage fuel-air ratio control Optional with VSD with speed feedback signal
7	G mod pneu	Modulating pneumatic		●		Gas direct ignition, modulating pneumatic fuel-air ratio control Optional with VSD without speed feedback signal
8	Gp1 mod pneu	Modulating pneumatic		●		Gas pilot ignition 1, modulating pneumatic fuel-air ratio control Optional with VSD without speed feedback signal
9	Gp2 mod pneu	Modulating pneumatic		●		Gas pilot ignition 2, modulating pneumatic fuel -air ratio control Optional with VSD without speed feedback signal
10	Lo Gp mod	Modulating Electronic	●	●	●	Oil pilot ignition, modulating electronic fuel-air ratio control Optional with VSD with speed feedback signal
11	Lo Gp 2-stufig	2-stage		●	●	Oil pilot ignition, 2-stage electronic fuel-air ratio control Optional with VSD with speed feedback signal
12	Lo mod 2V	Modulating Electronic	●	●	●	Oil direct ignition, 2 fuel valves, modulating electronic fuel-air ratio control. Optional with VSD with speed feedback signal
13	Lo Gp mod 2V	Modulating Electronic	●	●	●	Oil pilot ignition, 2 fuel valves, modulating electronic fuel-air ratio control. Optional with VSD with speed feedback signal
14	G mod pneu	Modulating pneumatic				Gas direct ignition, without actuator, modulating pneumatic fuel-air ratio control. Optional with VSD without speed feedback signal
15	Gp1 mod pneu	Modulating Pneumatic				Gas pilot ignition 1, without actuator, modulating pneumatic fuel-air ratio control. Optional with VSD without speed feedback signal
16	Gp2 mod pneu	Modulating Pneumatic				Gas pilot ignition 2, without actuator, modulating pneumatic fuel-air ratio control. Optional with VSD without speed feedback signal
17	Lo 2-stufig	2-stage			●	Oil direct ignition, without actuator, 2-stage electronic fuel-air ratio control. Optional with VSD with speed feedback signal
18	Lo 3-stufig	3-stage			●	Oil direct ignition, without actuator, 3-stage electronic fuel-air ratio control. Optional with VSD with speed feedback signal
19	G mod	Modulating Electronic	●		●	Gas direct ignition, firing on gas only, modulating electronic fuel-air ratio control. Optional with VSD with speed feedback signal
20	Gp1 mod	Modulating Electronic	●		●	Gas pilot ignition 1, firing on gas only, modulating electronic fuel-air ratio control. Optional with VSD with speed feedback signal
21	Gp2 mod	Modulating electronic	●		●	Gas pilot ignition 2, firing on gas only, modulating electronic fuel-air ratio control. Optional with VSD with speed feedback signal
22	Lo mod	Modulating Electronic	●		●	Oil direct ignition, firing on oil only, modulating electronic fuel-air ratio control. Optional with VSD with speed feedback signal

(Also refer to chapter *Fuel trains*)

The VSD can be used with any of the operating modes (refer to chapter *VSD*).

No.	Parameter
542	Activation of VSD / PWM fan 0 = inactive 1 = active

Note
For configuration of the analog output when the VSD is activated, refer to chapter *Load output X74.3*!

8.1 Deleting curves

To delete curves, the operating mode must be set to undefined «--». In that case, only the fuel curves are deleted, the direction of rotation or the reference position of the actuators is not changed.

9 Connection to load controllers

The LMV36... system can be connected to different load controllers. The heat request and the required burner output are determined in accordance with the priorities of the different heat sources.

9.1 Controller-on contact X5-03, terminal 1

This contact is given priority over all power sources. A heat request can be made only when this contact is closed. The contact is safety-related and can also be used in connection with controllers featuring an integrated temperature limiter function.

9.2 Load controller via BAC system X92

To control the LMV36... basic unit, the BAC system can predefine an output via a bus system. The BAC system is connected to the basic unit via the X92 interface.
Burner startup can take place only when contact X5-03/1 is closed (load controller (LR) On / Off).
For more detailed information about the connection of BAC systems, refer to chapter *Connection to superposed systems* in this document and to the Modbus User Documentation (A7541).

Minimum positioning step

To avoid unnecessary positioning steps of the actuators when the predefined target output varies, a minimum positioning step can be set. The basic unit changes the output only if the change in target output exceeds the minimum positioning step. The minimum positioning step only becomes active in modulating operation.

No.	Parameter
123.0	Minimum output positioning step: Output building automation

Behavior in the event the building automation and control system fails

If the basic unit system receives no more data from the system, it delivers the output set via parameter 148. The time that elapses until communication breakdown is detected can be set via parameter 142.

Parameter	
142	Setback time in the event of communication breakdown Setting value: 0 = inactive 1…7200 s
148	Predefined output in the event of communication breakdown with building automation Setting values: For **modulating operation**, the setting range is as follows: 0…19.9 = burner off 20…100 = 20…100% burner output For **multistage operation**, use the following settings: 0 = burner OFF, P1, P2, P3 Invalid = no output predefined by the BAC system in the event of communication breakdown Default setting: *Invalid*
149	Fuel 1: Predefined output in the event of communication breakdown with building automation Setting values: For **modulating operation**, the setting range is as follows: 0…19.9 = burner off 20…100 = 20…100% burner output For **multistage operation**, use the following settings: 0 = burner OFF, P1, P2, P3 Invalid = no output predefined by the BAC system in the event of communication breakdown Default setting: *Invalid*

Setting choices:

a) Output preset with parameter 148 set undefined (--):
In the event communication breaks down, the last valid preselected output is maintained. The next load controller activated in accordance with the priority (refer to chapter *Prioritization of load sources*) ensures control from this output position.

b) Output preset via parameter 148 set to 0, 20…100%, or parameterized as multistage:
If communication breaks down, the output requested by the BAC system is set invalid and the output set via parameter 148 is delivered.

Note
In that case, outputs via load controllers with a priority lower than that of the BAC system cannot be delivered.

9.3 Manual output

A manual output can be set with the *Normal display* of the display and operating unit or via the PC tool.

Manual output via the display and operating unit

Manual output can be activated or adjusted by keeping the **F** button depressed for at least 1 second and by pressing the **+** or **–** button.
Output **0** means *Manually off*.
As long as manual output is active, the output appearing on the normal display blinks.
To deactivate and to change to automatic operation, press **Esc** for 3 seconds.
If *Manually off* is activated, it is stored via mains OFF.
On power return, the burner assumes the *Manually off* position (**OFF** blinking) (refer to chapter *Operation*).

Fuel changeover resets the manual output to *Invalid*.

Exception:
Setting *Manually off* is maintained after fuel changeover also.

Activation of *Manually off* in operation
To activate *Manually off*, first run the system to the minimum output limit. Then, keep the **F** button depressed for at least 1 second and press the **–** button.

Manually off is activated by releasing the **F** button and by pressing again the **–** button.

Caution!
***Manually off* must not be used by itself to put a burner out of operation when doing mounting work, or when the burner is not ready for operation. The safety notes in chapter *Safety notes* must be observed!**

Manual output via the PC tool

Refer to description of the PC tool (J7352).

9.4 Output with curve settings

To set the curves via the display and operating unit or the PC tool, a special parameterization output is provided. Using this output, it is also possible to approach the point of ignition. The output is delivered automatically and cannot be set manually. It is only mentioned here for the sake of completeness.

9.5 External load controller via analog input X64.1 / X64.2

For the preselection of external outputs, an analog 4…20 mA input is provided. Burner startup can take place only when contact X5-03/1 is closed (load controller (LR) On / Off).

Switching thresholds / minimum positioning step

A disruption of the current input or a current signal <3 mA leads to deactivation of the analog input's external preselected output. To avoid unnecessary positioning steps of the actuators when the input signal varies, it is possible to set a minimum positioning step for the predefined output. The minimum positioning step only becomes active in modulating operation. For the external load controller via the analog input, a value of 1% is preset.

No.	Parameter
123.1	Minimum output positioning step: Output external load controller analog
204	Analog output invalid (4...20 mA) 0 = Default output low-fire 1 = Safety shutdown + prevention of startup

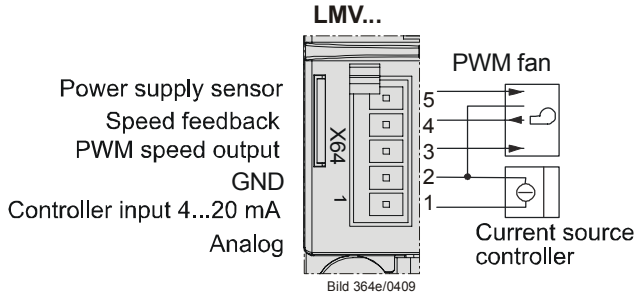


Figure 49: External load controller via analog input X64.1 / X64.2

9.5.1 Thresholds for modulating operation

Actual value	Current	Display / output value
Low-fire	3...4 mA	20%
Low-fire	4 mA	20%
High-fire	20 mA	100%

9.5.2 Switching thresholds for multistage operation

For multistage operation, a hysteresis band about the thresholds is provided. The hysteresis band replaces the minimum control step for multistage operation. The band width is approx. 1 mA.

2-stage operation

Actual value	Current	Display / output value
Stage 1	5 mA (3...12 mA)	P1
Hysteresis band	12...13 mA	---
Stage 2	15 mA (13...20 mA)	P2

3-stage operation

Actual value	Current	Display / output value
Stage 1	5 mA (3...7 mA)	P1
Hysteresis band 1	7...8 mA	---
Stage 2	10 mA (8...12 mA)	P2
Hysteresis band 2	12...13 mA	---
Stage 3	15 mA (13...20 mA)	P3

9.6 Prioritization of power sources

To simplify configuration of the system, the power source need not be selected. The system automatically detects the available power sources and selects them. If several sources are used, they are selected according to the following priorities:

Parameter 942	Priority	Active power source
	1 highest	Chapter Controller-on-contact X5-03, terminal 1 When the input is activated, the other power sources are assessed according to their priorities. When the input is deactivated, the burner is off
1	2	Chapter Output with curve settings
2	3	Chapter Manual output
3	4	Chapter Load controller via the building automation system X92
4	5 lowest	Chapter External load controller via analog input X64 terminal 1 / terminal 2

The active power source can be read out via parameter 942.

9.6.1 Emergency operation with several load controllers

By making use of the prioritization described above, it is also possible to implement emergency operation. Should the building automation and control system fail (provided parameter 148 is set to undefined (--)), the unit switches automatically over to the external load controller.
A load controller via analogue input or, if existing via contacts can be connected.

10 Electronic fuel-air ratio control

10.1 General

Electronic air-fuel ratio control is used to control the burner's actuators depending on burner output. It is possible to connect 2 actuators and, optionally, 1 VSD. Resolution is 0.1° with the actuators and 0.1% with the VSD. Output can be regulated in increments of 0.1% in modulating mode or with a maximum of 3 stages in multistage mode.
To reduce the electric power required for the actuators, they are never operated simultaneously, but in successive order, or alternately.

10.2 Behavior outside the operating positions

Outside their operating positions, the actuators approach the different positions in successive order. The program phase determines the position to be approached.

10.2.1 Traveling speed

The actuators' traveling speed is fixed at 5 seconds for covering a positioning angle of 90°.
The ramp speed of the VSD can be adjusted separately for higher and lower speeds.

No.	Parameter
522	Ramp up
523	Ramp down

The setting also applies to the operating position (refer to chapter *Operating position*).

10.2.2 Home position

This position is approached in the *Home run* (10), *Standby* (12) and *Lockout position* (00) phases.

The position can be set via the following parameters:

Parameter	**Actuator**
501.00	No-flame positions fuel actuator: Home position
502.00	No-flame positions air actuator: Home position
503.00	No-flame speeds VSD: No-load speed
504.00	Fuel 1: No-flame positions fuel actuator: Home position
505.00	Fuel 1: No-flame positions air actuator: Home position
506.00	Fuel 1: No-flame speeds VSD: No-load speed

10.2.3 Prepurging

This position is approached in phase *Traveling to prepurging* (24).

The position can be set via the following parameters:

Parameter	**Actuator**
501.01	No-flame positions fuel actuator: Prepurge position
502.01	No-flame positions air actuator: Prepurge position
503.01	No-flame speeds VSD: Prepurge speed
504.01	Fuel 1: No-flame positions fuel actuator: Prepurge position
505.01	Fuel 1: No-flame positions air actuator: Prepurge position
506.01	Fuel 1: No-flame speeds VSD: Prepurge speed

No.	Parameter
222	Gas: Prepurging 0 = inactive 1 = active
262	Oil: Prepurging 0 = inactive 1 = active
322	Fuel 1 gas: Prepurging 0 = inactive 1 = active
362	Fuel 1 oil: Prepurging 0 = inactive 1 = active

10.2.4 Ignition

The ignition position is approached in phase *Traveling to the ignition position* (38).
The position is set via curve parameterization under **P0**. In modulating operation, this point is assigned to an output of 10%.

10.2.5 Postpurging

This position is approached in phase *Traveling to postpurging* (72).

The position can be set via the following parameters:

Parameter	**Actuator**
501.02	No-flame positions fuel actuator: Postpurge position
502.02	No-flame positions air actuator: Postpurge position
503.02	No-flame speeds VSD: Postpurge speed
504.02	Fuel 1: No-flame positions fuel actuator: Postpurge position
505.02	Fuel 1: No-flame positions air actuator: Postpurge position
506.02	Fuel 1: No-flame speeds VSD: Postpurge speed

10.3 Modulating operation

In modulating mode, it is possible to operate 2 actuators and 1 VSD. The burner's output can be regulated between 20.0% (low-fire) and 100.0% (high-fire) in increments of 0.1%. Since the actuators are never allowed to operate simultaneously, the output is increased in small steps of 1%. In the case of an operating ramp of 20% after 100% in 32 seconds, this represents 1 step in 400 ms. Within such an output step, the air actuator is operated in the first 200 ms, and the VSD and fuel actuator in the second 200 ms.

10.3.1 Definition of curves

The fuel-air ratio curves are defined by 10 curvepoints that are firmly distributed across the output range.

The following assignment applies:

Curvepoint	Output	Meaning
P0	10%	Point of ignition, not approached in the operating position
P1	20%	Low-fire
P2	30%	
P3	40%	
P4	50%	
P5	60%	
P6	70%	
P7	80%	
P8	90%	
P9	100%	High-fire

The actuator positions can be set with a resolution of 0.1°.
Between the curvepoints, the positions are interpolated in a linear manner.

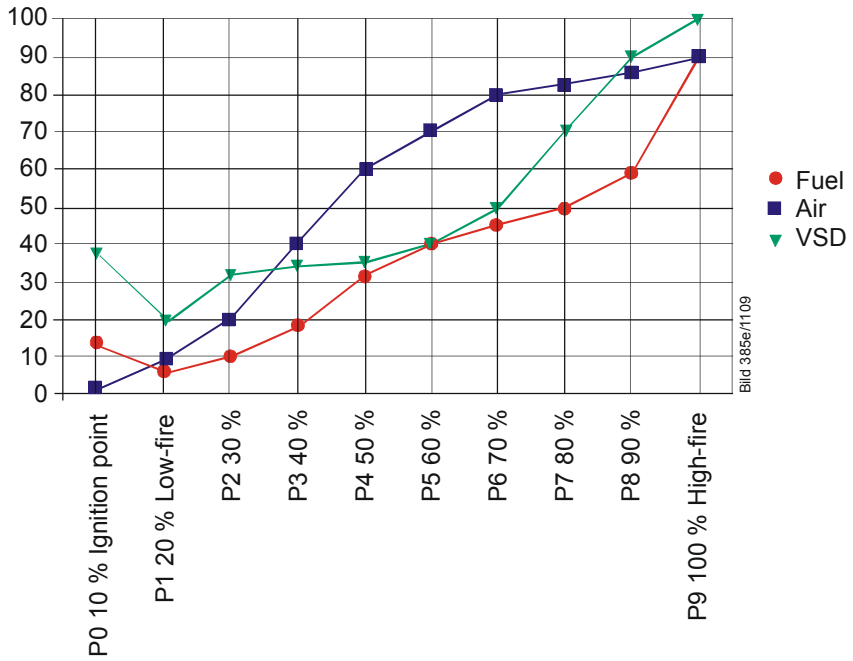


Figure 50: Definition of curves

No.	Parameter
401	Ratio control curves fuel actuator (curve setting only)
402	Ratio control curves air actuator (curve setting only)
403	Ratio control curves VSD (curve setting only)
404	Fuel 1: Ratio control curves fuel actuator (curve setting only)
405	Fuel 1: Ratio control curves air actuator (curve setting only)
406	Fuel 1: Ratio control curves VSD (curve setting only)

10.3.2 Traveling speed/maximum curve slope

The time required for modulating from low-fire to high-fire is 32 seconds.

In connection with the actuator's ramp in the basic unit, the following positioning angles or speed changes between maximum 2 curvepoints can be covered:

Type of actuator	**Positioning speed**	**Positioning angle**
Actuator	5 s / 90°	31°
VSD	5 s / 100%	40%
	10 s / 100%	20%
	20 s / 100%	10%

No.	Parameter
522	Ramp up
523	Ramp down

The setting also acts outside the operating position (refer to chapter *Traveling speed*).

VSD

Between the ignition time (P0) and the low-fire point (P1), a speed differential of up to 40% can be set for the VSD, independent of the selected ramp. This means that the period of time from ignition to low-fire can vary between 4…16 seconds (5 to 20 seconds ramp).

Error code	Diagnostic code	Meaning for the LMV36... system
84	Bit 0 Valency 1	VSD: Curve too steep in terms of ramp rate
	Bit 1 Valency 2…3	Fuel actuator: Curve too steep in terms of ramp rate
	Bit 2 Valency 4…7	Air actuator: Curve too steep in terms of ramp rate

The parameterized curve is steeper than permitted with the selected actuator speed.

10.3.3 Entering the running position

The burner is ignited when ignition position **P0** is reached. When entering operating phase **60**, the actuators follow the defined curves until the low-fire position is reached (20% or parameter 545 / 565 – lower output limit).

10.3.4 Operating position

As demanded by the load controller, the actuators are driven along the defined 20% and 100% curves. Point of ignition **P0** can only be reached via the curve settings.

10.3.5 Limitation of modulation range

If the modulation range shall be further restricted from 20 to 100% against the defined curve, 4 parameters are available to define a new low-fire and high-fire position.

No.	Parameter
545	Lower output limit undefined = 20 %
565	Fuel 1: Lower output limit undefined = 20 %
546	Upper output limit undefined = 100 %
566	Upper output limit undefined = 100 %

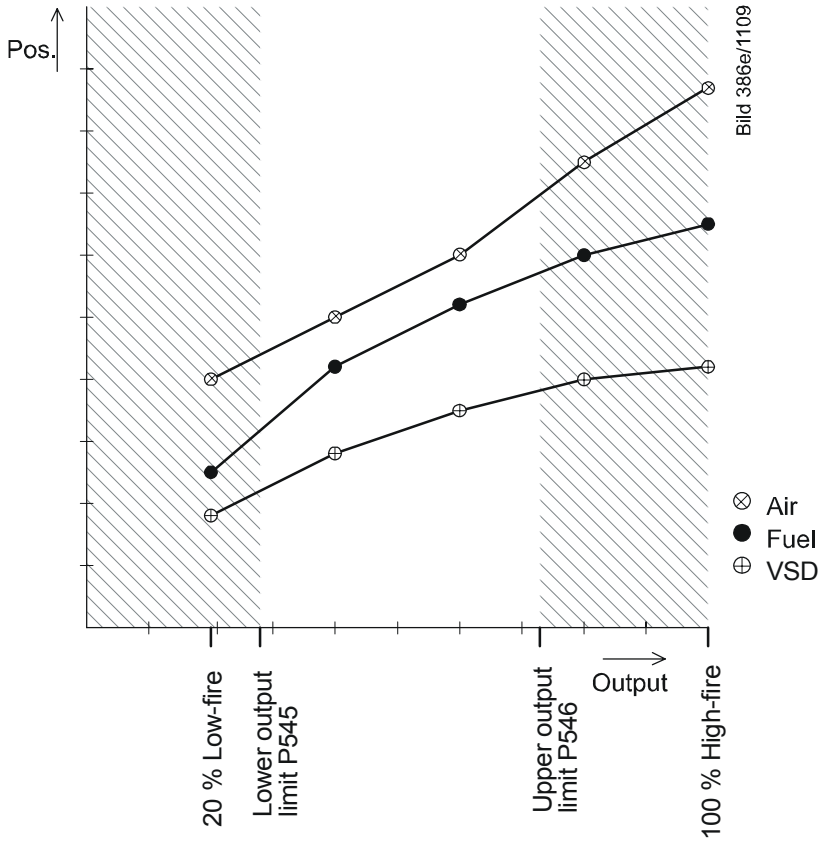


Figure 51: Restriction of modulation range

10.3.6 Setting the minimum and maximum output

For changes regarding setting of the minimum and maximum output after the curve settings, note the following:

After leaving the curve settings with completely defined curvepoints, proceed in modulating operation by setting the minimum / maximum output (parameters 546 / 545 or 566 / 565).

In case of the warm setting, the parameterized output remains active until setting of the minimum / maximum output is completed. Any change to the minimum / maximum output is included in the parameterized output. Automatic operation becomes active only after leaving the minimum / maximum output.
As a result of this procedure, the system maintains the output set by the user, thus ensuring **trouble-free** setting of the minimum / maximum output.

Advantages:
- The actual output always corresponds to the currently parameterized minimum / maximum output or the system output resulting from the curve setting made last, which means that the output can be ascertained accurately and without interference
- The load sources of low priority (contacts, analog input, BAC system output, manual output) are inactive
- During the curve and the subsequent minimum/maximum output settings, the *Manual OFF* function is deactivated
- Unambiguous and easy-to-understand behavior of the system

Note
If output limitation is not required, the minimum / maximum output need **not** be set.
In that case, an undefined minimum / maximum output corresponds to a minimum output of 20% and a maximum output of 100%.

10.4 Multistage operation

This operating mode is only available when firing on oil. There is a choice of 2-stage and 3-stage operation. Hence, the burner's output can be modulated via 2 or 3 stages. Modulation is accomplished by adjustment of the air actuator or the VSD and by switching the fuel valves for adjusting the amount of fuel.

10.4.1 Definition of curves

Fuel-air ratio control is defined via the 2 or 3 static output points. To switch the valves on and off, switch-on and switch-off points must be defined.

The following assignments apply:

Curve-point	**Meaning**	**Valve**
P0	Point of ignition (not approached in the operating position)	V1
P1	Stage 1	V1
P2on	Switch-on point stage 2. When the angle exceeds this point, the fuel valve for the second stage is switched on	V1
P2_d	Presetting of point P2 with no approach	V1
P2	Stage 2	V2
P2of	Switch-off point stage 2. When the angle falls below this point, the fuel valve for the second stage is switched off	V2
P3on	Switch-on point stage 3. When the angle exceeds this point, the fuel valve for the third stage is switched on	V2
P3_d	Presetting of point P3 with no approach	V2
P3	Stage 3	V3
P3of	Switch-off point stage 3. When the angle falls below this point, the fuel valve for the third stage is switched off	V3

The actuator positions can be set with a resolution of 0.1°, the speeds with a resolution of 0.1%.

10.4.2 Traveling speed

The air actuator or the VSD is operated like outside the operating position. The defined ramp speeds are used.
The traveling speed of the actuators is fixed at 5 seconds for a positioning angle of 90°.
The speed of the VSD can be adjusted separately for speed increase or decrease.

No.	Parameter
522	Ramp up
523	Ramp down

The setting also acts outside the operating position.

10.4.3 Adjustment of output

When the output increases, the system moves from the curvepoint of stage 1 (P1) to the switch-on point of stage 2 (P2on). If the switch-on point is exceeded, the valve for the second stage is switched on. Then, the system moves to the curvepoint for stage 2 (P2).
When the output decreases, the system moves from the curvepoint of stage 2 (P2) to the switch-off point of stage 2 (P2of). If this point is crossed, the valve for the second stage is switched off. Then, the system moves to the curvepoint for stage 1 (P1).
In 3-stage operation, the output between stage 2 and stage 3 is adjusted analogously to 2-stage operation. As static outputs, only **P1**, **P2** and **P3** can be approached.
The switch-on and switch-off points are crossed only when changing between stages.
The traveling speeds are fixed. Depending on the positioning angles to be covered, air actuator and VSD do not reach the operating or switch-on/switch-off points at the same time. The valves are switched on / off only after both actuators have reached their correct positions.

When parameterizing the curves, the switch-on points can also be approached in a stationary manner. In addition, when setting the curve via *P2_d* (P3_d), curvepoint *P2* (P3) can be readjusted without traveling to it. In that case, the system is at the respective switch-on point. This procedure is used to reduce the operating time if there is shortage of air.

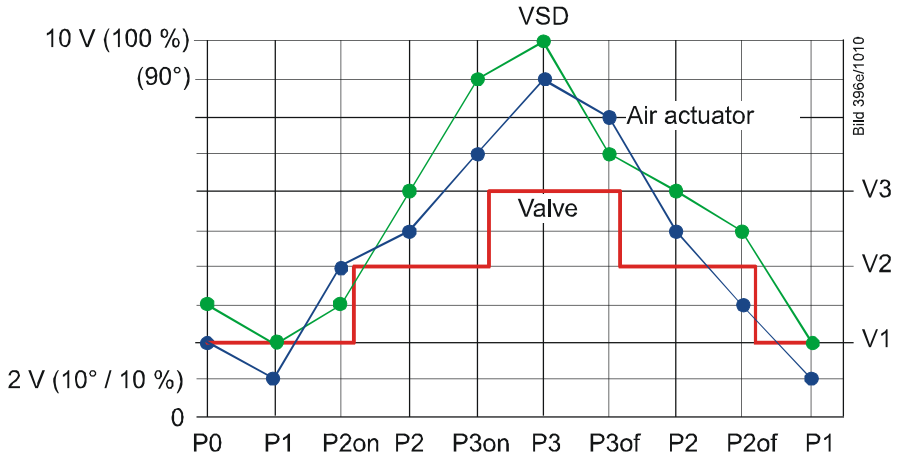


Figure 52: Adjustment of output

10.4.4 Entering the operating position

The burner is ignited at ignition position **P0**. When entering operating phase **60**, the actuators are driven from ignition position **P0** to the operating point of stage 1 (P1) at the respective traveling speed.

10.4.5 Operating position

In the operating position, the burner's output can be adjusted between operating points **P1** and **P2** or **P3** in accordance with the load controller's presetting, as described in chapter *Adjustment of output*. Ignition position **P0** is not approached anymore. It can only be reached via curve adjustment.

10.4.6 Limitation of modulation range

If the modulation range for stage 1 and stage 2, or stage 3, shall be further restricted, 4 parameters can be used to define a new low-fire and high-fire position.

No.	Parameter
545	Lower output limit undefined = 20 %
565	Fuel 1: Lower output limit undefined = 20 %
546	Upper output limit undefined = 100 %
566	Fuel 1: Upper output limit undefined = 100 %

10.5 End of operating position

When there is no more heat request, the system switches to phase 62. Here, the burner runs down to low-fire as long as possible before the valves are shut.
The available period of time can be set via parameter 212. If this time is set to the minimum value, the burner is immediately shut down if there is no more request for heat. If the time exceeds 32 seconds, the burner always runs to low-fire. Naturally, it is also possible to set intermediate times.

No.	Parameter
212	Max. time down to low-fire

10.6 Notes on settings and parameter settings

- When making the settings for the electronic fuel-air ratio control system integrated in the LMV36..., it must be ensured that sufficient amounts of excess air are available because over a period of time, the flue gas values are impacted by a number of factors, such as air density, wear of actuators and controlling elements, etc. For this reason, the flue gas values initially set must be checked at regular intervals
- To safeguard against accidental or unauthorized transfer of parameters from the parameter backup of the ACS410 to the LMV36... basic unit, the OEM (burner or boiler manufacturer) must enter an i**ndividual burner identificatio**n for every burner. Only when this requirement is satisfied does the LMV36... system make certain that the ACS410 does not transfer a parameter set from a plant (with unsuited and possibly dangerous parameter values) to the LMV36... basic unit
- With the LMV36..., it should be noted that the unit's characteristics are determined primarily by the parameter settings and not so much by the type of unit. This means that – among other considerations – the parameter settings must always be checked prior to commissioning the plant, and that the LMV36... must never be transferred from one plant to another without adapting its parameters to the new plant
- When using the ACS410 PC software, the safety notes given in the relevant Operating Instructions (J7352) must also be observed
- The parameter level is password-protected. The OEM assigns individual passwords to the parameter levels he can access. The unit is supplied with default passwords entered by Siemens; they must be changed by the OEM. These passwords are confidential and may be assigned to authorized personnel only
- The responsibility for setting parameters is assumed by the person who, in accordance with the access rights, has made changes on the respective setting level

In particular, the OEM assumes responsibility for the correct parameter settings in compliance with the standards covering the specific applications (e.g. EN 676, EN 267, EN 1643, etc.).

11 Actuators X53 / X54

One or 2 actuators can be connected to the LMV36... system, depending on the selected operating mode (refer to chapter *Selection of operating mode*).

Caution!
When mounting the actuators, it must be made certain that the mechanical link to the controlling elements is form-fitted!

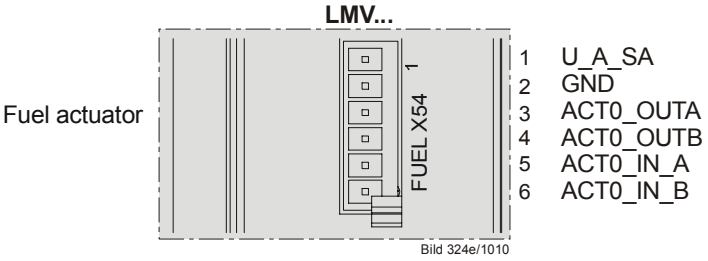


Figure 53: Fuel actuator (X54)

When using 2 fuel actuators for each type of fuel, they must be connected to the AGM60... switch unit (refer to chapter *AGM60...*). Otherwise, the fuel actuator must be connected directly to the LMV36...

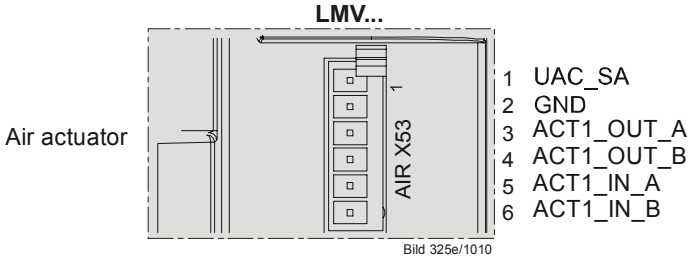


Figure 54: Air actuator (X53)

11.1 Function principle

The actuators are driven by stepper motors. The resolution reached when making 1 positioning step is 0.1°. The traveling speed is fixed at 5 seconds for a positioning angle of 90°.
An optical incremental transducer is used to monitor the current position. Due to the use of a gear train with almost no backlash, position control is not required.

11.2 Definition of angles

The angles and angular ranges are specified in the Data Sheets of the relevant actuators.

SQM33.4…: Refer to Data Sheet N7813
SQN1…: Refer to Data Sheet N7803

Also refer to figure *Angle definitions with SQM33...*

11.3 Referencing

An incremental transducer is used for position feedback. This means that referencing of the actuators must be performed after power-ON. In addition, at the end of each shut-down in phase 10, the actuators are referenced to ensure that individual stepping errors, which could lead to shutdown, do not accumulate. If a position error occurs, the system switches to the safety phase (phase 01), enabling the actuators with detected position errors to be referenced. During the following phase 10, the only actuators referenced are those that were not referenced before in the safety phase (phase 01). The position of the reference point can be selected depending on the type of burner, either the *Closed* position (<0°) or the *Open* position (>90°).

Listed below settings for air apply to both fuels:

- In single-fuel operation or in dual-fuel operation, the parameters 601...606 and 611 are assigned to fuel 0
- In dual-fuel operation, the parameters 608...610 and 612 are assigned to fuel 1

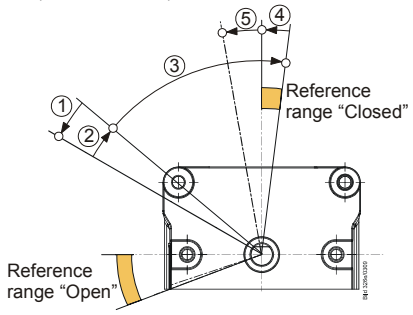
No.	Parameter
601	Selection of reference point Index 0 = fuel Index 1 = air 0 = closed (<0°) 1 = open (>90°)
602	Actuator's direction of rotation Index 0 = fuel Index 1 = air 0 = counterclockwise 1 = clockwise (exclusively for SQM3...)
606	Tolerance limit of position monitoring (0.1°) Index 0 = fuel Index 1 = air Greatest position error where an error is securely detected → error detection band: (P606 -0.6°) up to P606
608	Fuel 1: Selection of reference point 0 = closed (<0°) 1 = open (>90°)
609	Fuel 1: Actuator's direction of rotation 0 = counterclockwise 1 = clockwise (exclusively for SQM3...)
610	Fuel 1: Tolerance limit of position monitoring (0.1°) Greatest position error where an error is securely detected → Error detection band: (P606 -0.6°) up to P606
611	Type of reference Index 0 = fuel Index 1 = air 0 = standard 1 = range stop in the usable range 2 = internal range stop (SQN1…) 3 = both
612	Fuel 1: Type of reference for fuel actuator 0 = standard 1 = range stop in the usable range 2 = internal range stop (SQN1…) 3 = both

11.3.1 Reference run

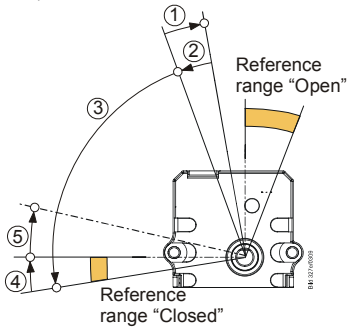
Two different reference runs are made to unambiguously determine the actuators' permissible working range. This means that, in the event of a power failure during referencing, the actuator is prevented from travelling to a range outside the optical feedback system or from running against a mechanical stop. Parameters 611 and 612 must be set, depending on the mechanical design and the type of actuator used. In the case of reference travel type 1 (parameter 611), the SQM33... and SQN13... actuators first travel 10° in counterclockwise direction, independent of the selected direction of rotation, the type of actuator, and the reference point set. The SQN14... actuator first travels 10° clockwise.

Reference travel type 1

SQM33... / SQN13...



SQN14...



Legend

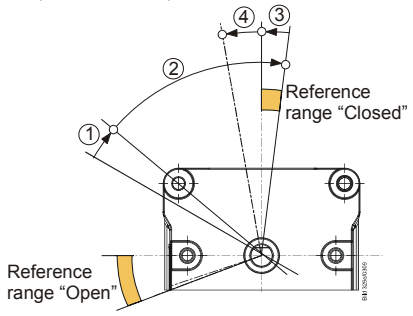
① Counterclockwise run
② Clockwise run to starting point
③ Run to reference point
④ Run to 0° position
⑤ Optional: Run to standby position

No.	Parameter	Setting for actuator		
		SQM33...	SQN13...	SQN14...
611	Type of referencing			
	Index 0 = Fuel	0	2	2
	Index 1 = Air	0	2	2
612	Fuel 1: Type of referencing for fuel actuator	0	2	2

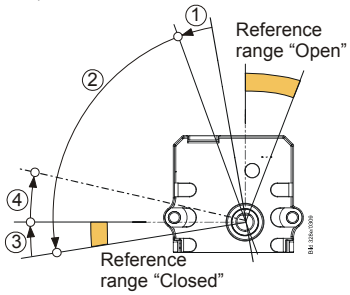
With reference travel type 1, the SQM33... and SQN13... actuators first travel 10° in the clockwise direction when direction of rotation *Left* and reference point *Close* or direction of rotation *Right* and reference point *Open* are set. The SQN14... first travels 10° in the counterclockwise direction. To prevent the actuator from running against a mechanical stop during referencing, the home position may have to be adjusted (depending on the direction of rotation and a reference point of about 3° or 87°). In the case of stops within the usable range, the prepurge or postpurge position must be checked also.

Reference travel type 2

SQM33... / SQN13...



SQN14...



Legend

① Counterclockwise run
② Run to reference point
③ Run to 0° position
④ Optional: Run to standby position

No.	Parameter	Setting for actuator		
		SQM33...	SQN13...	SQN14...
611	Type of referencing			
	Index 0 = Fuel	1	3	3
	Index 1 = Air	1	3	3
612	Fuel 1: Type of referencing for fuel actuator	1	3	3

Example of actuator with counterclockwise rotation:
When referencing in the CLOSED position, the actuator first travels a certain distance into the working range (toward the OPEN position). Then, it travels to a position representing maximum -7.7°, thereby crossing the reference mark for the fist time. Then, the actuator moves in the other direction again and detects the inner ramp of the reference mark. This is the reference point used by all positions. If the reference point is parameterized in the OPEN position, referencing takes place in a mirror-symmetrical manner. In that case, the actuator first travels into the working range (toward the OPEN position). Then, it crosses the reference mark and travels to a position representing maximum 110.6°, then back to the inner ramp of the reference mark.

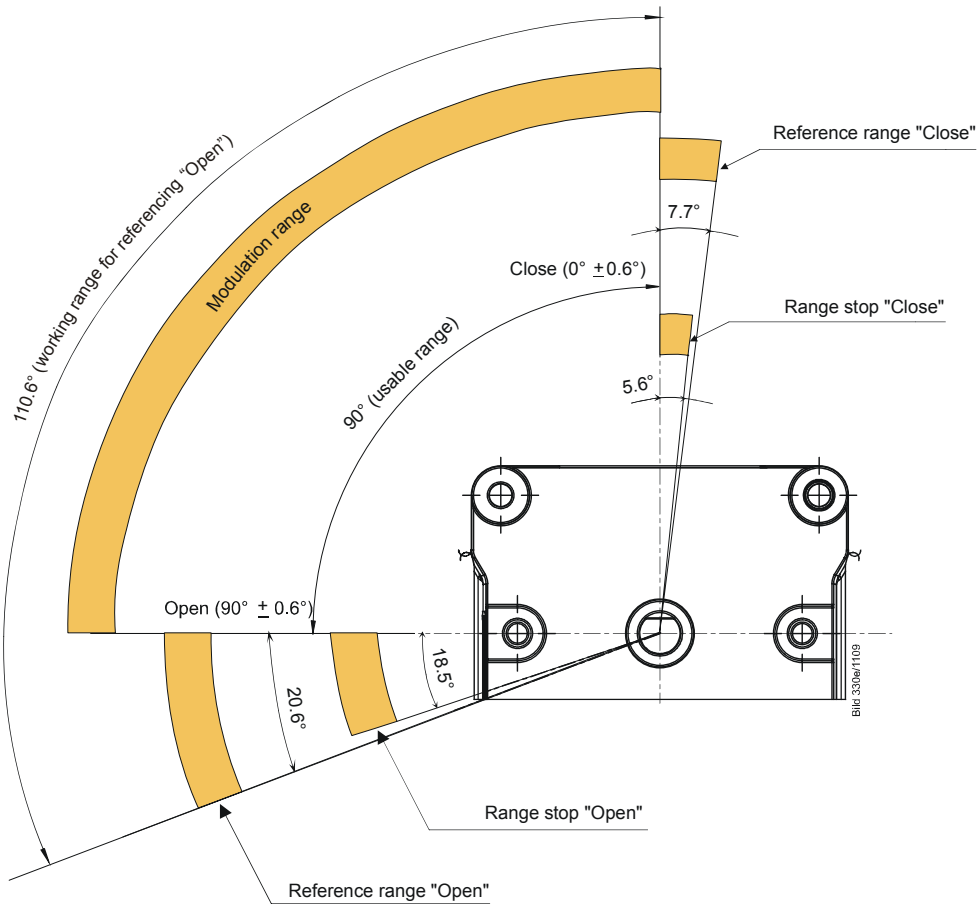


Figure 55: Angle definitions with SQM33...

Error code	Diagnostic code	Meaning for the LMV36... system
85	0	Referencing error of fuel actuator
	1	Referencing error of air actuator
	Bit 7 Valency ≥128	Referencing error due to parameter change

11.4 Direction of rotation

With the SQM3…actuator, the direction of rotation can be selected on an individual basis.

No.	Parameter
602.00	Actuator's direction of rotation Index 0 = fuel 0 = counterclockwise 1 = clockwise (exclusively for SQM3...)
602.01	Actuator's direction of rotation Index 1 = air 0 = counterclockwise 1 = clockwise (exclusively for SQM3...)
609.00	Fuel 1: Actuator's direction of rotation 0 = counterclockwise 1 = clockwise (exclusively for SQM3...)

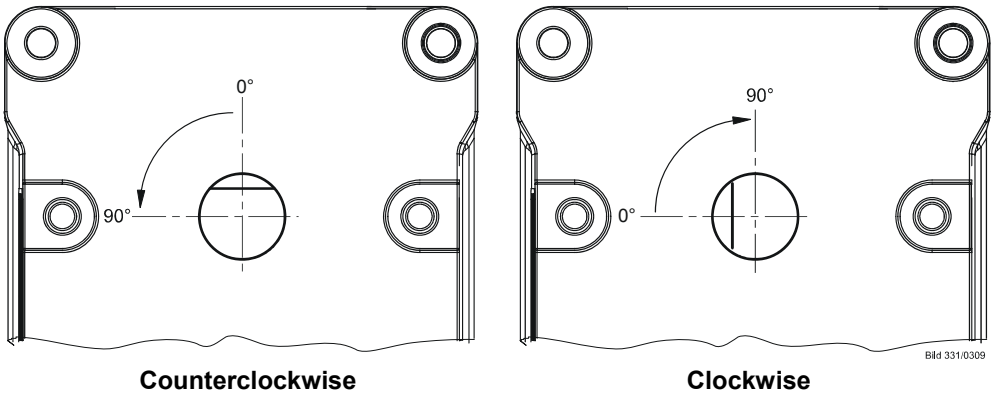


Figure 56: Direction of rotation (example SQM3...)

With the SQN1… actuators, the direction of rotation to be selected is always *Left*.

The direction of rotation of the SQN1... actuators depends on the version:

- SQN13...: Direction of rotation *Left*
- SQN14...: Direction of rotation *Right*

Note
The actuators are always supplied with the flat of the drive shaft facing upward.

11.5 Monitoring the actuator positions

To monitor the actuator's current positions, an optical incremental transducer with a resolution of 0.7° is used. The correct position of the drive shaft is ensured by comparing the motor steps made with the position obtained from the incremental transducer. Due to the different resolutions of motor steps and incremental transducer plus the selected tolerance band, the following error detection band is obtained. The position where – in the error detection band – shutdown takes place depends on the position currently required.

For the default setting made in the factory, the error detection band is as follows:

Smallest position error where an error can be detected	0.8°
Greatest position error where an error is securely detected (default setting parameter 606 or 610)	1.4°

The presetting of 1.4° (default setting, parameter 606 or 610) is suited for use with actuators type SQM3...

Note
When using SQN1… actuators equipped with plastic gear trains, we recommend to change the preset values as follows:

Product no.	Value
SQN13.14...	1,7°
SQN14.14...	1,7°
SQN13.17...	2,2°
SQN14.17...	2,2°

When referencing under output conditions, the resilience of the actuator's gear train must also be taken into consideration:

Product no.	Resilience at max. rated driving torque
SQM33.41...	0.2°
SQM33.51...	0.2°
SQN13.14...	0.3°
SQN13.17...	0.8°
SQN14.14...	0.3°
SQN14.17...	0.8°

The error detection time is <1 second.

Caution!
This means that – for the design and setting of the burner – a position error resulting from the sum of…
- **greatest position error from which an error is detected in all positions,**
- **resilience at the max. rated torque, and**
- **mechanical influence from the link between actuator and regulating unit (e.g. coupling)**

must not lead to a critical state in terms of safety.

No.	Parameter
606	Tolerance limit of position monitoring (0.1°) Index 0 = fuel Index 1 = air Greatest position error where an error is securely detected → error detection band: (P606 -0.6°) up to P606
610	Fuel 1: Tolerance limit of position monitoring (0.1°) Greatest position error where an error is securely detected → error detection band: (P606 -0.6°) up to P606

Error code	Diagnostic code	Meaning for the LMV36... system
86	0	Fuel actuator: Position error
87	0	Air actuator: Position error

11.6 Changing the error detection band for monitoring the actuator positions

The error detection band can be changed via parameter 606 or 610.
A change is to be made only when using SQN13.17… or SQN14.17… actuators which, due to their mechanical design, require greater tolerances.
For these types of actuators, set parameter 606 or 610 to 2.2°.

No.	Parameter
606	Tolerance limit of position monitoring (0.1°) Index 0 = fuel Index 1 = air Greatest position error where an error is securely detected → Error detection band: (P606 -0.6°) up to P606
610	Fuel 1: Tolerance limit of position monitoring (0.1°) Greatest position error where an error is securely detected → Error detection band: (P606 -0.6°) up to P606

11.7 Forced travel

There are errors in the actuators' feedback unit which can only be detected in connection with position changes. To be able to also detect such errors when maintaining the same position for longer periods of time, travel is enforced when, for more than 50 minutes, an actuator moves no more than 2.8°. With forced travel, both actuators are driven 2.8° in the direction of smaller positioning angles and back again to the initial angular position. If a damper is less than 2.8° open, the actuator is driven in the direction of positive angles in order not to run against mechanical stops, if present. Forced travel lasts a total of 1 second.

11.8 Detection of line interruptions

The connecting line ensuring position feedback from the actuator to the basic unit is monitored for interruptions, which means that position feedback cannot fail without being noticed.

Error code	Diagnostic code	Meaning for the LMV36... system
86	Bit 0 Valency 1	Line interruption fuel actuator
87	Bit 0 Valency 1	Line interruption air actuator

11.9 Protection against mixup of actuators

Mixup of actuators can be detected through appropriate installation (using different reference marks for the air and fuel actuator: OPEN / CLOSED / 0° / 90°). With at least one of the actuators, the reference mark not used must be blocked by a mechanical stop. Now, if the actuator connections with the basic unit have been interchanged, one of the actuators cannot reach the reference mark, which is detected by the basic unit. Protection against mixup is a question of burner application and must be ensured by the OEM.

Caution!
To be able to detect mixup of actuators, the burner manufacturer must ensure that the 2 actuators use opposing reference points. One of the actuators uses the OPEN reference, the other the CLOSED reference. Approach of the reference point not used must be blocked with at least one of the actuators!

11.9.1 Proposal for implementation

- Parameterize referencing of the air damper in the CLOSED position
- Parameterize referencing of the fuel damper in the OPEN position. Unnecessary travel can be avoided by defining a home position of **90°** for the fuel damper
- Mechanical stop at the air damper in the range between 90° and 108.5°, and / or mechanical stop at the fuel damper in the range between 0° and -5.6°

Referencing process

- From any position in the working range (0…90°), but typically from the home position, the air damper travels to the **-7.7°** position and back again to the home position
- From any position in the working range (0…90°), but typically from the home position, the fuel damper travels to the **110.6°** position and back again to the home position

Action in the event of mixup

- The fuel damper (fitted in place of the air damper) travels to the **-7.7°** position and back again to the home position
- The air damper (fitted in place of the gas damper) tries to travel to the **110.6°** position, but is prevented from doing so by the mechanical stop. This is unsuccessful travel and identified as mixup

The above procedure to prevent mixup of actuators by using different reference positions is only suited for 2 actuators. In the case of dual-fuel systems with 3 actuators, it can be employed to prevent mixup of air actuator and fuel actuators OR to prevent mixup of fuel actuators. With the LMV36..., the above procedure ensures protection against mixup of air actuator and fuel actuators (different reference positions and mechanical stops).

Note
It is recommended to color-code the actuators' assignment to the AGM60…, thus preventing mixup of actuators by observing the respective color marks on the AGM60… and the actuators' connectors.
Alternatively, protection against mixup of one of the actuators can also be ensured by a coding pin on the AGM60…

12 Fan control

12.1 Function principle

Optionally, the LMV36... system can be operated with a VSD or PWM fan. Control is accomplished via a DC 0…10 V interface. For control of the fan's speed, a safety-related speed feedback signal is required. With pneumatic fuel-air ratio control, the speed feedback signal is not evaluated. To facilitate the use of fans with different speed ranges, the fan's speed is standardized between 0…100%. If fan control is not connected, a load output and, alternatively, a fuel meter output are available (refer to chapters *Load output X74.3* and *Fuel meter input X75.1/X75.2*).

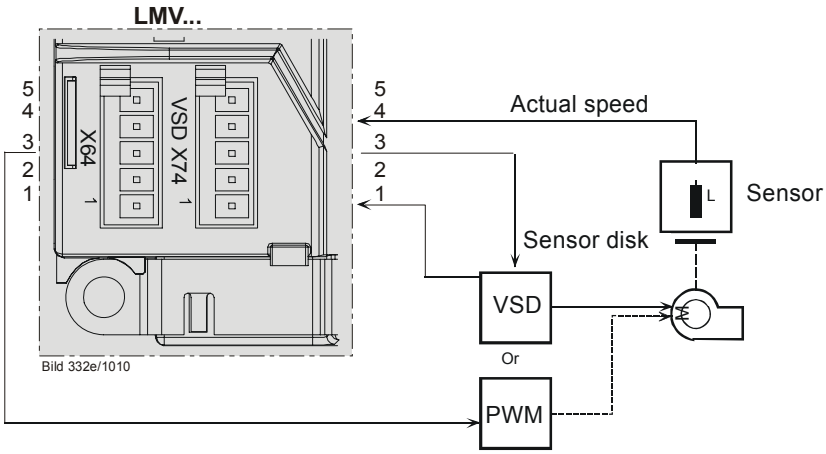


Figure 57: Function principle of fan control

12.2 Activation of VSD/PWM fan

The VSD can be activated in any of the operating modes (parameters 201 and 301).

No.	Parameter
542	Activation of VSD / PWM fan 0 = inactive 1 = active

Note
For configuration of the analog output when the VSD is activated, refer to chapter *Power output X74.3*!

12.3 VSD control X74.3

The VSD is controlled via a voltage interface (refer to chapter *Load output X74.3*)!

Depending on the type of VSD used, a release contact is required. This contact can be controlled via the fan motor contactor. To enable the VSD to bring the fan motor's speed to the correct no-load speed, the motor contactor's drop out delay time must be about 25 seconds.

Example:

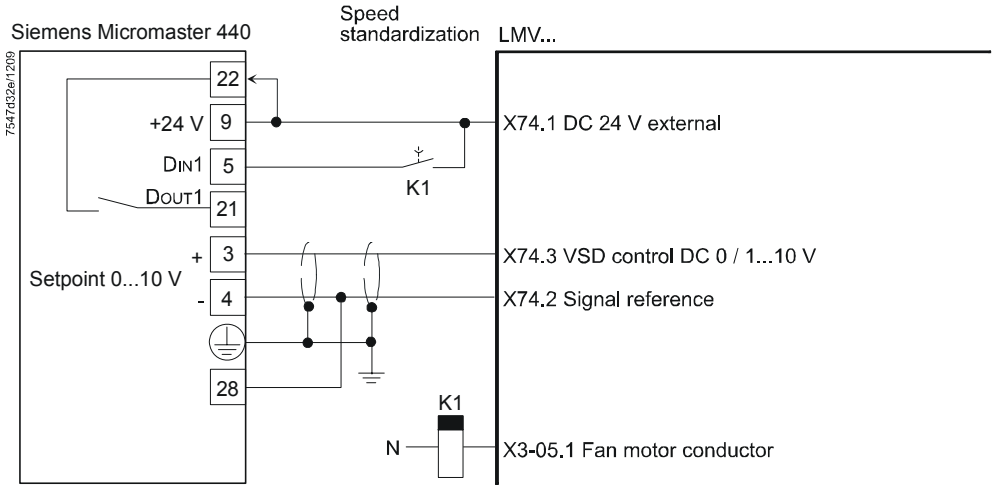


Figure 58: Connection of VSD to the W-FM 50

12.4 PWM fan control X64.3

The PWM fan is controlled via PWM voltage interface X64.3.

Caution!
The use of PWM fans is only possible in connection with pneumatic air-fuel ratio control!

12.5 Safe separation of mains voltage and protective extra low-voltage

Caution!
All inputs and outputs of PWM fan control are designed for use with protective extra low-voltage. For this reason, strict separation from the mains voltage side must be ensured!

This necessitates an external power supply by the VSD or an external power pack (X74.1, X74.2).

Note
Power must also be supplied via X74.1/2 in the case a PWM fan is used.

12.6 Ramp time

The ramp time for fan control can be set separately for acceleration and deceleration (also refer to chapter *Traveling speed/maximum curve slope*).

No.	Parameter
522	Ramp up
523	Ramp down

If shutdown occurs because the speed has not been reached, the VSD/fan motor might not be able to follow quickly enough the set ramp.

Remedy:
Shorten further the ramp of the VSD/fan motor or increase the ramp in the basic unit (parameters 522/523) (also refer to chapter *Traveling speed/maximum curve slope*).

For VSD operation

Caution!
The ramps parameterized for the VSD should be at least 20% shorter than the ramps in the LMV36...

Example:

10 s ramp	LMV36...	8 s ramp VSD
5 s ramp	LMV36...	4 s ramp VSD

12.7 Acquisition of speed

12.7.1 Acquisition of speed with proximity switch

The actual speed is acquired by an inductive proximity switch which scans a metal sensor disk. The sensor disk must be attached directly to the motor's drive shaft. Speed acquisition is safety-related. To facilitate the detection of the direction of rotation and to be able to make the plausibility check with only 1 sensor, a sensor disk with angular steps of 60°, 120° and 180° is used. It generates 3 pulse intervals of different length.

Speed acquisition is designed for the connection of different types of sensors.

Caution!
With electronic fuel-air ratio control, speed acquisition is safety-related!

We recommend using the AGG5.310 accessory set.
The absolute speed can be read out via the AZL2...

No.	Parameter
935	Absolute speed

The current speed in standardized form can be read out via the AZL2...

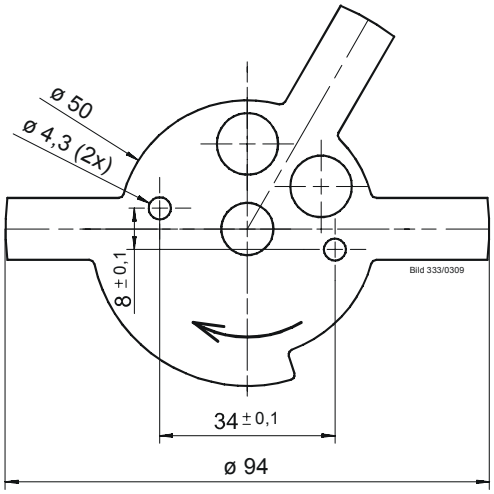
No.	Parameter
936	Standardized speed

Speed input X74.4

Motor speed:	300...6500 rpm
100% speed:	650...6500 rpm
Sensor:	Inductive sensor to DIN 19234 (Namur) or Open Collector (pnp) at U_{CEsat} <4 V, U_{CEmin} >DC 15 V
Power supply:	DC 10 V, max. 15 mA
Switching current:	>10 mA
Cable length:	Max. 3 m (sensor cable must be laid **separately**!)

Sensor disk

Sensor disk and speed sensor can be ordered as accessory set AGG5.310.



Number of tappets:	3
Angular steps:	60°, 120°, 180°
Accuracy:	±2°

Figure 59: Sensor disk

Speed sensor

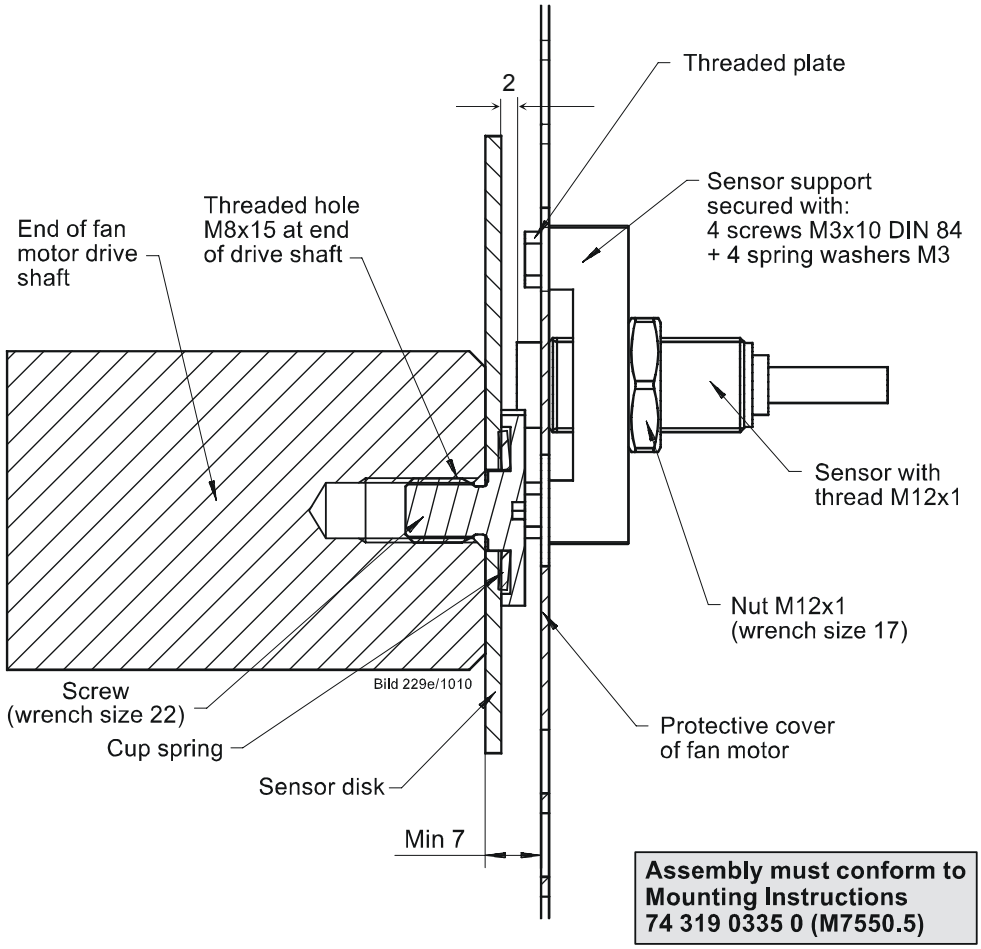


Figure 60: Speed sensor

Selection of fan motor

Motor supplier:

Selection of a motor **with** threaded hole M8 x 15 at the end of the fan motor's drive shaft.

Standard motor and machining (drilling hole and cutting thread M8 x 15).

12.7.2 Acquisition of speed with Hall generator

If the speed is acquired via a Hall generator, the requirements for safety-related applications are the same as those for the speed feedback signal via sensor disk.
Required is an asymmetric signal with the 3 pulses of 60°, 120° and 180° for detection of the direction of rotation.

12.8 Speed control

The LMV36... controls the fan motor's speed to the setpoint. To ensure that the speed can still be increased when the maximum speed is reached, the speed is standardized when the motor is controlled at 95%. Hence, with a speed setpoint of 100%, a speed increase of 5% is still possible.
The control range of the LMV36... is +15% / -10%. If this range is not sufficient, error 80 or 83 can occur.

Error code	Diagnostic code	Meaning for the LMV36... system
80	1	Control range limitation at the bottom
	2	Control range limitation at the top

Note
Internal control with a VSD or PWM fan motor must not be activated. Otherwise, speed variations can occur, resulting from simultaneous control actions from both the basic unit and internal control.

12.9 Speed supervision

The fan's current speed is acquired by the LMV36... and assessed from a safety point of view. If the fan does not operate at the speed setpoint, speed control makes a corrective action, trying to reach the setpoint. If it is not reached within a certain period of time, safety shutdown is initiated. To ensure a high level of availability and safety, a number of monitoring bands with different response times are defined.

Speed deviation in % points	**Shutdown time**
0…0.5%	Speed reached → no shutdown
0.6...2%	<8 s
2.1...10%	<3 s
>10%	<1 s

Error code	Diagnostic code	Meaning for the LMV36... system
83	Bit 0 Valency 1	Lower control range limitation of control
	Bit 1 Valency 2...3	Upper control range limitation of control
	Bit 2 Valency 4...7	Interruption via disturbance pulses
	Bit 3 Valency ≥8	Curve too steep in terms of ramp speed
	Bit 4 Valency ≥16	Interruption of speed signal
	Bit 5 Valency ≥32	Quick shutdown due to excessive speed deviation

12.10 Setting the parameters of the VSD

If a control signal of 95% (9.5 V) is not sufficient for the burner to deliver its rated capacity, you can proceed as follows:

- Set the maximum frequency to 105.3% of the motor's rated speed

In the case of a motor frequency of 50 Hz, this means:
Set the maximum frequency of the VSD to 50 Hz x 1.053 = 52.6 Hz (on the VSD).

- Then, standardize the speed (refer to chapter *Standardization of speed*)

There is no risk of motor overload since only 95% of the maximum control signal is delivered during standardization and – later in operation – the effective speed is controlled and monitored.
Frequencies of between 50 Hz and 52.6 Hz are delivered only if these are needed for reaching the required speed due to increased output.

- Set the ramp times of the VSD according to chapter *Setting the ramp times*

12.11 Standardization of speed

Since the different types of fans operate at different speeds and signal handling should be as straightforward as possible, all speeds in the system are standardized between 0 and 100%. For this reason, the VSD module uses a parameter which contains the *Standard speed* (100% speed). All absolute speeds refer to this speed.

If changes to the VSD or the fan are made, speed standardization should be repeated.

Caution!

- **If automatic speed standardization is activated, or if the standardized speed is changed, the settings of air-fuel ratio control must be checked! Any change of the standardized speed alters the assignment between the percentage values parameterized on the curves and the speed**
- **When the parameter set (refer to ACS J7352) is restored, the standardized speed is restored also. In that case, new standardization of speed is required**

Automatic speed standardization

To facilitate determination of the standardized speed, the LMV36... features automatic speed standardization. The speed must be standardized while in standby mode. Speed standardization is integrated in the setting process for electronic fuel-air ratio control, but can also be started later from the parameter setting level. When using a release contact for the VSD (external relay at fan output X3-05.1), the fan output is controlled during speed standardization.

1. Start speed standardization

To start automatic speed standardization, set parameter 641 to **1**.

No.	Parameter
641	Control of VSD's speed standardization Error diagnostics of negative values (refer to error 82) 0 = no speed standardization 1 = speed standardization active

2. Drive the air damper to the prepurge position

Speed standardization begins when the air damper travels to the prepurge position. When this position is reached, the damper should be fully open so that the fan operates at full capacity.

3. Control the VSD

Control the VSD at 95% of the maximum voltage.
A margin of 5% allows the speed to be readjusted should environmental conditions change. This means that full speed (100%) is reached with 95% VSD control (refer to chapter *Setting the parameters of the VSD*).

4. Wait until the speed is higher and has stabilized

Before the 100% speed can be measured, the fan must have reached stationary conditions. This means that the fan must operate under stable conditions above 650 rpm. When this state is reached, a certain waiting time is observed, allowing the speed to eventually stabilize.

5. Measure the speed and store it

When the speed has stabilized, measure and store it as the *Standardized speed* (100% speed).

6. Close the standardization
When standardization is successfully completed, reset parameter 641 to **0**.
If standardization was not successful, parameter 641 assumes a negative value.

The value provides information on the cause of fault:

Value	Error	Remedy
-1	*Timeout of standardization (VSD ramp down time too long)*	Timeout at the end of standardization during ramp down of the VSD → Ramp time settings of the VSD are not shorter than those of the basic unit (parameter: 523)
-2	*Storage of standardized speed not successful*	Error during storage of the standardized speed → lock the basic unit, then reset it and repeat the standardization
-3	*Line interruption speed sensor*	Basic unit receives no pulses from the speed sensor. 1. Motor does not run. 2. Speed sensor is not connected. 3. Speed sensor is not actuated by the sensor disk (check distance).
-4	*Speed variation / VSD ramp up time too long / speed below minimum limit for standardization*	Motor has not reached a stable speed after ramp up. 1. Ramp time settings of the VSD are not shorter than those of the basic unit (parameters 522, 523). 2. Characteristic of the VSD is not linear. Configuration of the voltage input at the VSD must accord with that of the basic unit (parameter 645). 3. VSD does not follow quickly enough the changes of the basic unit. Check settings of the VSD (input filter, slippage compensation, hiding different speeds) 4. Speed of VSD lies below the minimum for standardization (650 rpm).
-5	*Wrong direction of rotation*	Motor's direction of rotation is wrong. 1. Motor turns indeed in the wrong direction → change parameterization of the direction of rotation or interchange 2 live conductors. 2. Sensor disk is fitted the wrong way → turn the sensor disk.
-6	*Unplausible sensor signals*	The required pulse pattern (60°, 120°, 180°) has not been correctly identified. 1. Speed sensor does not detect all tappets of the sensor disk → check distance 2. As the motor turns, other metal parts are detected also, in addition to the tappets → improve mounting. 3. Electromagnetic interference on the sensor lines → check cable routing, improve EMC
-7	*Invalid standardized speed*	The standardized speed measured does not lie in the permissible range. → Motor turns too slowly or too fast.
-15	*Speed deviation µC1 + µC2*	The speeds of microcomputer 1 and 2 deviated too much. This can be caused by wrong standardized speeds (e.g. after restoring a data set to a new unit) → repeat standardization and check the fuel-air ratio
-20	*Wrong phase of phase manager*	Standardization was made in a wrong phase. Permitted are only phases ≤12 → controller OFF, start standardization again
-21	*Safety loop / burner flange open*	Safety loop or burner flange is open → repeat standardization with safety loop closed

Value	Error	Remedy
-22	*Air actuator not referenced*	Air actuator is not referenced or has lost its reference. 1. Check if the reference position can be approached. 2. Check if actuators have been mixed up. 3. If error only occurs after the start of standardization, the actuator might be overloaded and cannot reach its destination.
-23	*VSD deactivated*	Standardization was started with VSD deactivated → activate the VSD and repeat standardization
-24	*No valid operation mode*	Standardization was started without valid operation mode → activate valid operation mode and repeat standardization
-25	*Pneumatic air-fuel ratio control*	Standardization was started with pneumatic air-fuel ratio control → standardization with pneumatic air-fuel ratio control is not possible
-128	*Running command with no preceding standardization*	VSD is controlled but not standardized → make standardization
-255	*No standardized speed available*	Motor turns but is not standardized → make standardization

The result of speed standardization (100% speed) can be read out via parameter. The speeds acquired by the 2 microcontrollers can differ by about 1.5%, the reason being slightly different resonator frequencies.

No.	Parameter
642.0	Standardized speed Index 0 = speed 1
642.1	Standardized speed Index 1= speed 2 (internal monitoring)

12.12 Control of fan motor with pneumatic fuel-air ratio control

If control of the fan motor is employed for burners with pneumatic air-fuel ratio control, only the control path is used. There is no need to connect a speed feedback signal and to have speed control (for operating modes, refer to chapter *Selection of operating mode*).

12.13 EMC of LMV36... and VSD

The function and EMC tests with the LMV36... system have been successfully conducted in connection with the following makes and types of VSDs:

Siemens:	SED2-0.37 / 22 X
Danfoss:	VT2807

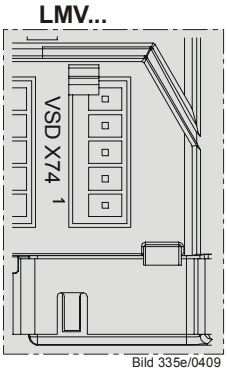
During operation, VSDs generate electromagnetic interference on the mains network. For this reason, the supplier's specifications must be strictly observed to ensure that makeup of the system is in compliance with EMC regulations:

Siemens:	Operating Instructions → installation conforming to EMC
Danfoss:	Technical Brochure → radio suppression filter
	Data Sheet on Danfoss EMC filter for long motor cables

Caution!
When using other types of VSD, compliance with EMC regulations and trouble-free operation are not ensured!

12.14 Description of connection terminals

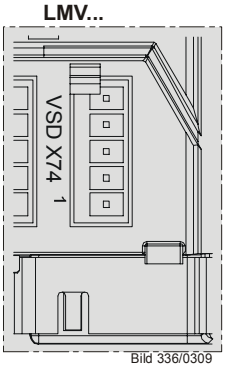
12.14.1 VSD



5 Power supply for speed sensor
4 Speed input
3 VSD control
2 GND
1 24V EXT

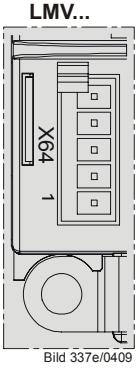
Figure 61: VSD connection X74

12.14.2 PWM fan



5
4
3
2 GND
1 24V EXT

Figure 62: PWM fan X74



5 Power supply for sensor
4 Speed feedback
3 PWM speed output
2 GND
1 Controller input 4...20 mA

Figure 63: PWM fan X64

13 Load output X74.3

The load output is only available as an alternative to VSD control. If the VSD is deactivated, the output for the VSD delivers the current burner output. The analog output is a voltage output and – using parameter 645 – can be switched between DC 0…10 V, DC 2…10 V and DC 0/2…10 V.

Parameter 645	Voltage range	Remarks
0	DC 0…10 V	No detection of line interruption
1	DC 2…10 V	Detection of line interruption possible
2	DC 0/2…10 V	No detection of line interruption. Recommended setting in connection with Micromaster VSD

Note
When changing the analog output configuration from DC 0…10 V to DC 2…10 V or DC 0/2…10 V, the voltage values with modulating, 2-stage and 3-stage operation change (refer to chapters *Modulating operation*, *2-stage operation* and *3-stage operation*).

Conversion: New value = (initial value * 0.8) + 2

Example: Initially 2 V → (2 * 0.8) + 2 = 3.6 V
Initially 5 V → (5 * 0.8) + 2 = 6 V

13.1 Safe separation of mains voltage and extra low-voltage

Caution!
The load output is designed for SELV or PELV (refer to chapter *Electrical connection of the LMV36... and AGM60...*).
For this reason, strict separation from the mains voltage side must be ensured!

This necessitates power supply by an external power pack (X74.1, X74.2).

13.2 Modulating operation

Actual value	Voltage	Curvepoint	Display / output value
Off	DC 0 V	---	Off
Ignition load	DC 1 V	P0	10%
Low-fire	DC 2 V	P1	20%
High-fire	DC 10 V	P9	100%

The values between low-fire and high-fire are interpolated in a linear manner.

13.3 2-stage operation

Actual value	Voltage	Curvepoint	Display / output value
Off	DC 0 V	---	Off
Stage 1	DC 5 V	P1	P1
Stage 2	DC 10 V	P2	P2

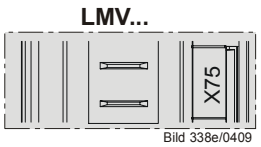
13.4 3-stage operation

Actual value	Voltage	Curvepoint	Display / output value
Off	DC 0 V	---	Off
Stage 1	DC 3 V	P1	P1
Stage 2	DC 5 V	P2	P2
Stage 3	DC 10 V	P3	P3

14 Fuel meter input X75.1 / X75.2

A fuel meter can be connected to acquire the amount of fuel burnt.
The fuel meter function is only available as an alternative to VSD control. If the VSD is deactivated, a fuel meter can be connected to terminals X75.1 and X75.2.

The pulses per volume unit can be set separately for Fuel 0 and Fuel 1. In terms of hardware, the fuel meter input exists only once however, that is, the change between 2 pulse counters must be made externally. Changeover can be accomplished either via the fuel selector or an additional contactor at the safety valve output of the AGM60...



2 Fuel meter input
1 Sensor supply fuel meter

Figure 64: Fuel meter input X75

14.1 Configuration of fuel meter

14.1.1 Types of fuel meters

The LMV36... system is designed for use with fuel meters equipped with a Reed contact. Pulse frequency at maximum fuel throughput must be below 300 Hz.

14.1.2 Configuration of pulses per volume unit

Depending on the type of fuel meter used, the number of pulses supplied per **m³** or **l** fuel must be parameterized. A maximum of 400 pulses per volume unit can be preset. The correct amount of fuel is acquired only when this parameter is set.

When the parameter is 0, the fuel meter stops.

No.	Parameter
128	Fuel meter: Pulse valency (pulses/volume unit)
129	Fuel meter 1: Pulse valency (pulses/volume unit)

14.1.3 Reading and resetting the meter readings

No.	Parameter
167	Fuel volume resettable [m³, l, ft³, gal]
177	Fuel 1: Fuel volume resettable (m³, l, ft³, gal)

The cumulated fuel volume can be read out per parameter. The meter reading can also be reset on the parameter level.

14.2 Fuel throughput

With the fuel meter connected, the system calculates continuously the current fuel throughput. The time required for calculating the fuel throughput varies and lies between 1 and 10 seconds. If the meter delivers no pulses for more than 10 seconds, the display shows **0** fuel throughput. This means that when fuel throughput is at its minimum, the sensor should have a pulse frequency of at least 0.1 Hz. The display is smoothed to improve the settling process. With fuel throughput at its maximum, the maximum frequency is 300 Hz.

14.2.1 Configuration

Calculation of fuel throughput is configured based on the pulse valency of the connected fuel meter.

No.	Parameter
128	Fuel meter: Pulse valency (pulses/volume unit)
129	Fuel meter 1: Pulse valency (pulses/volume unit)

When the pulse valency is set to **0.00**, the display shows **0** throughput.

14.2.2 Reading out the fuel throughput

The current fuel throughput can be read out via the following parameter on the service menu:

No.	Parameter
960	Fuel throughput in volume unit /h (m³/h, l/h, ft³/h, gal/h)

Display of fuel throughput is possible up to 6553 volume units/h.

Note
Display of fuel throughput up to a value of 99.9 on the service menu is made with one decimal place, from 100 with no decimal place.

15 Connection and internal diagram

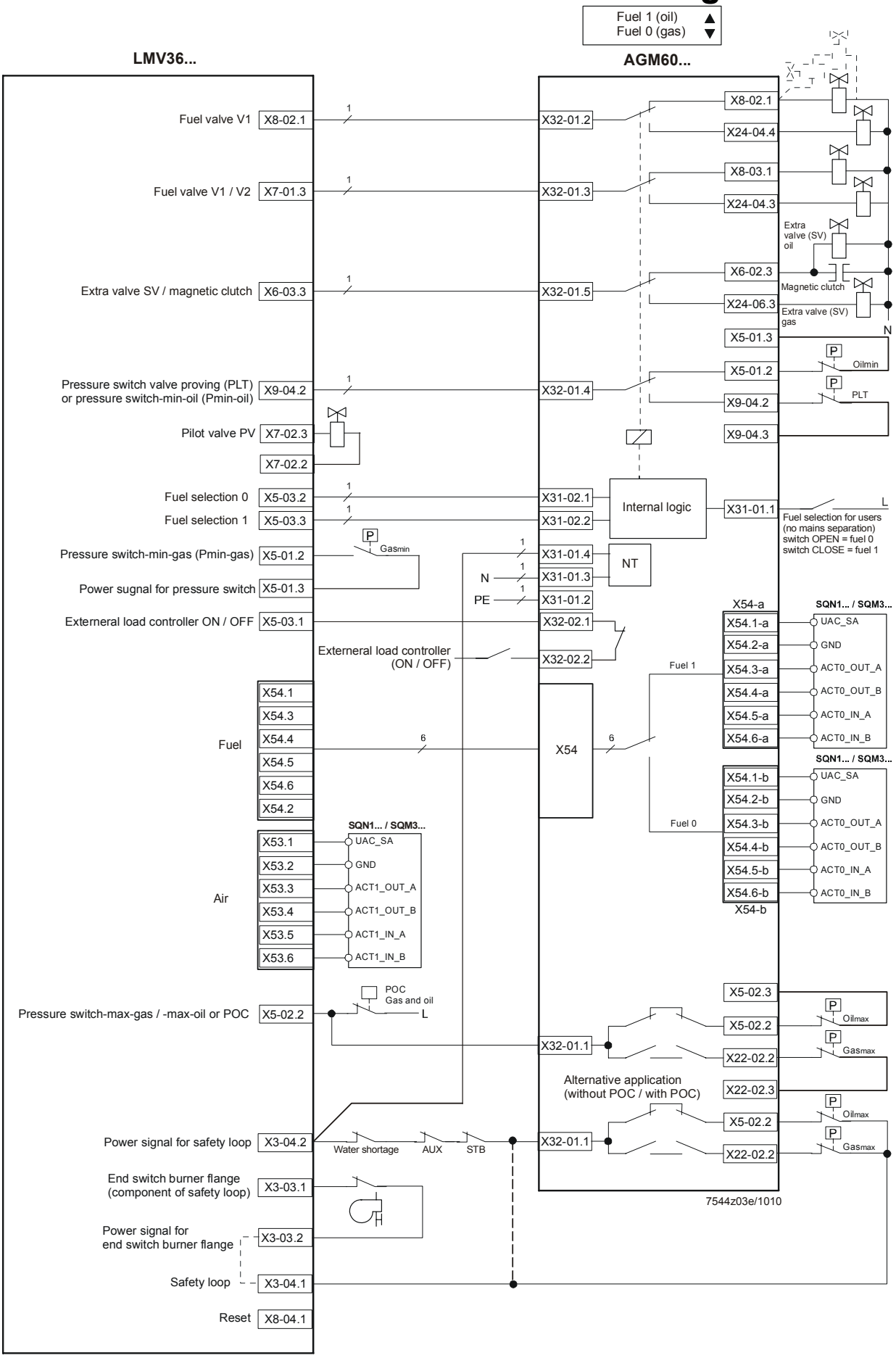


Figure 65: Inputs and outputs

Shielding:

For shielding the cables on the VSD, refer to:

- Siemens *SED2* VSD Commissioning Manual (G5192), chapters 4 and 7, or
- Danfoss Operation Manual *VLT 6000* (MG60A703), chapter *Installation*

16 Special feature: Burner identification (ID)

The OEM must assign an individual burner identification to every burner. This ensures that, during backup / restore, incompatible parameter sets cannot be copied between different burners (also refer to documentation on ACS410 PC tool chapter *Backup / Restore* and in this document chapter *Backup / Restore*).

No.	Parameter
113	Burner identification

17 Connection to superposed systems

17.1 General information and building automation functions

Communication with a BAC system is made possible via a data link using the COM X92 port and a special interface with galvanic separation and physical bus level adaptation. This port can be used for connection of a Modbus, depending on the configuration made.

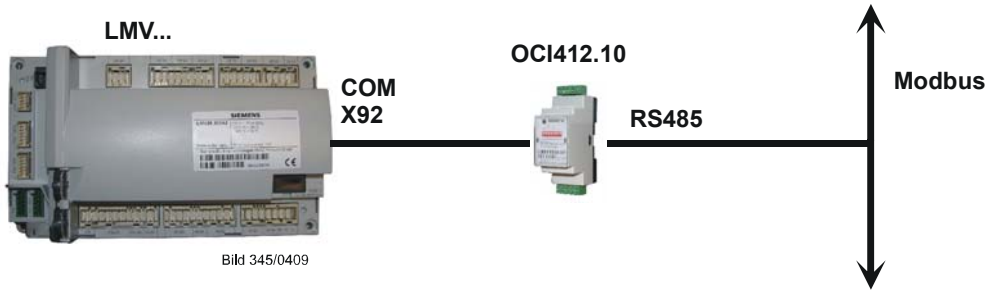


Figure 66: Connection via COM X92 to superposed systems

Note
Breakdown of bus communication

If the basic unit detects a breakdown of bus communication, the BAC system must rewrite the value upon restoration of communication for the Modbus operating mode and predefined target output

Note
Fuel changeover on the basic unit.

After a change of fuel, the BAC system must rewrite the predefined target output. A change of fuel can be detected by cyclic sampling of the type of fuel currently burnt.

General setting values for connection of the basic unit to building automation (for factory settings, refer to the *Parameter list*):

Bus communication may only be interrupted for the time set.
If communication is disturbed for a longer period of time, the LMV36... basic unit delivers a fault status message and the values set in the basic unit by building automation are reset.

No.	Parameter
141	Operating mode BACS 0 = off 1 = Modbus 2 = reserved
142	Setback time in the event of communication breakdown Setting value: 0 = inactive 1…7200 s
148	Default output if communication with building automation is interrupted Setting values: For **modulating operation** the setting range is as follows: 0…19.9 = burner OFF 20…100 = 20…100% burner rating For **multistage operation**, the following settings apply: 0 = burner OFF, P1, P2, P3 Invalid = no default output from building automation Default setting: *Invalid*
149	Fuel 1: Default output if communication with building automation is interrupted Setting values: For **modulating operation** the setting range is as follows: 0…19.9 = burner OFF 20…100 = 20…100% burner rating For **multistage operation**, the following settings apply: 0 = burner OFF, P1, P2, P3 Invalid = no default output from building automation Default setting: *Invalid*

The factory settings of the parameters are shown on the *Parameter list*.

Note
For a detailed description of parameters 148 and 149, refer to chapter *Default output via building automation*.

17.2 Modbus

With this type of bus protocol, the LMV36... basic unit operates as a slave on the Modbus and the transmission mode used is RTU (Remote Terminal Unit).
For more detailed information, refer to the Modbus User Documentation (A7541).

No.	Parameter
145	Device address for Modbus of basic unit Setting value: 1…247
146	Baud rate for Modbus Setting value: 0 = 9600 1 = 19200
147	Setting of parity for Modbus communication Setting value 0 = none 1 = odd 2 = even

The factory settings of the parameters are shown on the parameter list.

Note
If bus communication breaks down, the mode, Modbus operating mode and predefined target output must be rewritten.

18 PC software ACS410

The ACS410 PC software serves primarily as an operating module for the LMV36... system, providing the following basic functions:

- Visualization of system state via the following data:
  - Parameters
  - Process data
- Configuration and parameterization of the basic unit (individual parameters)
- Backup and recovery of parameter sets

Note
For notes on operation and commissioning, refer to chapter *Operation.*

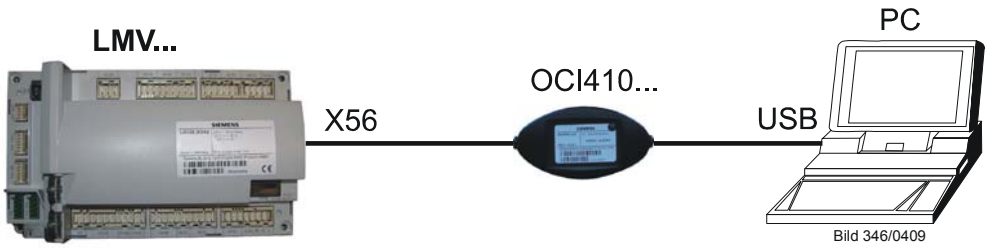


Figure 67: Communication with display / BCI (RJ11 jack) (X56)

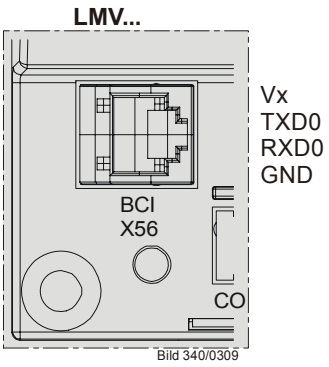


Figure 68: Display input / BCI (RJ11 jack) X56

If communication between the LMV36... and the ACS410 (70 seconds) has broken down, the password level is reset to *Info / Service*.

Caution!
Interruption of communication between the LMV36... and the ACS410 (30 seconds) during the time the curves are set leads to lockout!

Error-code	Diagnostic code	Meaning for the LMV36... system
167	9	Manual locking by the PC tool Communication breakdown

19 Error history

The LMV36... system provides an error history in which the last 25 errors are stored. The first entry represents the current error state and can also be *error-free*, refer to *Error code list*.

Error code	Diagnostic code	Meaning for the LMV36... system
200 OFF	#	System error-free

19.1 Error classes

The errors are subdivided into error classes, depending on the severity of the switch-off response. The current error shows all classes. Only the errors of the most important classes are included in the history.

Error class	**Priority**	**Meaning**	**History**
0	Highest	Lockout	●
1		Safety shutdown with software reset	●
2		Undervoltage	
3		Safety shutdown: Safety phase	●
4		Safety shutdown: Start prevention	
5		Safety shutdown: Shutdown	●
6	Lowest	Message without shutdown response	

19.2 Makeup of error history

Parameter	Index	Description
701		Current error state, can also be error-free
	.01	Code (200 = error-free) → refer to *Error code list*
	.02	Diagnostic code → refer to *Error code list*
	.03	Error class → error classes
	.04	Phase: Phase in which error occurred → sequence diagrams
	.05	Startup counter: (P166) at which the error occurred
	.06	Output: Burner output at which the error occurred
	.07	Fuel in which error occurred
702	.01..07	Latest error in the history
.		
.		
.		
725	.01..07	Oldest error in the history

Deleting the error history

Both the service menu and the parameter setting menu show the error history.
The display on the service menu can be deleted in a way that the only errors shown are those that occurred after the deletion.
The error history on the parameter setting menu cannot be deleted.
For the deletion, parameter 130 must be set to **1** and then to **2** within 6 seconds.
When the parameter returns to **0**, the deletion process is completed.

No.	Parameter
130	Delete display of error history To delete the display: Set parameter to **1**, then to **2** Return value 0: Job successfully completed Return value -1: Timeout of 1_2 sequence

20 Lifecycle function

If the startup counter exceeds a defined threshold, a display error code is set and displayed. The error can be acknowledged.
The display code is always set in standby (when there is no heat request). Hence, the moment the threshold is exceeded, the user is notified that the end of the lifecycle will soon be reached.

Error code	Diagnostic code	Meaning for the LMV36... system
116	0	Designed life time exceeded (250´000 startups)

Note
The unit should be replaced when this message appears.

21 Safety notes on use of the AZL2...

Caution!
To prevent the risk of fire and explosions, damage to heating plant or damage resulting from improper use of the products, ensure that the following safety notes are observed:

The burner management system covered by the present Basic Documentation may only be used as specified and only in connection with the appropriate burner and heating plant.

The burner management system with its display and operating unit and the associated heating control system may only be installed and commissioned by authorized technical personnel.

The operating unit may only be used in dry spaces. Do not use it outdoors and protect it against excessive temperatures and frost, and liquids, such as water, oil, fuel oil, etc.

Follow exactly the procedures and setting notes given in this Basic Documentation. Appropriately identified settings must only be made by authorized technical personnel.

If the display and operating unit is dusty or dirty, clean it with a dry cloth.

Do not carry out any maintenance or repair work on the unit. Such work may only be performed by authorized technical personnel.

If you have any questions in connection with the display and operating unit, please contact your heating engineer or refer to one of the addresses given in this Basic Documentation.

22 Operating the AZL2... unit
22.1 Description of unit/display and buttons

Function and operation of unit versions AZL21… and AZL23… are identical.

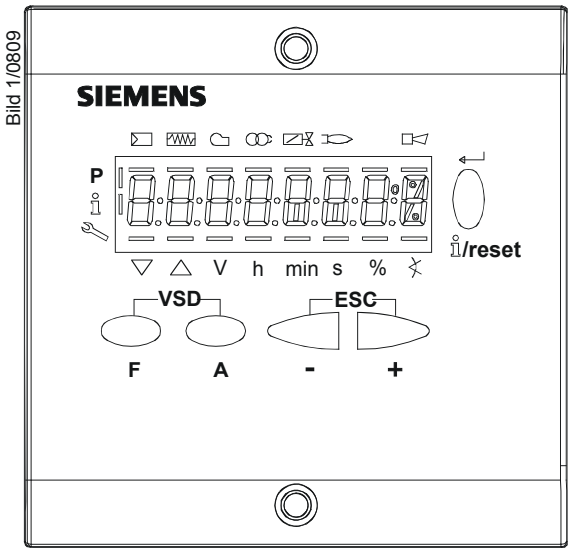


Figure 69: Description of unit/display and buttons

Button	Function
F	**Button F** - For adjusting the fuel actuator (keep F depressed and adjust the value by pressing - or +)
A	**Button A** - For adjusting the air actuator (keep A depressed and adjust the value by pressing - or +)
VSD F A	**Buttons A and F: VSD function** - For changing to parameter setting mode **P** (press simultaneously F and A plus - or +)
i/reset	**Info and Enter button** - For navigating in info or service mode * Selection (symbol flashing) (press button for <1 s) * For changing to a lower menu level (press button for 1…3 s) * For changing to a higher menu level (press button for 3…8 s) * For changing the operating mode (press button for >8 s) - **Enter** in parameter setting mode - **Reset** in the event of fault - One menu level down
-	**- button** - For decreasing the value - For navigating during curve adjustments in info or service mode
+	**+ button** - For increasing the value - For navigating during curve adjustments in info or service mode
ESC - +	**+ and - button: Escape function** (press - and + simultaneously) - No adoption of value - One menu level up

22.2 Meaning of symbols on the display

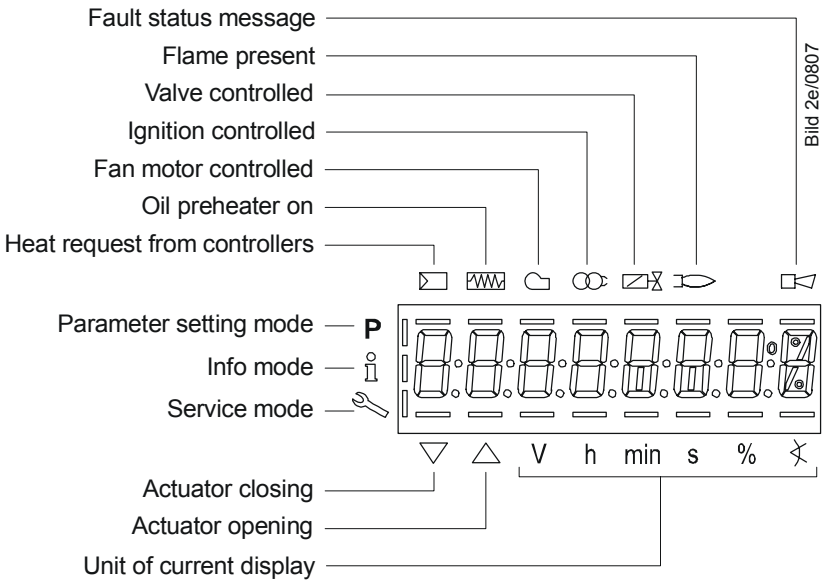


Figure 70: Meaning of display

22.3 Brightness of display

Only available with backlit LCD:

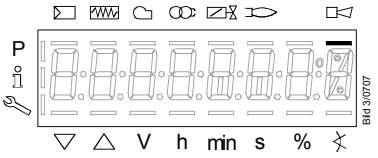
The function of the backlit display is dependent on the type of basic unit.

The brightness of the display can be adjusted from 0…100% using parameter 126.

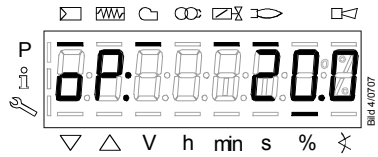
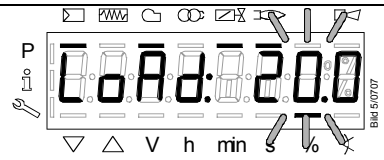
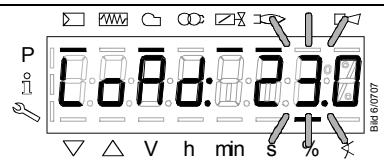
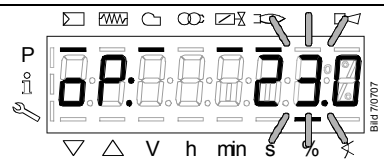
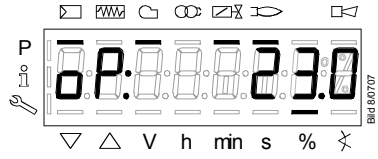
No.	Parameter
126	Display brightness

22.4 Special functions

22.4.1 Manual lockout

i/reset plus other button		Press i/reset **simultaneously** with any other button. The basic unit switches instantly to the lockout position, irrespective of the operating position. The display shows the fault status message, except when in parameter setting mode.

22.4.2 Manual control (manual request for output)

		Burner is in operation. The display shows **oP:** on the left, the **percentage** of the current output on the right. Example: **oP: 20.0**
F 1 s		Press F for 1 s. The display shows **LoAd:**, the current output flashes.
F and - or +		Press - or + to adjust the required manual output. Example: **oP: 23.0**
		Release F . The current manual output flashes, indicating that manual control is activated.
ESC - +		Press ESC - + for 3 seconds to return to automatic mode. The output no longer flashes. The display shows **oP:** on the left, the **percentage** value on the right. Example: **oP: 23.0**

22.5 Timeout for menu operation

The time for automatically leaving the parameter setting level can be adjusted between 10 and 120 minutes, using the following parameter:

No.	Parameter
127	Timeout for menu operation

If, during that period of time, there is no operation via the AZL2..., the parameter setting level is quit and the password level reset to *Info / Service*.

Caution!
In addition, this timeout or interruption of communication between LMV36... and the AZL2... during the time the curves are set, leads to lockout!

Error-code	Diagnostic code	Meaning for the LMV36... system
167	8	Manual locking by the AZL2... Timeout / communication breakdown

22.6 Backup / restore

Using the ABE W-FM 50, the settings made on the basic unit can be stored (backup) and then transferred back to the basic unit at a later point in time.

Creating a backup data set

No.	Parameter
050.0	Index 0: Creation of backup

The following parameters can be used to read information about the backup data set:

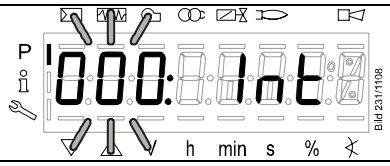
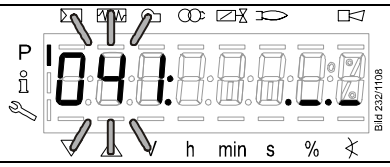
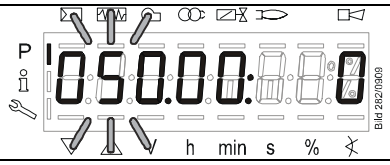
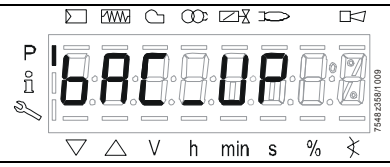
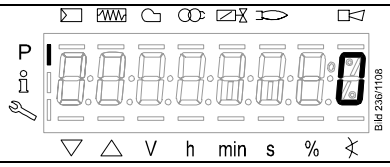
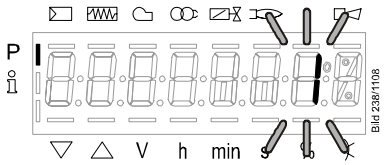
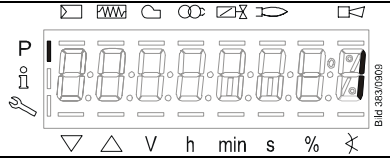
No.	Parameter
055	Burner identification of the ABE W-FM 50 backup data set
056	ASN extraction of the ABE W-FM 50 backup data set
057	Software version used when creating the ABE W-FM 50 backup data set

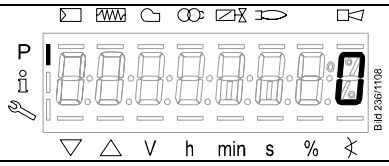
Restoring a backup data set

To transfer a backup data set back to the basic unit, the parameter must be set to **1.**

No.	Parameter
050.1	Index 1: Execute restore

22.6.1 Backup

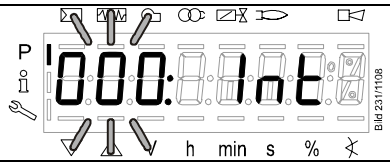
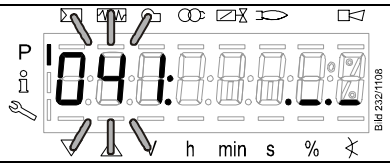
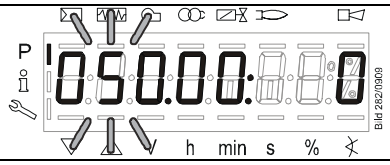
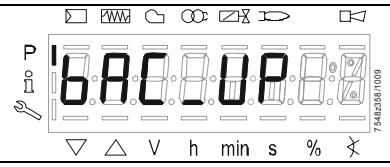
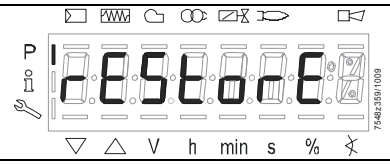
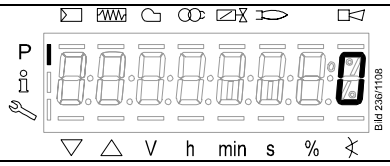
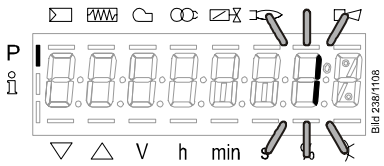
		Parameter **000:** flashes. Display: Parameter **000:** flashes, **Int** does not.
	 **/reset**	
Only OEM level		Press /reset to go to parameter group **041**. Display: Parameter **041:** flashes, **._._** does not.
+		Press + to select parameter **050** Display: Parameter **050.** flashes, index **00:** and value **0** do not.
	 **/reset**	
		Press /reset to select parameter **bAC_UP** Display: Parameter **bAC_UP**
	 **/reset**	
		Press /reset to select the backup process. Display: Value **0**
+		Press + to shift the value in change mode 1 position to the left. Display: Value **1** flashes Note To detect potential display errors, the value is displayed 1 place shifted to the left.
/reset		Press /reset to activate the backup process. Display: **1** appears

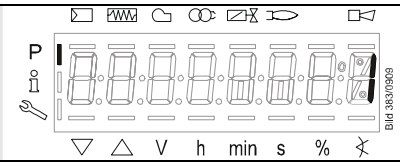
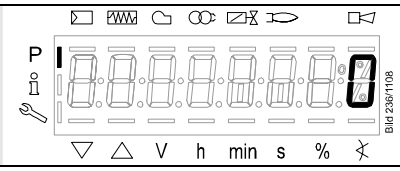
Approx. 5 s		After about 5 seconds (depending on the duration of the program), **0** appears on the display, indicating the end of the backup process. Display: **0**

Note
If an error occurs during the backup process, a negative value is displayed. For error diagnostics, the cause of the error can be determined from the diagnostic code of error message 137 (see *Error code list*).

Caution!
We recommend to make a backup whenever a parameter is changed!

22.6.2 Restore

		Parameter **000:** flashes. Display: Parameter **000:** flashes, **Int** does not.
		
Only OEM level		Press i/reset to go to parameter group **041**. Display: Parameter **041:** flashes, **_._._** does not.
+		Press + to select parameter **050** Display: Parameter **050.** flashes, index **00:** and value **0** do not.
		
		Press i/reset to go to parameter **bAC_UP** Display: Parameter **bAC_UP**
+		Press + to select parameter **rEStorE** Display: Parameter **rEStorE**
		
		Press i/reset to select the restore process. Display: Value **0**
+		Press + to shift the value in change mode 1 position to the left. Display: Value **1** flashes. Note To detect potential display errors, the value is displayed 1 place shifted to the left.

i/reset		Press i/reset to activate the restore process. Display: **1** appears
Ca. 8 s		After about 8 seconds (depending on the duration of the program), **0** appears on the display, indicating the end of the backup process. Display: **0**

Note

- Before restoring the backup data on the basic unit, the latter compares the burner identification and product no. (ASN) with the burner identification and product no. (ASN) of the backup data set. If the data accord, they are restored. If not, the restore process is aborted. In case of abortion, or if an error occurs during the restore process, the display shows a negative value. For error diagnostics, the cause of the error can be determined from the diagnostic code of error message 137 (see *Error code list*). When the restore process is successfully completed, value **0** appears on the display. The W-FM 50 is supplied with undefined burner identification. In that case, the restore process from the ABE W-FM 50 is possible without having to enter the burner identification in the basic unit
- Information **Err C: 136 D: 1** (restore started) is displayed for a short moment

Caution!

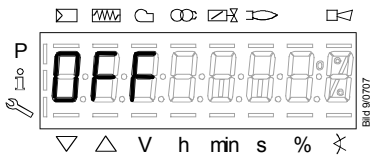
- **On completion of the restore process, the sequence of functions and the parameter settings must be checked**
- **When using a VSD, it might be necessary to repeat standardization**

23 Operation of basic unit via the AZL2...

23.1 Normal display

Normal display is the standard display in normal operation, representing the highest menu level. From the normal display, you can change to the info, service or parameter level.

23.1.1 Display in standby mode



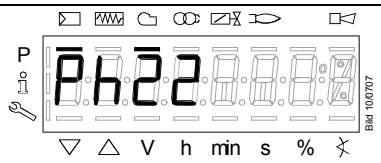
Unit is in standby mode.

Note

OFF flashes when the *Manual OFF* function, the manual output, or controller OFF is activated.

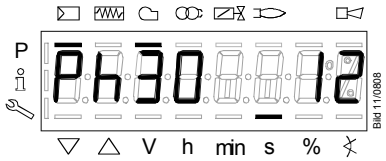
23.1.2 Display during startup / shutdown

23.1.2.1. Display of program phases



The unit is in p**h**ase **22**. The controller calls for heat. The bar below the ⊠ symbol appears. The individual program phases and controlled components are displayed in accordance with the program sequence.

23.1.2.2. Display of program phase with remaining running time until end of the phase is reached



The unit is in p**h**ase **30** and shows the remaining running time in that phase.

Example: **12** s, p**h**ase **30**

23.1.2.3. List of phase displays

Phase	Function
Ph00	Lockout phase
Ph02	Safety phase
Ph10	Home run
Ph12	Standby (stationary)
Ph22	Fan ramp up time (122) (fan motor = ON, safety valve = ON)
Ph24	Traveling to the prepurge position
Ph30	Prepurge time
Ph36	Traveling to the ignition position
Ph38	Preignition time
Ph39	Valve proving filling time (test pressure-switch-min when mounted between fuel valve V1 and fuel valve V2)
Ph40	1st safety time (ignition transformer ON)
Ph42	1st safety time (ignition transformer OFF)
Ph44	Interval 1
Ph50	2nd safety time
Ph52	Interval 2
Ph60	Operation 1 (stationary)
Ph62	Max. time low-fire (operation 2, preparing for shutdown, traveling to low-fire)
Ph70	Afterburn time
Ph72	Traveling to the postpurge position
Ph74	Postpurge time (no extraneous light test)
Ph78	Postpurge time 3 (abortion when load controller ON)
Ph80	Valve proving evacuation time
Ph81	Valve proving test time atmospheric pressure, atmospheric test
Ph82	Valve proving filling test, filling
Ph83	Valve proving test time gas pressure, pressure test
Ph90	Gas shortage waiting time

23.1.3 Display of operating position

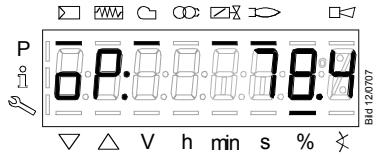


Bild 12/0707

Display **oP** stands for *Operating position reached*.

Modulating mode: Current output in %

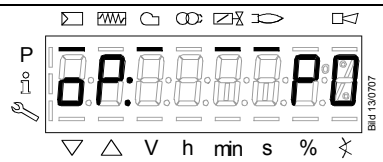


Bild 13/0707

Display **oP: P0** stands for *Ignition point*.

Multistage operating mode: Current fuel stage

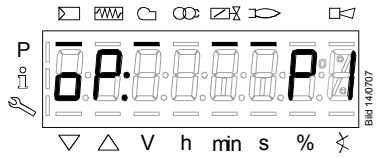


Bild 14/0707

Display **oP: P1** stands for *Stage 1*.
Multistage operating mode: Current fuel stage

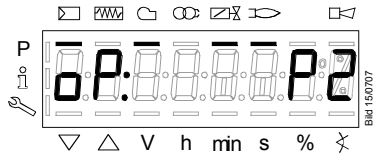


Bild 15/0707

Display **oP: P2** stands for *Stage 2*.
Multistage operating mode: Current fuel stage

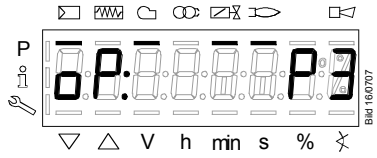
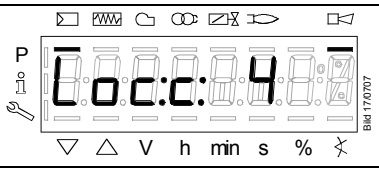


Bild 16/0707

Display **oP: P3** stands for *Stage 3*.
Multistage operating mode: Current fuel stage

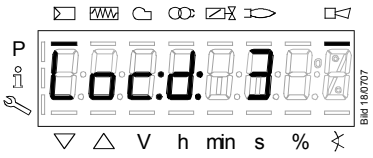
23.1.4 Fault status messages, display of errors and info

23.1.4.1. Display of errors (faults) with lockout



The display shows **Loc:**, the bar under the fault status message ☐◁ appears.

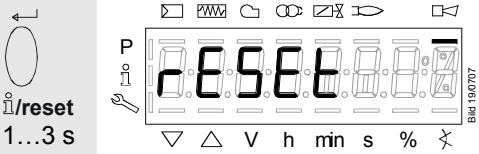
The unit is in the lockout position.



The display shows current error code **c:** alternating with diagnostic code **d:** (refer to *Flash code list*).

Example: Error code **4** / diagnostic code **3**

23.1.4.2. Reset



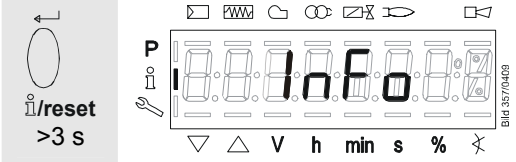
Press i/reset for 1...3 s so that **rESEt** appears on the display.

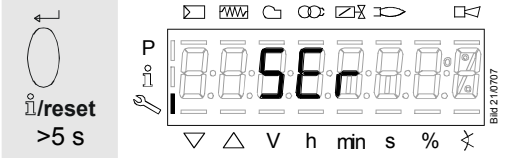
When you release the button, the basic unit is reset.

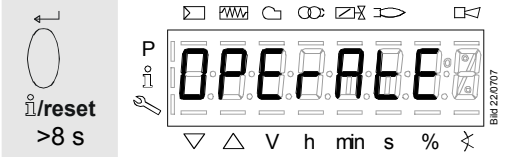
If you press i/reset for >1 s or <1 s, the system returns to the former menu.

Exception:
If a fault occurs in connection with the curve setting, the system returns to the parameter setting level.

23.1.4.3. Activating info / service mode from lockout



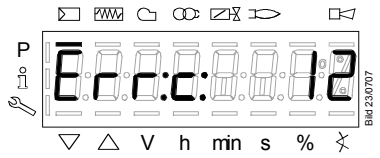




Press i/reset for >3 s so that **InFo**, **SEr** and then **OPErAtE** appear on the display.

When the button is released, a change to info / service mode is made.

23.1.4.4. Error with safety shutdown



The display shows **Err:**.

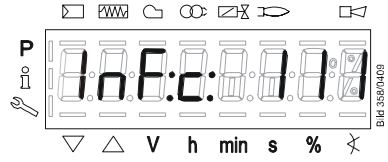
The unit initiates safety shutdown.

The display shows current error code **c:** alternating with diagnostic code **d:**.

Press i/reset to return to the normal display.

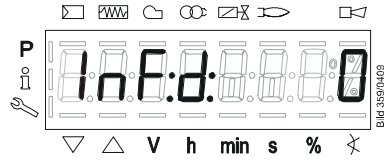
Example: Error code **12** / diagnostic code **0**

23.1.4.5. General information



The unit displays an event which does not lead to shutdown.

The display shows current error code **c:** alternating with diagnostic code **d:**.

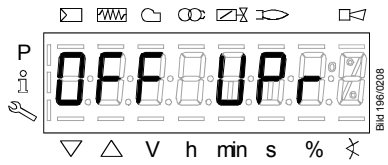


Press i/reset to return to the former menu.

Example: Error code **111** / diagnostic ode **0**

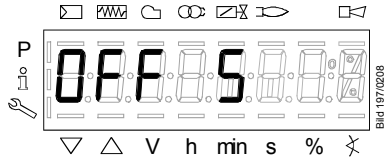
Note
For meaning of the error and diagnostic codes, refer to chapter *Error code list*.
When an error has been acknowledged, it can still be read out from the error history.

23.1.4.6. Prevention of startup



OFF UPr appears if a unit was not programmed or not completely parameterized, or its operating mode was reset or changed.
The display shows **OFF UPr0** or **OFF UPr1**, depending on the type of fuel currently burnt.

23.1.4.7. Safety loop



OFF S appears if a unit's safety loop and / or burner flange contact is open, and a controller ON signal is present.

24 Menu-driven operation
24.1 Assignment of levels

The various levels can be accessed via different button combinations. The parameter level can only be accessed via password.

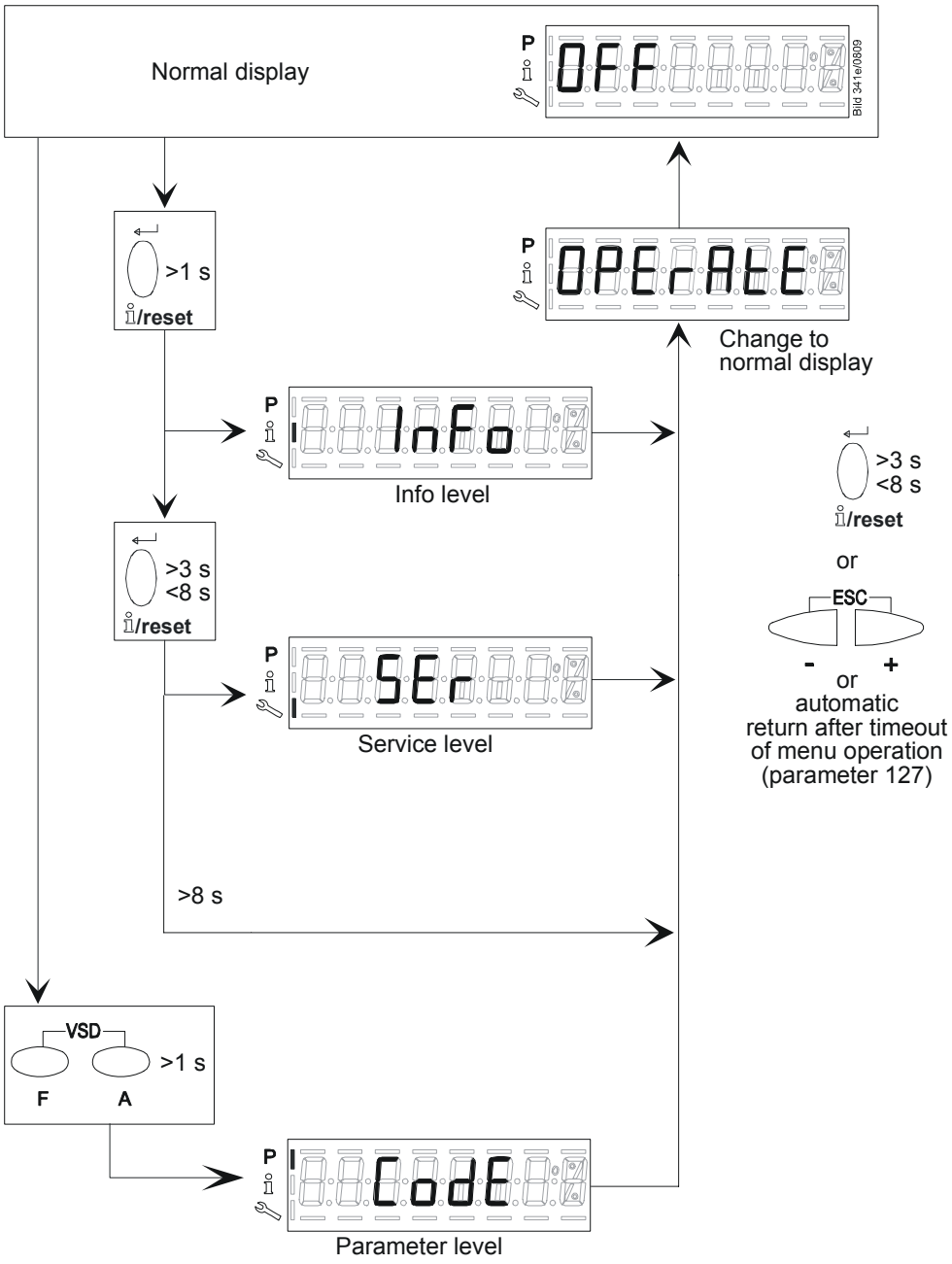


Figure 71: Assignment of levels

25 Info level

The info level displays information about the basic unit and about operation in general.

Note

On the info level, you can display the next or the previous parameter by pressing - or + .

Instead of pressing + , you can also press i/reset for <1 s.

Note

Press ESC - + or i/reset for >3 s to return to the normal display.

Note

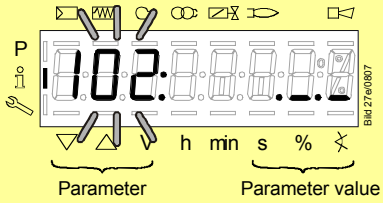


Fig. 72: Info level

No change of values on the info level!

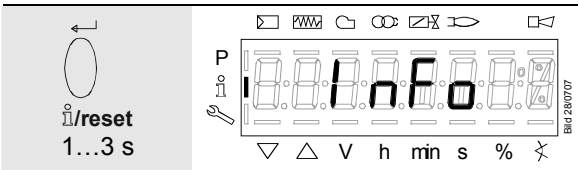
If the display shows _._._._ below the parameter value, the value may consist of more than 5 digits.

The value is displayed by pressing i/reset for >1 s and <3 s.

Press i/reset for >3 s or press ESC - + to return to the selection of the parameter numbers (parameter no. flashes).

No.	Parameter
Info level	
167	Fuel volume resettable [m³, l, ft³, gal]
162	Operating hours resettable
164	Number of startups resettable
165	Number of startups
177	Fuel 1: Fuel volume resettable (m³, l, ft³, gal)
172	Fuel 1: Operation hours resettable
174	Fuel 1: Number of startups resettable
175	Fuel 1: Number of startups
163	Operating hours when unit is live
166	Total number of startups
113	Burner identification
107	Software version
108	Software variant
102	Identification date
103	Identification number
104	Preselected parameter set: Customer code
105	Preselected parameter set: Version
143	reserved
End	

25.1 Display of info level

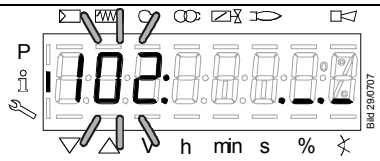


Press i/reset until **InFo** appears.

When releasing i/reset, you are on the info level.

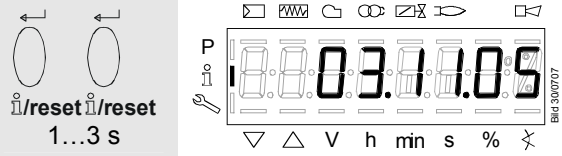
25.2 Display of info values (examples)

25.2.1 Identification date



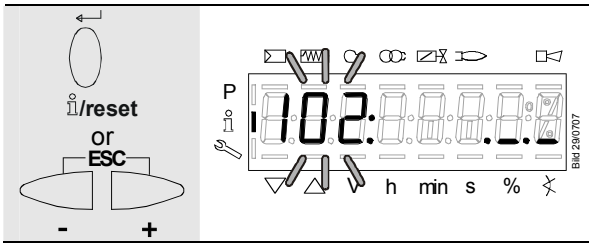
The display shows parameter **102:** flashing on the left, characters **._._** on the right.

Example: **102: ._._**



Press i/reset for 1…3 s to show the identification date **TT.MM.JJ**.

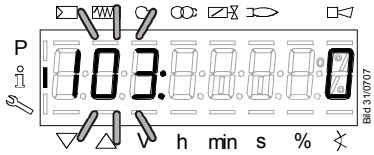
Example: Identification date **03.11.05**



Press i/reset for >3 s or ESC - + to return to the display of parameters.

To the next parameter

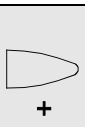
25.2.2 Identification number



The display shows parameter **103:** flashing on the left, identification number **0** on the right.

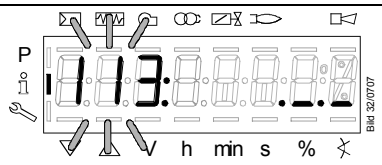
Example: **103: 0**

To the next parameter



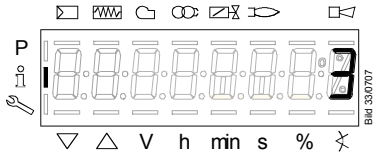
Back to the previous parameter

25.2.3 Burner identification



The display shows parameter **113:** flashing on the left, characters **._._** on the right.

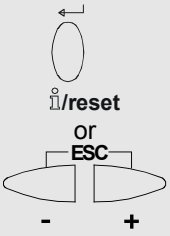
Example: **113: ._._**

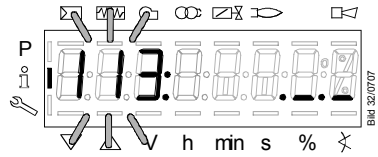


Press i/reset for 1…3 s to show the burner's identification.

Default setting: - - - - - - - -

Example: **3**



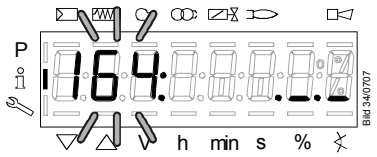


Press i/reset or ESC - + to return to the display of parameters.

The burner's identification can be set on the parameter level!

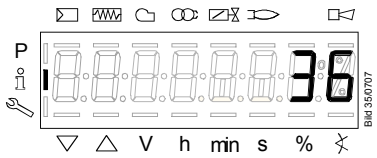
To the next parameter	+	-	Back to the previous parameter

25.2.4 Number of startups resettable



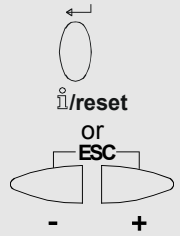
The display shows parameter **164:** flashing on the left, characters **._._** on the right, since display of the number of startups may comprise more than 5 digits.

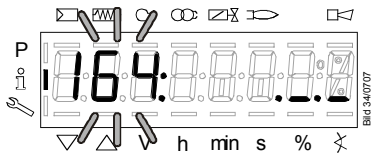
Example: Parameter **164: ._._**



Press i/reset for 1…3 s to show the number of startups (resettable).

Example: **36**



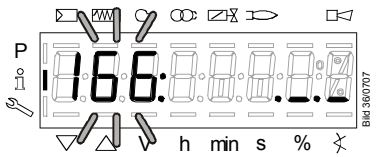


Press i/reset or ESC - + to show parameter **164** flashing again.

The number of startups can be reset on the parameter level!

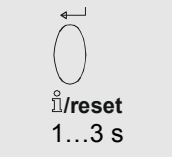
To the next parameter	+	-	Back to the previous parameter

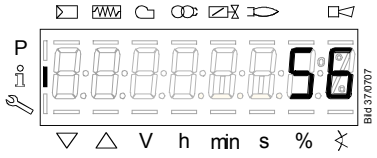
25.2.5 Total number of startups



The display shows parameter **166:** flashing on the left, characters **._._** on the right, since the display of the total number of startups may comprise more than 5 digits.

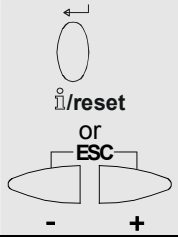
Example: Parameter **166: ._._**

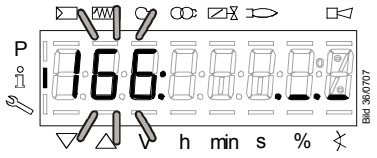




Press i/reset for 1…3 s to show the total number of startups.

Example: **56**

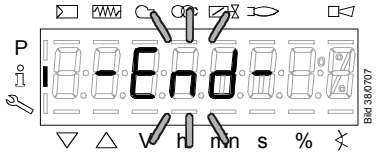




Press i/reset or ESC - + to return to the display of parameters.

To the next parameter	 +	 -	Back to the previous parameter

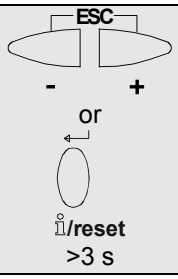
25.2.6 End of info level

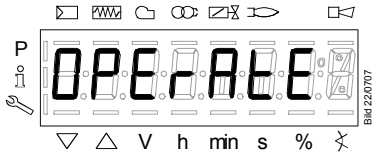


When this display appears, you have reached the end of the info level.

The display shows **– End –** flashing.

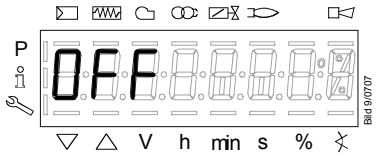
To the start of the info level	 + or i/reset <1s	 -	Back to the previous parameter





Press i/reset for >3 s or ESC - + to return to the normal display.

OPErAtE appears for a short moment.



When this display appears, you are back on the normal display and you can change to the next level mode.

26 Service level

The service level is used to display information about errors including the error history and information about the basic unit.

Note

When on the service level, you can press - or + to display the next or the previous parameter.

Instead of pressing + , you can also press i/reset for <1 s.

Note

Press ESC - + or i/reset for >3 s to return to the normal display.

Note

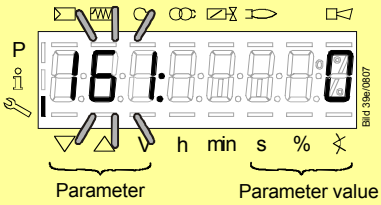


Figure 73: Service level

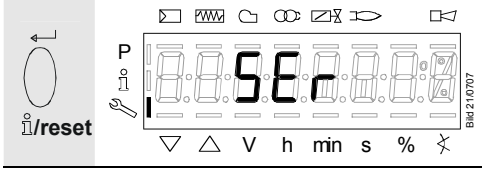
No change of values on the service level.

If characters - - - - - - are displayed by the parameter, the value may consist of more than 5 digits.

Press i/reset for >1 s and <3 s to display the value.

Press i/reset for >3 s or ESC - + to return to the selection of the parameter number (flashing).

26.1 Display of service level



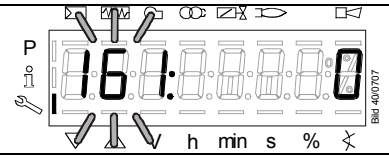
Press i/reset for >3 s until **SEr** appears.

When releasing i/reset, you are on the service level.

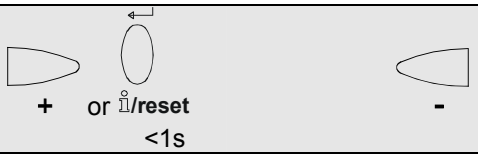
No.	Parameter
Service level	
954	Intensity of flame
960	Actual flow rate (fuel throughput in m³/h, l/h, ft³/h, gal/h)
945	Actual fuel 0 = fuel 0 1 = fuel 1
121	Manual output Undefined = automatic operation
922	Incremental position of actuators Index 0 = fuel Index 1 = air
936	Standardized speed
161	Number of faults
701	Error history: 701-725.01.Code

26.2 Display of service values (example)

26.2.1 Number of faults



The display shows parameter **161:** flashing on the left, the number of faults that occurred thus far on the right **0**.
Example: Parameter **161: 0**



To the next parameter

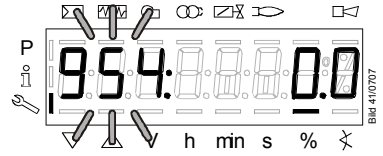
Back to the previous parameter

26.2.2 Error history

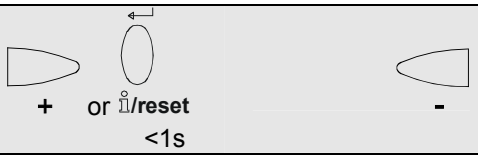
Refer to chapter *Parameter with index, without direct display/Example of parameter 701: Error history*!

Note
Can be deleted for service (refer to chapter *Parameter list*)!

26.2.3 Intensity of flame



The display shows parameter **954:** flashing on the left.
On the right, the flame's intensity is displayed as a percentage.
Example: **954: 0.0**

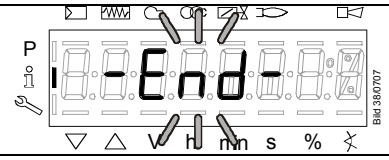


To the next parameter

Back to the previous parameter

Note
Also refer to chapter *Intensity of flame during curve settings*.

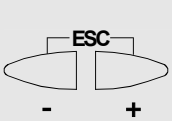
26.2.4 End of service level

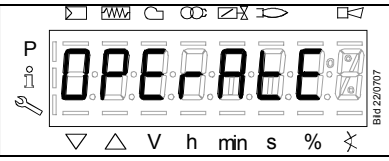


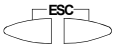
When this display appears, you have reached the end of the service level.
Display **– End –** appears flashing.

To the start of the service level

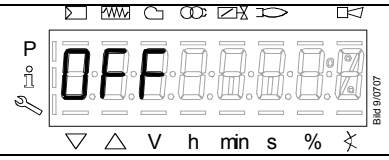
Back to the previous parameter





Press 

to return to the normal display.
OPErAtE appears for a short moment.



When this display appears, you are back on the normal display and you can change to the next level mode.

27 Parameter level

The parameters stored in the basic unit can be displayed or changed on the parameter level.
The change to the parameter level requires a password.

Siemens supplies the LMV36... with the factory settings according to *Type summary*.

The OEM can change the Siemens default settings to match his own requirements.

With the LMV36..., the basic unit's characteristics are determined primarily through parameter settings. Every time the unit is recommissioned, the parameter settings must be checked. The LMV36... must never be transferred from one plant to another without matching the unit's parameters to the new plant.

Caution!
Parameters and settings may only be changed by **qualified personnel**.
If parameters are changed, responsibility for the new parameter settings is assumed by the person who – in accordance with the access rights – has made parameter changes on the respective access level.
After parameterization, the OEM must check to ensure that safe burner operation is warranted.
The OEM which made the settings is always responsible for the parameters, their settings and compliance of the respective application with the relevant national and international standards and safety regulations, such as EN 676, EN 267, EN 1643, etc. Siemens, its suppliers and other Group Companies of Siemens AG do not assume responsibility for special or indirect damage, consequential damage, other damage, or damage resulting from wrong parameter settings.

Warning!
If the factory settings are changed, all changes made must be documented and checked by the OEM.

The OEM is obliged to mark the unit accordingly and to include at least the list of device parameters and settings in the burner's documentation.

Siemens also recommends attaching an additional mark on the LMV36... in the form of an adhesive label. According to EN 298, the label should be easy to read and wipe proof.

The label with a maximum size of 70 mm x 45 mm can be attached to the upper part of the housing.

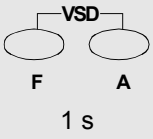
Example of label:

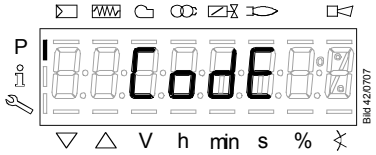
OEM logo
Type / part no.: 1234567890ABCD

Caution! OEM settings:	
Parameter no.	
225 = 30 s (t1)	226 = 2 s (t3)
230 = 10 s (t4)	234 = 0 s (t8)
240 = 1 (repetition)	
257 = 2 s (t3n)	TSA = t3n + 0.7 s
259 = 30 s (t11)	
260 = 30 s (t12)	

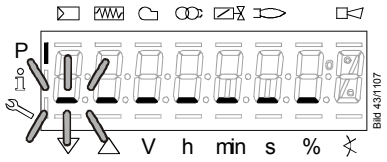
27.1 Entry of password

Note
The **OEM**'s password must consist of **5** characters, the **heating engineer's** of **4** characters.

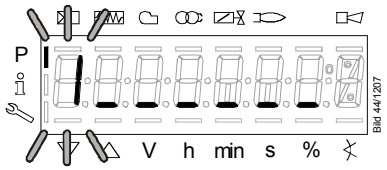




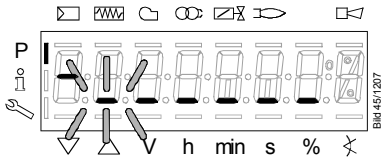
Press button combination VSD F A to display **CodE**.



When releasing the buttons, 7 bars appear the first of which flashes.



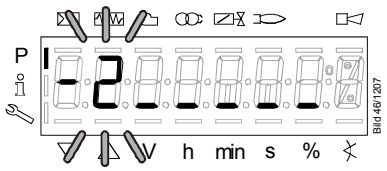
Press - or + to select a number or letter.



Press i/reset to confirm the value.

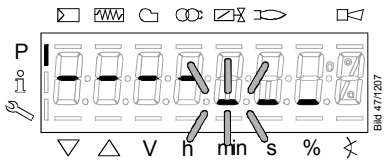
The value entered changes to a minus sign (**–**).

The next bar starts flashing.



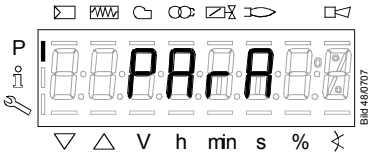
Press - or + to select a number or letter.

•
•
•



After entry of the last character, the password must be confirmed by pressing i/reset.

Example: Password consisting of 4 characters.



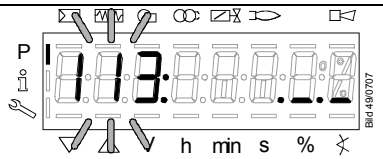
As a confirmation of correct entry, **PArA** appears for a maximum of 2 seconds.

Note
For entry of passwords or burner IDs, the following numbers and letters can be used:

1	= 1	A	= A	L	= L
2	= 2	b	= b	n	= n
3	= 3	C	= C	o	= o
4	= 4	d	= d	P	= P
5	= 5	E	= E	r	= r
6	= 6	F	= F	S	= S
7	= 7	G	= G	t	= t
8	= 8	H	= H	u	= u
9	= 9	I	= I	Y	= Y
0	= 0	J	= J		

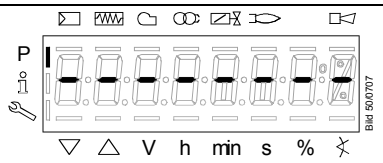
27.2 Entry of burner identification

The burner's identification is entered like a password (character by character), but from right to left and ending with «_».



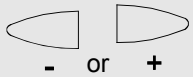
Parameter **113:** flashes.

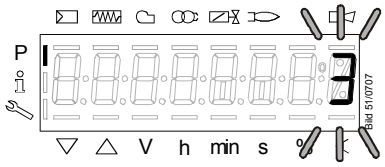
Press i/reset to go to editing mode.



You are on the display for undefined burner identification.

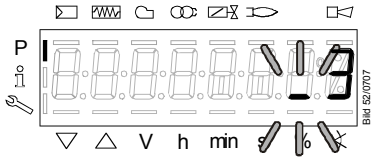
8 bars appear.





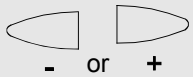
Press - or + to select a number.

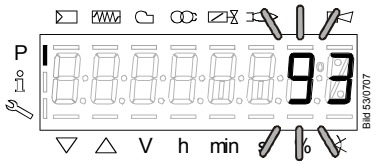
Example: Number **3** flashes.



Press i/reset to confirm the value.

Make the entry number by number.

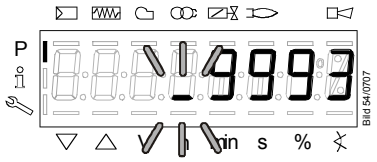




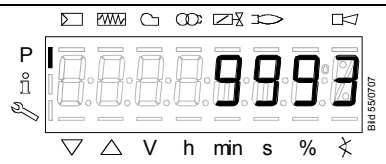
Press - or + to select the next number.

Example: Number **9** flashes.

•
•
•

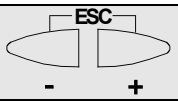


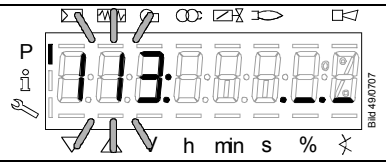
After entry of the last number, burner identification must be confirmed by pressing i/reset.



The display no longer flashes.

Example: Burner identification **9993**



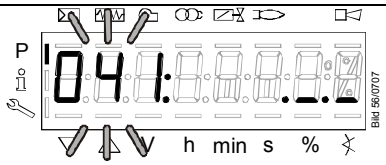


Press 

to return to the parameter level.

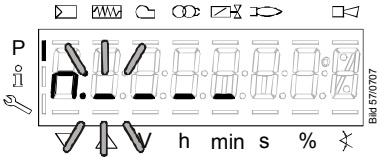
PArAmeter **113:** for burner identification.

27.3 Change of heating engineer's password



Parameter **041:** flashes.

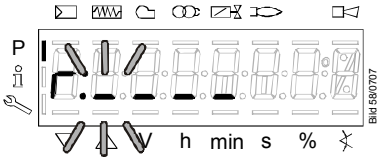
Press  to go to level **c:** for password changes.



Letter **n:** for **n**ew.

Proceed as described in chapter *Entry of password* and enter the new password (4 characters).

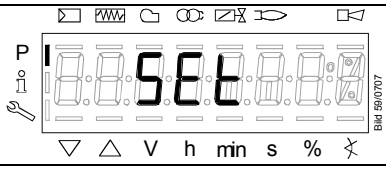
After entry of the last character, the password must be confirmed by pressing 
.



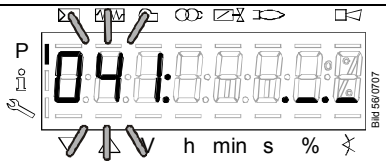
Letter **r:** for **r**epeat.

Proceed as described in chapter *Entry of password* and repeat entry of the new password.

After entry of the last character, the password must be confirmed by pressing 
.

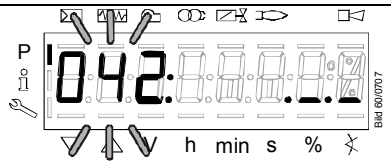


SEt confirms that the new password has been saved.



Parameter **041:** flashes again.

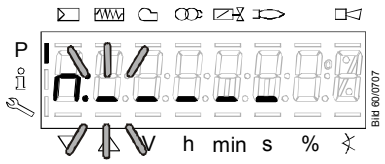
27.4 Change of OEM's password



Parameter **042:** flashes.

Press i/reset to go to level **c:** for password changes.

i/reset

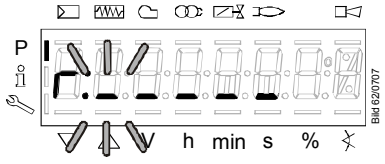


Letter **n:** for **n**ew.

Proceed as described in chapter *Entry of password* and enter the new password (5 characters).

After entry of the last character, the password must be confirmed by pressing i/reset.

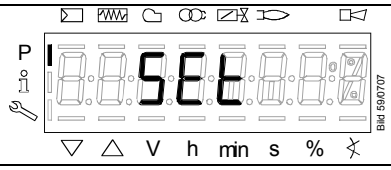
i/reset



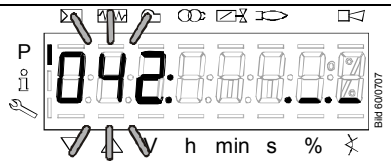
Letter **r:** for **r**epeat.

Proceed as described in chapter *Entry of password* and repeat entry of the new password.

After entry of the last character, the password must be confirmed by pressing i/reset.



SEt confirms that the new password has been saved.



Parameter **042:** flashes again.

27.5 Use of parameter level

The parameters stored in the LMV36... basic unit can be displayed and changed on the parameter level. Normally, all parameters have been set by the burner manufacturer – with the exception of those for the fuel train and for fuel-air ratio control.
A description of parameter level **400,** which is used for setting the fuel train and the fuel-air ratio curve, is given in chapter *Fuel-air ratio curves – settings and commissioning*.

27.6 Structure of parameter levels

The parameters are assigned to different levels.

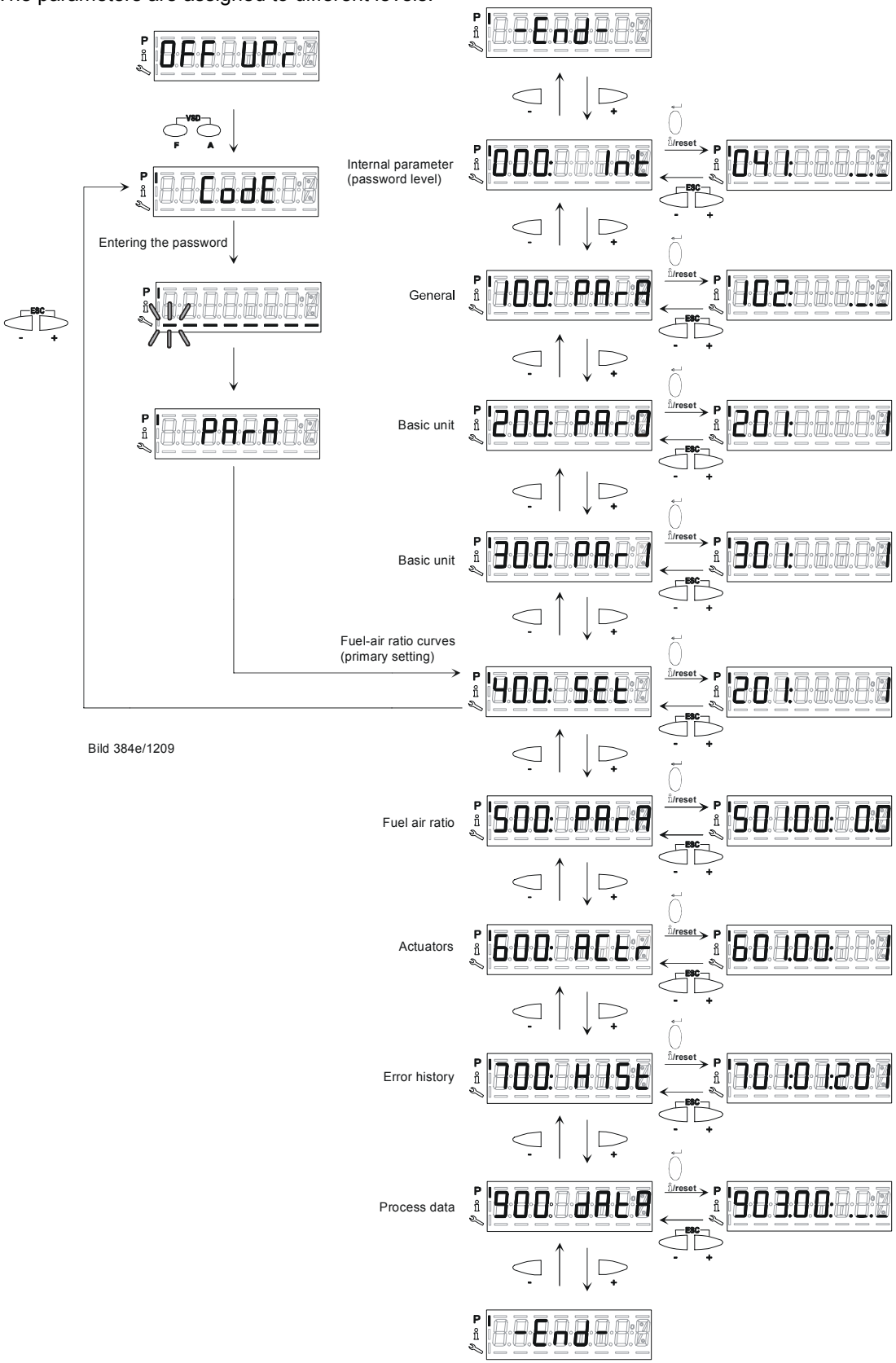


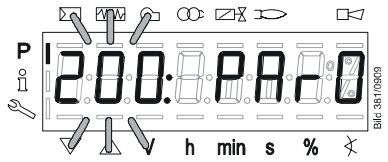
Bild 384e/1209

Note
The following sections explain the operating philosophy behind the parameter levels using a number of examples.

Caution!
Pay special attention to chapter *Safety notes on settings and parameter settings*!

27.7 Parameters without index, with direct display

27.7.1 Using the example of parameter 208: Program stop

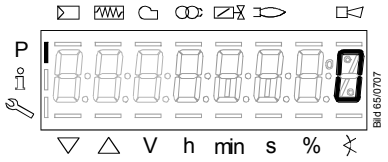


PArAmeter level **200:** for basic units.

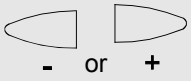
Press i/reset to go to menu level **200:**

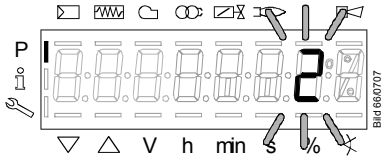
Press + to select *Program stop*.

Display: Parameter **208:** flashes, value **0** does not.



Press i/reset to go to editing mode.
Display:
Program stop time set
Here: Value **0**
→ corresponding to program stop deactivated.



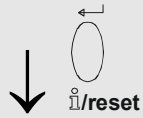


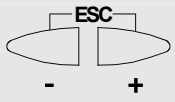
Press - or + to select the required program stop time.

0 = inactive
1 = PrePurgP (Ph24)
2 = IgnitPos (Ph36)
3 = Interv1 (Ph44)
4 = Interv2 (Ph52)

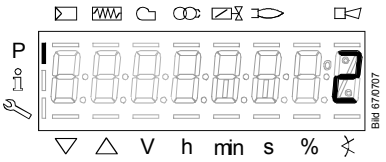
Example: **2** IgnitPos (Ph36)

Adopt the value!



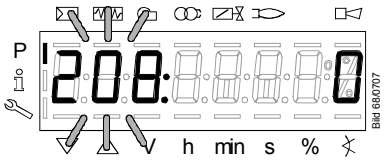


Discard the change!



Press i/reset to return to editing mode.

The value set is adopted.

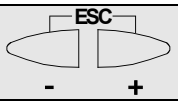


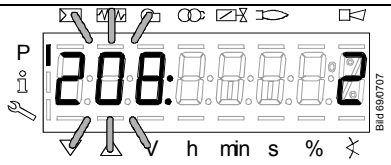
Press to return to the parameter level.

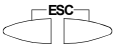
Display: Parameter **208:** flashes, value **0** does not.

Note
To detect potential display errors, the value is displayed 1 place shifted to the right.

Display: Value **2**

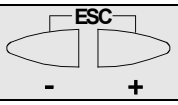


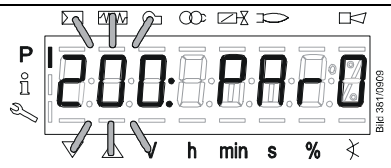


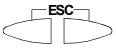


Press to return to the parameter level.

PArAmeter **208:** flashes, value **2** does not.







Press to return to the parameter level.

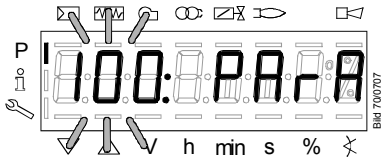
PArAmeter **200:** for basic units.

To the next parameter level

Back to the previous parameter level

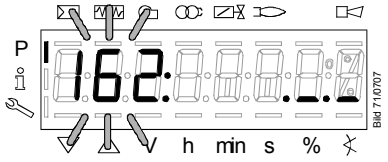
27.8 Parameters without index, with no direct display (with parameters having a value range >5 digits)

27.8.1 Using the example of parameter 162: Operating hours resettable



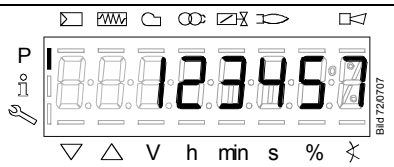
PArAmeter level **100:** for general.

Press i/reset to go to menu level **100:**.



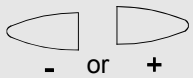
Press + to select *Operating hours resettable*.

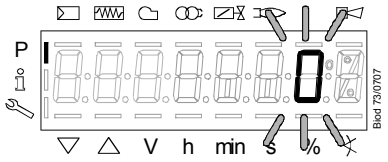
Display: Parameter **162:** flashes, characters ·–·– do not.



Press i/reset to go to editing mode.

Display: **123457**

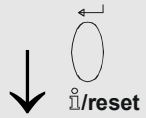


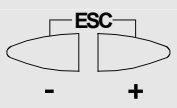


You can press - or + to set the number of operating hours to **0**.

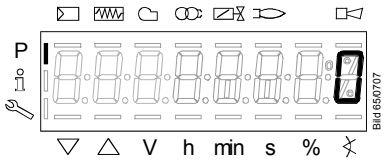
Display: Operating hours **0** flashes.

Adopt the value!





Discard the change!

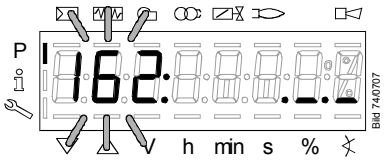


Press i/reset to return to editing mode.

The value set will be adopted.

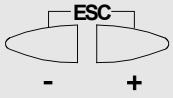
Note
To detect potential display errors, the value is displayed 1 place shifted to the right.

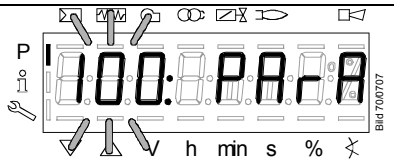
Display: Value **0**



Press ESC - + to return to the parameter level.

Display: Parameter **162:** flashes, characters ·–·– do not.



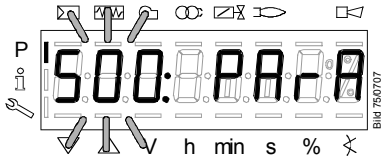


Press ESC - + to return to the parameter level.

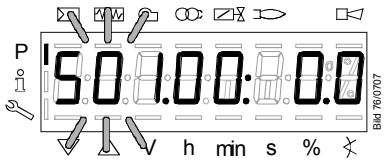
PArAmeter **100:** for general.

27.9 Parameter with index, with direct display

27.9.1 Using the example of parameter 501: No-flame positions fuel actuator

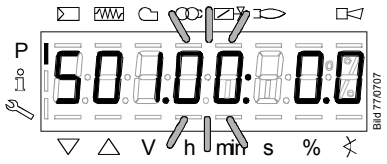


PArAmeter level **500:** for fuel-air ratio control.



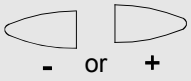
Press /reset to go to menu level **500:**.

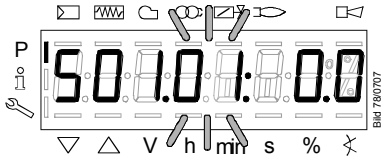
Display: Parameter **501.** flashes, index **00:** and value **0.0** do not.



Press /reset to go to the index.

Display: Parameter **501.** does not flash, index **00:** flashes, value **0.0** does not.

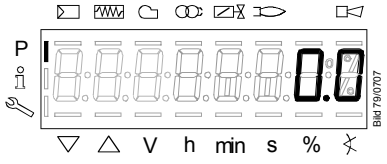




Press - or + to select the required index.

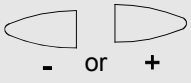
.00 = home position
.01 = prepurge position
.02 = postpurge position

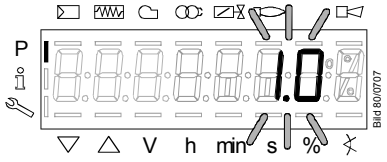
Display: Index **01:** for prepurge position flashes, value **0.0** does not.



Press /reset to go to editing mode.

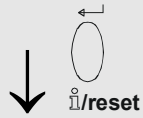
Display: Value **0.0**

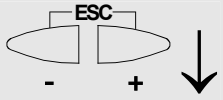




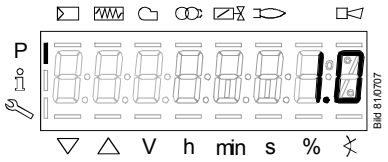
Press - or + to select the required prepurge position.

Example: **1.0**

Adopt the value! 



Discard the change!

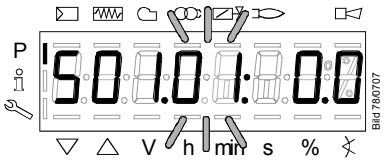


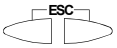
Press 

to return to editing mode.

The value set will be adopted.

Note
To detect potential display errors, the value is displayed 1 place shifted to the right.

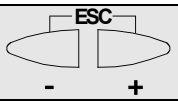


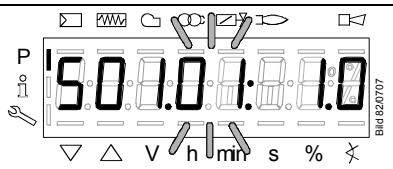
Press 

to return to the index.

Display: Parameter **501.** does not flash, index **01:** flashes, value **0.0** has not changed and does not flash.

Display: Value **1.0**

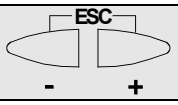


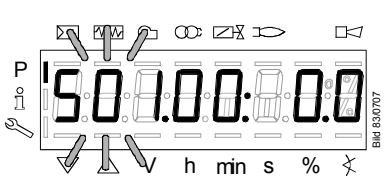


Press 

to return to the index.

PArAmeter **501:** does not flash, index **01:** flashes, value **1.0** does not.

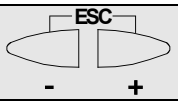


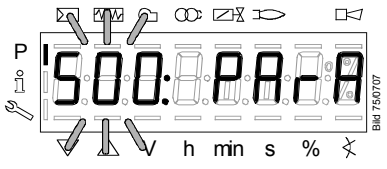


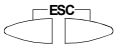
Press 

to return to the parameter level.

Display: Parameter **501.** flashes, index **00:** and value **0.0** do not.





Press 

to return to the parameter level.

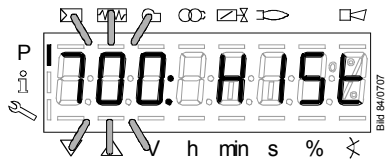
PArAmeter **500:** for fuel-air ratio control.

27.10 Parameters with index, with no direct display

27.10.1 Using the example of parameter 701: Errors

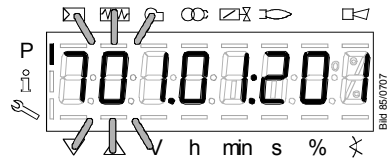
Refer to chapter *Error code list*!

Note
Can be deleted for service, refer to chapter *Parameter list*!



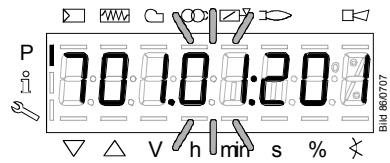
HIStorie **700:** for error history.

Press i/reset to go to the parameter level.



Press + to select parameter **701**.

Display: Parameter **701.** flashes, index **01:** and value **201** do not.

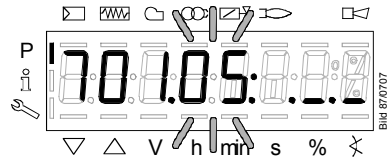


Press i/reset to go to index **01:**.

Display: Parameter **701.** does not flash, index **01:** flashes, value **201** does not.

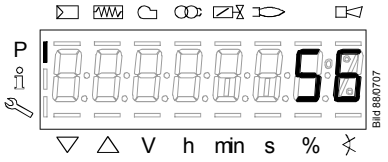
To the next index

Back to the previous index



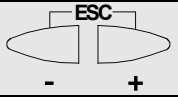
Press + to select the index:
.01 = error code
.02 = diagnostic code
.03 = error class
.04 = error phase
.05 = startup counter
.06 = output

Example:
Parameter **701.**, index **05:** for startup counter, diagnostic code ·–·–



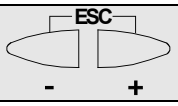
Press i/reset to go to display mode.

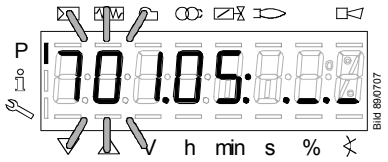
Display: Value **56**



Press ESC - + to return to the index.

Display: Parameter **701.** does not flash, index **05:** flashes, characters ·–·– do not.



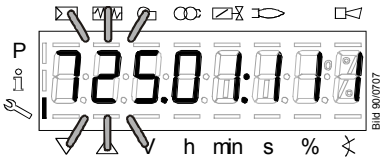


Press ESC - + to return to the parameter level.

Display: Parameter **701.** flashes index **05:** does not, characters ·–·– do not.

To the next older error

•
•
•

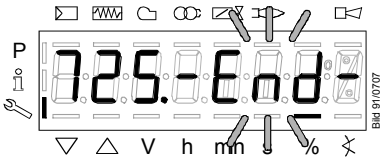


Parameters cover the period of time back to the last error since history was deleted (max. to parameter **725.**)

Example:
Parameter **725.**, index **01:**, error code **111**

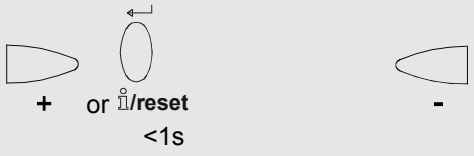
To the next parameter

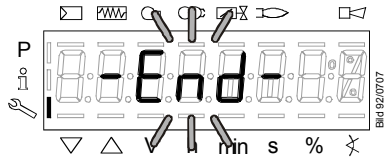
Back to the previous parameter



When this display appears, you have reached the end of the error history index.

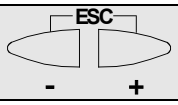
Display **– End –** appears flashing.

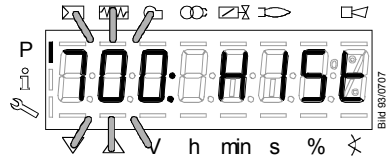
To the next parameter		Back to the previous parameter

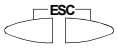


When this display appears, you have reached the end of the error history.

Display **– End –** appears flashing.

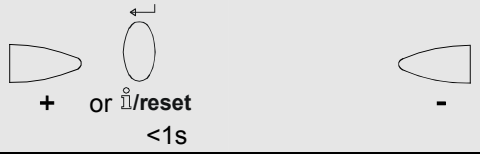




Press 

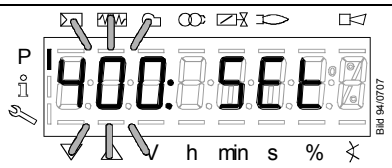
to return to the parameter level.

HISt 700: for error history

To the next parameter		Back to the previous parameter

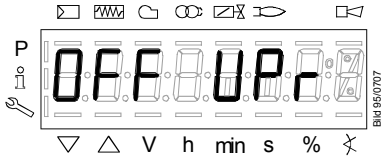
Note
If you wish, you can delete the error history via parameter **130**.
To delete the display, set the parameter to **1** and then to **2**.
The error history is deleted when the parameter returns to **0**.

27.11 Fuel-air ratio curves – settings and commissioning



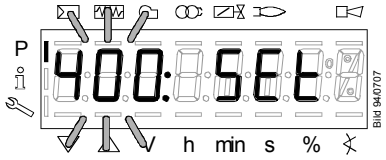
The display shows **400:** flashing on the left, **SEt** appears on the right.

27.11.1 Initial commissioning

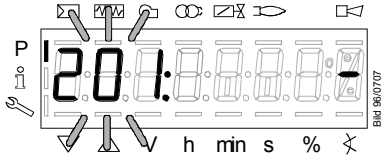


An unprogrammed unit or a unit whose operating mode has been reset or changed displays **OFF UPR0** or **OFF UPR1**.

For initial commissioning, change to the parameter level (refer to chapter *Operation)*.
The settings can then be made on parameter level **400**.



Press /reset to select parameter **400** for initial commissioning and for setting fuel-air ratio control.

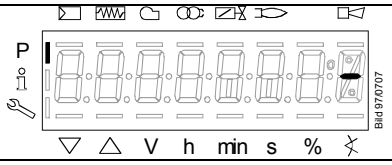
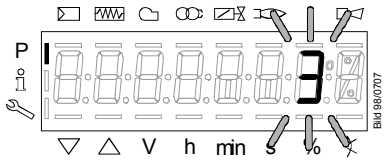
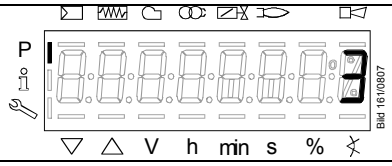
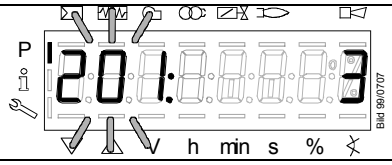
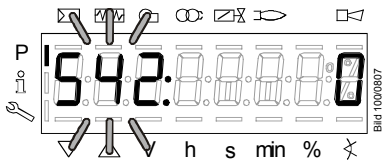
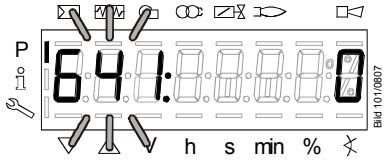


Press /reset to go to the settings for fuel-air ratio control and parameter **201** for selecting the operating mode.

201: appears flashing.

Note
Ensure that the fuel train is correctly set in compliance with the type of burner used.

No.	Parameter	Actuator controlled	
		Air	Fuel
201	Burner operating mode (fuel train, modulating / multistage, actuators, etc.)		
	-- = undefined (delete curves)	●	●
	1 = gas modulating (G mod)	●	●
	2 = gas modulating with pilot valve (Gp1 mod)	●	●
	3 = gas modulating with pilot valve (Gp2 mod)	●	●
	4 = oil modulating (Lo mod)	●	●
	5 = oil 2-stage (Lo 2 stage)	●	---
	6 = oil 3-stage (Lo 3 stage)	●	---
	7 = gas modulating (G mod pneu)	●	---
	8 = gas modulating (Gp1 mod pneu)	●	---
	9 = gas modulating (Gp2 mod pneu)	●	---
	10 = oil modulating with gas pilot (LoGp mod)	●	●
	11 = oil 2-stage with gas pilot (LoGp 2-stage)	●	---
	12 = oil modulating with 2 fuel valves (Lo mod 2V)	●	●
	13 = oil modulating with gas pilot and 2 fuel valves (LoGp mod 2V)	●	●
	14 = gas modulating (G mod pneu, 0 active)	---	---
	15 = gas modulating with pilot (Gp1 mod pneu, 0 active)	---	---
	16 = gas modulating with pilot (Gp2 mod pneu, 0 active)	---	---
	17 = oil 2-stage (Lo 2-stage, 0 active)	---	---
	18 = oil 3-stage (Lo 3-stage, 0 active)	---	---
	19 = gas modulating only when firing on gas (G mod fuel active)	---	●
	20 = gas modulating with pilot only when firing on gas (Gp1 mod fuel active)	---	●
	21 = gas modulating with pilot only when firing on gas (Gp2 mod fuel active)	---	●
	22 = oil modulating only when firing on oil (Lo mod fuel active)	---	●

i/reset		Press i/reset to go to editing mode.
- or +		Press - or + to select the required setting. Example: **3** for gas modulating with pilot valve (Gp2 mod)
i/reset		Press i/reset to save the selected setting.
ESC - +		Press ESC - + to return to the parameter level.
To the next parameter	+	
i/reset		Press i/reset to change to parameter **542:** to activate the VSD. You can choose: 0 = VSD OFF 1 = VSD ON
To the next parameter	+ -	Back to the previous parameter
		Press + to change to parameter **641:** to control speed standardization of the VSD. You can choose: 0 = speed standardization OFF 1 = speed standardization ON After setting speed standardization to **1**, standardization of the VSD commences. If successful, the parameter is reset to **0.** Negative values indicate errors (refer to chapter *Automatic speed standardization*).

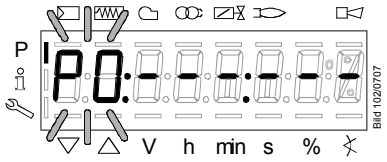
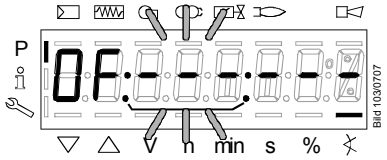
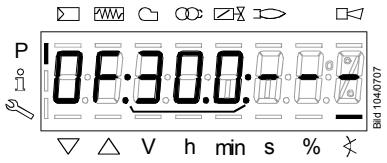
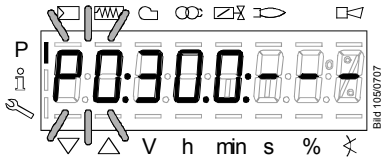
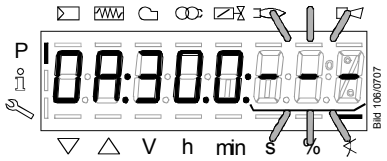
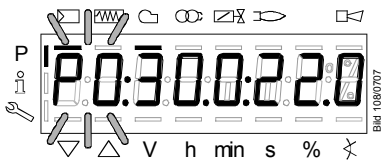
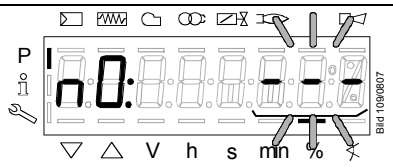
- **For operating modes 1…4, 7…10, 12…16 and 19…22, refer to chapter *Setting curvepoints P0, P1 and P9 for modulating mode («G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)***
- For operating modes 5, 6, 11, 17 and 18, refer to chapter *Setting the curvepoints for multistage mode («Lo 2-stage» and «Lo 3-stage»)*

To the next parameter	+

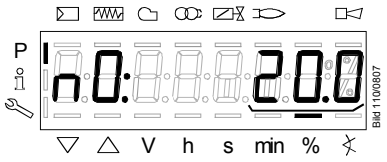
27.11.2 Setting curvepoints P0 and P9 for modulating operation («G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)

Note
Not all actuators used in the following example can be set, depending on the selected operating mode.

Example of «G mod»

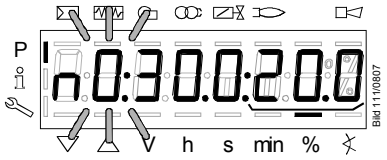
		Display **P0** appears blinking. Curvepoint for ignition load.
F		Keep F depressed. You are now in setting **P0** of fuel setting **F** for ignition position **P0**.
F and - or +		Press simultaneously F and - or + to set ignition position **P0** of the fuel damper. Example: **30.0**
		Release F . The selected value is adopted. Example: **30.0**
A		Keep A depressed. You are now in setting **P0** of air actuator **A** for ignition position **P0**.
A and - or +		Press simultaneously A and - or + to set ignition position **P0** of the air actuator. Example: **22.0**
		Release A . The selected value is adopted. Example: **22.0**
F and A		Keep F and A depressed. You are now in setting **n0,** speed **n** is for ignition position **n0**

F and A
and
- or +



Press simultaneously F and A and - or + to adjust speed **n0** of the VSD.

Example: **20.0**



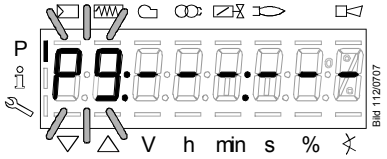
Release F and A.

The selected value is adopted.

Example: **20.0**

To the next curvepoint

+



Press +.

P9 appears blinking.

Curvepoint for high-fire.

Same procedure as with **P0**

Note

If - is pressed first, the display jumps to 90!

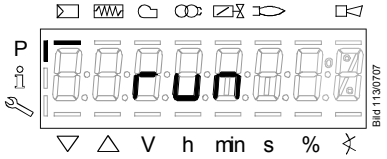
To the next curvepoint

+

Back to the previous curvepoint

-

+



Press +.

The display shows **run** (identification of start for setting the curve parameters).
The display shows **run Gas0** or **run Gas1** or **run Oil0** or **run Oil1,** depending on the type of fuel currently burnt or the type of fuel train.

Note

When pressing i/reset, you are given the choice of proceeding with the *warm settings* (refer to chapter *Warm settings for modulating mode («G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)* or, by pressing ESC - +, with the *cold settings* (refer to chapters *Cold settings for «G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)*.

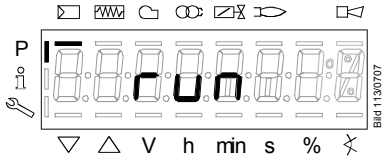
27.11.3 Setting curvepoints P0 and P9 for «G mod pneu», «Gp1 mod pneu» and «Gp2 mod pneu»

Note

Refer to chapter *Setting curvepoints P0 and P9 for modulating operation («G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)*! Here, only the air requires adjustment with A.

27.11.4 Warm settings for modulating operation («G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)

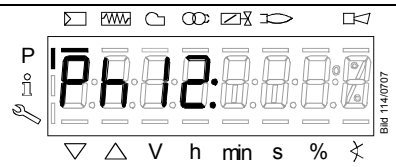
Note
With the *warm settings*, the burner is started up after pressing the **Info** button. Air-fuel ratio control can now be accurately set while the flame is present. When traveling along the precalculated curve to high-fire point **P9**, all intermediate curvepoints (**P2…P8**) must be set. Automatic operation is released when – after reaching **P9** – the curve settings are quit by pressing **ESC**. If the curve settings are aborted earlier (**ESC** or shutdown due to fault), prevention of startup **OFF UPR0** or **OFF UPR1** continues to be active until all points are set.
If required, the gas pressure can be set at the high-fire point. In case the gas pressure is changed, all points must be checked by traveling along the curve downward and – if required – readjusted.



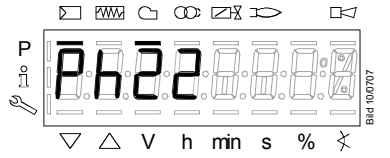
Identification of start for setting the curve parameters. The display shows **run Gas0** or **run Gas1** or **run Oil0** or **run Oil1,** depending on the type of fuel currently burnt or the type of fuel train.

When there is a request for heat.

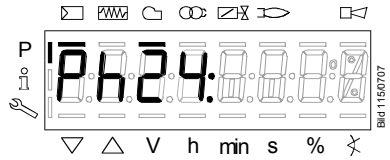
Note
If, during the time the curve is parameterized, an error occurs which leads to safety shutdown, parameterization of the curve is quit.



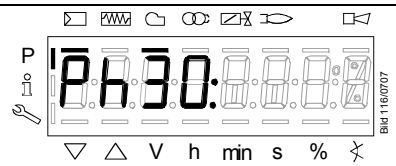
Phase *Standby* (stationary)



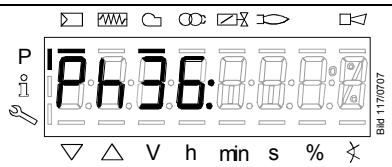
Phase *Fan ramp up*
(fan motor = ON, safety valve = ON)



Phase *Traveling to prepurge position*

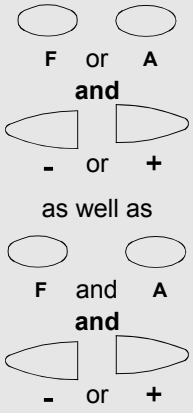


Phase *Prepurging*



Phase *Traveling to ignition position*

Wait until the burner is operating and symbol ▲ or ▼ is no longer highlighted!
The startup sequence stops in phase 36 *Traveling to ignition position*.
The ignition point can be adjusted under cold conditions.

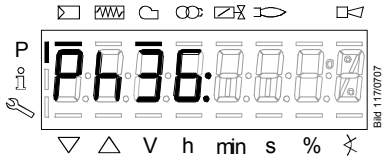


Ignition position **P0** can only be set after symbol ▲ or ▼ is no longer highlighted.

For fuel, keep F depressed, for air A, as well as for VDS F and A

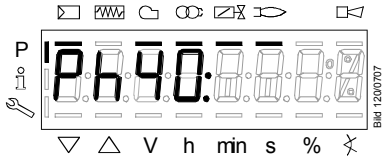
Press - or + to adjust the value.

When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P1** can be selected with + .

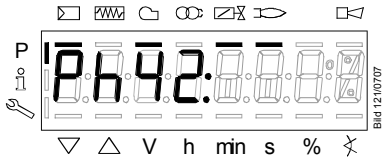


Phase *Traveling to ignition position*

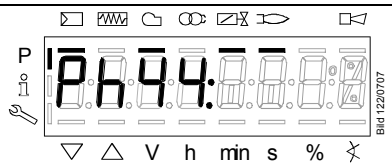
Phase *Preignition*



Phase *1st safety time* (ignition transformer ON)



Phase *1st safety time* (ignition transformer OFF), preignition time OFF



Phase *Interval 1*

Starting the warm settings

F or A
and
\- or +
as well as
F and A
and
\- or +

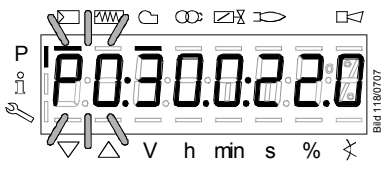


Bild 118/0707

Ignition position **P0** can only be set when symbol ▲ or ▼ is no longer highlighted.

For fuel, keep F depressed, for air A, as well as for VSD F and A

Press - or + to adjust the value.

When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P1** can be selected with +.

+

F or A
and
\- or +
as well as
F and A
and
\- or +

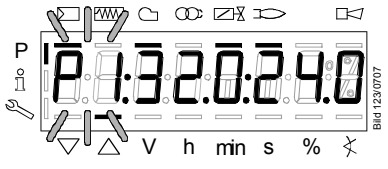


Bild 123/0707

Low-fire position **P1** can only be set when symbol ▲ or ▼ is no longer highlighted.

The value is adopted from **P0**.

For fuel, keep F depressed, for air A, as well as for VSD F and A

Press - or + to adjust the value.

When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P2** can be selected with +.

To the next curvepoint

+

-

Back to the previous curvepoint

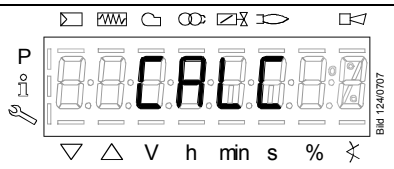


Bild 124/0707

When changing from **P1** to **P2** for the first time, curvepoints **P2…P8** automatically calculated and saved.
CALC appears for a short moment.

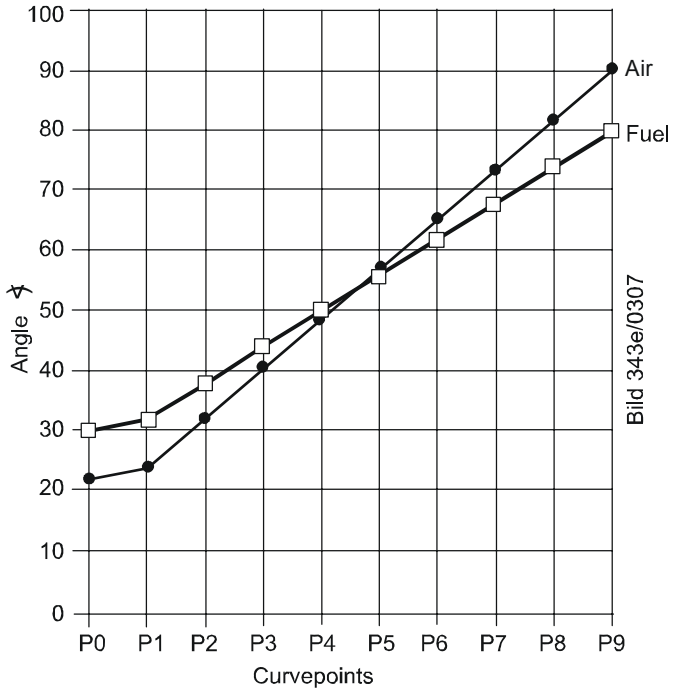


Figure 74: Setting the curvepoints

Note
Curvepoints **P2 to P8** are automatically computed as a straight line between **P1** and **P9**.

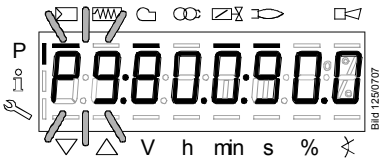
Example 1 = gas modulating

P0, **P1** and **P9** are set as described:	**Curvepoint**	**Value 1 fuel**	**Value 2 air**
	P0	30.0	22.0
	P1	32.0	24.0
	P9	80.0	90.0

P2 through **P8** have automatically been calculated:	**Curvepoint**	**Value 1 fuel**	**Value 2 air**
	P2	38.0	32.3
	P3	44.0	40.5
	P4	50.0	48.8
	P5	56.0	57
	P6	62.0	65.3
	P7	68.0	73.5
	P8	74.0	81.8

Continue the same way with P2 through P9!

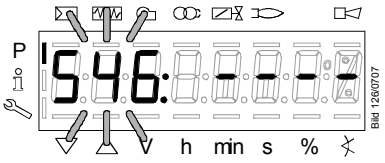
F or A
and
- or +
as well as
F and A
and
- or +



High-fire position **P9** can only be set when symbol ▲ or ▼ is no longer highlighted.
If required, readjust the gas pressure.
For fuel, keep F depressed, for air A, as well as for VSD F and A
Press - or + to adjust the value.
When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P8** can be selected with -.

After setting the high-fire (P9), either a change to parameter 546 (automatic operation) can be made (ESC) or all curvepoints can be run through in the reverse order.
If the gas pressure is changed, all points must be checked and – if required – readjusted.

ESC
- +

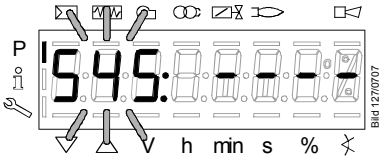


The maximum capacity is displayed.

If the display shows **- - - -**, the maximum capacity has not yet been specified.
The system can be run up to 100%.

You can press i/reset to go to editing mode, enabling you to change the maximum capacity.

To the next parameter +



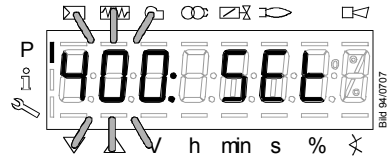
The minimum capacity is displayed.

If the display shows **- - - -**, the minimum capacity has not yet been entered.
The system can be run down to 20%.

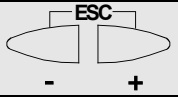
You can press i/reset to go to editing mode, enabling you to change the minimum capacity.

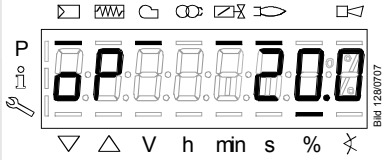
ESC
- +
Completing parameterization of the curve

-
Back to the previous parameter



When symbol ▼ or ▲ is no longer highlighted, you can press **ESC** a second time.





The warm settings for fuel-air ratio control by the LMV36... are now completed.

27.11.5 Warm settings for modulating mode («G mod pneu», «Gp1 mod pneu» and «Gp2 mod pneu»)

Note
Refer to chapter *Warm settings for modulating mode («G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)*! Here, only the air requires adjustment with A.

27.11.6 Cold settings for «G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»

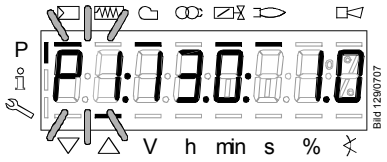
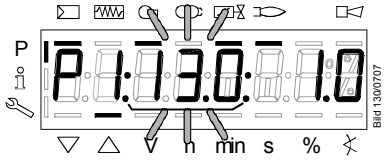
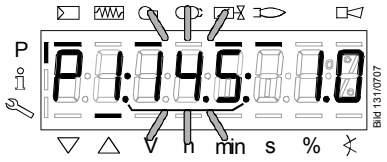
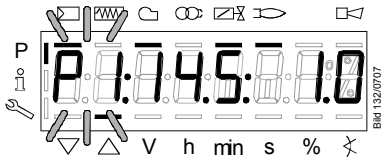
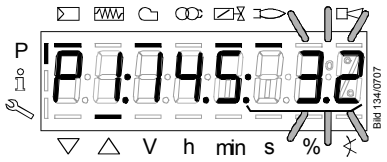
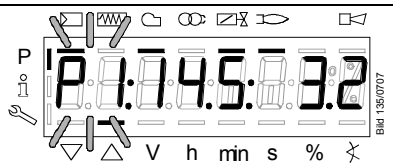
Note
Refer to chapter *Warm settings for modulating mode («G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)*!
With no flame, however, no actuator travel and no automatic operation after the settings have been made.

27.11.7 Cold settings for «G mod pneu», «Gp1 mod pneu» and «Gp2 mod pneu»

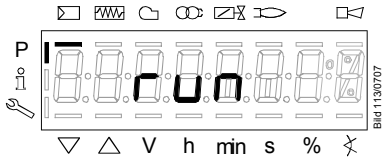
Note
Refer to chapter *Warm settings for modulating mode («G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)*!
With no flame, however, no actuator travel and no automatic operation after the settings have been made. Here, only the air requires adjustment with A.

27.11.8 Interpolation of curvepoints

Note
Changing a curvepoint in the cold position requires a new approach to all curvepoints in the warm position to verify the change on the burner itself. After changing the curvepoint, the normal display of the AZL2... shows **OFF UPR0 / OFF UPR1**.

To the next curvepoint	- **or** +	to select the curvepoint
		The selected curvepoint is displayed.
F		Keep F depressed. The fuel actuator has been selected for changing.
F and - or +		Keep F depressed and press - or + to adjust the fuel actuator. In the case of warm settings, the actuator follows directly the adjustments made. The changes are saved.
		After releasing F, the point is selected again.
A		Keep A depressed. The air actuator has been selected for editing.
A and - or +		Keep A depressed and press - or + to adjust the air actuator. In the case of warm settings, the actuator follows directly the adjustments made. The changes are saved.
		After releasing A, the point is selected again.
To the next curvepoint	+ -	Back to the previous curvepoint

27.11.9 Interpolating the curvepoints



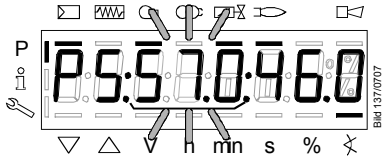
Identification of start for setting the curve parameters.

Example 1 = gas modulating

P0, **P1** and **P9** are set as described:	**Curvepoint**	**Value 1 fuel**	**Value 2 air**
	P0	30.0	22.0
	P1	32.0	24.0
	P9	80.0	90.0

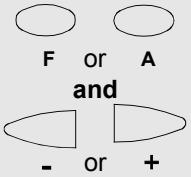
P2 through **P8** have automatically been calculated:	**Curvepoint**	**Value 1 fuel**	**Value 2 air**
	P2	38.0	32.3
	P3	44.0	40.5
	P4	50.0	48.8
	P5	56.0	57
	P6	62.0	65.3
	P7	68.0	73.5
	P8	74.0	81.8

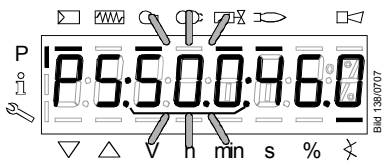
P5 shall now be changed:



Keep F or A depressed.

Example: F





Press - or + to change the value as required.

Example: 50.0

F and A
and
- or **+**

Press **-** or **+** to change the value as required.

Example: **00.0**

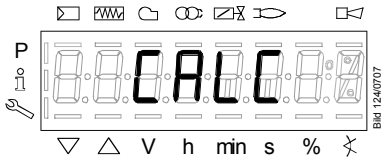
F or A

Release F or A .

The required value is adopted.

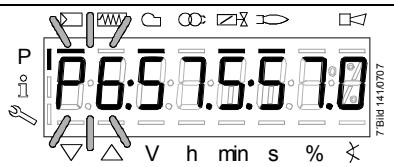
Example: **P5:50.0:46.0**

+
>3 s



Keep **+** depressed for >3 s.

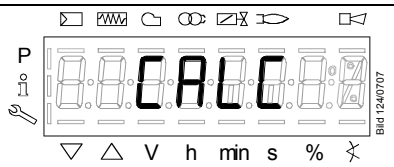
CALC appears.



The display jumps to **P6**.

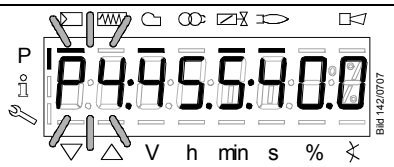
All curvepoints from **P5 to P9** have now been automatically recalculated (linear interpolation):	**Curvepoint**	**Value 1 fuel**	**Value 2 air**
	P5	50.0	46.0
	P6	57.5	57.0
	P7	65.0	68.0
	P8	72.0	79.0
	P9	80.0	90.0

-
>3 s



Keep **-** depressed for >3 s.

CALC appears.



The display jumps to **P4**.

All curvepoints from **P1 to P5** have now been automatically recalculated (linear interpolation):	**Curvepoint**	**Value 1 fuel**	**Value 2 air**
	P5	50.0	46.0
	P4	45.5	40.0
	P3	41.0	35.0
	P2	36.5	29.5
	P1	32.0	24.0

If it is not only the current curvepoint that shall be changed, but all other points in the direction of travel as well, a new straight line from the current point to **P9** (press +) or **P1** (press -) can be calculated by a long push on - or + .

Display **CALC**

Example of presentation

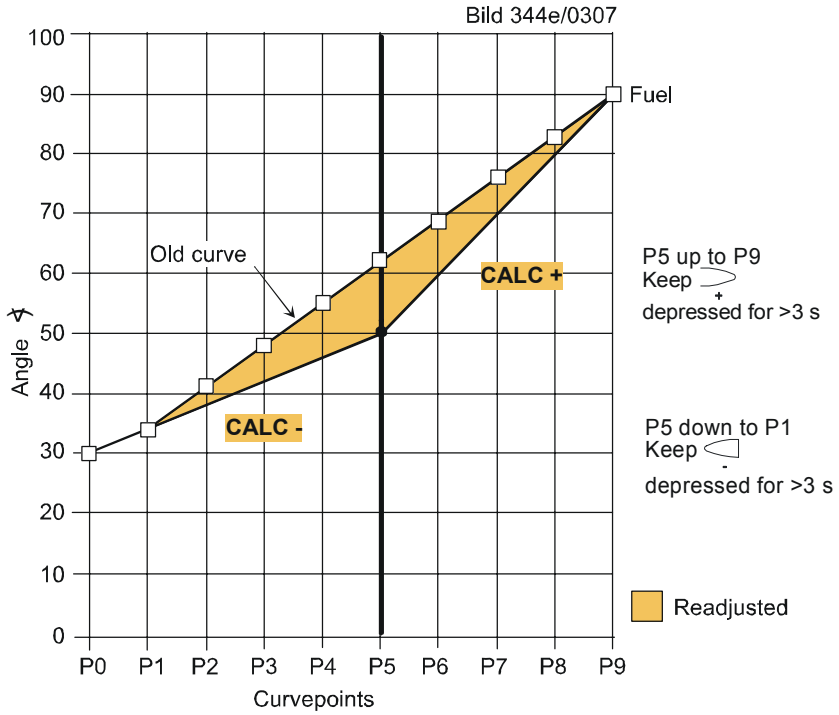
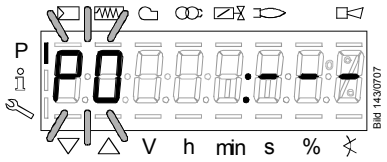
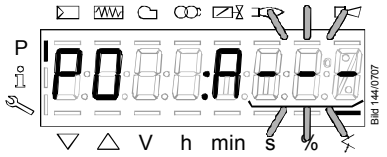
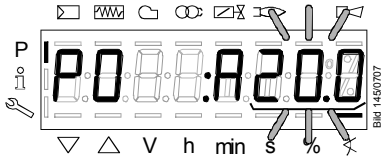
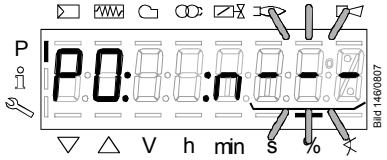
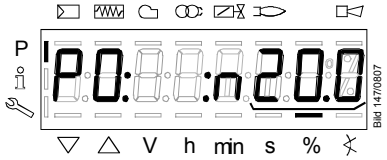
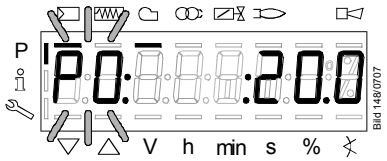
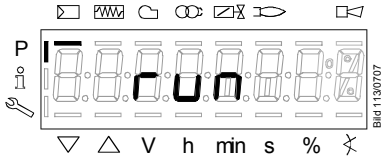


Figure 75: Changing several curvepoints

Note
Due to interpolation, a number of curvepoints change. The curvepoints changed must be approached while using the warm settings to be able to make a check on the burner. If these points have not yet been completely approached, the normal display of the AZL2... shows **OFF UPR 0 / OFF UPR1**.

27.11.10 Setting of curvepoints for multistage mode («Lo 2-stage» and «Lo 3-stage»)

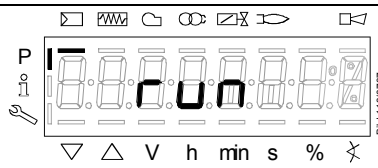
Example of «Lo 2-stage»

		**P0** appears blinking. Curvepoint for ignition load.
A		Keep A depressed. You are now at **P0** of air actuator **A**.
A and - or +		Press simultaneously A and - or + to adjust ignition position **P0** of the air actuator. Example: **20.0**
F and A		Keep F and A depressed. You are now at **n0** of the VSD.
F and A and - or +		Press simultaneously F and A and - or + to adjust speed **n0** of the VSD. Example: **20.0**
		Now, release A. The selected value is adopted. Example: **20.0**
+		
		Identification of start for setting the curve parameters. The display shows **run Oil0** or **run Oil1**, depending on the type of fuel currently burnt.

Note

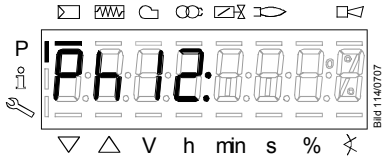
You are now given the choice of proceeding with the warm settings by pressing i/reset (refer to chapter *Warm settings for modulating mode «G mod», «Gp1 mod», «Gp2 mod» and «Lo mod»)*, or with the cold settings by pressing ESC - + (refer to chapter *Cold settings for «G mod», «Gp1 mod», «Gp1 mod», «Gp2 mod» and «Lo mod»*).

27.11.11 Warm settings for «Lo 2-stage» and «Lo 3-stage»

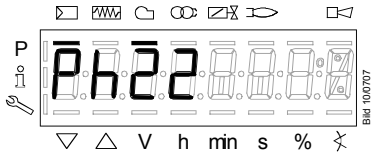


Identification of start for setting the curve parameters.
The display shows **run Oil0** or **run Oil1**, depending on the type of fuel currently burnt.

Provided the controller is enabled!

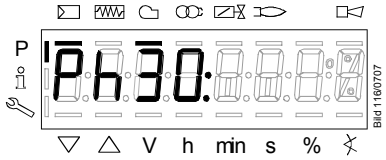


Phase *Standby* (stationary)

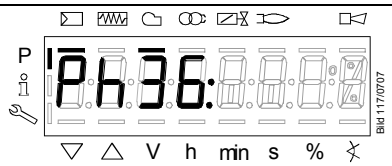


Phase *Fan ramp up*
(fan motor = ON, safety valve = ON)

Phase *Traveling to prepurge position*

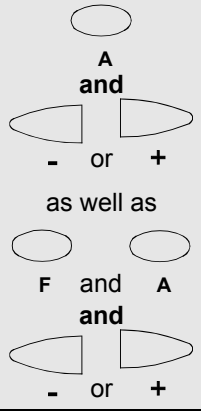


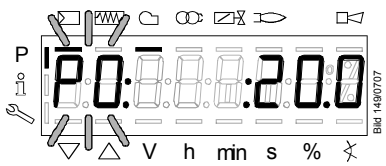
Phase *Prepurging*



Phase *Traveling to ignition position*

Wait until the burner is operating and symbol ▲ or ▼ is no longer highlighted! The startup sequence stops in phase 36 *Traveling to ignition position*. The ignition point can be adjusted under cold conditions.





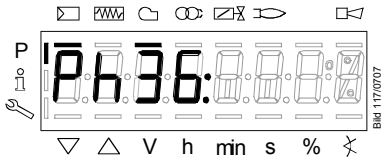
Ignition position **P0** can be set only when symbol ▲ or ▼ is no longer highlighted.

Keep A depressed and, for VSD F and A.

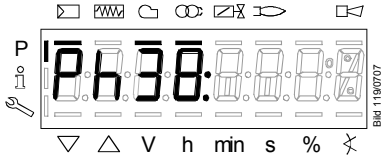
Press - or + to adjust the value.

When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P1** can be selected with + .

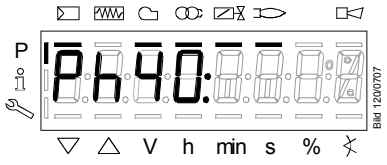
+



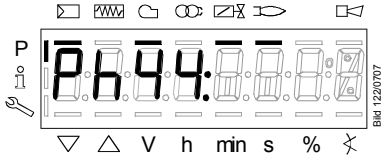
Phase *Traveling to ignition position*



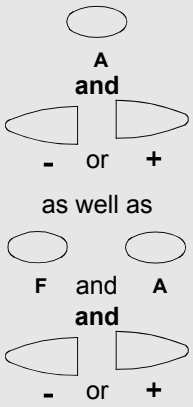
Phase *Preignition*

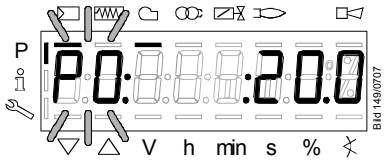


Phase *1st safety time* (ignition transformer ON)



Phase *Interval 1*





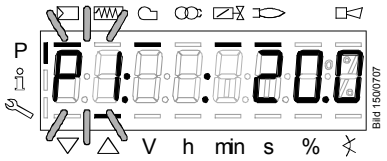
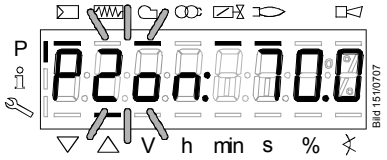
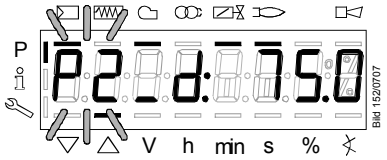
Ignition position **P0** can be set only when symbol ▲ or ▼ is no longer highlighted.

Keep A depressed and, for VSD F and A.

Press - or + to adjust the value.

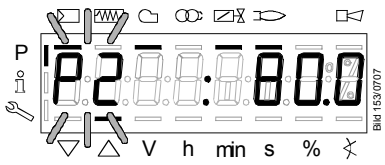
When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P1** can be selected with + .

+

A **and** **-** or **+** as well as **F** and **A** **and** **-** or **+**		Low-fire position **P1** can be set only when symbol ▲ or ▼ is no longer highlighted. Set stage 1 **P1**. Fuel valve **V1** is switched on. Keep A depressed and, for VSD F and A. Press - or + to adjust the value. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P2on** can be selected with +.
To the next curvepoint	**+**	
A **and** **-** or **+** as well as **F** and **A** **and** **-** or **+**		Curvepoint **P2on** can be set only when symbol ▲ or ▼ is no longer highlighted. Set switch-on point stage 2 **P2**. Fuel valve **V2** is still off. Keep A depressed and, for VSD F and A. Adjust the value with - or +. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P2_d** can be selected with +.
To the next curvepoint	**+**	**-** Back to the previous curvepoint
A **and** **-** or **+** as well as **F** and **A** **and** **-** or **+**		Curvepoint **P2_d** can be set only when symbol ▲ or ▼ is no longer highlighted. Fuel valve **V2** is still off and the system remains at curvepoint **P2on**. Presetting of operating stage **P2** with no travel, aimed at cutting the operating time if there is shortage of air. Keep A depressed and, for VSD F and A. Press - or + to adjust the value. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P2** can be selected with -.

To the next curvepoint	+	- Back to the previous curvepoint

A and - or + as well as F and A and - or +



Curvepoint **P2** can only be adjusted when symbol ▲ or ▼ is no longer highlighted.

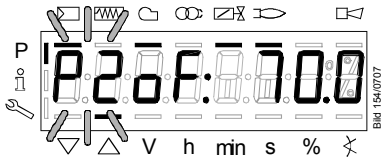
Fuel valve **V2** is switched on.

Keep A depressed and, for VSD F and A.

Press - or + to adjust the value.

When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P2of** can be selected with -.

	-	Back to the previous curvepoint



Curvepoint **P2of** is now adjusted.

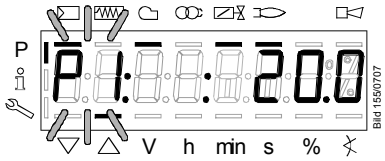
The system remains at P2.

Adjust the switch-off point with no travel.

Now, the point is approached dynamically when traveling from **P2** to **P1**.

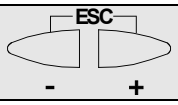
When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P1** can be selected with -.

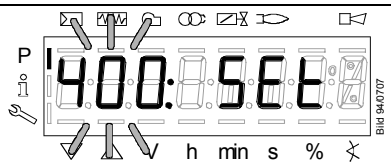
To the next curvepoint	+	- Back to the previous curvepoint



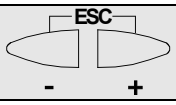
Automatic mode is released when, after reaching **P1**, the curve settings are quit with **ESC**.

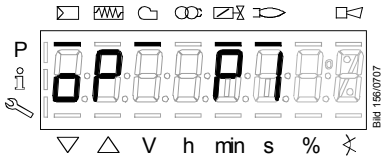
If the settings are aborted earlier (**ESC** or shutdown due to fault), start prevention **OFF UPR0** or **OFF UPR1** is still active until all points are set.





When symbol ▲ or ▼ is no longer highlighted, **ESC** can be pressed a second time.





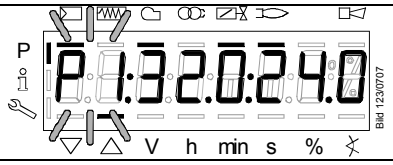
The warm settings for fuel-air ratio control of the LMV36... have now been configured.

27.11.12 Cold settings for multistage mode («Lo 2-stage» and «Lo 3-stage»)

Note
Refer to chapters *Warm settings for «Lo 2-stage» and «Lo 3-stage»*!
But with no flame, no actuator travel and no automatic operation after the settings have been made.

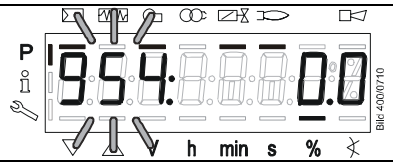
27.11.13 Intensity of flame during curve settings

When setting the curve and the curvepoint is displayed, you can press i/reset to show the intensity of flame. When pressing the button for >1 s, a change to parameter 954 is made; when releasing the button, you return to the curvepoint.

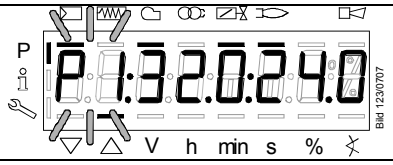


Example: Curvepoint *Low-flame position* **P1.**

Change to parameter **954**



Parameter **954:** flashes.
The intensity of flame in % is shown on the right.
Example: **954: 0.0**



Release i/reset to return to curvepoint *Low-fire position* **P1.**

28 Parameter list LMV36...

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
000	**Internal parameters**								
041	Password heating engineer (4 characters)	1	Std_u16	Edit	0	65535	1		OEM
042	OEM password (5 characters)	1	Std_u16	Edit	0	65535	1		OEM
050	Backup / Restore via AZL2... / PC tool starting (parameterizing on 1) Index 0 = store backup Index 1 = start restore Error diagnostic via negative value (refer to error code 137)	2	Std_s8	Edit	-99	2	1	0; 0	SO
055	Burner ID of AZL2... backup data record	1	Std_s32	Read only	0	99999999	1	0	SO
056	ASN summary of AZL2... backup data record	8	Std_u8	Read only	0	127	1	0	SO
057	Software version when setting the AZL2... backup data record	1	Hex_16	Read only	0x100	0xFFF9	1	0	SO

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
100	**General**								
102	Identification date	1	Date	Read only	0	255	1		Info / Service
103	Identification number	1	Std_u16	Read only	0	65535	1		Info / Service
104	Preselected parameter set: Customer code	1	Std_u8	Read only	0	255	1	9	Info / Service
105	Preselected parameter set: Version	1	Hex_16	Read only	0	0xFFFF	1	V 01.05	Info / Service
107	Software version	1	Hex_16	Read only	0x100	0xFFF9	1	V 03.30	Info / Service
108	Software variant	1	Std_u8	Read only	0	255	1	2	Info / Service
111	ASN summary for verification with AZL2... backup data restore	8	Std_u8	Read only	0	127	1	0	SO
113	Burner identification	1	Std_s32	Edit	0	99999999	1	undefined	Info / Service Password level write: SO
121	Manual output Undefined = automatic mode	1	Output	Edit / clear	0%	100%	0.1%	undefined	Info / Service
123	Minimum output positioning step Index 0 = output building automation Index 1 = output external load controller analog Index 2 = reserved	3	Output	Edit	0 %	100 %	0.1 %	0 %; 1 %; 0 %	SO
124	Loss of flame test (TÜV test) starting (parameterized on 1) (switch off the fuel valves → loss of flame) Error diagnostic via negative value (refer to error code 150)	1	Std_s8	Edit	-6	1	1	0	SO
125	Mains frequency 0 = 50 Hz 1 = 60 Hz	1	Selection	Edit	0	1	1	0	SO
126	Display brightness	1	Std_u8	Edit	0%	100%	1%	100 %	SO
127	Timeout for menu operation	1	Std_u8	Edit	10 min	120 min	1 min	60 min	OEM
128	Fuel meter: Pulse valency [pulses / volume unit]	1	Std_u16	Edit	0	400	0.01	0	SO
129	Fuel meter 1: Pulse valency [pulse / unit of volume]	1	Std_U16	Edit	0	400	0.01	0	SO

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
130	Delete display of error history To delete the display: Set parameter to 1, then to 2 Return value 0: Job successfully completed Return value -1: Timeout of 1_2 sequence	1	Std_s8	Edit	-5	2	1	0	SO
133	Default output at TÜV test Invalid = TÜV test at active output 2000...10000 = low-fire...high-fire or stage 1 / stage 2 / stage 3	1	Output	Edit / clear	20 %	100 %	0.1 %	Undefined	SO
134	Fuel 1: Default output at TÜV test Invalid = TÜV test at active output 2000...10000 = low-fire...high-fire or stage 1 / stage 2 / stage 3	1	Output	Edit / clear	20 %	100 %	0.1 %	Undefined	SO
141	Operating mode BACS 0 = off 1 = Modbus 2 = reserved	1	Selection	Edit	0	2	1	0	SO
142	Setback time in the event of communication breakdown Setting value: 0 = inactive 1…7200 s	1	Std_u16	Edit	0 s	7200 s	1 s	120 s	SO (BA)
143	reserved	1	Std_u8	Edit	1	8	1	1	Info / Service
144	reserved	1	Std_u16	Edit	10 s	60 s	1 s	30 s	SO
145	Device address for Modbus of basic unit Setting value: 1…247	1	Std_u8	Edit	1	247	1	1	SO
146	Setting of Baud rate for Modbus communication Setting values 0 = 9600 1 = 19200	1	Selection	Edit	0	1	1	1	SO

Par. No.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
147	Setting of parity for Modbus communication Setting value 0 = none 1 = odd 2 = even	1	Selection	Edit	0	2	1	0	SO
148	Default output if communication with building automation is interrupted Setting values For **modulation operation** the setting range is as follows: 0…19.9 = burner off 20…100 = 20…100% burner rating For **multistage operation** apply to setting range: 0 = burner OFF, P1, P2, P3 Invalid = no default output predefined by building automation Default setting: *Invalid*	1	Output	Edit / clear	0%	100%	0.1%	undefined	SO (BA)

Par. No.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
149	Fuel 1: Default output if communication with building automation is interrupted Setting values For **modulation operation** the setting range is as follows: 0…19.9 = burner off 20…100 = 20…100% burner rating For **multistage operation** apply to setting range: 0 = burner OFF, P1, P2, P3 Invalid = no default output predefined by building automation Default setting: *Invalid*	1	Output	Edit / clear	0%	100%	0.1%	undefined	SO (BA)
161	Number of faults	1	Std_u16	Read only	0	65535	1	0	Info / Service
162	Operating hours resettable	1	Std_s32	Reset	0 h	9999999 h	1 h	0 h	Info / Service
163	Operating hours when unit is live	1	Std_s32	Read only	0 h	9999999 h	1 h	0 h	Info / Service
164	Number of startups resettable	1	Std_s32	Reset	0	9999999	1	0	Info / Service
165	Number of startups	1	Std_s32	Read only	0	9999999	1	0	Info / Service
166	Total number of startups	1	Std_s32	Read only	0	9999999	1	0	Info / Service
167	Fuel volume resettable [m³, l, ft³, gal]	1	Std_s32	Reset	0	99999999	1	0	Info / Service
172	Fuel 1: Operation hours resettable	1	Std_s32	Reset	0 h	9999999 h	1 h	0 h	Info / Service
174	Fuel 1: Number of startups resettable	1	Std_s32	Reset	0	9999999	1	0	Info / Service
175	Fuel 1: Number of startups	1	Std_s32	Read only	0	9999999	1	0	Info / Service
177	Fuel 1: Fuel volume resettable (m³, l, ft³, gal)	1	Std_s32	Reset	0	99999999	1	0	Info / Service
186	Software drop out delay of flame signal (100 ms) Index = = QRB... (0 = inactive, >1) Index 1 = ION / QRA... (0 = inactive, >3 - only 200 ms-steps)	2	Std_u8	Edit	0	20	1	0; 0	OEM
187	Fuel 1: Software drop out delay of flame signal (100 ms) Index = = QRB... (0 = inactive, >1) Index 1 = ION / QRA... (0 = inactive, >3 - only 200 ms-steps)	2	Std_u8	Edit	0	20	1	0; 0	OEM

Par. No.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
200	**Basic unit**								
201	Burner operating mode (fuel train, modulating / multistage, actuators, etc.) -- = undefined (delete curves) 1 = G mod 2 = Gp1 mod 3 = Gp2 mod 4 = Lo mod 5 = Lo 2-stage 6 = Lo 3-stage 7 = G mod pneu 8 = Gp1 mod pneu 9 = Gp2 mod pneu 10 = LoGp mod 11 = LoGp 2-stage 12 = Lo mod 2 fuel valves 13 = LoGp mod 2 fuel valves 14 = G mod pneu without actuator 15 = Gp1 mod pneu without actuator 16 = Gp2 mod pneu without actuator 17 = Lo 2-stage without actuator 18 = Lo 3-stage without actuator 19 = G mod gas actuator only 20 = Gp1 mod gas actuator only 21 = Gp2 mod gas actuator only 22 = Lo mod oil actuator only	1	Selection	Edit / clear	1	22	1	undefined	SO
204	Analog output invalid (4...20 mA) 0 = Default output load-fire 1 = Safety shutdown + prevention of startup	1	Std_U8	Edit	0	1	1	1	SO
208	Program stop 0 = inactive 1 = PrePurgP (Ph24) 2 = IgnitPos (Ph36) 3 = interval 1 (Ph44) 4 = interval 2 (Ph52)	1	Selection	Edit	0	4	1	0	SO (BA)

Par. No.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
210	Alarm in the event of start prevention 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	SO
211	Fan ramp up time	1	Time	Edit	2 s	60 s	0.2 s	2 s	SO
212	Max. time down to low-fire	1	Time	Edit	0.2 s	10 min	0.2 s	45 s	SO
213	Waiting time home run	1	Time	Edit	2 s	60 s	0.2 s	2 s	OEM
214	Max. time start release	1	Time	Edit	0.2 s	10 min	0.2 s	35 s	OEM
215	Repetition limit safety loop 1 = no repetition 2...15 = number of repetitions 16 = constant repetition	1	Std_u8	Edit	1	16	1	1	SO
217	Max. waiting time for detection of detector or pressure signal (e.g. home run, preignition «Lo»)	1	Time	Edit	5 s	10 min	0.2 s	30 s	OEM
221	Gas: Active detector flame evaluation 0 = QRB 1 = ION / QRA	1	Selection	Edit	0	1	1	1	SO
222	Gas: Prepurging 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	SO
223	Repetition limit gas pressure switch-min 1 = no repetition 2...15 = number of repetitions 16 = constant repetition	1	Std_u8	Edit	1	16	1	1	SO
225	Gas: Prepurge time	1	Time	Edit	20 s	60 min	0,2 s	30 s	SO
226	Gas: Preignition time	1	Time	Edit	0.4 s	60 min	0,2 s	2 s	SO
227	Gas: Safety time 1 (TSA1)	1	Time	Edit	1 s	10 s	0,2 s	5 s	OEM
229	Gas: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)	1	Time	Edit	0.4 s	9.6 s	0,2 s	1,8 s	OEM
230	Gas: Interval 1	1	Time	Edit	0.4 s	60 s	0,2 s	2 s	SO
231	Gas: Safety time 2 (TSA2)	1	Time	Edit	1 s	10 s	0,2 s	7 s	OEM
232	Gas: Interval 2	1	Time	Edit	0.4 s	60 s	0,2 s	2 s	SO
233	Gas: Afterburn time	1	Time	Edit	0.2 s	60 s	0.2 s	8 s	SO
234	Gas: Postpurge time (no extraneous light test)	1	Time	Edit	0.2 s	108 min	0.2 s	15 s	SO

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
236	Gas: Pressure switch-min input 0 = inactive 1 = pressure switch-min (before fuel valve 1 (V1)) 2 = valve proving via pressure switch-min (between fuel valve 1 (V1) and fuel valve 2 (V2))	1	Selection	Edit	1	2	1	1	SO
237	Gas: Pressure switch-max / POC input 0 = inactive 1 = pressure switch-max 2 = POC	1	Selection	Edit	1	3	1	1	SO
239	Gas. Forced intermittent operation 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	SO
240	Repetition limit loss of flame 1 = no repetition 2 = 1 repetition	1	Std_u8	Edit	1	2	1	1	OEM
241	Gas: Execution valve proving 0 = no valve proving 1 = valve proving on startup 2 = valve proving on shutdown 3 = valve proving on startup and shutdown	1	Selection	Edit	0	3	1	0	SO
242	Gas: Valve proving evacuation time	1	Time	Edit	0.2 s	10 s	0.2 s	3 s	OEM
243	Gas: Valve proving time test atmospheric pressure	1	Time	Edit	0.2 s	60 s	0.2 s	10 s	OEM
244	Gas: Valve proving filling time	1	Time	Edit	0.2 s	10 s	0.2 s	3 s	OEM
245	Gas: Valve proving time test gas pressure	1	Time	Edit	0.2 s	60 s	0.2 s	10 s	OEM
246	Gas: Waiting time gas shortage	1	Time	Edit	0.2 s	60 s	0.2 s	10 s	OEM
248	Gas: Postpurge time (t3) (abortion if load controller On)	1	Time	Edit	1 s	108 min	0.2 s	1 s	SO
261	Oil: Active detector of flame evaluation 0 = QRB 1 = ION / QRA	1	Selection	Edit	0	1	1	0	SO
262	Oil: Prepurging 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	OEM
265	Oil: Prepurge time	1	Time	Edit	15 s	60 min	0.2 s	30 s	SO
266	Oil: Preignition time	1	Time	Edit	0.6 s	60 min	0,2 s	2 s	SO
267	Oil: Safety time 1 (TSA1)	1	Time	Edit	1 s	15 s	0,2 s	5 s	OEM

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Max	Resolution	Default setting	Password level
269	Oil: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)	1	Time	Edit	0.4 s	14.6 s	0,2 s	1,8 s	OEM
270	Oil: Interval 1	1	Time	Edit	0.4 s	60 min	0,2 s	2 s	SO
271	Oil: Safety time 2 (TSA2)	1	Time	Edit	1 s	15 s	0,2 s	10 s	OEM
272	Oil: Interval 2	1	Time	Edit	0.4 s	60 min	0,2 s	2 s	SO
273	Oil: Afterburn time	1	Time	Edit	0.2 s	60 s	0.2 s	8 s	SO
274	Oil: Postpurge time (no extraneous light test)	1	Time	Edit	0.2 s	108 min	0.2 s	15 s	SO
276	Oil: Pressure switch-min input 0 = inactive 1 = active from phase 38 2 = active from safety time (TSA)	1	Selection	Edit	1	2	1	1	SO
277	Oil: Pressure switch-max/POC input 0 = inactive 1 = pressure switch-max 2 = POC	1	Selection	Edit	1	2	1	1	SO
279	Oil: Forced intermittent operation 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	SO
280	Repetition limit value loss of flame 1 = no repetition 2 = 1 repetition	1	Std_u8	Edit	1	2	1	2	OEM
281	Oil: Point in time oil is ignited 0 = short preignition (Ph38) 1 = long preignition (with fan) (Ph22)	1	Selection	Edit	0	1	1	0	SO
284	Oil: Postpurge time 3 (abortion if load controller On)	1	Time	Edit	1 s	108 min	0.2 s	1 s	SO
285	Oil: gas pressure switch-min with «Lo Gp» 0 = inactive 1 = active	1	Selection	Edit	0	1	1	0	SO

Par. No.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
300	**Basic unit**								
301	Fuel 1: Burner operating mode (fuel train, modulating / multistage, actuators, etc.) -- = undefined (delete curves) 1 = G mod 2 = Gp1 mod 3 = Gp2 mod 4 = Lo mod 5 = Lo 2-stage 6 = Lo 3-stage 7 = G mod pneu 8 = Gp1 mod pneu 9 = Gp2 mod pneu 10 = LoGp mod 11 = LoGp 2-stage 12 = Lo mod 2 fuel valves 13 = LoGp mod 2 fuel valves 14 = G mod pneu without actuator 15 = Gp1 mod pneu without actuator 16 = Gp2 mod pneu without actuator 17 = Lo 2-stage without actuator 18 = Lo 3-stage without actuator 19 = G mod gas actuator only 20 = Gp1 mod gas actuator only 21 = Gp2 mod gas actuator only 22 = Lo mod oil actuator only	1	Selection	Edit / clear	1	22	1	Undefined	SO
321	Fuel 1 gas: Active detector of flame evaluation 0 = QRB 1 = ION / QRA	1	Selection	Edit	0	1	1	1	SO
322	Fuel 1 gas: Prepurging 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	SO
323	Repetition limit value gas pressure switch-min 1 = no repetition 2...15 = number of repetitions 16 = constant repetition	1	Std_u8	Edit	1	16	1	1	SO
325	Fuel 1 gas: Prepurge time	1	Time	Edit	20 s	60 min	0.2 s	30 s	SO
326	Fuel 1 gas: Preignition time	1	Time	Edit	0.4 s	60 min	0.2 s	2 s	SO

Par. No.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
327	Fuel 1 gas: Safety time 1 (TSA1)	1	Time	Edit	1 s	10 s	0.2 s	5 s	OEM
329	Fuel 1 gas: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)	1	Time	Edit	0.4 s	9.6 s	0.2 s	1.8 s	OEM
330	Fuel 1 gas: Interval 1	1	Time	Edit	0.4 s	60 s	0.2 s	2 s	SO
331	Fuel 1 gas: Safety time 2 (TSA2)	1	Time	Edit	1 s	10 s	0.2 s	7 s	OEM
332	Fuel 1 gas: Interval 2	1	Time	Edit	0.4 s	60 s	0.2 s	2 s	SO
333	Fuel 1 gas: Afterburn time	1	Time	Edit	0.2 s	60 s	0.2 s	8 s	SO
334	Fuel 1 gas: Postpurge time (no extraneous light test)	1	Time	Edit	0.2 s	108 min	0.2 s	15 s	SO
336	Fuel 1 gas: Pressure switch-min input 0 = inactive 1 = pressure switch-min (before fuel valve 1 (V1)) 2 = valve proving via pressure switch-min (between fuel valve 1 (V1) and fuel valve 2 (V2))	1	Selection	Edit	1	2	1	1	SO
337	Fuel 1 gas: Pressure switch-max / POC input 0 = inactive 1 = Pressure switch-max 2 = POC	1	Selection	Edit	1	3	1	2	SO
339	Fuel 1 gas. Forced intermittent operation 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	SO
340	Repetition limit value loss of flame 1 = no repetition 2 = 1 repetition	1	Std_u8	Edit	1	2	1	1	OEM
341	Fuel 1 gas: Execution valve proving 0 = no valve proving 1 = valve proving on startup 2 = valve proving on shutdown 3 = valve proving on startup and shutdown	1	Selection	Edit	0	3	1	0	SO
342	Fuel 1 gas: Valve proving evacuation time	1	Time	Edit	0.2 s	10 s	0.2 s	3 s	OEM
343	Fuel 1 gas: Valve proving time test atmospheric pressure	1	Time	Edit	0.2 s	60 s	0.2 s	10 s	OEM
344	Fuel 1 gas: Valve proving filling time	1	Time	Edit	0.2 s	10 s	0.2 s	3 s	OEM
345	Fuel 1 gas: Valve proving time test gas pressure	1	Time	Edit	0.2 s	60 s	0.2 s	10 s	OEM
346	Fuel 1 gas: Waiting time gas shortage	1	Time	Edit	0.2 s	60 s	0.2 s	10 s	OEM
348	Fuel 1 gas: Postpurge time (t3) (abortion if load controller ON)	1	Time	Edit	1 s	108 min	0.2 s	1 s	SO

Par. No.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
361	Fuel 1 oil: Active detector of flame evaluation 0 = QRB 1 = ION / QRA	1	Selection	Edit	0	1	1	1	SO
362	Fuel 1 oil: Prepurging 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	OEM
365	Fuel 1 oil: Prepurge time	1	Time	Edit	15 s	60 min	0.2 s	30 s	SO
366	Fuel 1 oil: Preignition time	1	Time	Edit	0.6 s	60 min	0.2 s	2 s	SO
367	Fuel 1 oil: Safety time 1 (TSA1)	1	Time	Edit	1 s	15 s	0.2 s	5 s	OEM
369	Fuel 1 oil: Time to respond to pressure faults within safety time 1 (TSA1) and safety time 2 (TSA2)	1	Time	Edit	0.4 s	14.6 s	0.2 s	1.8 s	OEM
370	Fuel 1 oil: Interval 1	1	Time	Edit	0.4 s	60 min	0.2 s	2 s	SO
371	Fuel 1 oil: Safety time 2 (TSA2)	1	Time	Edit	1 s	15 s	0.2 s	10 s	OEM
372	Fuel 1 oil: Interval 2	1	Time	Edit	0.4 s	60 min	0.2 s	2 s	SO
373	Fuel 1 oil: Afterburn time	1	Time	Edit	0.2 s	60 s	0.2 s	8 s	SO
374	Fuel 1 oil: Postpurge time (no extraneous light test)	1	Time	Edit	0.2 s	108 min	0.2 s	15 s	SO
376	Fuel 1 oil: Pressure switch-min input 0 = inactive 1 = active from phase 38 2 = active from safety time (TSA)	1	Selection	Edit	1	2	1	1	SO
377	Fuel 1 oil: Pressure switch-max / POC input 0 = inactive 1 = pressure switch-max 2 = POC	1	Selection	Edit	1	2	1	1	SO
379	Fuel 1 oil: Forced intermittent operation 0 = inactive 1 = active	1	Selection	Edit	0	1	1	1	SO
380	Repetition limit value loss of flame 1 = no repetition 2 = 1 repetition	1	Std_u8	Edit	1	2	1	1	OEM
381	Fuel 1 oil: Point in time oil is ignited 0 = short preignition (Ph38) 1 = long preignition (with fan) (Ph22)	1	Selection	Edit	0	1	1	0	SO
384	Fuel 1 oil: Postpurge time 3 (abortion if load controller ON)	1	Time	Edit	1 s	108 min	0.2 s	1 s	SO

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
400	**Ratio curves**								
401	Ratio control curves fuel actuator (curve setting only)	13	Std_s16	Edit	0 °	90 °	0.1 °	0 °; 0 °; 15 °; undefined	SO
402	Ratio control curves air actuator (curve setting only)	13	Std_s16	Edit	0 °	90 °	0.1 °	0 °; 90 °; 45 °; undefined	SO
403	Ratio control curves VSD (curve setting only)	13	Std_s16	Edit	20%	100%	0.1%	0%; 100%; 50%; undefined	SO
404	Fuel 1: Ratio control curves fuel actuator (curve setting only)	13	Std_s16	Edit	0°	90°	0.1°	0°, 0°, 15°, undefined	SO
405	Fuel 1: Ratio control curves air actuator (curve setting only)	13	Std_s16	Edit	0°	90°	0.1°	0°, 90°, 45°, undefined	SO
406	Fuel 1: Ratio control curves VSD (curve setting only)	13	Std_s16	Edit	20 %	100 %	0.1 %	0 %, 100 %, 50 %, undefined	SO

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
500	**Ratio control**								
501	No-flame positions fuel actuator Index 0 = home position Index 1 = prepurge position Index 2 = postpurge position	3	Std_s16	Edit	0 °	90 °	0.1 °	0 °; 0 °; 15 °	SO
502	No-flame positions air actuator Index 0 = home position Index 1 = prepurge position Index 2 = postpurge position	3	Std_s16	Edit	0 °	90 °	0.1 °	0 °; 90 °; 45 °	SO
503	No-flame speeds VSD Index 0 = no-load speed Index 1 = prepurge speed Index 2 = postpurge speed	3	Std_s16	Edit	0%	100%	0.1%	0%; 100%; 50%	SO
504	Fuel 1: No-flame position fuel actuator Index 0 = home position Index 1 = prepurge position Index 2 = postpurge position	3	Std_s16	Edit	0°	90°	0.1°	0°, 0°, 15°	SO
505	Fuel 1: No-flame position air actuator Index 0 = home position Index 1 = prepurge position Index 2 = postpurge position	3	Std_s16	Edit	0°	90°	0.1°	0°, 90°, 45°	SO
506	Fuel 1: No-flame speed VSD Index 0 = no-load speed Index 1 = prepurge speed Index 2 = postpurge speed	3	Std_s16	Edit	0 %	100 %	0.1 %	0 %, 100 %, 50 %	SO
522	Ramp up	1	Std_u8	Edit	5 s	20 s	1 s	10 s	SO
523	Ramp down	1	Std_u8	Edit	5 s	20 s	1 s	10 s	SO
542	Activation of VSD / PWM fan 0 = inactive 1 = active	1	Selection	Edit	0	1	1	0	SO
545	Lower output limit undefined = 20 %	1	Output	Edit / clear	20%	100%	0.1%	undefined	SO (BA)

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
546	Upper output limit undefined = 100 %	1	Output	Edit / clear	20%	100%	0.1%	undefined	SO (BA)
565	Fuel 1: Lower output limit undefined = 20 %	1	Output	Edit	20 %	100 %	0.1 %	Undefined	SO (BA)
566	Fuel 1: Upper output limit undefined = 100 %	1	Output	Edit	20 %	100 %	0.1 %	Undefined	SO (BA)

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
600	**Actuators**								
601	Selection of reference point Index 0 = fuel Index 1 = air 0 = closed (<0°) 1 = open (>90°)	2	Selection	Edit	0	1	1	1; 0	OEM
602	Actuator's direction of rotation Index 0 = fuel Index 1 = air 0 = counterclockwise 1 = clockwise (exclusively for SQM3...)	2	Selection	Edit	0	1	1	0; 0	OEM
606	Tolerance limit of position monitoring [0.1°] Index 0 = fuel Index 1 = air Greatest position error where a fault is securely detected → error detection band: (P606-0.6°) to P606	2	Std_u8	Edit	0.5 °	4°	0,1°	1.7°; 1.7°	SO Password level write: OEM
608	Fuel 1: Selection of reference point 0 = closed (<0°) 1 = open (>90°)	1	Std_u8	Edit	0	1	1	1	OEM
609	Fuel 1: Actuator's direction of rotation 0 = counterclockwise 1 = clockwise (exclusively for SQM3...)	1	Std_u8	Edit	0	1	1	0	OEM
610	Fuel 1: Tolerance limit of position monitoring (0.1°) Index 0 = fuel Index 1 = air Greatest position error where an error is securely detected → Error detection band: (P606 -0.6°) up to P606	1	Std_u8	Edit	0°	4°	0.1°	1.7°	SO
611	Type of reference Index 0 = fuel Index 1 = air 0 = standard 1 = range stop in the usable range 2 = internal range stop (SQN1…) 3 = both	2	Std_u8	Edit	0	3	1	0; 0	OEM

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
612	Fuel 1: Type of reference for fuel actuator 0 = standard 1 = range stop in the usable range 2 = internal range stop (SQN1…) 3 = both	1	Std_u8	Edit	0	3	1	0	OEM
641	Control of speed standardization of VSD Error diagnostics of negative values (refer to error code 82) 0 = no speed standardization 1 = speed standardization active	1	Std_s8	Edit	-25	1	1	0	SO
642	Standardized speed Index 0 = speed 1 Index 1 = speed 2 (internal monitoring)	2	Std_u16	Read only	650	6500	0.1	undefined	SO
645	Configuration of analog output 0 = DC 0...10 V 1 = DC 2...10 V 2 = DC 0/2...10 V	1	Std_u8	Edit	0	2	1	0	SO

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
700	**Error history**								
701	Error history: 701-725.01.Code	25	Std_u8	Read only	0	255	1	0	Info / Service
•	Error history: 701-725.02.Diagnostic code	25	Std_u8	Read only	0	255	1	0	Info / Service
•	Error history: 701-725.03.Error class	25	Std_u8	Read only	0	6	1	0	Info / Service
•	Error history: 701-725.04.Phase	25	Std_u8	Read only	0	255	1	0	Info / Service
•	Error history: 701-725.05.Startup counter	25	Std_s32	Read only	0	99999999	1	0	Info / Service
•	Error history: 701-725.06.Output	25	Output	Read only	0%	100%	0.1%	0%	Info / Service
725	Error history: 701-725.07.Fuel	25	Std_u8	Read only	0	255	1	0	Info / Service

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
900	**Process data**								
903	Current output Index 0 = fuel Index 1 = air	2	Output	Read only	0%	100%	0.1%	0%	Info / Service
922	Incremental position of actuators Index 0 = fuel Index 1 = air	2	Std_s16	Read only	-50°	150°	0.01°	0°	Info / Service
935	Absolute speed	1	Std_u16	Read only	0	6553.5	0.1	0	SO
936	Standardized speed	1	Std_s16	Read only	-200%	200%	0.1%	0%	Info / Service
942	Active load source 1 = output during curve settings 2 = manual output 3 = default output via building automation 4 = default output via analog input 5 = external load controller via contacts	1	Selection	Read only	0	255	1	0	SO
945	Actual fuel 0 = fuel 0 1 = fuel 1	1	Std_u8	Read only	0	255	1	0	Info / Service
947	Results of contact release (bit-coded) Bit 0.0 = 1: pressure switch-min Bit 0.1 = 2: pressure switch-max Bit 0.2 = 4: pressure switch valve proving Bit 0.3 = 8: pressure switch air pressure switch Bit 0.4 = 16: internal fuel selection 1 Bit 0.5 = 32: load controller ON Bit 0.6 = 64: internal fuel selection 0 Bit 0.7 = 128: safety loop Bit 1.0 = 1: safety valve Bit 1.1 = 2: ignition Bit 1.2 = 4: fuel valve 1 Bit 1.3 = 8: fuel valve 2 Bit 1.4 = 16: fuel valve 3 / pilot valve Bit 1.5 = 32: reset	2	Std_u8	Read only	0	255	1	0	Info / Service

Par. no.	Parameter LMV36...	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting	Password level
950	Required relay state (bit-coded) Bit 0 = 1: Alarm Bit 1 = 2: Safety valve Bit 2 = 4: Ignition Bit 3 = 8: Fuel valve 1 Bit 4 = 16: Fuel valve 2 Bit 5 = 32: Fuel valve 3 / pilot valve	1	Std_u8	Read only	0	255	1	0	Info / Service
954	Intensity of flame	1	Std_u8	Read only	0%	100%	1%	0%	Info / Service
960	Actual flow rate (m³/h, l/h, ft³/h, gal/h)	1	Std_u16	Read only	0	6553.5	0.1	0	Info / Service
961	Phase (state for external module and display)	1	Std_u8	Read only	0	255	1	0	Info / Service
981	Error memory: Code	1	Std_u8	Read only	0	255	1	0	Info / Service
982	Error memory: Diagnostic code	1	Std_u8	Read only	0	255	1	0	Info / Service
992	Error flags	10	Hex_32	Reset	0	0xFFFFFFFF	1	0	SO

Legend

Std_u8 8 bit integer, not signed

Std_u16 16 bit integer, not signed

Std_u32 32 bit integer, not signed

Std_s8 8 bit integer, signed

Note
This data type is also used to mark an invalid or non-signed value by using the value of **-1**!

Std_s16 16 Bit integer, signed

Note
This data type is also used to mark an invalid or non-signed value by using the value of **-1**!

Std_s32 32 Bit integer, signed

Note
This data type is also used to mark an invalid or non-signed value by using the value of **-1**!

29 Error code list

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
no Comm		**No communication between LMV36... basic unit and AZL2...**	Check wiring for line interruption/loose contact
2	**#**	**No flame at the end of safety time (TSA)**	
	1	*No flame at the end of safety time 1 (TSA1)*	
	2	*No flame at the end of safety time 2 (TSA2)*	
3	**#**	Air pressure failure	
	0	*Air pressure off*	
	1	*Air pressure on*	
	4	*Air pressure on – prevention of startup*	
	20	*Air pressure, combustion pressure – start prevention*	
	68	*Air pressure, POC – start prevention*	
	84	*Air pressure, combustion pressure, POC – start prevention*	
4	**#**	**Extraneous light**	
	0	*Extraneous light during startup*	
	1	*Extraneous light during shutdown*	
	2	*Extraneous light during startup – prevention of startup*	
	6	*Extraneous light during startup, air pressure – start prevention*	
	18	*Extraneous light during startup, combustion pressure – start prevention*	
	24	*Extraneous light during startup, air pressure, combustion pressure – start prevention*	
	66	*Extraneous light during startup, POC – start prevention*	
	70	*Extraneous light during startup, air pressure, POC – start prevention*	
	82	*Extraneous light during startup, combustion pressure, POC – start prevention*	
	86	*Extraneous light during startup, air pressure, combustion pressure, POC – start prevention*	

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
7	**#**	**Loss of flame**	
	0	*Loss of flame*	
	3...255	*Loss of flame due to TÜV test (loss-of-flame test)*	Diagnostics corresponds to the period of time from shutdown of fuel valves to the detection of loss of flame (resolution 0.2 s → Value 5 = 1 s)
12	**#**	**Valve proving**	
	0	*Fuel valve 1 (V1) leaking*	Check to see if valve on the gas side is leaking Check to see if there is a line interruption
	1	*Fuel valve 2 (V2) leaking*	Check to see if valve on the burner side is leaking Check to see if pressure switch for the valve proving is closed when gas pressure is present Check wiring to see if there is a short-circuit
	2	*Valve proving not possible*	Valve proving activated, but DWmin selected as input function for X9-04 (check parameters 238 and 241)
	3	*Valve proving not possible*	Valve proving activated, but no input assigned (check parameters 236 and 237)
	4	*Valve proving not possible*	Valve proving activated, but 2 inputs assigned (set parameter 237 to DWmax or POC)
	5	*Valve proving not possible*	Valve proving activated, but 2 inputs assigned (check parameters 236 and 237)
14	**#**	**POC**	
	0	*POC open*	Check to see if the valve's closing contact is closed
	1	*POC closed*	Check wiring Check to see if the valve's closing contact opens when valve is controlled
	64	*POC open – prevention of startup*	Check wiring to see if there is a line interruption. Check to see if the valve's closing contact is closed
19	*80*	*Combustion pressure, POC – start prevention*	Check to see if pressure switch has closed with no combustion pressure present Check wiring for short-circuit
20	**#**	**Pressure switch-min (Pmin)**	
	0	*No minimum gas / oil pressure*	Check wiring for line interruption
	1	*Gas shortage / prevention of startup*	Check wiring for line interruption
21	*0*	*Pressure switch-max (Pmax): Max. gas / oil pressure exceeded*	Check wiring to see if there is a line interruption. POC: Check to see if the valve's closing contact is closed.

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
22 OFF S	**#**	**Safety loop / burner flange**	
	0	*Safety loop / burner flange open*	
	1	*Safety loop / burner flange open / prevention of startup*	
	3	*Safety loop/burner flange, extraneous light – start prevention*	
	5	*Safety loop/burner flange, air pressure – start prevention*	
	17	*Safety loop/burner flange, combustion pressure – start prevention*	
	19	*Safety loop/burner flange, extraneous light, combustion pressure – start prevention*	
	21	*Safety loop/burner flange, air pressure, combustion pressure – start prevention*	
	23	*Safety loop/burner flange, extraneous light, air pressure, combustion pressure – start prevention*	
	65	*Safety loop/burner flange, POC – start prevention*	
	67	*Safety loop/burner flange, extraneous light, POC – start prevention*	
	69	*Safety loop/burner flange, air pressure, POC – start prevention*	
	71	*Safety loop/burner flange, extraneous light, air pressure, POC – start prevention*	
	81	*Safety loop/burner flange, combustion pressure, POC – start prevention*	
	83	*Safety loop/burner flange, extraneous light, combustion pressure, POC – start prevention*	
	85	*Safety loop/burner flange, air pressure, combustion pressure, POC – start prevention*	
	87	*Safety loop/burner flange, extraneous light, air pressure, combustion pressure, POC – start prevention*	
50	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
51	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
55	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
56	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
57	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
58	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
60	**#**	**Internal error: No valid heat source**	
	1	*Analog output preset valid – prevention of startup*	Check wiring of analog predefined output to see if there is an open-circuit / loose contact
	2	*Analog output preset valid – default output low-fire*	Check wiring of analog predefined output to see if there is an open-circuit / loose contact Note: This information is provided in connection with the thermal shock protection function (manual interruption of 4...20 mA analog input)
61 Fuel Chg	**#**	**Fuel changeover**	
Fuel Chg	*0*	*Fuel 0*	No error - change to Fuel 0
Fuel Chg	*1*	*Fuel 1*	No error - change to Fuel 1
62 Fuel Err	**#**	**Invalid fuel signals / fuel information**	
Fuel Err	*0*	*Invalid fuel selection (Fuel 0 + 1 = 0)*	Check wiring to see if there is an open-circuit Note Curves cannot be set
Fuel Err	*1*	*Different fuel selection between the µCs*	Make a reset; if error occurs repeatedly, replace the unit
Fuel Err	*2*	*Different fuel signals between the µCs*	Make a reset; if error occurs repeatedly, replace the unit
Fuel Err	*3*	*Invalid fuel selection (Fuel 0 + 1 = 1)*	Check wiring for short-circuit Note Curves cannot be set. LMV36...: Optional press reset button >3 seconds.
65	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
66	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
67	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
70	**#**	**Internal error fuel-air ratio control: Position calculation modulating**	
	23	*Output invalid*	No valid output
	26	*Curvepoints undefined*	Adjust the curvepoints for all actuators
71	**#**	**Special position undefined**	
	0	*Home position*	Parameterize the home position for all actuators used
	1	*Prepurge position*	Parameterize the prepurge position for all actuators used
	2	*Postpurge position*	Parameterize the postpurge position for all actuators used
	3	*Ignition position*	Parameterize the ignition position for all actuators used
72	**#**	**Internal error fuel-air ratio control**	Make a reset; if error occurs repeatedly, replace the unit

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
73	**#**	**Internal error fuel-air ratio control: Position calculation multistep**	
	23	*Output invalid*	No valid output
	26	*Curvepoints undefined*	Adjust the curvepoints for all actuators
75	**#**	**Internal error fuel-air ratio control: Data clocking check**	
	1	*Current output different*	
	2	*Target output different*	
	4	*Target positions different*	
	16	*Different positions reached*	Can be caused by different standardized speeds (e.g. after restore of data set) when the VSD is activated → standardize again and check adjustment of the fuel-air ratio control system
76	**#**	**Internal error fuel-air control**	Make a reset; if error occurs repeatedly, replace the unit
80	**#**	**Control range limitation of VSD**	Basic unit could not correct the difference in speed and reached a control range limit. 1. Basic unit is not standardized for this motor → repeat standardization.  **Caution!** **Settings of fuel-air ratio control must be checked!** 2. Ramp time settings of the VSD are not shorter than those of the basic unit (parameters 522, 523). 3. Characteristic of the VSD is not linear. Configuration of the voltage input at the VSD must accord with that of the basic unit (parameter 645). 4. VSD does not follow quickly enough the changes of the basic unit. Check settings of the VSD (input filter, slippage compensation, hiding different speeds)
	1	*Control range limitation at the bottom*	VSD speed was too high
	2	*Control range limitation at the top*	VSD speed was too low
81	*1*	*Interrupt limitation speed input*	Too much electromagnetic interference on the sensor line → improve EMC

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
82	**#**	**Error during VSD's speed standardization**	
	1	*Timeout of standardization (VSD ramp down time too long)*	Timeout at the end of standardization during ramp down of the VSD → Ramp time settings of the VSD are not shorter than those of the basic unit (parameter: 523)
	2	*Storage of standardized speed not successful*	Error during storage of the standardized speed → lock the basic unit, then reset it and repeat the standardization
	3	*Line interruption speed sensor*	Basic unit receives no pulses from the speed sensor: 1. Motor does not turn. 2. Speed sensor is not connected. 3. Speed sensor is not activated by the sensor disk (check distance)
	4	*Speed variation / VSD ramp up time too long / speed below minimum limit for standardization*	Motor has not reached a stable speed after ramp up. 1. Ramp time settings of the VSD are not shorter than those of the basic unit (parameters 522, 523). 2. Characteristic of the VSD is not linear. Configuration of the voltage input at the VSD must accord with that of the basic unit (parameter 645). 3. VSD does not follow quickly enough the changes of the basic unit. Check settings of the VSD (input filter, slippage compensation, hiding different speeds) 4. Speed of VSD lies below the minimum for standardization (650 1/min)
	5	*Wrong direction of rotation*	Motor's direction of rotation is wrong. 1. Motor turns indeed in the wrong direction → change parameterization of the direction of rotation or interchange 2 live conductors. 2. Sensor disk is fitted the wrong way → turn the sensor disk.
	6	*Unplausible sensor signals*	The required pulse pattern (60°, 120°, 180°) has not been correctly identified. 1. Speed sensor does not detect all tappets of the sensor disk → check distance 2. As the motor turns, other metal parts are detected also, in addition to the tappets → improve mounting. 3. Electromagnetic interference on the sensor lines → check cable routing, improve EMC
	7	*Invalid standardized speed*	The standardized speed measured does not lie in the permissible range. → Motor turns too slowly or too fast.
	15	*Speed deviation µC1 + µC2*	The speeds of microcomputer 1 and 2 deviated too much. This can be caused by wrong standardized speeds (e.g. after restoring a data set to a new unit) → repeat standardization and check the fuel-air ratio

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
	20	*Wrong phase of phase manager*	Standardization was made in a wrong phase. Permitted are only phases ≤12 → controller OFF, start standardization again
	21	*Safety loop / burner flange open*	Safety loop or burner flange is open → repeat standardization with safety loop closed
	22	*Air actuator not referenced*	Air actuator has not been referenced or has lost its referencing. 1. Check if the reference position can be approached. 2. Check if actuators have been mixed up. 3. If error only occurs after the start of standardization, the actuator might be overloaded and cannot reach its destination.
	23	*VSD deactivated*	Standardization was started with VSD deactivated → activate the VSD and repeat standardization
	24	*No valid operation mode*	Standardization was started without valid operation mode → activate valid operation mode and repeat standardization
	25	*Pneumatic air-fuel ratio control*	Standardization was started with pneumatic air-fuel ratio control → standardization with pneumatic air-fuel ratio control not possible
	128	*Running command with no preceding standardization*	VSD is controlled but not standardized → make standardization
	255	*No standardized speed available*	Motor turns but is not standardized → make standardization

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
83	**#**	**Speed error VSD**	Required speed has not been reached
	Bit 0 *Valency 1*	*Lower control range limitation of control*	Speed has not been reached because control range limitation has become active → for measures, refer to error code 80
	Bit 1 *Valency 2...3*	*Upper control range limitation of control*	Speed has not been reached because control range limitation has become active → for measures, refer to error code 80
	Bit 2 *Valency 4...7*	*Interruption via disturbance pulses*	Speed has not been reached due to too much electromagnetic interference on the sensor line → for measures, refer to error code 81
	Bit 3 *Valency ≥ 8*	*Curve too steep in terms of ramp speed*	Speed has not been reached because detected curve slope was too steep. 1. With a LMV36... ramp of 20 s, the curve's slope may be a maximum of 10% speed change between 2 curvepoints in modulating mode. With a LMV36... ramp of 10 s, the curve's slope may be a maximum of 20% speed change between 2 curvepoints in modulating mode. With a LMV36... ramp of 5 s, the curve's slope may be a maximum of 40% speed change between 2 curvepoints in modulating mode. → Between the ignition point (P0) and the low-fire point (P1), the speed change in modulating mode may be a maximum of 40%, independent of the LMV36... ramp. 2. The setting of the VSD ramp must be about 20% faster than the ramps in the basic unit (parameters 522, 523).
	Bit 4 *Valency ≥ 16*	*Interruption of speed signal*	No speed detected in spite of control. 1. Check if the motor turns. 2. Check if the speed sensor delivers a signal (LED / check distance from the sensor disk). 3. Check wiring of the VSD.
	Bit 5 *Valency ≥ 32*	*Quick shutdown due to excessive speed deviation*	Speed deviation was for about 1 s >10% outside the anticipated range. 1. Check ramp times of the LMV36... and VSD. 2. Check wiring of the VSD.

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
84	**#**	**Curve slope actuators**	
	Bit 0 *Valency 1*	*VSD: Curve too steep in terms of ramp speed*	1. The curve's slope may be a maximum of 10% speed change between 2 curvepoints in modulating operation, with a LMV36... ramp of 20 seconds The curve's slope may be a maximum of 20% speed change between 2 curvepoints in modulating operation, with a LMV36... ramp of 10 seconds The curve's slope may be a maximum of 40% speed change between 2 curvepoints in modulating operation, with a LMV36... ramp of 5 seconds → Between the ignition point (P0) and the low-fire point (P1), the speed change in modulating mode may be a maximum of 40%, independent of the LMV36... ramp. 2. Setting of the VSD ramp must be about 20% shorter than the ramps in the basic unit (parameters 522 and 523)
	Bit 1 *Valency 2..3*	*Fuel actuator: Curve too steep in terms of ramp rate*	The slope of the curve may be a maximum position change of 31° between 2 curvepoints in modulating mode
	Bit 2 *Valency 4..7*	*Air actuator: Curve too steep in terms of ramp rate*	The slope of the curve may be a maximum position change of 31° between 2 curvepoints in modulating mode
85	**#**	*Referencing error ones actuators*	
	0	*Referencing error of fuel actuator*	Referencing of fuel actuator not successful. Reference point could not be reached. 1. Check to see if actuators have been mixed up 2. Check to see if actuator is locked or overloaded
	1	*Referencing error of air actuator*	Referencing of fuel actuator not successful Reference point could not be reached. 1. Check to see if actuators have been mixed up 2. Check to see if actuator is locked or overloaded
	Bit 7 *Valency ≥ 128*	*Referencing error due to parameter change*	Parameterization of an actuator (e.g. the reference position) has been changed. To trigger new referencing, this error is set
86	**#**	**Error fuel actuator**	
	0	*Position error*	Target position could not be reached within the required tolerance band. → Check to see if actuator is locked or overloaded.
	Bit 0 *Valency 1*	*Line interruption*	*Line interruption* detected at actuator's terminals. → Check wiring (voltage X54 across pin 5 or 6 and pin 2 >0.5 V).
	Bit 3 *Valency ≥8*	*Curve too steep in terms of ramp rate*	The slope of the curve may be a maximum position change of 31° between 2 curvepoints in modulating mode
	Bit 4 *Valency ≥ 16*	*Step deviation in comparison with last referencing*	Actuator was overloaded or mechanically twisted. 1. Check to see if the actuator is blocked somewhere along its working range. 2. Check to see if the torque is sufficient for the application.

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
87	**#**	**Error air actuator**	
	0	*Position error*	Target position could not be reached within the required tolerance band. → Check to see if actuator is locked or overloaded.
	Bit 0 *Valency 1*	*Line interruption*	Line interruption detected at actuator's terminals. → Check wiring (voltage X53 across pin 5 or 6 and pin 2 >0.5 V).
	Bit 3 *Valency ≥ 8*	*Curve too steep in terms of ramp rate*	The slope of the curve may be a maximum position change of 31° between 2 curvepoints in modulating mode
	Bit 4 *Valency ≥ 16*	*Sectional deviation in comparison with last referencing*	Actuator was overloaded or mechanically twisted. 1. Check to see if the actuator is blocked somewhere along its working range. 2. Check to see if the torque is sufficient for the application.
90	**#**	**Internal error basic unit**	
91	**#**	**Internal error basic unit**	
93	**#**	**Error flame signal acquisition**	
	3	*Short-circuit of sensor*	Short-circuit at QRB... 1. Check wiring. 2. Flame detector possibly fault.
95	**#**	**Error relay supervision**	
	3 Ignition transformer *4 Fuel valve 1* *5 Fuel valve 2* *6 Fuel valve 3*	*External power supply NO contact*	Check wiring
96	**#**	**Error relay supervision**	
	3 Ignition transformer *4 Fuel valve 1* *5 Fuel valve 2* *6 Fuel valve 3*	*Relay contacts have welded*	Test the contacts: 1. Unit connected to power: Fan output must be dead. 2. Disconnect power: Disconnect fan. No resistive connection between fan output and neutral conductor allowed. If one of the 2 tests fails, release the unit since contact have definitively welded and safety can no longer be ensured.
97	**#**	**Error relay supervision**	
	0	*Safety relay contacts have welded or external power supply fed to safety relay*	Test the contacts: 1. Unit connected to power: Fan output must be dead. 2. Disconnect power: Disconnect fan. No resistive connection between fan output and neutral conductor allowed. If one of the 2 tests fails, release the unit since contacts have definitively welded and safety can no longer be ensured.

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
98	**#**	**Error relay supervision**	
	2 Safety valve *3 Ignition transformer* *4 Fuel valve 1* *5 Fuel valve 2* *6 Fuel valve 3*	*Relay does not pull in*	Make a reset; if error occurs repeatedly, replace the unit
99	**#**	**Internal error relay control**	Make a reset; if error occurs repeatedly, replace the unit
	3	*Internal error relay control*	Make a reset. If error occurs repeatedly, replace the unit Software version V03.10: If error C:99 D:3 occurs during standardization of the VSD, deactivate temporarily function *Alarm in case of start prevention* (parameter number 210 = 0, when using a release contact) or *interrupt* the controller-ON signal
100	**#**	**Internal error relay control**	Make a reset; if error occurs repeatedly, replace the unit
105	**#**	**Internal error contact sampling**	
	0 Pressure switch-min *1 Pressure switch-max / POC* *2 Pressure switch valve proving* *3 Air pressure* *4 Fuel selection Fuel 1* *5 Load controller on / off* *6 Fuel selection Fuel 0* *7 Safety loop / Burner flange* *8 Safety valve* *9 Ignition transformer* *10 Fuel valve 1* *11 Fuel valve 2* *12 Fuel valve 3* *13 Reset*	*Stuck-At failure*	Can be caused by capacitive loads or supply of DC voltage to the mains voltage inputs. The diagnostic code indicates the input where the problem occurred
106	**#**	**Internal error contact request**	Make a reset; if error occurs repeatedly, replace the unit
107	**#**	**Internal error contact request**	Make a reset; if error occurs repeatedly, replace the unit
108	**#**	**Internal error contact request**	Make a reset; if error occurs repeatedly, replace the unit
110	**#**	**Internal error voltage monitor test**	Make a reset; if error occurs repeatedly, replace the unit
111	**#**	**Power failure**	Mains voltage to low Exchange ratio diagnostics code → voltage value (120 V: 0.843)
112	*0*	*Mains voltage recovery*	Error code for triggering a reset on power restoration (no error)
113	**#**	**Internal error mains voltage supervision**	Make a reset; if error occurs repeatedly, replace the unit
115	**#**	**Internal error system counter**	
116	*0*	*Designed life time exceeded (250´000 startups)*	Warning threshold has been reached. The unit should be replaced

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
117	*0*	*Life time exceeded* *Operation no longer allowed*	Switch-off threshold has been reached
120	*0*	*Interrupt limitation fuel meter input*	Too many disturbance pulses at the fuel meters input → Improve EMC
121	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
122	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
123	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
124	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
125	**#**	**Internal error EEPROM read access**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
126	**#**	**Internal error EEPROM write access**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
127	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
128	*0*	*Internal error EEPROM access - synchronization during initialization*	Make a reset; if error occurs repeatedly, replace the unit
129	**#**	**Internal error EEPROM access – command synchronization**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
130	**#**	**Internal error EEPROM access - timeout**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
131	**#**	**Internal error EEPROM access - page on abort**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
132	**#**	**Internal error EEPROM register initialization**	Make a reset; if error occurs repeatedly, replace the unit
133	**#**	**Internal error EEPROM access – Request synchronization**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
134	**#**	**Internal error EEPROM access – Request synchronization**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
135	**#**	**Internal error EEPROM access – Request synchronization**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
136	*1*	*Restore started*	Restore of a backup has been started (no error)

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
137	**#**	**Internal error – backup / restore**	
	157 (-99)	*Restore – ok, but backup < data set of current system*	Restore successful, but backup data record is smaller than in the current system
	239 (-17)	*Backup – storage of backup in AZL2... faulty*	Reset and repeat backup
	240 (-16)	*Restore – no backup in AZL2...*	No backup stored in AZL2...
	241 (-15)	*Restore – abortion due to unsuitable product no. (ASN)*	Backup has an unsuitable product no. (ASN) and must not be restored
	242 (-14)	*Backup – backup made is inconsistent*	Backup is faulty and cannot be transferred back
	243 (-13)	*Backup – data comparison between µCs faulty*	Reset and repeat backup
	244 (-12)	*Backup data are incompatible*	Backup data are incompatible with the current software version, restore not possible
	245 (-11)	*Access error to parameter Restore_Complete*	Reset and repeat backup
	246 (-10)	*Restore – timeout when storing in EEPROM*	Reset and repeat backup
	247 (-9)	*Data received are inconsistent*	Backup data record invalid, restore not possible
	248 (-8)	*Restore cannot at present be made*	Reset and repeat backup
	249 (-7)	*Restore – abortion due to unsuitable burner identification*	Backup has an unsuitable burner identification and must not be transferred to the unit
	250 (-6)	*Backup – CRC of one page is not correct*	Backup data record invalid, restore not possible
	251 (-5)	*Backup – burner identification is not defined*	Define burner identification and repeat backup
	252 (-4)	*After restore, pages still on ABORT*	Reset and repeat backup
	253 (-3)	*Restore cannot at present be made*	Reset and repeat backup
	254 (-2)	*Abortion due to transmission error*	Reset and repeat backup
	255 (-1)	*Abortion due to timeout during backup / restore*	Make a reset, check the connections and repeat backup / restore In case of repeated backup timeout, the AZL2... does not yet support backup functionality
146	**#**	**Timeout building automation interface**	Refer to Modbus User Documentation (A7541)
	1	*Modbus timeout*	
	2	*reserved*	
150	**#**	**TÜV test**	
	1 (-1)	*Invalid phase*	TÜV test may only be started in phase 60 (operation)
	2 (-2)	*TÜV test default output too low*	TÜV test default output must not be smaller than the lower output limit
	3 (-3)	*TÜV test default output too high*	TÜV test default output must not be greater than the upper output limit
	4 (-4)	*Manual interruption*	No error: Manual abortion of TÜV test by user
	5 (-5)	*TÜV test timeout*	No loss of flame after shutdown of fuel valves 1. Check to see if there is extraneous light 2. Check wiring to see if there is a short-circuit Check to see if valve is leaking

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
165	**#**	**Internal error**	
166	*0*	*Internal error watchdog reset*	
167	**#**	**Manual locking**	Unit has been manually locked (no error)
	1	*Manual locking by contact*	
	2	*Manual locking by AZL2...*	
	3	*Manual locking by PC tool*	
	8	*Manual locking by the AZL2...* *Timeout / communication breakdown*	During a curve adjustment via the AZL2..., the timeout for menu operation has elapsed (setting via parameter 127), or communication between the LMV36... and the AZL2... has broken down
	9	*Manual locking by the PC tool* *Communication breakdown*	During a curve adjustment via the ACS410, communication between the LMV36... and the ACS410 was interrupted for more than 30 seconds
	33	*Manual locking by the PC tool* *Test of lockout*	PC tool made a reset attempt with an error-free system
168	**#**	**Internal error management**	Make a reset; if error occurs repeatedly, replace the unit
169	**#**	**Internal error management**	Make a reset; if error occurs repeatedly, replace the unit
170	**#**	**Internal error management**	Make a reset; if error occurs repeatedly, replace the unit
171	**#**	**Internal error management**	Make a reset; if error occurs repeatedly, replace the unit
200 OFF	**#**	**System error-free**	No error
201 OFF UPr0 or **OFF UPr1**	**#**	**Prevention of startup**	Start prevention due to unparameterized unit Go to error history, entry 702, for initial cause of the error with shutdown in connection with the first curve settings
	Bit 0 *Valency 1*	*No operating mode selected*	
	Bit 1 *Valency 2..3*	*No fuel train defined*	
	Bit 2 *Valency 4..7*	*No curves defined*	
	Bit 3 *Valency 8..15*	*Standardized speed undefined*	
	Bit 4 *Valency 16..31*	*Backup / restore was not possible*	
202	**#**	**Internal error operating mode selection**	Redefine the operating mode (parameter 201)
203	**#**	**Internal error**	Redefine the operating mode (parameter 201). Make a reset; if error occurs repeatedly, replace the unit

Error code	Diagnostic code	Meaning for the LMV36... system	Remedy
204	**Phase number**	**Program stop**	Program stop is active (no error)
205	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
206	*0*	*Inadmissible combination of units (basic unit – AZL2...)*	
207	**#**	**Version compatibility basic unit – AZL2...**	
	0	*Basic unit version too old*	
	1	*AZL2... version too old*	
208	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
209	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
210	*0*	*Selected operation mode is not released for the basic unit*	Select a released operation mode for the basic unit
240	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
245	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
250	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit

30 Revision history of basic unit LMV36...

Software changes

Software version V03.00

- Optimization: Maximum time of safety phase reduced from 28 to 27 seconds
- Optimization: Correction of error diagnostics C:61 D:0 or 1 (Fuel Chg)
- Optimization: No error *Fuel Err* when pressing the reset button for a short moment after a reset / power-on
- Parameter 376: Deactivation of oil pressure switch-min for fuel 1

Software version V03.10

- Optimization: If power supply fails during the restore process, the data set can be repaired by starting a new restore process (since the backup / restore option is not yet available with V03.00 because there is no suitable AZL2..., this effect cannot occur)
- Optimization: If the analog input is interrupted, error C:60 (no valid output source) is canceled or reset when *Default output low-fire* is parameterized (only with LMV36...)
- Optimization: When making a reset via the AZL2..., an *incomplet*e reset occurred in very rare cases (display showed *RESEt*, but reset was not triggered)
- Optimization: The time of 0.2 seconds ascertained by the loss-of-flame test was too long
- Optimization: No continuous purging with the LMV36... (in prepurge / ignition position) during the gas shortage waiting time when using a VSD and valve proving via gas pressure switch-min
- Optimization: With fuel changeover, error codes C:85 / C:86 do not occur any more
- Optimization: Reduced detection of undervoltage when fan motor is started in phase 22 (when a single-phase motor and the LMV37.8… 120 V were powered via the same phase, undervoltage detection could occur on startup; in that case, the LMV37.8… system was not operated as specified)
- Optimization: Better overview through text changes of groups 200 = PAr0, 300 = PAr1 and 600 = ACtr on the parameter menu (initially PArA), and hiding of unused parameters after selection of fuel train / operating mode
- Optimization: Control of the fan output during standardization (standby) for using a release contact via an external relay at the fan's output
- Optimization: Curve setting invalid (OFF UPr) after new / further standardization
- Optimization: To shorten the startup time, there is no referencing when postpurging is aborted via controller-ON (direct start)
- Automatic return travel of the SQN1... at the lower internal stop
- Parameter on Siemens level
  Longer ignition off time during safety time 1 (TSA1) (increased from 0.4 to 0.6 seconds) to prevent wrong error diagnostics in connection with QRA2… (C:7 in place of C:2)
- Parameter at the Siemens level:
  Readjustment of threshold for detection of interruption based on operation with AGM60... and 2 fuel actuators
- Creation of new parameter sets for the burner output test based on V01.05
  (otherwise, due to a restore process with old data sets during the burner output test, parameter changes at the safety limit thermostat level might be overwritten again)

Software version V03.30

- Extension: Display of intensity of flame when setting the curves
- Optimization: Display and diagnostics of changing start preventions
- Optimization: No unplausible relay setpoint (error C:99 D:3) when starting standardization, alarm in case of start prevention and controller-ON signal
- Optimization: No VSD standardization with pneumatic air-fuel ratio control
- Optimization: Referencing in connection with direction of rotation *Right* and home position 90°
- Extension: Separate pressure switch valve proving via X5-02 (Pmax / POC)

31 List of figures

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